The High-Tech Downturn in Silicon Valley: What Happened to All Those Skilled Workers?

FINAL REPORT

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Summary

During Silicon Valley's dramatic economic growth fueled by the internet boom and business investment in information technology, employment in the region's high-tech sector tripled between 1995 and 2000. The economic boom gave rise to many new firms, drawing employees into high-tech jobs from other regions and other industries. In addition to longer term structural changes in high tech industries, this period of growth witnessed increased shares of both small and new firms in the region's industrial composition. By 2000, the region's unprecedented growth came to an abrupt end, and the Bay Area endured the heaviest employment losses of any urban high-tech center in the U.S. The highly skilled, highly paid tech workforce faced high levels of unemployment, and many left the region entirely.

This study seeks to better understand what happened to the tech workforce in the recent downturn and how they have fared in the job market since. To put this in context, however, we also look back to the boom and before. In particular, we consider:

- How did this business cycle compare to previous cycles experienced in California?
- How has the composition of Silicon Valley's high-tech firms changed over the course of its rapid economic expansion and abrupt downturn?
- Which firms led the boom? Were these the firms most affected in the bust?
- Where did employees come from to fuel the boom? Where did they go in the bust?
- What were the wage losses (or gains) experienced by workers in the downturn?

To address these questions, this study tracks the experiences of high-tech workers and the firms that employed them, examining eight sub-sectors within high-tech: Semiconductors, Computer Hardware, Electronic Components, Software, Computer Services, Internet Publishing, Engineering & Scientific Services, and Biomedical. The study relies on firm and employee data from the California Employment Development Department, including the quarterly payroll records of several million workers employed in high tech between 1995 and 2003. The central focus of the study is an analysis of the one million California workers who were employed in high-tech industries at the beginning of 2000, the peak of Silicon Valley employment. We follow the employment experiences of these workers from 1995 to 2003 including their movements into and out of the high-tech sector and their use of unemployment insurance after the downturn.

Central findings

- **Growth in new firms (formed in 1995 or later), though volatile, contributed significantly to the boom and still represent a large share of high-tech employment.** Firms established after 1995 accounted for more of the employment gains during the boom and fewer of the employment losses in the bust. By 2003, 39 percent of high-tech employment in the Bay Area was in firms formed since 1995, and employees in these newer firms typically had slightly higher earnings than those in older firms.

- **Among California tech workers employed in the first quarter of 2000, only 41 percent were employed in California tech industries in 1995.** About one in five peak period tech workers were employed in a non-tech industry in 1995. More than 30 percent of those employed in tech in 2000 were not in the California workforce in 1995, either because they were employed in other states or because they were new entrants to the workforce during the boom.
- **Only half of the workers who had been employed in high-tech firms during the first quarter of 2000 remained employed in high-tech firms in California by the end of 2003**. More than 20 percent of the peak period tech workers had moved (or moved back to) non-tech industries by 2003, with no one industry dominating the non-tech employment. For each of the eight sub-sectors, these workers employed in non-tech in 2003 typically had earned below the industry median in 2000. Around 30 percent had no UI-covered wages in California in 2003. For those without UI-covered California wages, we cannot distinguish those who left the state (or country) from those who left the labor force or who became self-employed.
- **Of those still employed in California but outside of the high-tech sector, most suffered wage losses, and large numbers showed primary earnings from temporary employment agencies at some point between 2000 and 2003.** By 2003, about 24 percent of peak period tech workers were employed in non-tech industries. Workers leaving any of the hardware industries, especially Semiconductors, experienced the greatest wage losses upon entering a non-tech industry. The worst income losses were sustained by those tech workers employed by Employment Services (largely temporary or contract employment) in 2003 with losses ranging from 18 to 43 percent. These workers spent an average of three quarters with their primary employment in this industry. The median worker who stayed in the same tech industry between 2000 and 2003 saw wage gains of 8 percent to 14 percent over the three years and those who switched to another tech industry generally fared as well.
- **About 23 percent of all peak period tech workers experienced at least one full quarter with zero wages between quarters with wages.** Workers moving to non-tech industries were twice as likely to have such wage gaps as those who left the state's workforce, and they were almost three times as likely as those who remained in tech. Combined with the lower non-tech wages, this suggests that workers endured significant periods of unemployment or self-employment before accepting lower paying jobs in other industries.
- **San Francisco Bay Area workers experienced both the boom and bust more extremely than the rest of the state.** During the boom, wage growth in the Bay Area was twice that in the rest of the state; after the bust, the rate of unemployment claims was many times higher and weeks longer than those in the rest of the state.

While this study provides a deeper understanding of the experiences of workers through the boom and bust in Silicon Valley, the challenge for Workforce Investment Boards is always in looking forward. WIBs must predict where employment growth will occur and where to target resources to help re-employ those who are displaced in downturns. Nevertheless, this analysis does provide some basic insights as well as suggestions on where to pursue additional findings. First, the role of new firms in the tech boom, as well as their persistence since then, indicates the

importance of identifying and involving such firms in WIB activities and employer outreach. Networking across such firms may be required, because not only will individual firms each have lower numbers of employees, but they also may have less structured human resources policies, including strategies to train new employees. Of course, the case of Internet Publishing reminds one that even very well-publicized, fast growing industries may in fact employ few people in total. Second, and not surprisingly, among employees who changed industries, earnings were most comparable for those who moved to similar industries. Third, among the core tech worker group examined in our central analysis we saw substantial movement into tech from other fields in the boom. Yet workers commonly endured long wage gaps before moving into non-tech fields. Additional research incorporating data on the individual characteristics of workers (information not available in wage records) might help predict which specific workers are most likely to successfully move back into work in the same or related field at comparable wages and which may need to develop an alternative strategy earlier. Finally, this boom occurred hand in hand with a clear structural shift in the nature of the region's high-tech economy. Thus, even in a growing economy, it is necessary for workers at all levels to have accessible avenues for acquiring new skills to keep pace with such structural changes.

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1 Introduction

In the 1990s, the San Francisco Bay Area – particularly Silicon Valley – entered a new phase of high-technology innovation and growth. Thanks to both a massive increase in business investment in information technology (IT) equipment and the broader internet boom, employment tripled in Silicon Valley's IT sectors tripled between 1995 and 2000. Venture capitalists, innovative companies, and a skilled entrepreneurial workforce combined to win the region worldwide acclaim as a model for high-tech economic development, and other regions rushed to create their own Silicon Alley, Glen, Forest, Prairie and so on, as capital and workers flooded into Silicon Valley.

Unfortunately, the end of the internet-led stock boom and the sharp decline in business equipment investment brought an abrupt end to the region's explosive growth. Following the peak in 2000, the San Francisco Bay Area suffered the largest decline in metro area employment in the last fifty years. The region experienced three consecutive years of large job losses (Hurd 2004: 1.2) outpacing losses in all other urban IT centers nationwide (Daly & Valletta 2004: 10-11). Not only did employment fall, but a number of Bay Area counties experienced a net population outflow (U.S. Census 2002). In the midst of such a massive recession in a region long praised for the quality of its high-tech workforce, it is natural to ask: What happened to the hundreds of thousands of Silicon Valley tech workers?

To fully understand the job losses from the tech bust, however, it is equally important to examine the boom and consider the changing structure of high-tech industries. Together, these two factors provide the backdrop to understanding firm dynamics in the boom and bust and how these dynamics lead to workforce trends. Therefore, this study addresses a number of inter-related questions about firms and their employees:

- How did this business cycle compare to previous cycles experienced in California?
- How has the composition of Silicon Valley's high-tech firms changed over the course of its rapid economic expansion and abrupt downturn?
- Which firms led the boom? Were these the firms most affected in the bust?
- Where did employees come from to fuel the boom? Where did they go in the bust?
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To address these questions, this study tracks the experiences of high-tech workers and the firms that employed them, based on quarterly payroll records of several million workers employed in high tech between 1995 and 2003. The central focus of the study is an analysis of the one million California[1] workers who were employed in high-tech industries at the beginning of 2000, the peak of Silicon Valley employment. For these workers, we follow

[1] Wage records are linked to the employer, and one cannot link a worker's wage record to a specific establishment within a multi-establishment firm. In order to make regional comparisons, all multi-establishment firms that are not unambiguously either within or without the observed region must be removed from the sample. This is done in Chapter 5 in which the San Francisco Bay Area is compared to the rest of the state. For the core tech worker analysis, however, tech wages from firms are considered regardless of the dispersion of their establishments across the state.

their employment experiences from 1995 to 2003 including movements into and out of the high-tech sector, and we track their use of unemployment insurance after 2000.

To understand the dynamics and evolution of the high-tech industry, it is critical to recognize that the term "high-tech" in fact covers a number of different industries that experienced different growth rates in the boom and bust. The adaptation of the regional workforce to industry change is as much as story of movements within the high-tech sector as it is about movements in and out of tech. To capture this important distinction, we divide firms and establishments in the high-tech sector into eight sub-sectors using definitions similar to those of the American Electronics Association and Joint Venture: Silicon Valley Network. The eight sectors include:

1. Semiconductors
2. Computer Hardware
3. Electronic Components
4. Biomedical
5. Software
6. Internet Publishing
7. Computer Services
8. Engineering & Scientific Services

This report describes the regional context over the past two business cycles, how the high-tech sectors evolved during the boom and subsequent bust, and how their workers fared. It provides the workforce investment boards (WIBs) with a sense of the broader employment patterns from which their clients emerge and an idea of where workers from various industries, with varying tenures within those industries, have ended up. By examining the types of industries and firms that workers have moved to (and how costly those moves were), the WIBs and other participants in workforce development can better target their efforts.

This report is organized as follows: Chapter 2 sets the regional context and provides an overview of industry trends over past business cycles. It also presents the recent downturn in relation to the downturn suffered in Los Angeles with the collapse of the aerospace industry in the prior recession, another recession that strongly affected highly-skilled, highly-paid workers. Chapter 3 explores how the population of high-tech firms has changed and how the roles of old and new firms have shifted over the boom and bust. This chapter also looks in detail at how firm growth dynamics differed across the eight tech industries, particularly between hardware and software industries. Chapter 4 analyzes tech workers' employment histories by tracking them from the early years of the expansion to late into the downturn. As noted above, the employment analysis looks at all tech workers in California. However, since there are strong reasons to believe that tech workers in the Bay Area faced a more severe job market situation than those elsewhere in the state, Chapter 5 examines how workers' experiences differed in the Bay Area and the rest of California during this business cycle. Chapter 6 summarizes the study's results and suggests some avenues for further analysis.

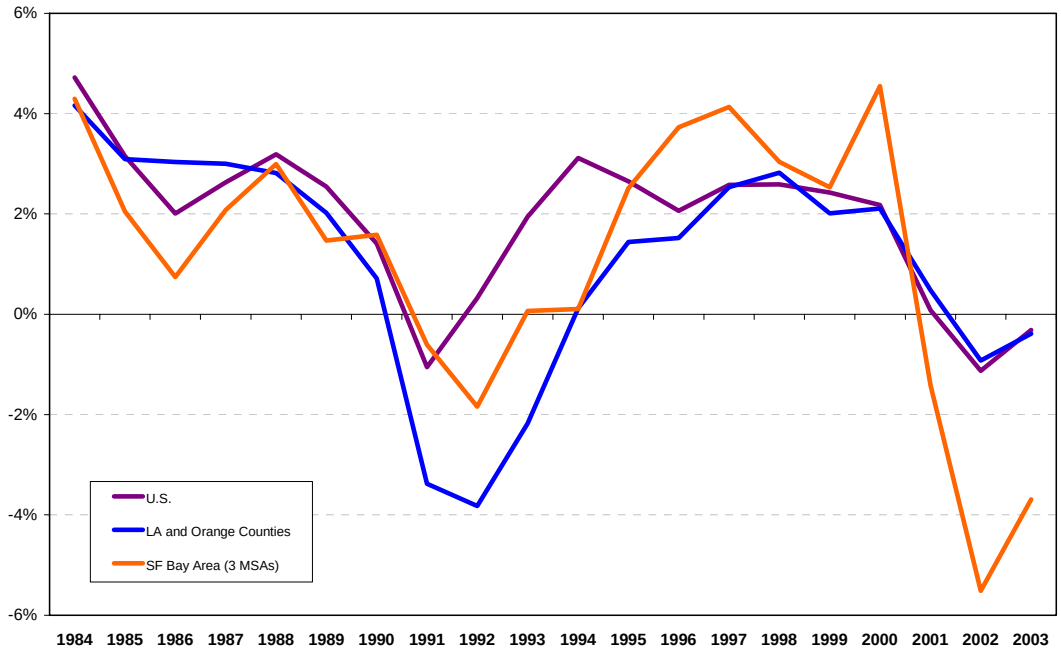
2 Regional Context and Trends

Before we examine the experiences of high-tech workers, it is helpful to recall the larger economic context for their employment. In this section, we first review the Bay Area's economic performance in the boom and bust, and then consider the changing structure of high-tech industries. Together, these two factors provide the backdrop to understanding firm dynamics in the boom and bust and how these dynamics lead to workforce trends.

2.1. Comparison of Two Downturns: Bay Area and Los Angeles

Over the past two decades, the U.S. economy experienced two major business cycles.[2] During the 1980s, employment growth in California's two largest regions, the Los Angeles and San Francisco Bay metro areas[3], did not diverge dramatically from national rates, as Figure 2.1 shows. However, during the 1990s, the different industrial mixes (particularly in high tech) of the two regional economies led to very different outcomes. In the early 1990s, L.A. was harder hit than the Bay Area. The L.A. region's employment decline began gradually, plunged in 1991 by four percent, and bottomed out in 1992 before slowly regaining some of the lost jobs over the

Figure 2.1 Nonfarm Employment Growth Rates, 1984- 2003



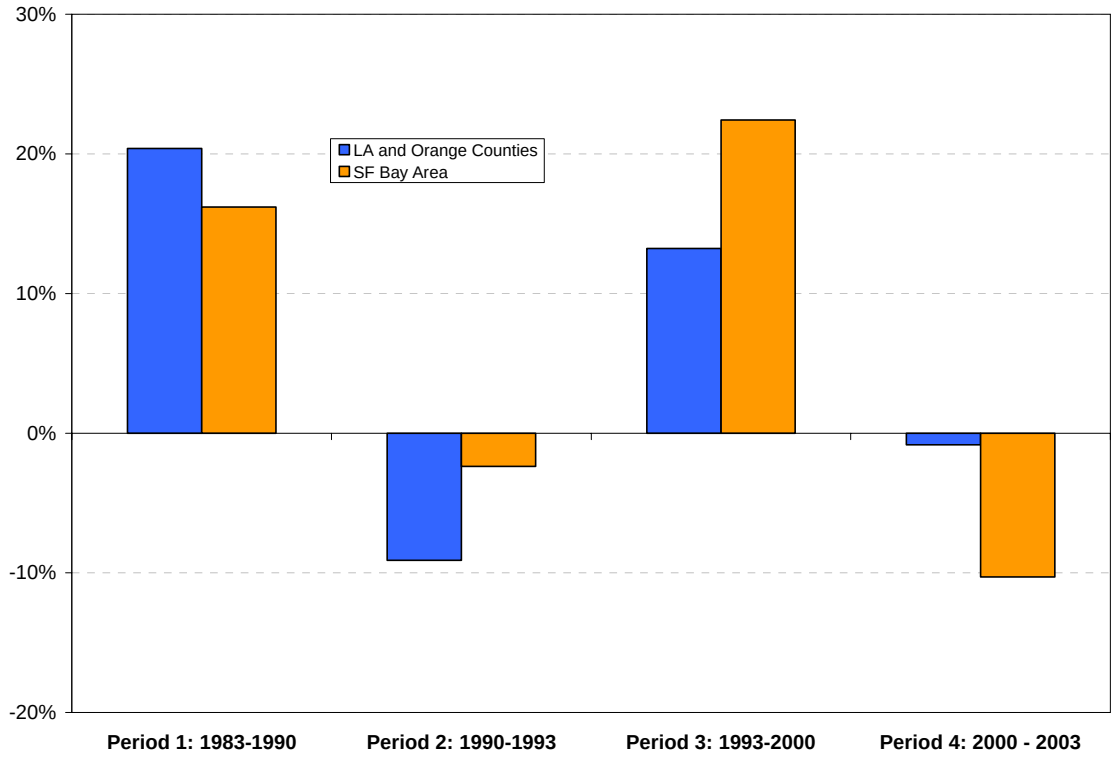
[2] A business cycle is defined as the recurring cycle of economic fluctuation that is characterized by increased economic activity that reaches a peak (its highest point), then falls until it reaches a trough (its lowest point) from which point it begins a new cycle as economic activity returns. These cycles of growth and recession vary in length, frequency, and magnitude.

[3] For uses of this report, the term "Silicon Valley" is used interchangeably with the "San Francisco Bay Area" and includes the San Jose, Oakland, and San Francisco Metropolitan Statistical Areas. The Los Angeles region includes the Los Angeles and Orange County MSAs.

rest of the decade. It took L.A. three years after its sharp fall in employment to return to positive growth rates in 1995.

Bay Area job losses in the latest recession have been more intense. In a dramatic two-year dive, employment changes turned from a five percent growth in 2000 to a loss of five percent in 2002. Though total nonfarm employment was still in decline, 2003 reversed the sharp trend. Figure 2.2 highlights the variation in employment growth rates over the last two cycles within the two regions. The Bay Area's growth rates during the recent boom exceeded those of L.A.'s expansion period, and its rates of job loss in the following downturn also exceed those of L.A. in the early nineties.

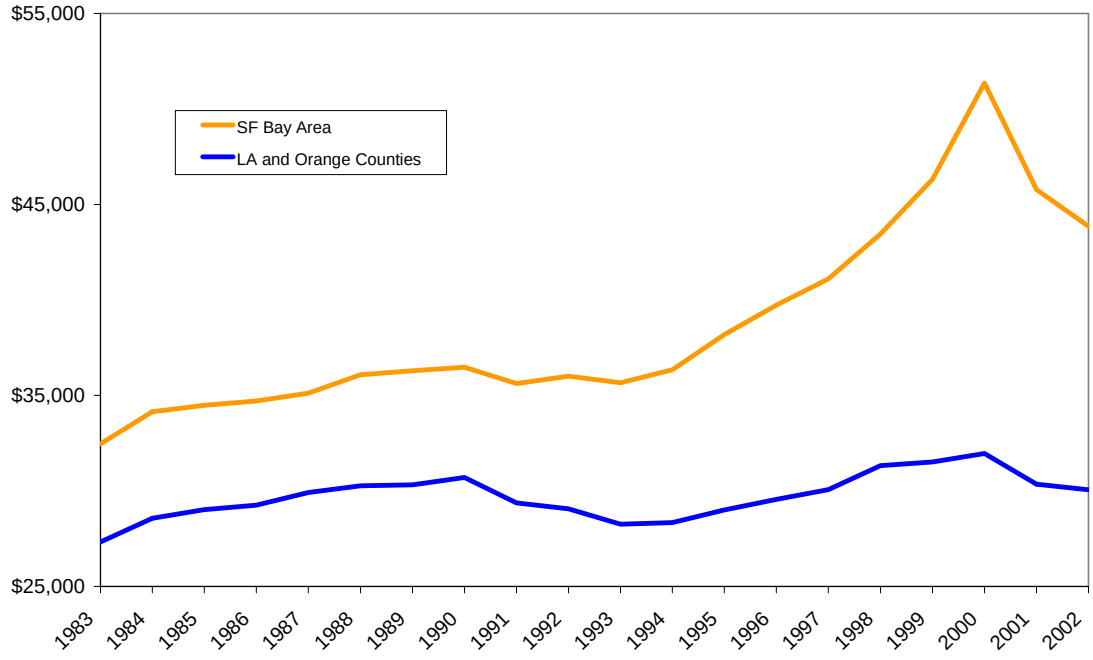
Figure 2.2 Nonfarm Employment Growth Rates



Thanks to the high wages commanded by the highly-skilled workforce and the widespread use of stock options by regional firms, personal incomes soared in the Bay Area during the boom. Between 1983 and 1990, inflation-adjusted per capita income[4] was about $5000 higher in the Bay Area than in L.A. (Figure 2.3). The Bay Area's lead began to widen in 1990 and intensified after 1995. Between 1995 and 2000, per capita income grew 34.5 percent in the Bay Area,

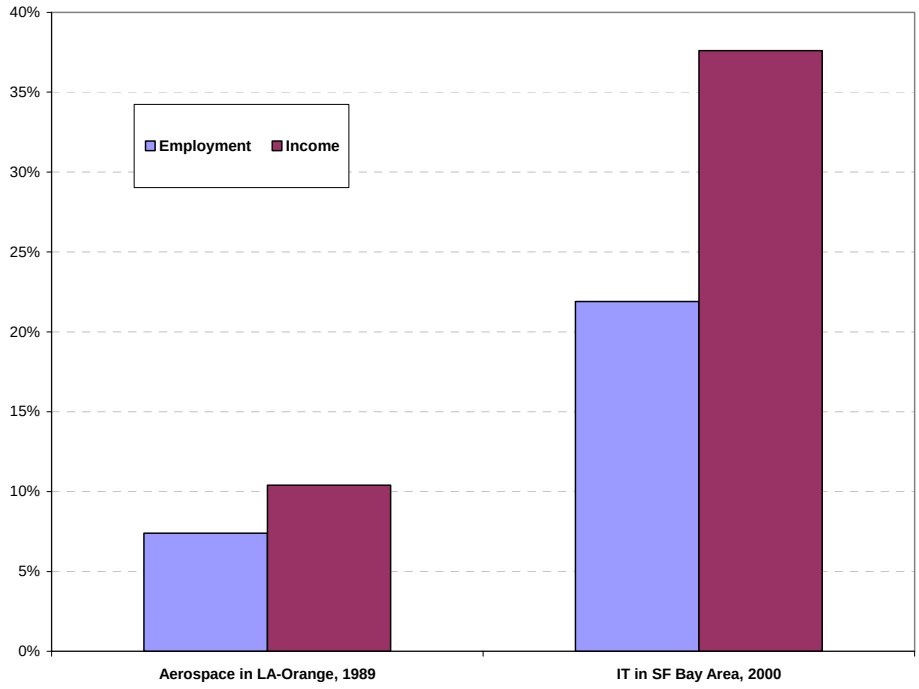
[4] In this case, per capita income is a region's total income divided by its total number of people (adults and children). It is the average "per head" income for the region. "Income" includes any income from: wage or salary; self-employment; interest, dividend, or net rental income; Social Security; Supplemental Security Income; public assistance; retirement or disability; other period income other than earnings, such as unemployment compensation, child support, and Veterans' Administration payments (U.S. Census).

Figure 2.3 Inflation-Adjusted Per Capita Income (2001 Dollars), 1983-2002



Source: U.S. Bureau of Economic Analysis, Regional Accounts Data

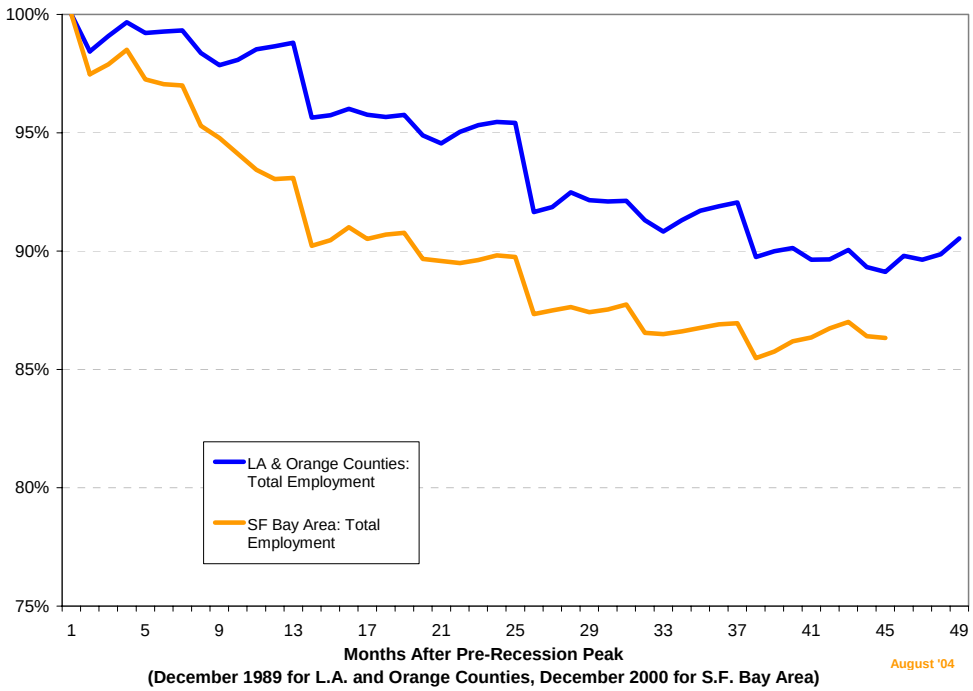
Figure 2.4 Pre-recession Peak Employment & Income Shares of Industry in Region



compared to 10.2 percent in the L.A. region. Only twelve months later, personal income in the Bay Area dropped by more than 10 percent, to just below 1999 levels. A year after that, in 2002, Bay Area income per capita dropped to 1998 levels, although due to the wide gap in educational attainment as well as industry mix, personal income was still 44 percent higher there than in the L.A. region. The Bay Area has had relatively more wealth to fall back on during the present economic slowdown, which may help explain why the region has not displayed a greater degree of suffering than it has. This is despite the fact that the Bay Area's high-tech sector constituted greater employment and income shares than aerospace did at its employment peak in the L.A. region in the 1980s (Figure 2.4).

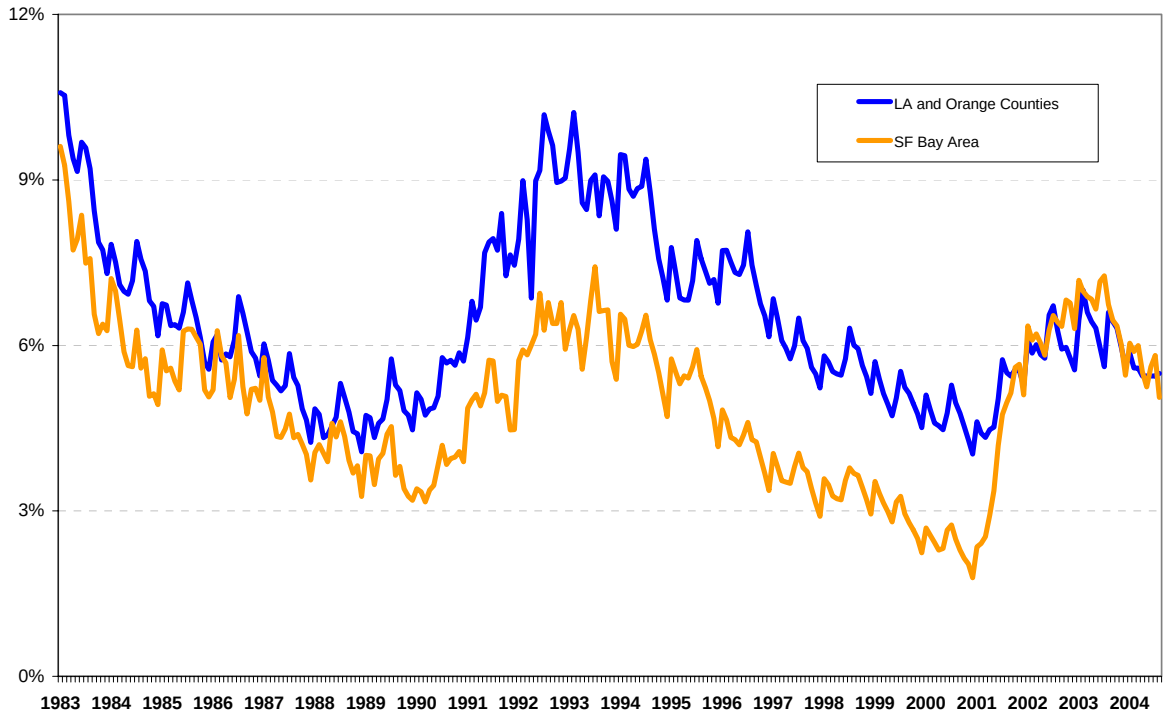
Figure 2.5 tracks the monthly employment decline beginning at the point of 100 percent of peak employment for both regions. L.A.'s employment decline of the last recession, beginning in 1989, is set against that of the Bay Area in the most recent cycle. Total nonfarm employment in the Bay Area declined by ten percent in the 24 months that followed its pre-recession peak in December 2000. In contrast, 24 months after its pre-recession peak in December 1989, the L.A. region's total non-farm employment had dropped by five percent. The annual drops in employment show a clear seasonal pattern, with the steepest declines in December/January. Employment declines slowed after January 2004 (month 38 from the peak), similar to the stabilization in L.A. three years after their peak.

Figure 2.5 Employment Decline by Month after Pre-recession Peak



The region's sudden job losses sent its civilian unemployment rate up sharply. The lowest rate of unemployment in this twenty-year period was 1.8 percent in December 2000 (Figure 2.6). Within twelve months, it had risen to 5.65 percent, converging with L.A.'s unemployment levels for the first time since 1989. Over the 19 months that followed, the unemployment rate rose steadily and peaked in July 2003, at 7.26 percent. Despite the sharp increase, this peak remains below the highest rates of unemployment seen in the last 20 years (9.6 percent in 1983 and 7.4 percent in 1993). The severity of the present recession is quite pronounced in the rapidity of its onset.

Figure 2.6 Monthly Unemployment Rate, January 1983-August 2004



These large and sustained employment declines are a key motivation for this study. Such declines may drive workers to seek work outside the region, with telling impact on the broader health of the region. As Figure 2.7 illustrates, when L.A.'s economy fell this far in relative terms, 600,000 more people left the region than moved in.[5] The L.A. region experienced three years of sharp decline in employment levels from 1991 to 1993; but the region sustained nine consecutive years of population loss from 1990-1998. In 1995, though the region experienced employment growth for the first time since 1990, out-migration peaked at 1.3 percent (i.e., a net population loss of 121,785 residents).

[5] Employment change described in this context explains the change (positive or negative) in one year relative to the level of employment of the preceding year.

Figure 2.7 Net Migration and Employment Change, L.A. County

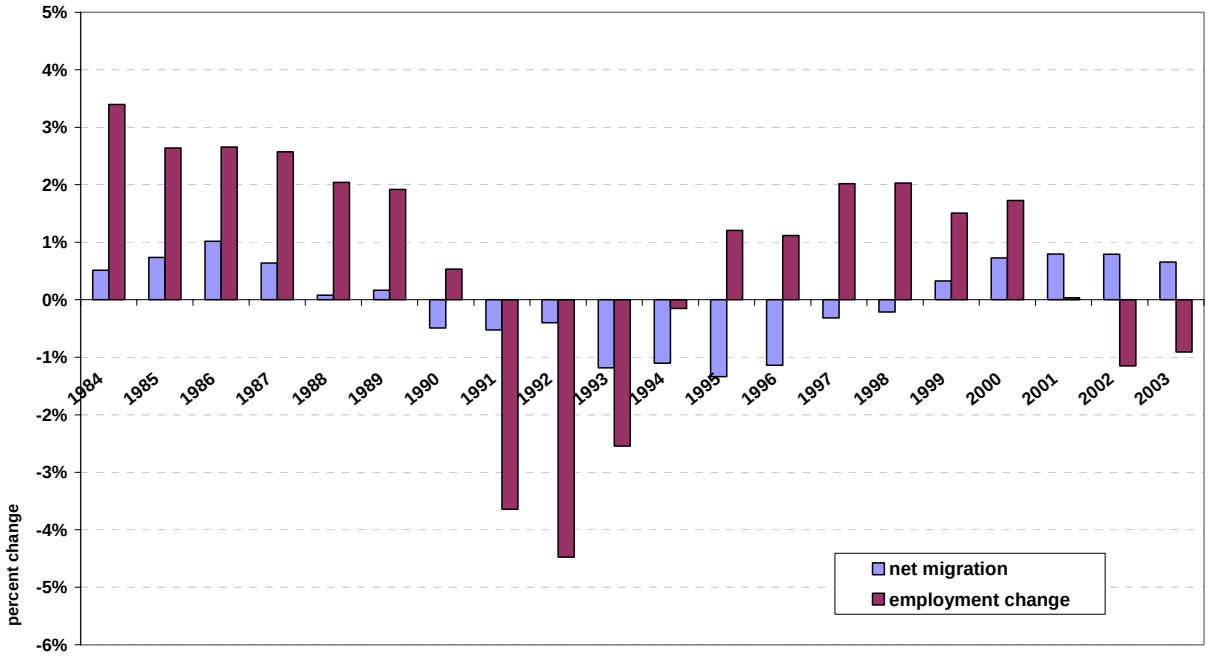
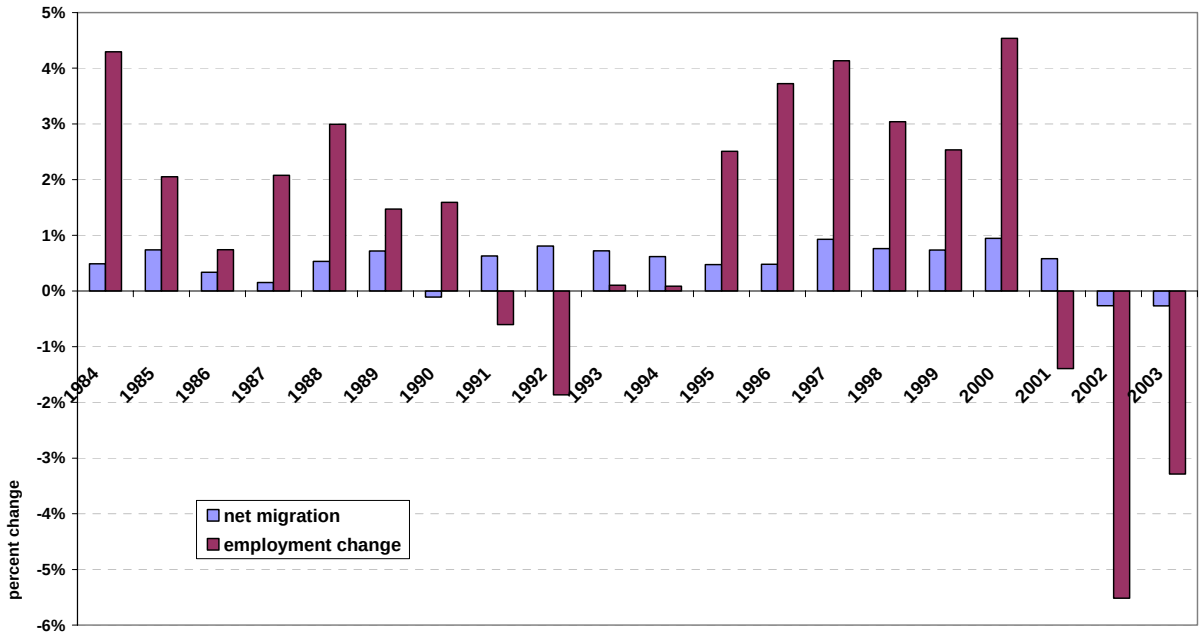


Figure 2.8 Net Migration and Employment Change, San Francisco Bay Area

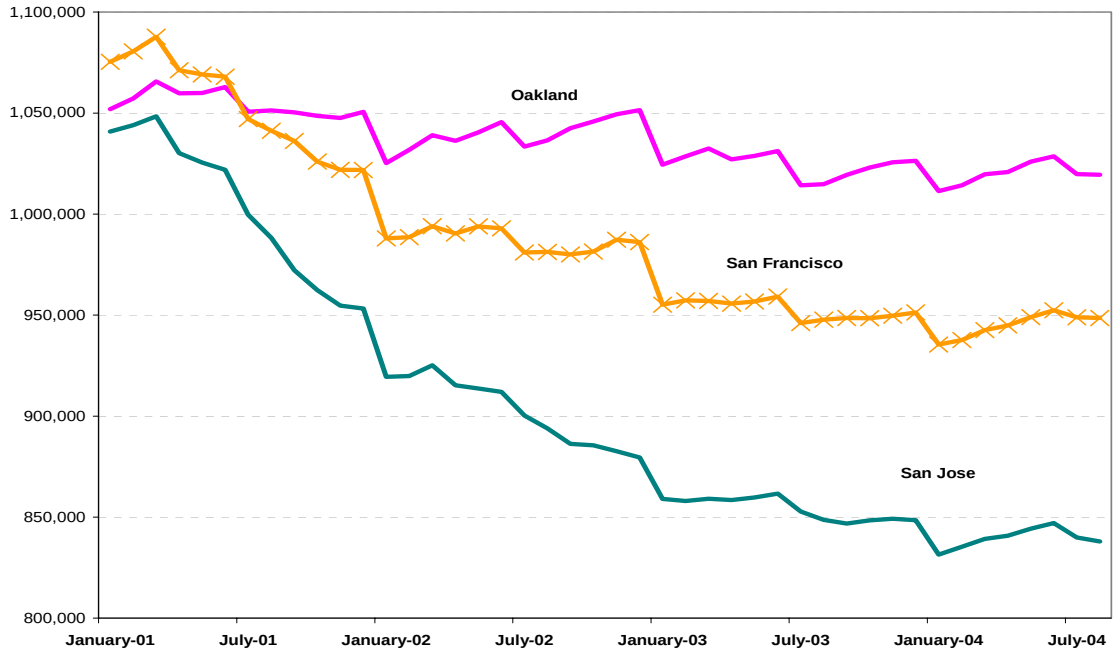


So far, out-migration in the Bay Area has been relatively low (Figure 2.8), but so has job creation. The region has experienced three years of employment decline and, so far, two years of small net out-migration. This partially reflects labor force differences: Silicon Valley's tech workers likely possess skills that are more transferable into other sectors than L.A.'s aerospace workers. By some assessments as of mid-2004, the region was starting to show signs of life. Wholesale and retail, which had remained "flat," are presently picking up, and shipping and transportation is improving since trade volumes have rebounded (Hurd 2004: 1.6).

2.2. Changing Structure of High-Tech Industry

Since the 1980s, the Bay Area's high-tech industry has experienced industrial changes that parallel the larger economy, especially the rise of services over more traditional manufacturing. However, the high-tech sector has also experienced some unique changes: greater geographic dispersion and, in part due to decentralized and specialized production, more small firms. Finally, the demand for high-tech occupations has expanded into non-tech industries. As further background to our analysis, we briefly examine each of these trends.

Figure 2.9 Total Nonfarm Employment, January 2001-August 2004

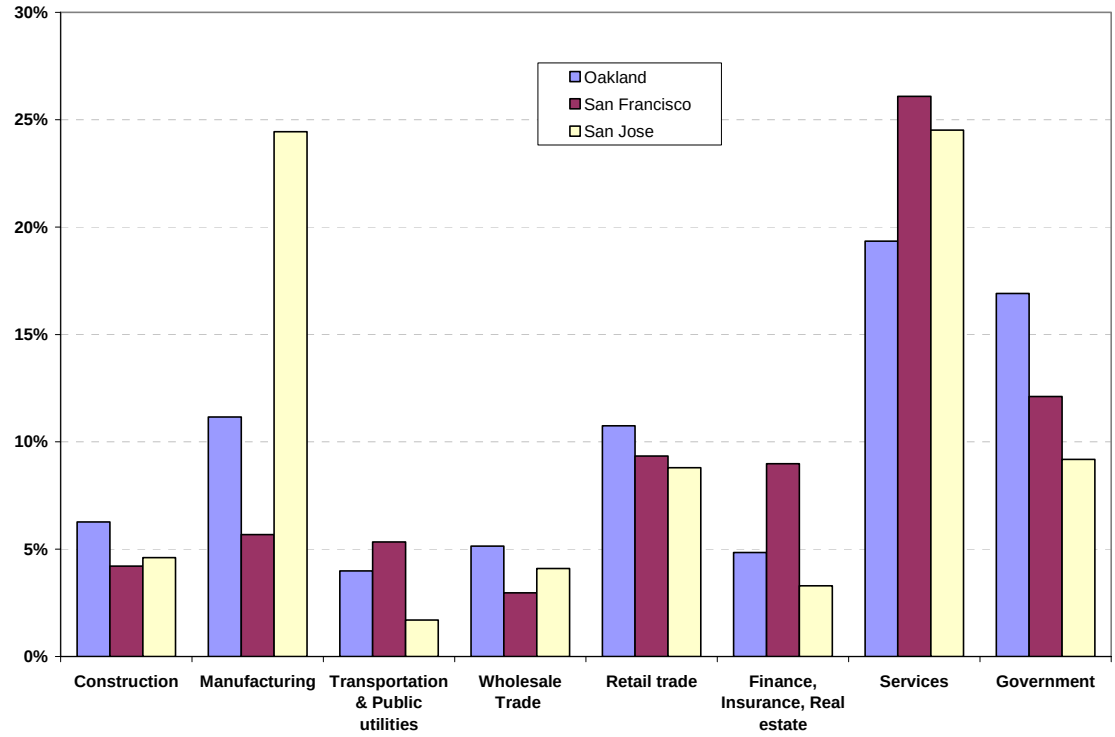


Structural Shift from Manufacturing to Services

Within the Bay Area, San Jose bore the largest share of job losses. Total nonfarm monthly employment levels for each of the three MSAs from January 2001 to August 2004 are depicted in Figure 2.9. San Jose's greater losses reflect its heavier dependence upon IT manufacturing.

The South Bay metro area's manufacturing share of employment constitutes twice that of Oakland's and four times that of San Francisco's share of employment in manufacturing (Figure 2.10).

Figure 2.10 Employment by Sector, 2000



The sluggish pace of job creation nationally has been attributed by some to an accelerated pace of structural changes, namely the permanent shift of workers between industries (Groshen & Potter 2003). Unlike cyclical displacement, structural displacement is permanent. Employment losses due to cyclical changes occur during lulls in economic activity but are then followed by employment gains in the same industries when activity rebounds. This increased importance of structural over cyclical change nationally is shown in Figure 2.11. The recessions of the 1970s and 1980s involved almost equal shares of industries going through cyclical and structural changes. The share of industries undergoing structural change in the recession of the early 1990s grew to 57 percent, and in the present recession makes up 79 percent of industries (Groshen & Potter 2003: 4). As is characteristic of structural change, in both recessions, the recovery in output was not matched by a corresponding rise in employment. This means that job losses are more likely to be permanent, and workers will need to move into other industries to find employment, lengthening average jobless spells.

Figure 2.11 Share of Industries Undergoing Structural and Cyclical Change in Recent Recessions

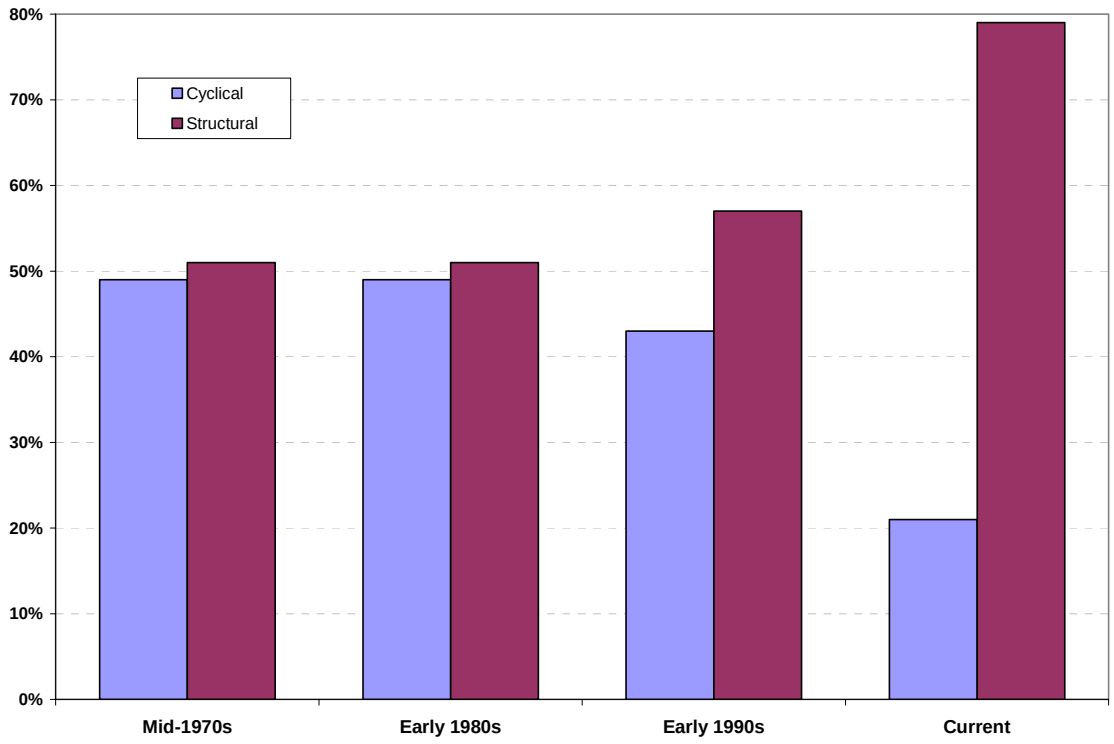
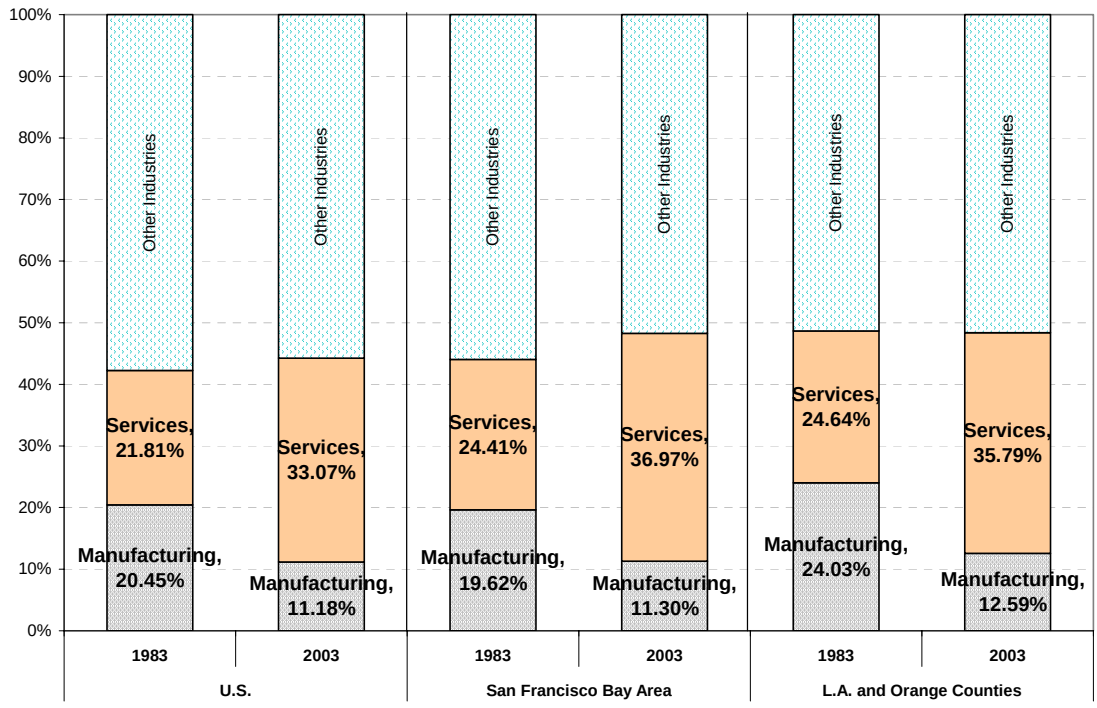


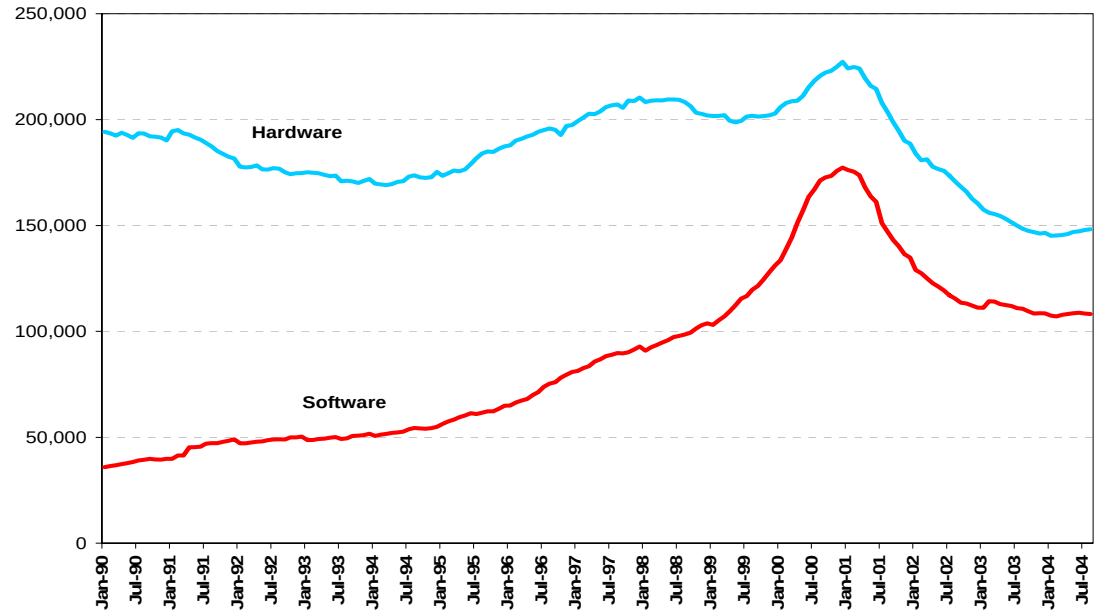
Figure 2.12 Service and Manufacturing Employment as Share of Total Nonfarm Employment, 1983 and 2003



Looking at shares of manufacturing[6] and services employment between 1983 and 2003 in Figure 2.12, the Bay Area's share of manufacturing employment in 1983 was smaller relative to its employment in services while nationally, there was close to an equal split (20.4 percent in manufacturing and 21.8 percent in services). The shift in employment from manufacturing to services has been a global phenomenon, and by 2003 the Bay Area's manufacturing employment share was only slightly more than that of the nation.

Silicon Valley's high-tech sector has proven its adaptability in the past.[7] Two defining structural changes for the region's high-tech sector were the reduction in defense spending and the internet revolution. Between 1990 and 2001, the defense/aerospace industry lost 60 percent of its jobs while the software industry grew by 136 percent and the computers/communications industry by 32 percent (Zhang 2003: 16).

Figure 2.13 High-Tech Employment in San Francisco Bay Area, January 1990-August 2004



The structure of the region's high-tech sector changed dramatically with the rise of software (Figure 2.13). In January 1990, employment in software was one-fifth that in hardware. By December 2000, both industries had peaked, and employment in software was three-quarters that in hardware. The recent declines in both seem to have bottomed out in mid-2004, and in contrast to hardware, employment in software remains above its pre-boom levels, now at two-thirds that in hardware.

[6] The U.S. Census Bureau defines manufacturing as "the mechanical, physical, or chemical transformation of materials and substances into new products" (U.S. Census Bureau).
[7] This is described in detail by Saxenian (1994) and by Zhang (2003).

Also indicative of structural change is the different experiences of IT services and IT manufacturing, as described by Daly and Valletta (2004: 9-10). During the boom from 1995 to 2000, IT services employment grew at an annual average of 8.5 percent while IT manufacturing employment only managed 1.7 percent over the same period. From 2001 to 2003, annual average employment losses in IT manufacturing were 10 percent, while losses in IT services were 4.4 percent.

Between 2000 and 2004, the Bay Area lost 400,000 manufacturing jobs in durable and nondurable goods, and most of these jobs are not expected to return (Hurd 2004: 1.6). A recent Bureau of Labor Statistics (BLS) study argued that the job flow dynamics for traditionally declining industries are different from those for traditionally expanding industries, and that if there are structural changes taking place, they are in the expanding industries such as high tech (Faberman 2004). The study also suggested that the historically low job creation rate this far into the present recovery is possibly the result of an employment bubble bursting. This seems to support the common perception that the "internet bust" has wiped out all of the gains achieved during the "internet boom," although some researchers have tied both the boom and bust more to patterns of business investment in IT equipment than to the internet boom per se.[8]

Although the Bay Area's high tech concentration is unrivalled, the sector has experienced some geographic dispersion. High-tech firms tend to be more mobile and to out-grow space more quickly than non-tech firms, and therefore were more likely to relocate and/or expand between 1990 and 2001. In general, more firms relocated within Silicon Valley than left, and more firms moved out of the region than moved in. Most firms that left Silicon Valley remained in the greater San Francisco Bay Area, spreading as far north as San Ramon and as far east as Livermore. Outside of the Bay Area, San Diego was the next destination of choice for high-tech firms and Sacramento was the top choice for non-tech firms (Zhang 2003: 54-56).

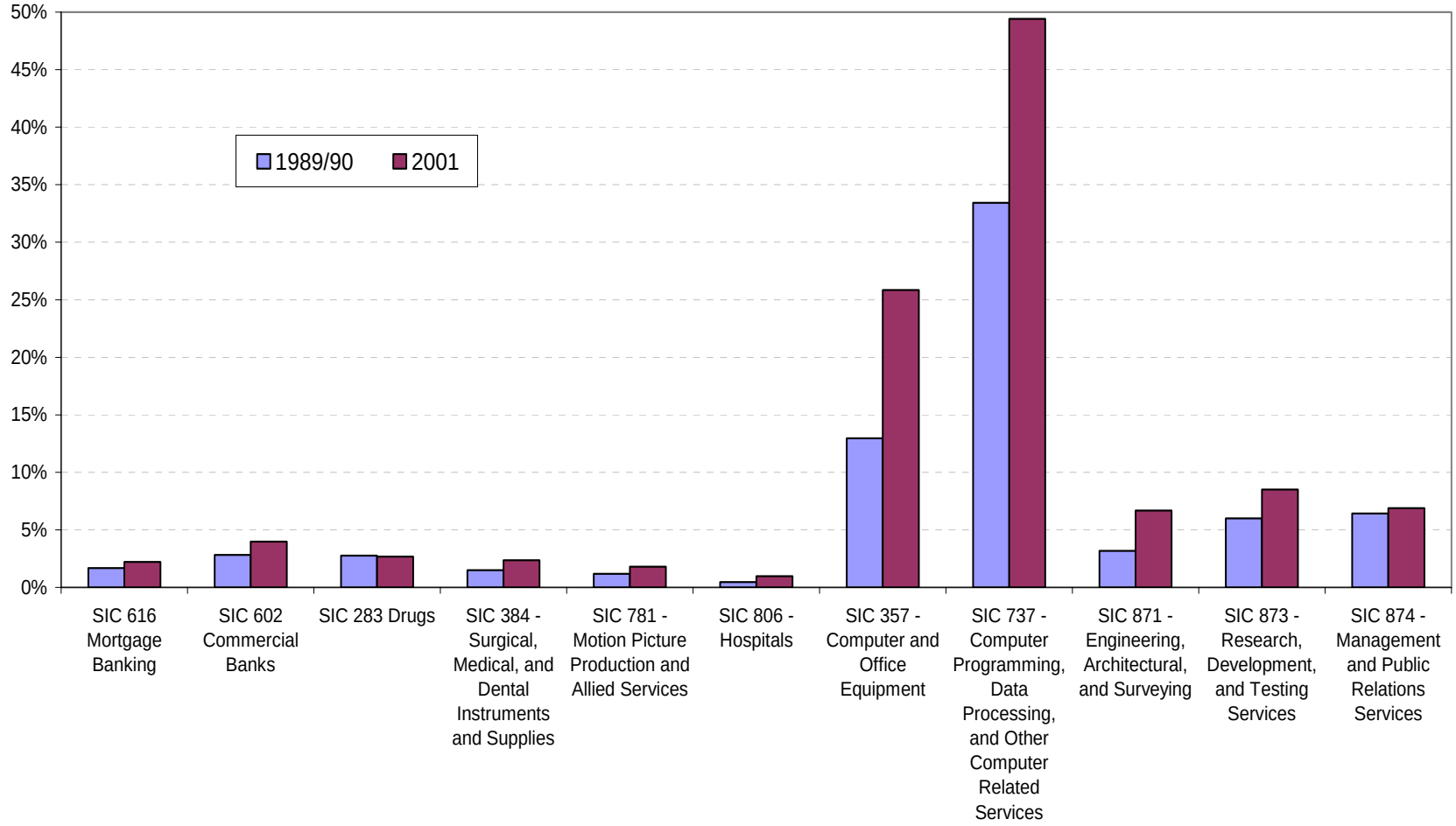
Rise of Tech-Related Occupations

Since 1990, computer and math occupations have grown in most industries. Figure 2.14 shows that nationally from 1989/90 to 2001, tech jobs increased as a share of all jobs in both technology-heavy industries and non-tech industries. The shares of computer and math occupations in the Computer and Office Equipment (SIC 357) and Engineering, Architectural & Surveying (SIC 871) industries have doubled over the last decade. In Computer Programming, Data Processing, & Other Computer Related Services (SIC 737) the share of computer/math occupations has increased by 43 percent, and by 18.3 percent in Research, Development, & Testing Services (SIC 837).

Though the number, and share, of workers in computer and math occupations are lower in non-tech industries, the percentage gains for these occupations have been similar to those in tech industries. The employment share of computer and math occupations in Hospitals (SIC 806) increased two-fold in the last ten years. In Surgical, Medical, Dental Instruments and Supplies (SIC 384), the industry share of these jobs increased by two-thirds, and by almost 60 percent in

[8] See Daly & Valletta (2004) and Faberman (2004).

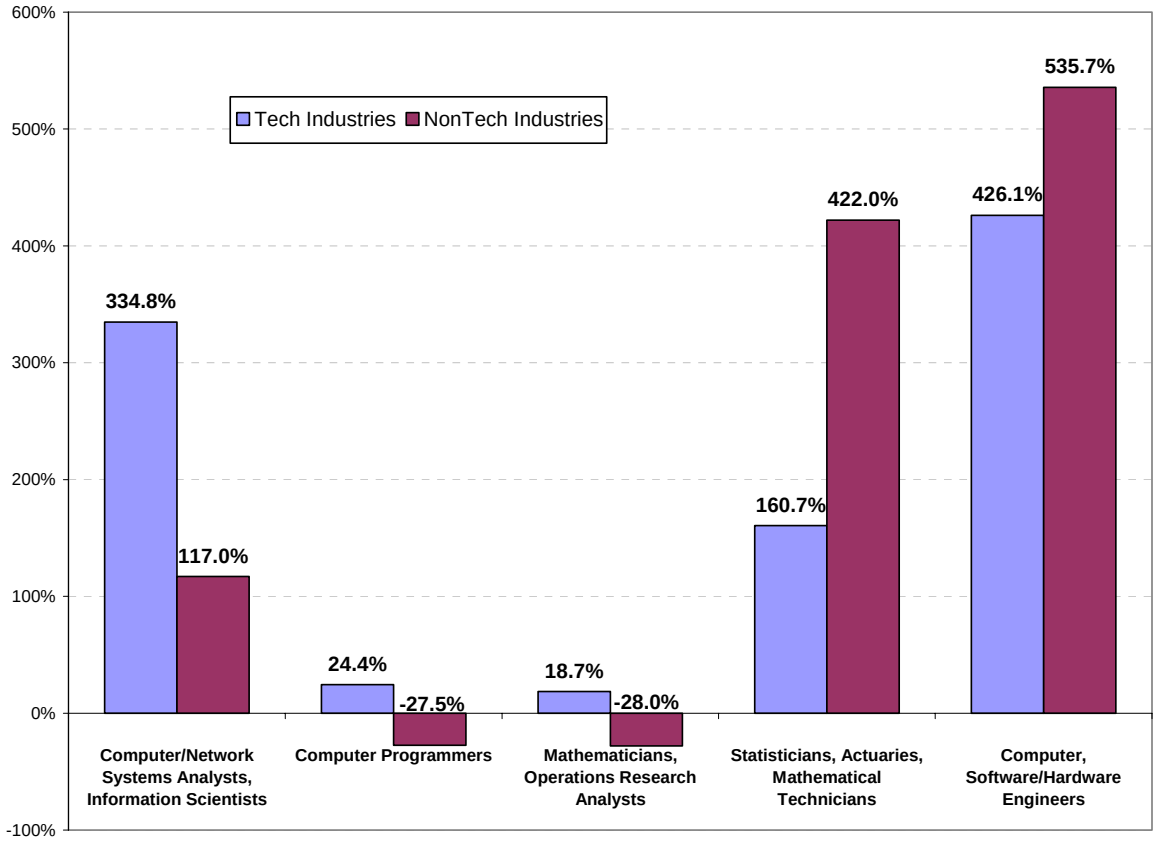
Figure 2.14 National Shares of Computer/Math Occupations in Non-Tech and Tech Industries, 1989/90 and 2001



Mortgage Banking (SIC 616) and Commercial Banking (SIC 602). The share of computer/math occupations in Motion Picture Production and Allied Services (SIC 781) expanded by 25 percent. The increases suggest that, over time, displaced tech workers may find that their job-search strategies need to encompass a wider range of industries than in the past. It also suggests that the workforce development community may need to broaden its network of employers to include more of the new sources of jobs for technical occupations.

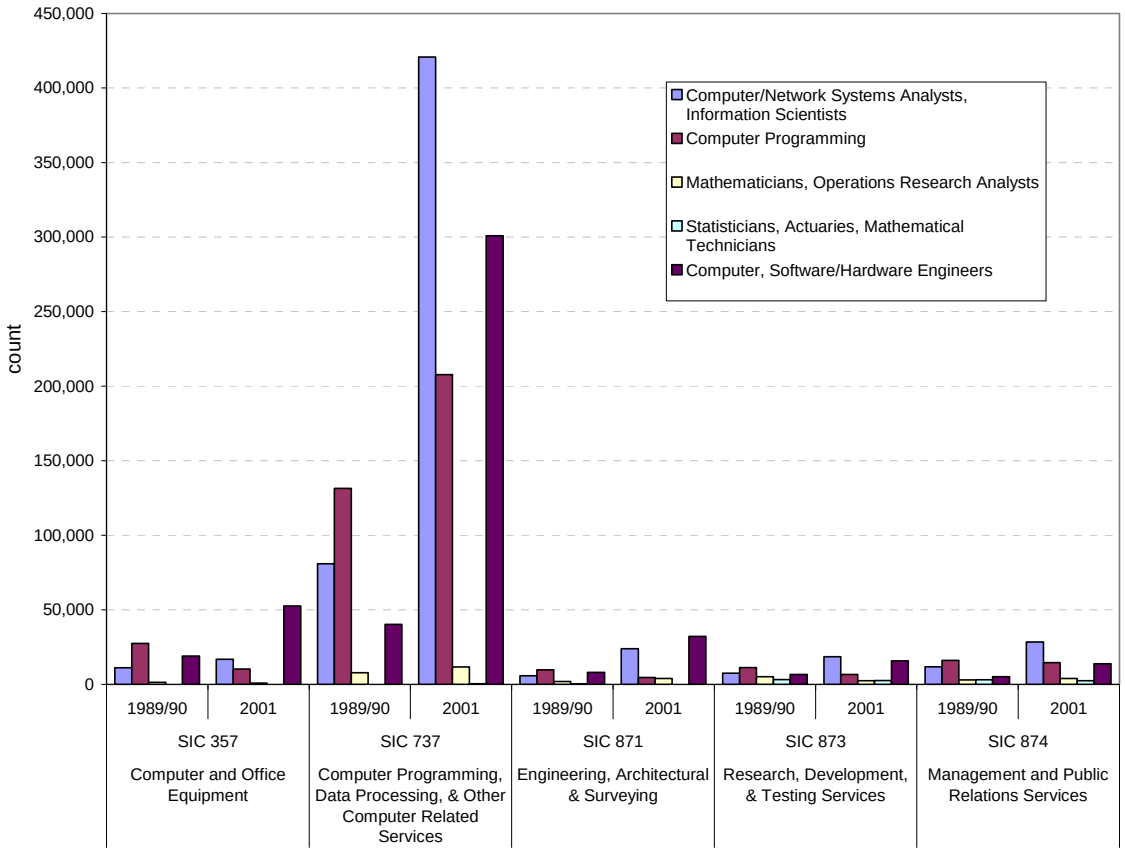
Some tech-related occupations grew rapidly during the 1990s, as illustrated in Figure 2.15. Although demand for Computer Programmers was muted, demand greatly increased for Computer Software and Hardware Engineers by over five-times in tech and more than four-times non-tech industries. The demand for Statisticians, Actuaries, Mathematical Technicians grew especially in non-tech industries. Computer and Network Systems Analysts employment shares increased more than three fold in tech industries in the last decade and more than doubled in non-tech industries.

Figure 2.15 Percentage Change in Employment in Computer/Math Occupations, 1989/90-2001



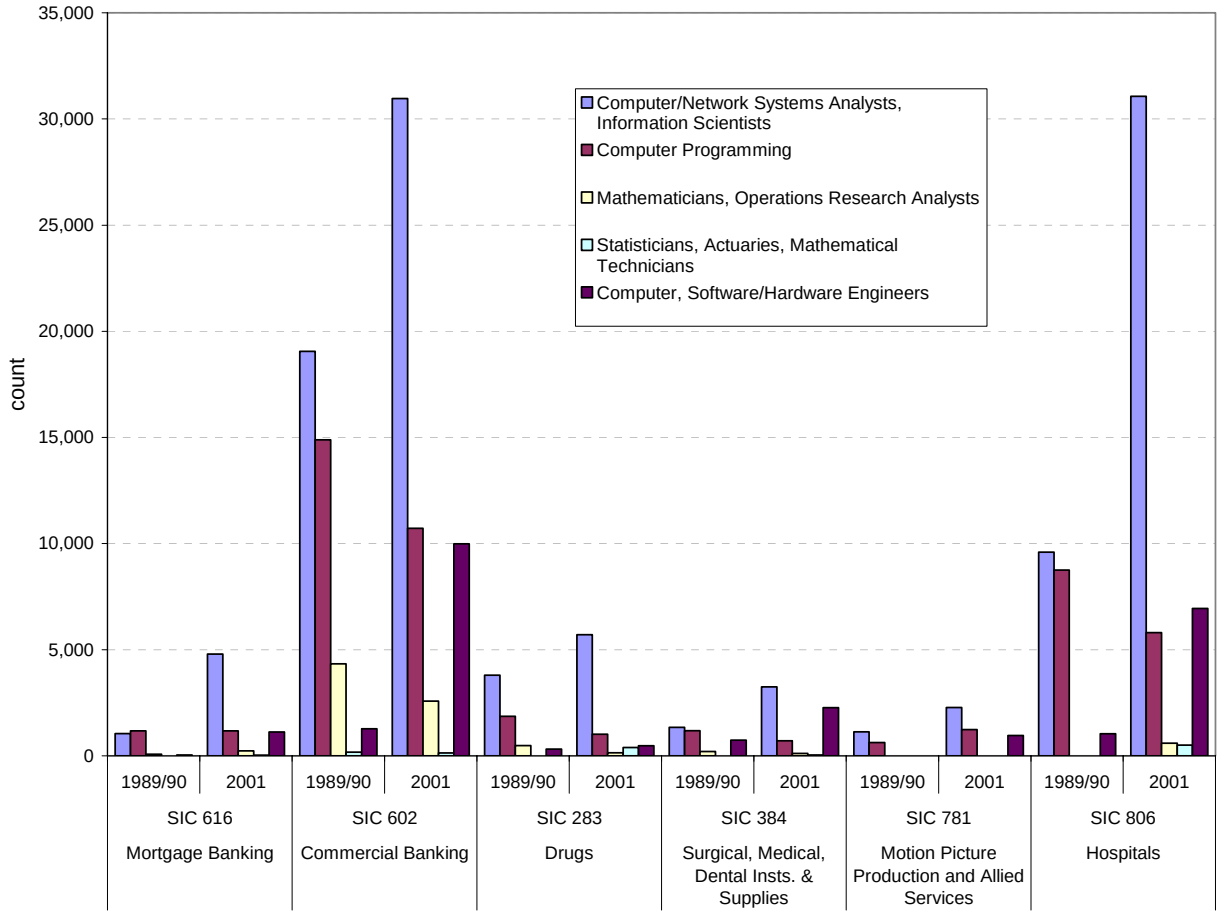
Within high-tech industries, job gains were split among occupational groups (Figure 2.16). Across all tech industries, computer hardware and software engineers witnessed the largest job gains, growing by more than sevenfold in Computer Programming, Data Processing, & Other Computer Related Services (SIC 737), and at least doubling in all other tech industries. Computer and network systems analysts also saw sizable increases in Research, Development, & Testing Services (SIC 837) and in Computer Programming, Data Processing, & Other Computer Related Services (SIC 737) over the last decade. Computer programming jobs actually decreased in all tech industries excluding Computer Programming, Data Processing, & Other Computer Related Services (SIC 737) where employment grew by almost 60 percent.

Figure 2.16 Computer/Math Occupations in High-Tech Industries



In the last decade, employment shares of computer and math occupations have expanded considerably within a number of non-tech industries. Even in the Silicon Valley region, non-tech sectors combined account for more establishments and employ more people than its high-tech sector (Zhang 2003: 57, 95). Figure 2.17 illustrates two points: first, it shows the dispersion of computer/math occupations across non-tech industries in actual numbers, and second, it shows how these numbers have changed over the course of the 1990s. As indicated in Figure 2.17, the greatest increase in demand was for network and systems analysts in non-tech industries, especially in Mortgage Banking (SIC 616) and Hospitals (SIC 806). Demand for computer hardware and software engineers increased by almost eight times in Commercial Banking (SIC 602) and by over six times in Hospitals (SIC 806). In contrast, employment in computer programming decreased in all non-tech industries except in Motion Picture Production and Allied Services (SIC 781) where employment increased from none in 1989/90 to 960 in 2001.

Figure 2.17 Computer/Math Occupations in Non-Tech Industries



Relative Rise of Small Firms Over Large Firms

One defining characteristic of the success of the region's high-tech industry has been its decentralized and specialized organization of production. In contrast to the traditional model in which every step from conception and development to production and marketing took place under one roof, the production process in Silicon Valley's high-tech industry has been decentralized, resulting in a large number of market niches served by individual, highly specialized firms.

A recent study by Zhang (2003) analyzed firm dynamics in Silicon Valley from 1990 to 2000. Using Dun & Bradstreet's firm-level NETS data, a broader definition for high tech, and a smaller geographical area of study than in this study, Zhang concludes that the region's high-tech firms do in fact start small and tend to stay small and that the employment growth during the boom can be attributed mostly to new firms. Of the 29,000 high-tech firms started in Silicon Valley[9] between 1990 and 2000, three-quarters had four or fewer employees. And contrary to the extraordinary growth of firms such as Yahoo! and eBay, most high-tech start-ups remain small (Zhang: 11). Despite the differences in data and definitions between the two studies, the picture derived from data used in Chapter 3 is consistent with the central trends described by Zhang.

[9] Zhang uses Joint Venture's definition of Silicon Valley: Santa Clara County and adjacent cities in Alameda, San Mateo and Santa Cruz Counties (2003: 81).

3 Firm Dynamics in Boom and Bust

The changes in the high-tech industry over the last business cycle can be better viewed at the firm level. New firms have played a major role in the high tech expansion and downturn, a result that emerges when we view the changes in the high-tech industry at the firm level. To do this, we have divided the tech sector into eight industry categories: Semiconductors, Computer Hardware, Electronic Components, Biomedical, Software, Internet Publishing, Computer Services, and Engineering & Scientific Services.[10] In addition to this industry classification, firms were sorted by employment size and by age.[11] The term "establishment" denotes an individual location or plant of a given firm.

3.1. High Tech at the Peak

The two bubble charts (Figures 3.1 and 3.2) depict the relative sizes of the eight industrial groups within the San Francisco Bay Area and the rest of California[12] in the first quarter of 2000. They illustrate the level of concentration of California's tech industries in the Bay Area in employment levels, establishment numbers and annual payroll. Figure 3.1 presents a snapshot of the San Francisco Bay Area's high-tech industry. The size of each bubble denotes the relative employment size of the industry segments. The y-axis shows the number of establishments in that industry. Computer Services comprise more establishments and jobs than any other high-tech industry group in the Bay Area. In fact, employment in this sector in this region (118,369) is greater than that in the rest of California combined (94,557). Semiconductors and Computer Hardware have almost equal numbers of establishments and workers, with just under 96,000 employees each. Employment in Semiconductors in the Bay Area is twice that in the rest of the state, but the number of establishments is almost equal. Employment in Semiconductors, Internet Publishing, Biomedical, Computer Services, Software, Electronic Components, and Computer Hardware is higher in the Bay Area than in all of the rest of the state. In 2000, total annual payroll[13] in Bay Area industries tended to be higher, sometimes twice as high, than elsewhere in California.

[10] The study utilizes quarterly payroll data to define the high-tech sector using six-digit NAICS (North American Industry Code System) level, based upon the definitions of the high-technology sector used by the American Electronics Association and Joint Venture: Silicon Valley Network.
[11] Age is defined by when the firm first employed workers in California; their non-California employment was not observed.
[12] "Rest of California" means all of California excluding the San Francisco, San Jose, and Oakland MSAs.
[13] Dollar figures are reported in inflation-adjusted 2000 dollars unless otherwise noted.

Figure 3.1 **San Francisco Bay Area Peak Year 2000: Employment, Establishments, Payroll (2000 Dollars)**

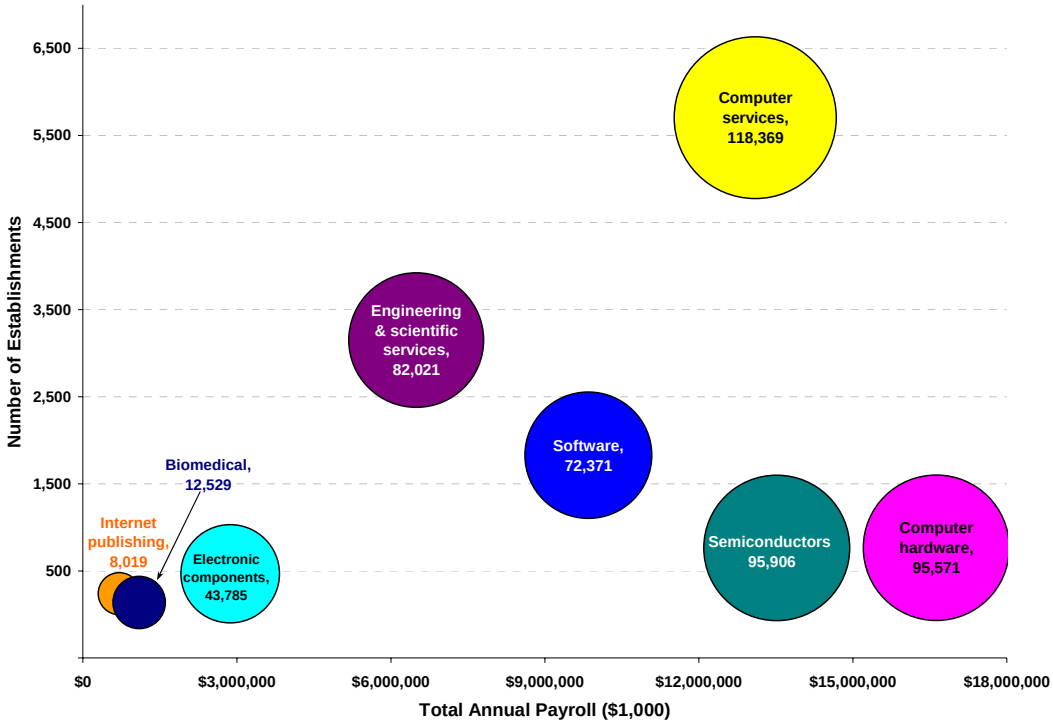
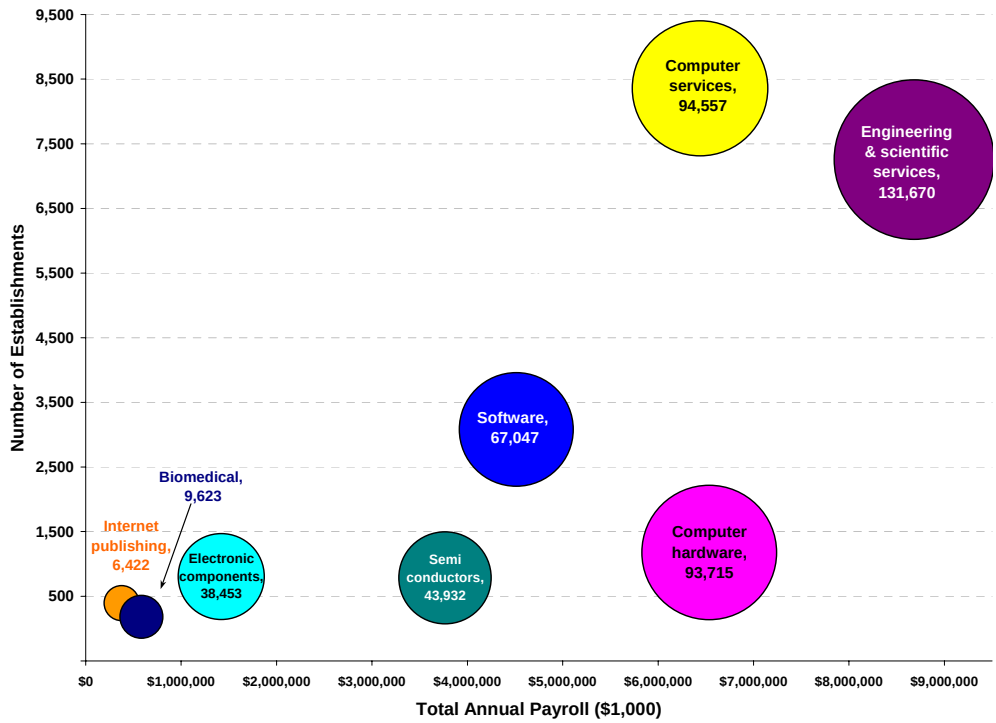


Figure 3.2 **Rest of California Peak Year 2000: Employment, Establishments, Payroll (2000 Dollars)**



3.2. Changes in High-Tech Industries in Last Business Cycle

Establishment and Employment Growth

Some of the most significant changes that took place from 1995 to 2003 are illustrated in the establishment and employment growth rates for the eight industry groups in Figures 3.3 through 3.6. The pairs of graphs, each with the Bay Area and the rest of California, show the degree of concentration of the state's high-tech industry within the Bay Area, in both employment levels and establishment numbers. These graphs illustrate the variations in growth across the eight high-tech industries in terms of numbers of plants and levels of employment relative to 1995.

Internet Publishing was by far the leader in rates of establishment and employment growth in the Bay Area as well as in the rest of the state, as shown in Figures 3.3 and 3.5. From barely existing in 1995, the number of establishments rose to nine times its 1995 level and employment rose to 25 times its 1995 level. Yet with only 8,019 employees even at its 2000 peak, Internet Publishing still only made up two percent of all tech employment in the San Francisco Bay Area in 2000. This industry category also sustained the heaviest relative losses, although the number of establishments and level of employment in 2003 still far exceeded the levels in 1995.

Because the growth rate in Internet Publishing by far surpassed the other industries, it is difficult to see the variations among the other seven tech industries in a single chart; we also include a separate set of charts (Figures 3.4 and 3.6) without Internet Publishing. As these figures show, Computer Services and Software were the other fast growers. Together these sectors accounted for about one in five Bay Area tech jobs in 1995. By 2000, they accounted for more than one in three. As with Internet Publishing, even after the contraction these industries continued to be much larger than in 1995.

Other sectors have fared worse. The number of Computer Hardware establishments steadily contracted beginning in 1999 (Figure 3.4). By 2003, employment levels in Computer Hardware, Electronic Components and Semiconductors were lower than at the outset of the boom in 1995. Though Engineering & Scientific Services experienced growth and subsequent decline, employment levels in 2003 for it and Biomedical resembled pre-boom levels in 1995. (See Appendix 2, Figure 3 for charts of employment levels by industry category and employment shares for both regions.)

Figure 3.3 **Relative Change in Number of Plants by High-Tech Industry Category**

(a) San Francisco **(b) Rest of California**

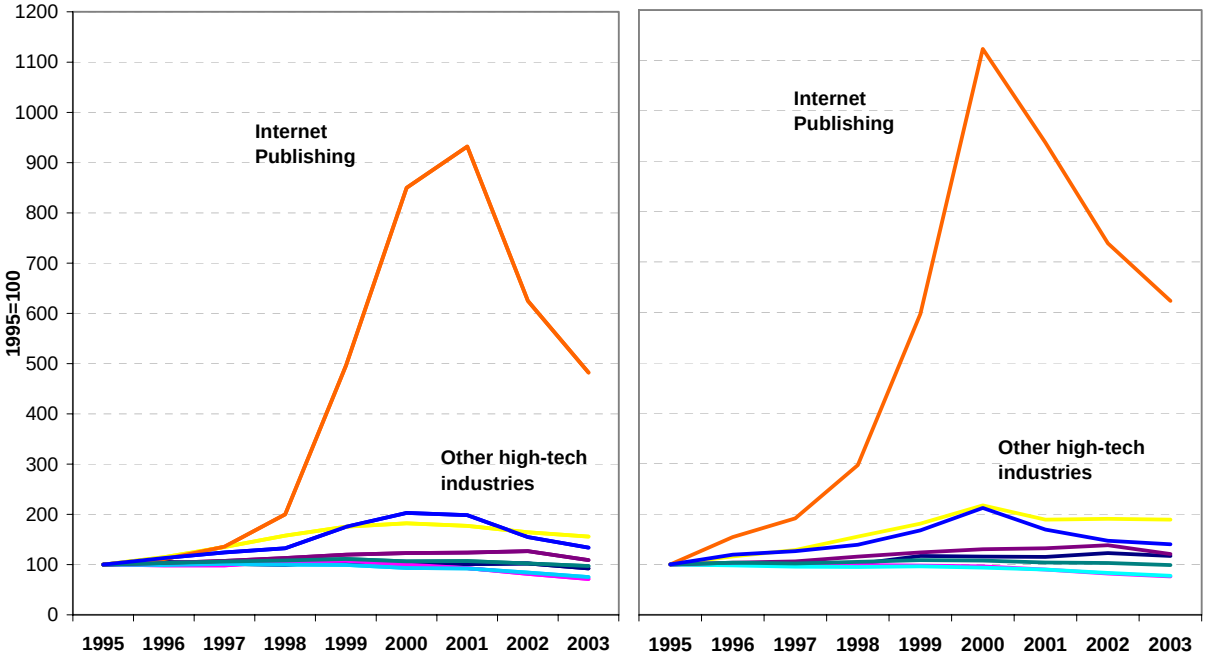


Figure 3.4 **Relative Change in Number of Plants by High-Tech Industry Category, excluding Internet Publishing**

(a) San Francisco **(b) Rest of California**

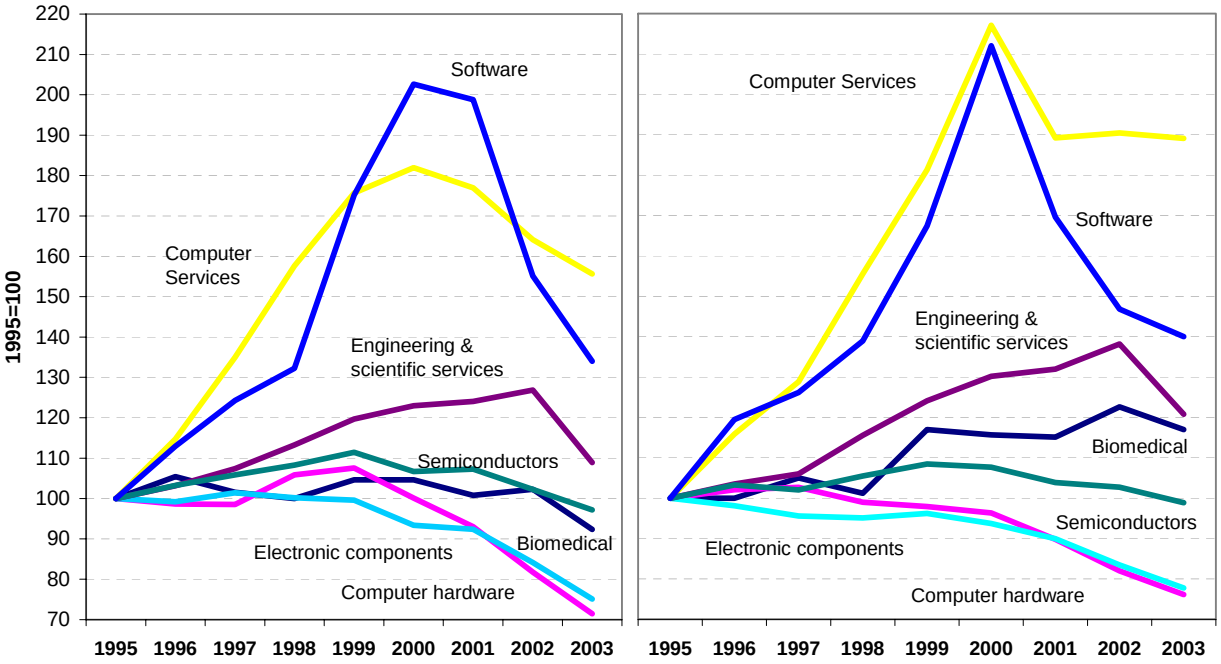


Figure 3.5 **Relative Change in Employment by High-Tech Industry Category**

(a) San Francisco **(b) Rest of California**

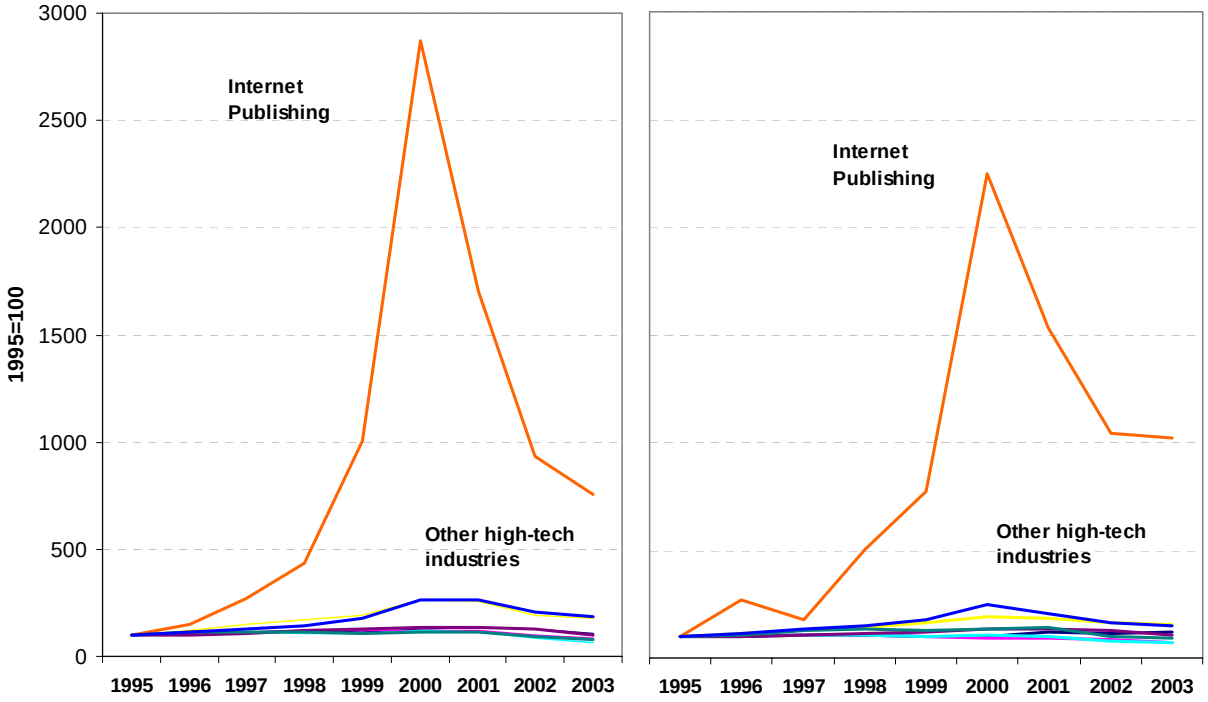
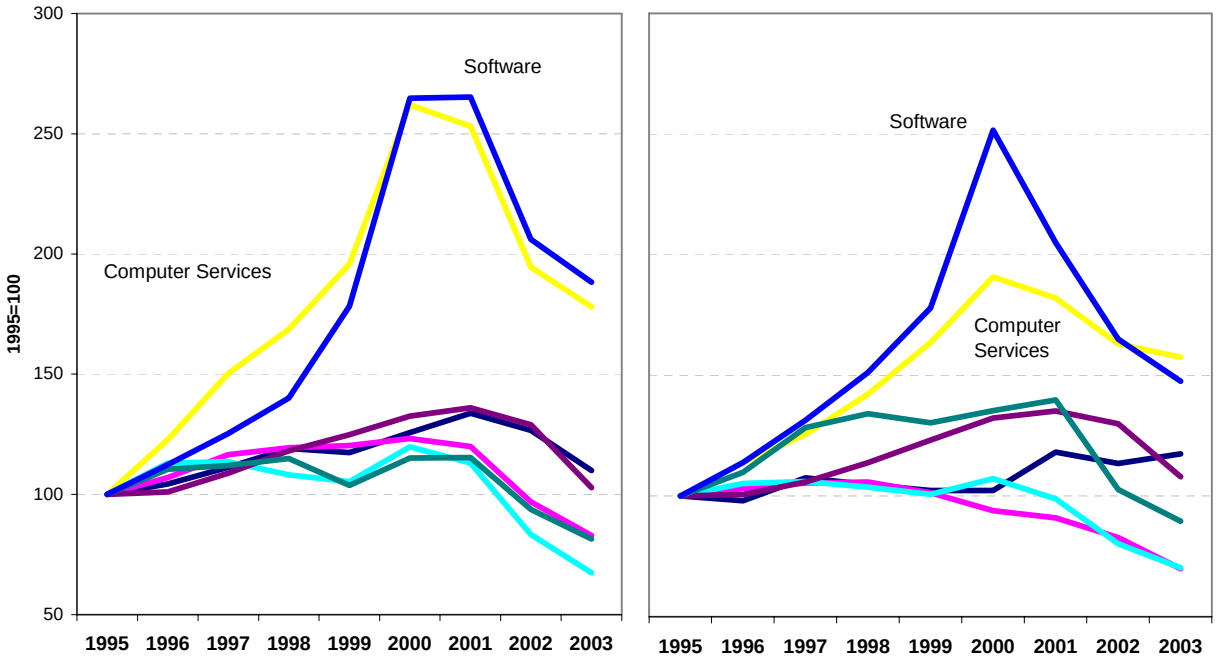


Figure 3.6 **Relative Change in Employment by High-Tech Industry Category, excluding Internet Publishing**

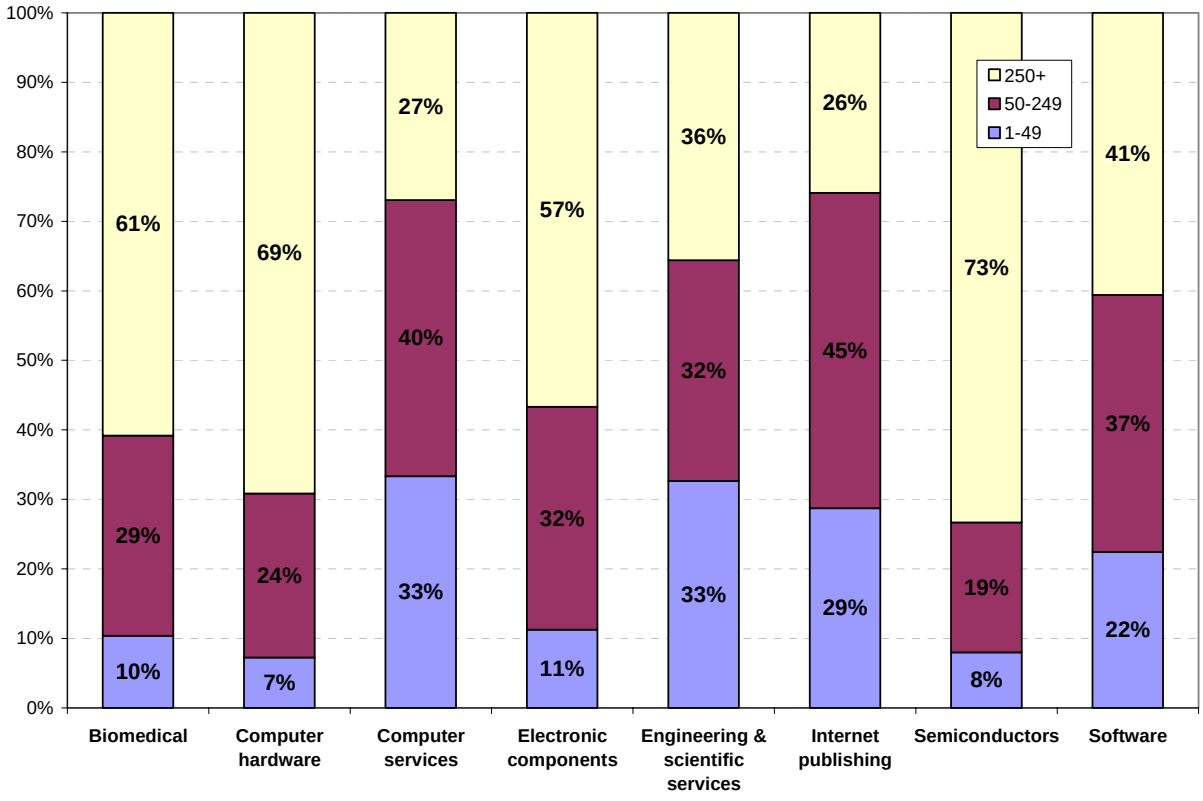
(a) San Francisco **(b) Rest of California**



Average Firm Size Is Progressively Decreasing

The share of workers within large firms varies widely by industry (Figure 3.7). In 2000, employment in the hardware industries (Computer Hardware, Semiconductors, and Electronic Components) and in Biomedical was concentrated primarily in large firms (defined as those with more than 250 employees). Roughly a quarter of employment in Computer Services and Internet Publishing was found in large firms. In contrast, nearly one-third of employment in these two industries as well as in Engineering & Scientific Services was in firms with fewer than 50 employees.

Figure 3.7 Distribution of Bay Area Employment by Firm Size, 2000



Over the course of the expansion and downturn, only Internet Publishing and Software showed significant changes in the employment distribution by firm size (Figure 3.8). In 1995, all employees in Internet Publishing firms worked in firms employing fewer than 50 people. Large firms only accounted for a significant share of employment (26%) at the peak in 2000. By 2003, there were no large firms in this sector. Even when large firms were at their peak in 2000, these large employers represented only a tiny fraction of all Internet Publishing establishments (Figure 3.9). In 2003, 93 percent of Internet Publishing establishments employed fewer than 50 people. Software was the other sector that saw a rise in large firms during the boom, with employment in large firms rising from 34 to 41 percent of all employment in this sector. Unlike Internet

Figure 3.8 **Distribution of Bay Area Employment by Firm Size in Internet Publishing and Software, 2000**

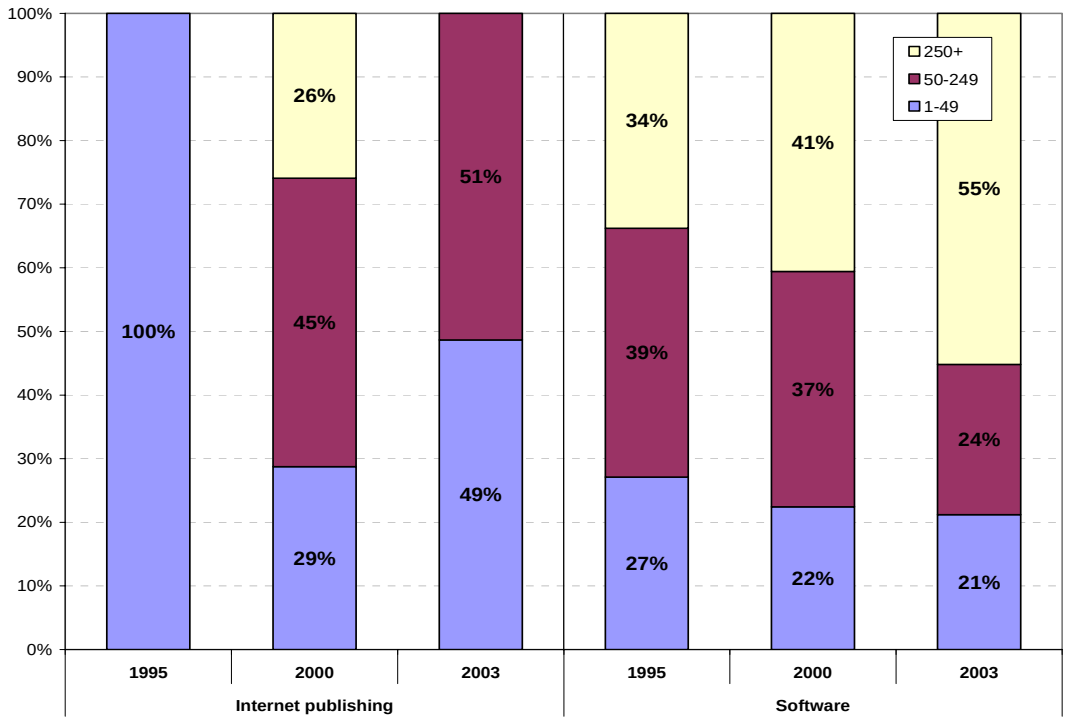


Figure 3.9 **Distribution of Bay Area Employment in Internet Publishing and Software by Establishment Size, 2000**

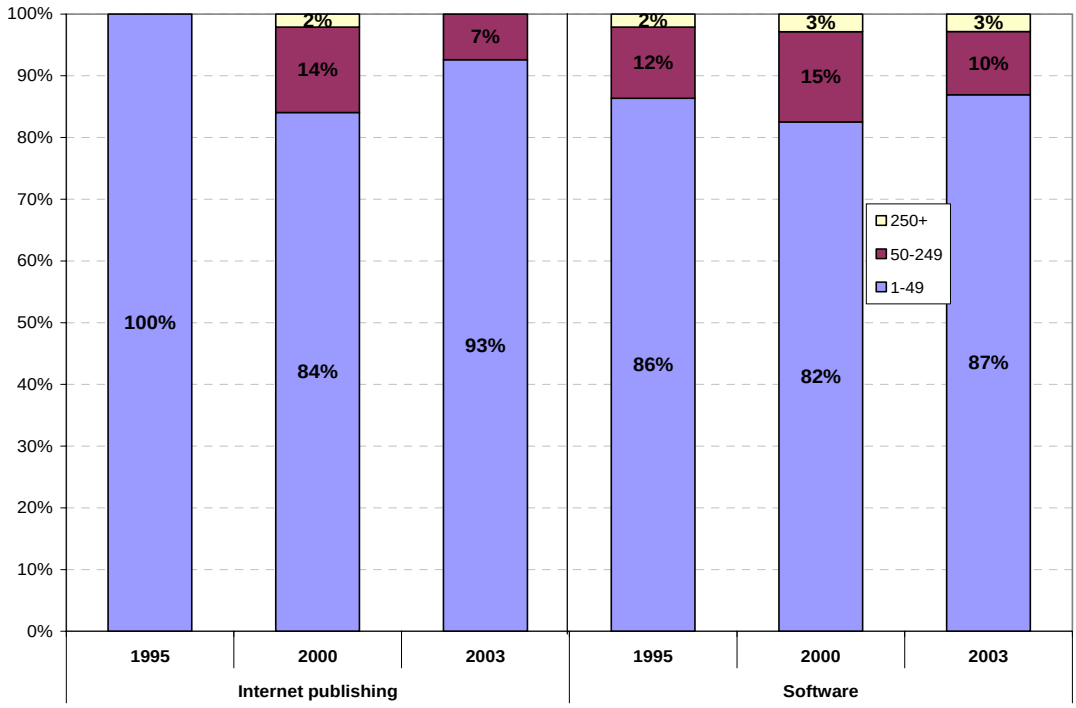
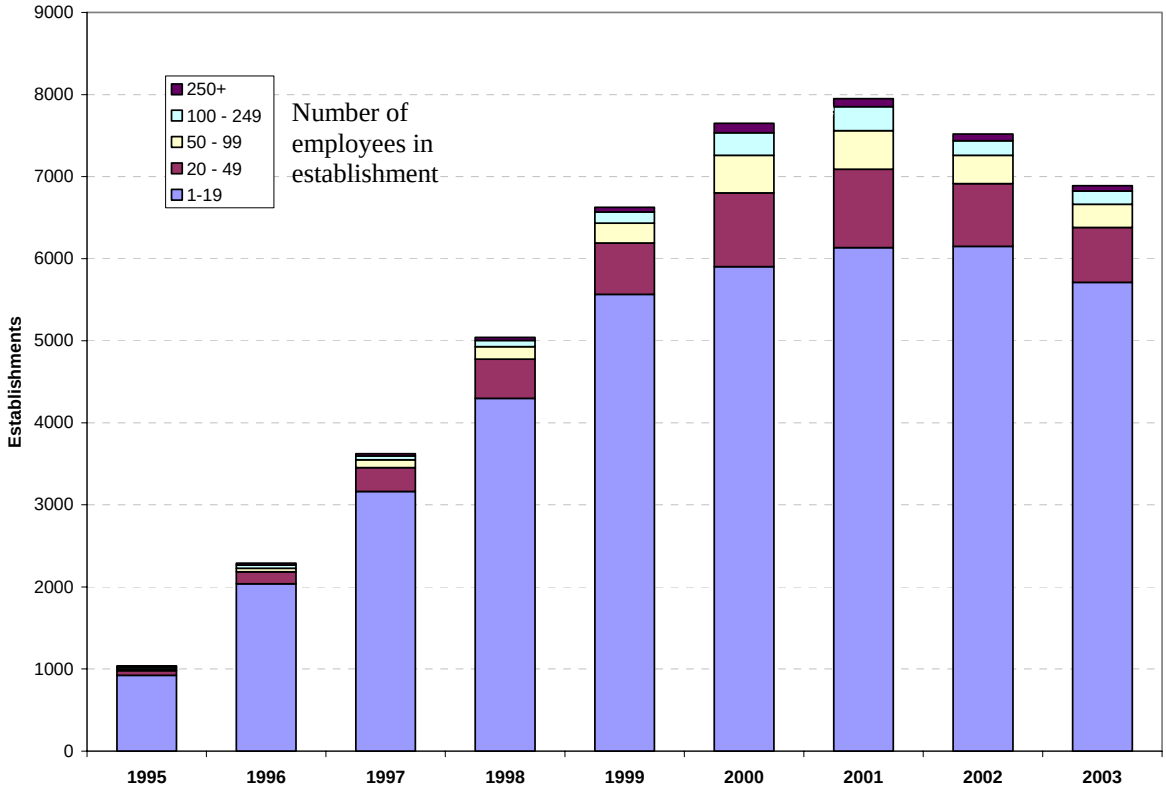


Figure 3.10 Distribution of Establishments by Employment Size, New Firms



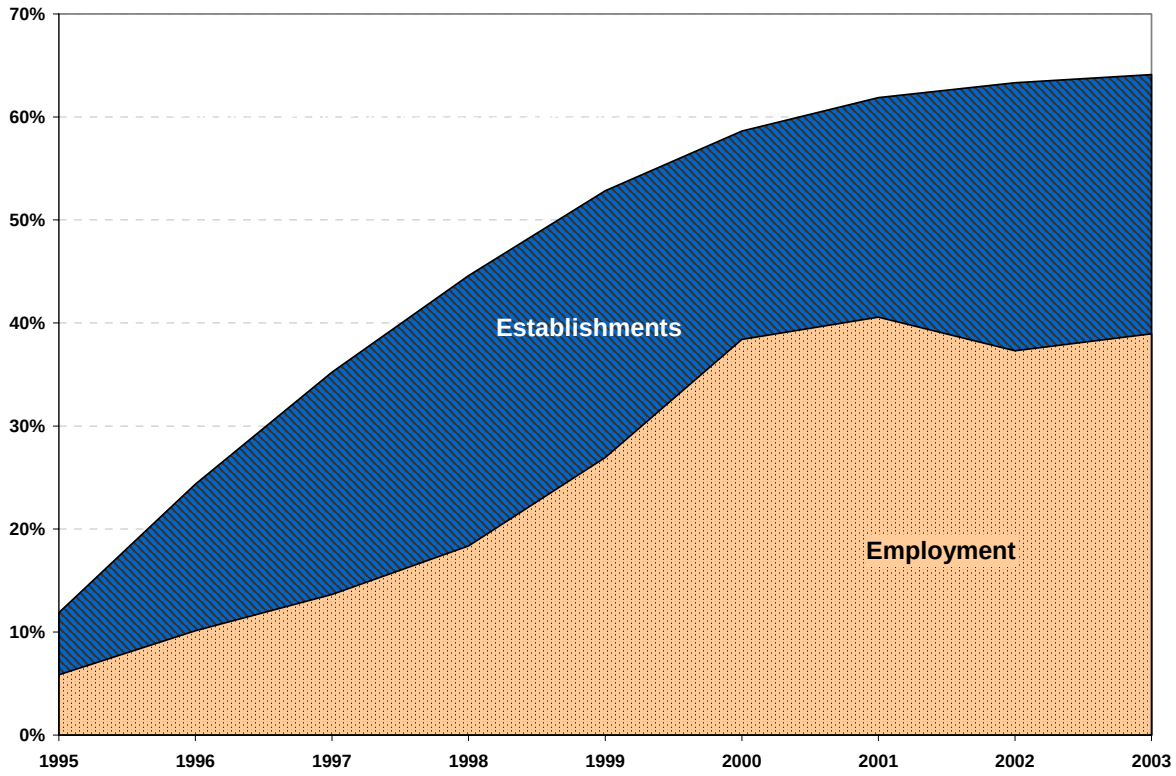
Publishing, this trend has continued: in 2003, 55 percent of Software employment was in large firms. Like Internet Publishing, however, these large firms remain a small fraction of all establishments. Firms established during the expansion, in general, started small and have remained small, most with fewer than 20 employees (Figure 3.10).[14]

[14] A similar result found by Zhang (2003).

3.3. New Firm Growth

The growth experienced in the last business cycle was driven by growth in both establishments and employment on the part of relatively young firms. New firms (i.e., started since 1995) have grown considerably as a share of total high-tech firms in the region, and account for most of the birth and death activity in the period from 1995 to 2003 (Figure 3.11). In 1995, almost twelve percent of establishments and six percent of employment were in firms founded in that year. The contribution of new firms later expanded to sixty-four percent of all tech establishments. The share of employment in new firms peaked at over 40 percent in 2001 and fell just one percentage point to 39 percent in 2003. New firms also accounted for most of the birth and death activity (i.e. establishment openings and closures) in the period from 1995 to 2003.

Figure 3.11 Establishments and Employment from New Firms as Percentage of Total High-Tech Establishments and Employment. San Francisco Bay Area, 1995-2003



Establishment Birth and Death Rates

The extent to which new firms outpaced old firms in establishment births is depicted in Figure 3.12. Also displayed in this figure is that the birth rate of new establishments peaked already in 1998, two years before the onset of the downturn. For all firms, Internet Publishing out-paced all other industries in establishment birth rates (Figure 3.13). Computer Software had the next highest establishment birth rate, and both peaked in 1999. Looking exclusively at new firms (firms established 1995 or later), after Internet Publishing, firm expansion in terms of new establishments was greatest for Software and Computer Services firms (Figure 3.14).

Figure 3.12 Establishment Birth Rate, High-Tech Industry, San Francisco Bay Area

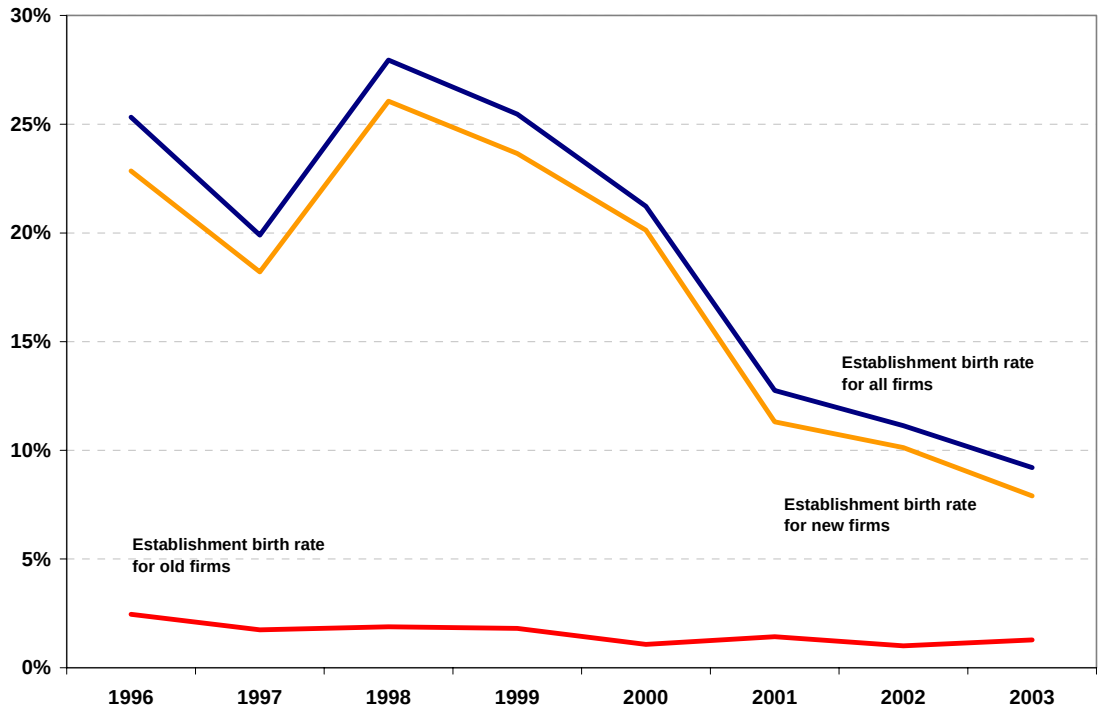


Figure 3.13 Establishment Birth Rate by High-Tech Industry Category

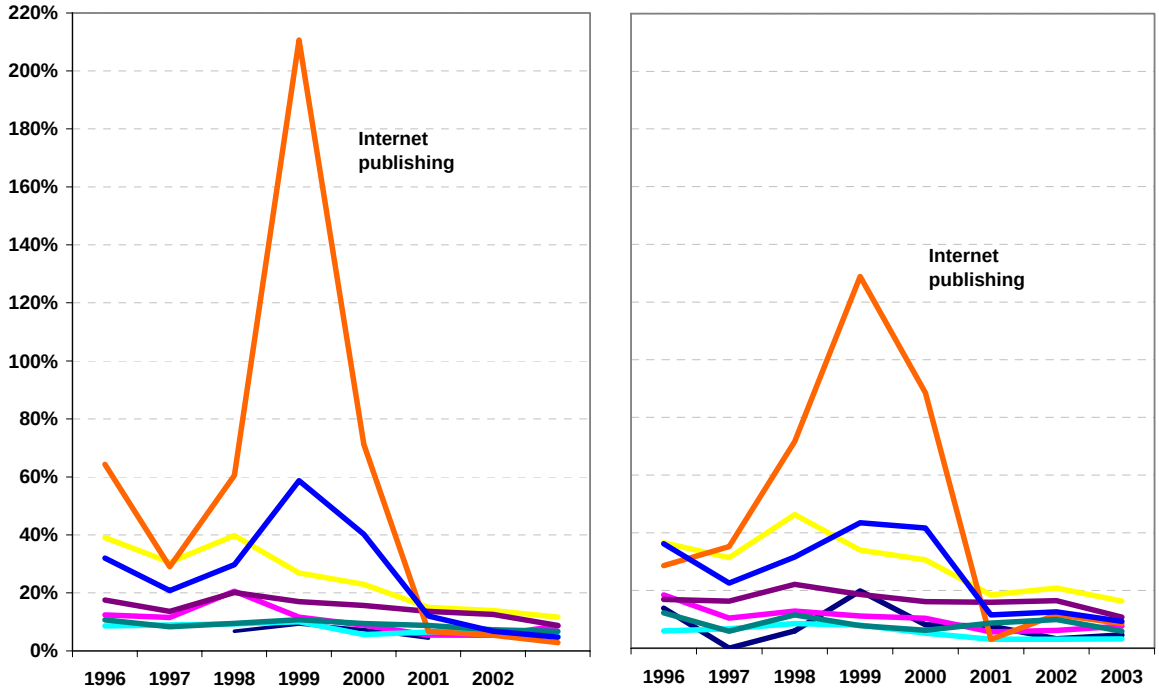


Figure 3.14 New Establishment Birth Rates by High-Tech Industry excluding Internet Publishing

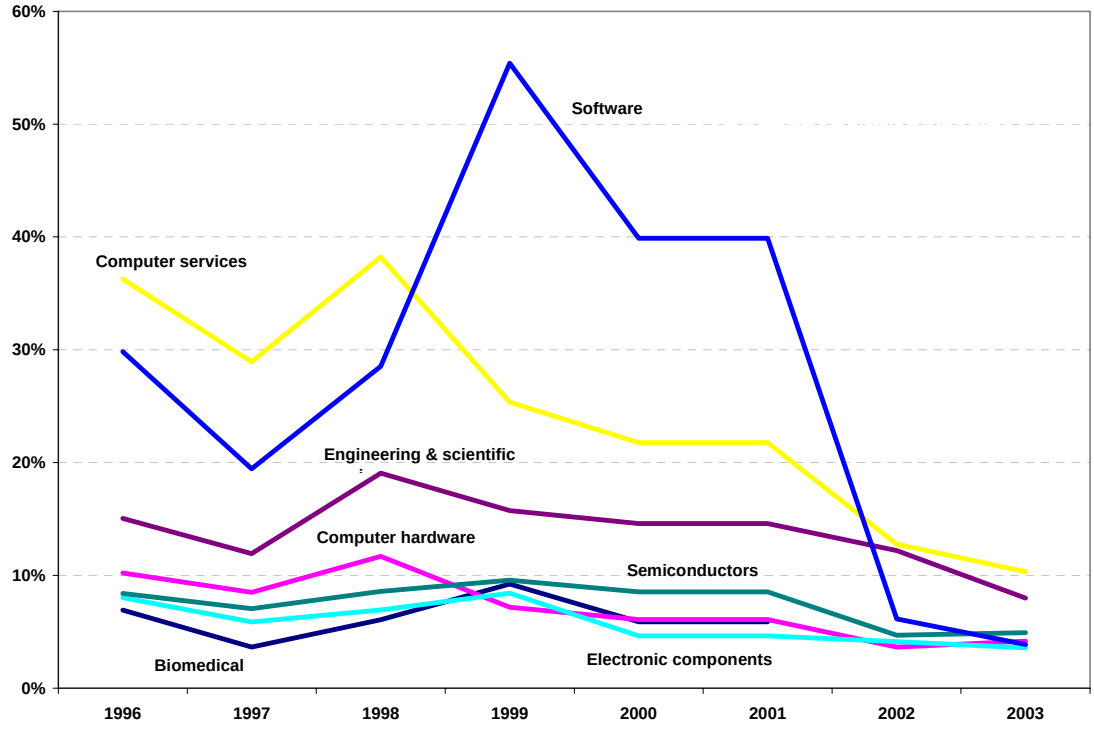
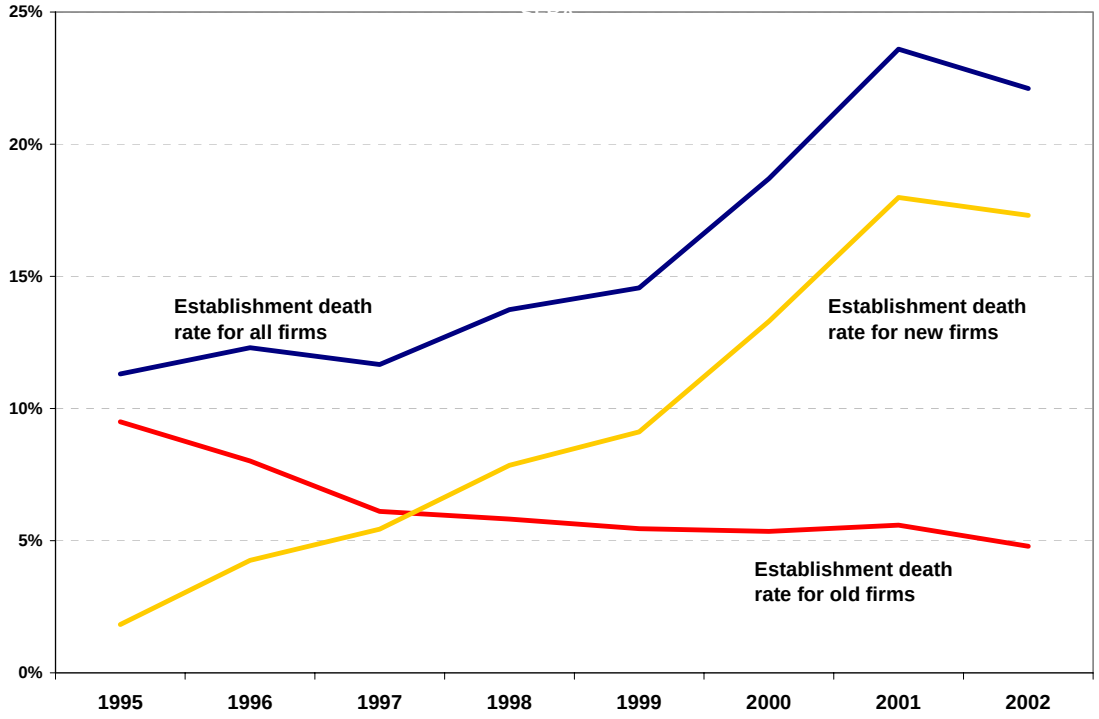


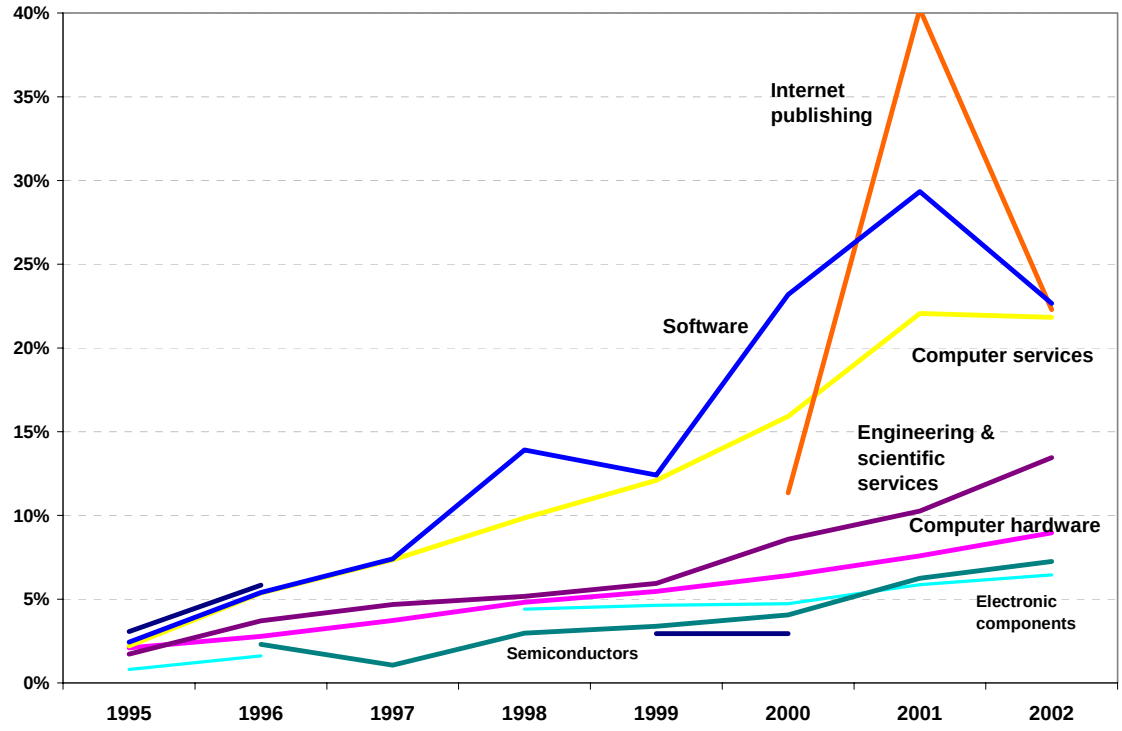
Figure 3.15 Establishment Death Rate, High-Tech Industry, San Francisco Bay Area



Though old firms accounted for most of employment losses, their establishment death rate was far lower than that of new firms. Before 1997, old firms had a higher rate of contraction through establishment closures than new firms; after 1997, new firms accounted for most establishment closures. Between 1995 and 2003, new firm death rates increased steadily for most industries (Figure 3.15). Visible in Figure 3.16, the three tech categories with the highest birth rates, Internet Publishing, Software and Computer Services, also had the highest establishment closure rates. The death rates of the top three peaked in 2001 while death rates for the other industries continued on a slow incline.[15]

[15] The rate of employment loss due to establishment closures increased dramatically for Internet Publishing in 2001 and moderately for Electronic Components, Software and Computer Services. By 2002, the rate of employment loss was only on the rise for Biomedical. See Appendix 2, Figure 1.

Figure 3.16 Establishment Death Rate for New Firms, High-Tech Industry, San Francisco Bay Area



For all firms, although Computer Hardware establishments have fallen in number steadily since 2000, it is the only industry (of the eight tech categories) in 2003 to have employment gains through establishment births outpace losses due to establishment closures (Figure 3.17). See Appendix 2, Figures 4 through 8 for similar graphs displaying employment gains through establishment births (in first year with positive wages), employment losses through establishment closures (from previous year), and numbers of establishments by year for each tech industry for Semiconductors, Electronic Components, Software, Engineering & Scientific Services, and Computer Services.

Figure 3.17 Computer Hardware Employment: Growth due to Establishment Births, Loss due to Establishment Closures

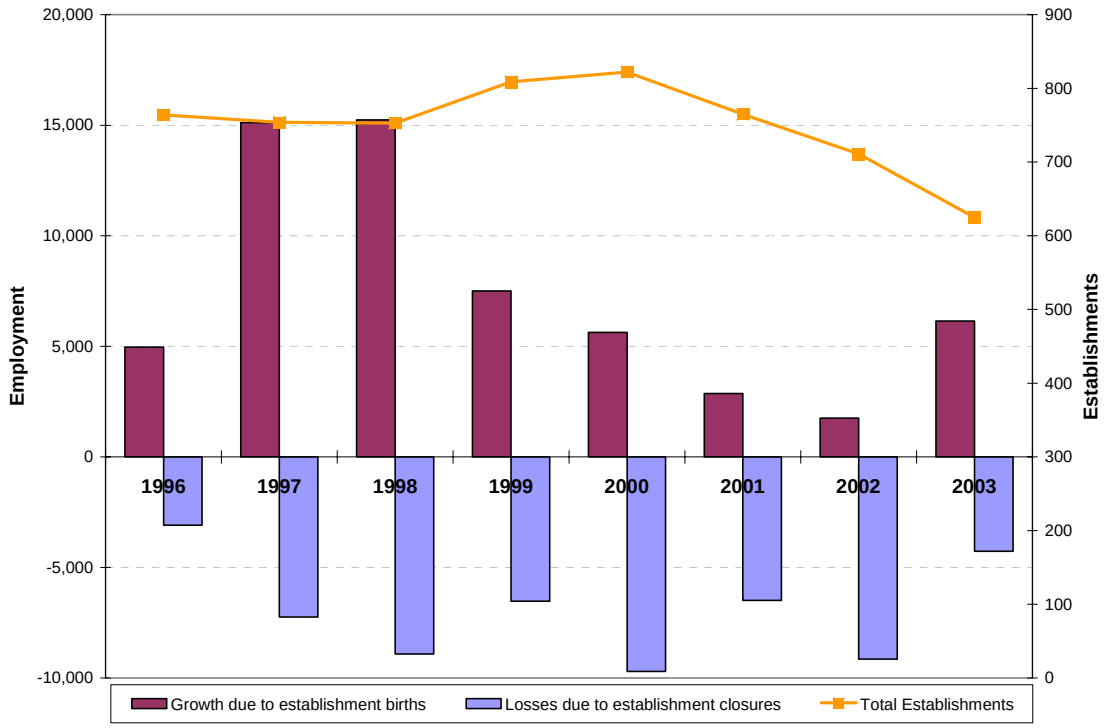
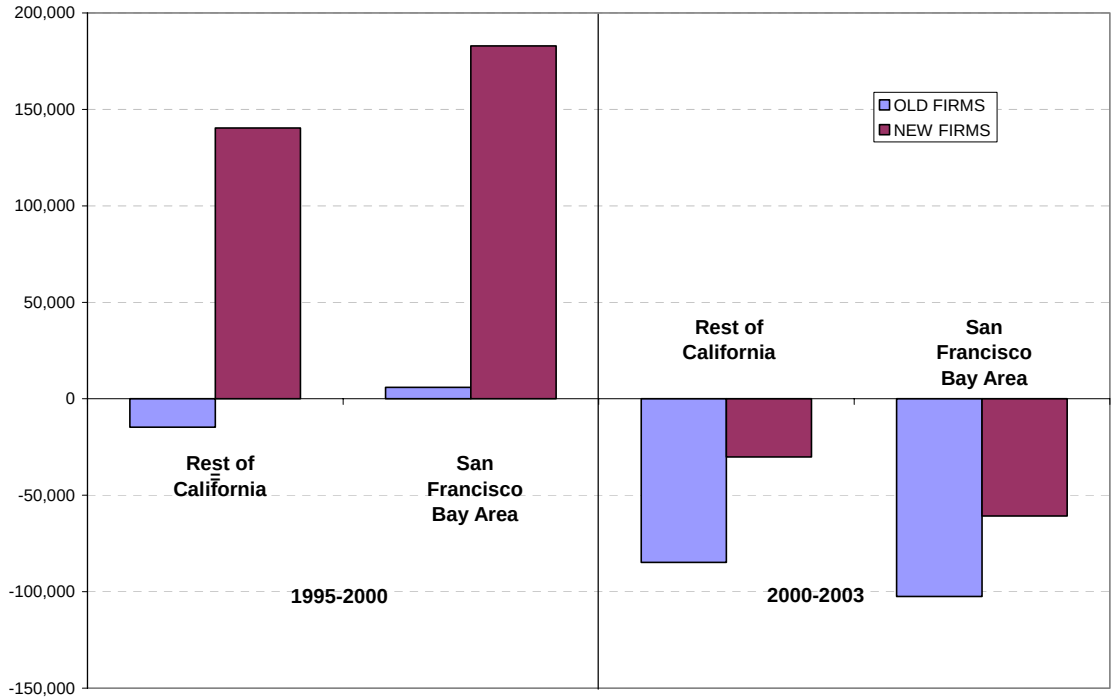


Figure 3.18 Employment Change in the San Francisco Bay Area and the Rest of California

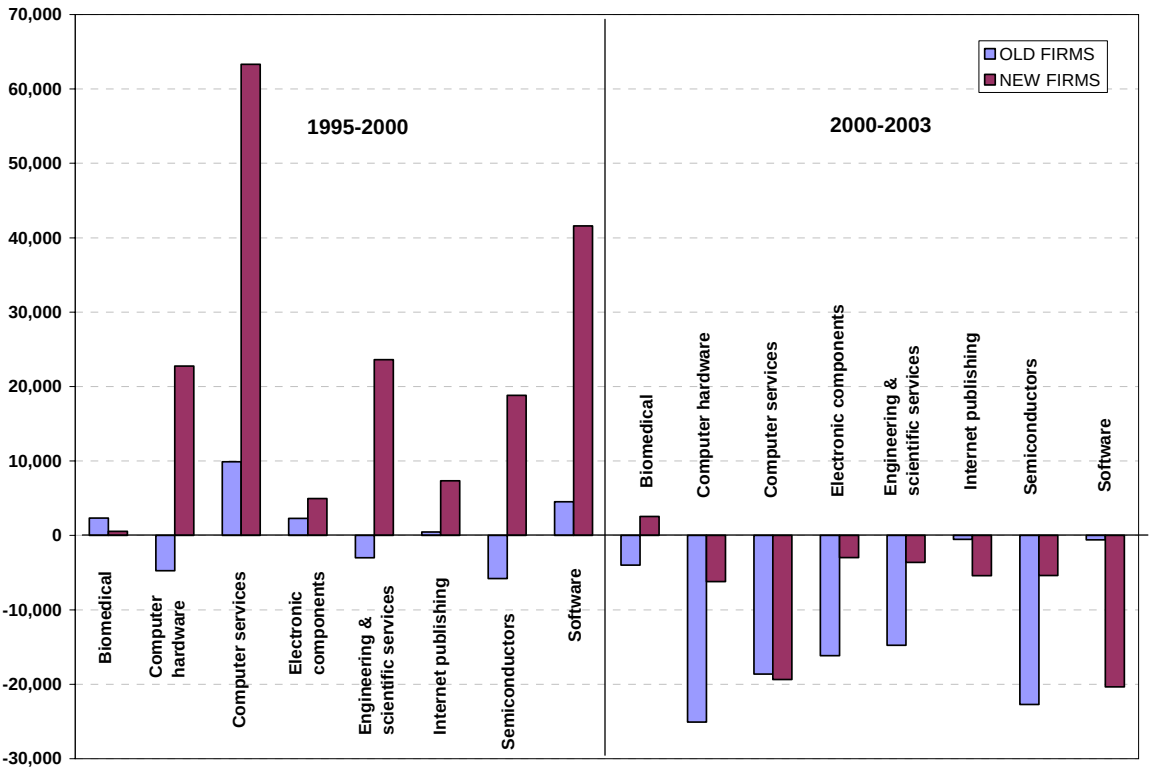


New Firm Employment

In the San Francisco Bay Area as well as in the rest of California, new firms accounted for more employment gains during the boom, and old firms for more of the losses during the bust. Gains and losses were both greater in the Bay Area than the in rest of California (Figure 3.18). Figures 3.19 and 3.20 demonstrate the variations by industry in employment change in old and new firms for each period for each of the two regions. In the Bay Area, only in Computer Services, Internet Publishing and Software did employment losses from new firms out-pace those from old firms (Figure 3.19). For the rest of California, old firms in Computer Hardware bore severe losses during the boom. New firms in Engineering & Scientific Services faired relatively better than in the Bay Area (Figure 3.20).

Most job gains occurred in new firms, and employment in new firms remained a large share in 2003. This holds for the all of California, although both gains and losses were greater in the Bay Area. The bars in Figure 3.21 represent employment levels by industry in 1995, 2000, and 2003. The upper portions of the bars in 2003 show the significant employment shares still attributable to new firms after the bust. The trend illustrated here supports the conclusion by Zhang and others that the growth of the boom was powered by new firms.[16]

Figure 3.19 Employment Change by High-Tech Industry Category, San Francisco Bay Area



[16] As described earlier, exact comparisons are not possible because of dissimilar datasets, geographical areas of study, time frame, and tech definitions. "During 1998-2001, start-ups younger than age five consistently accounted for more than 20 percent of high-tech employment in Silicon Valley" (Zhang 2003: 28).

Figure3.20 Employment Change by High-Tech Industry Category, Rest of California

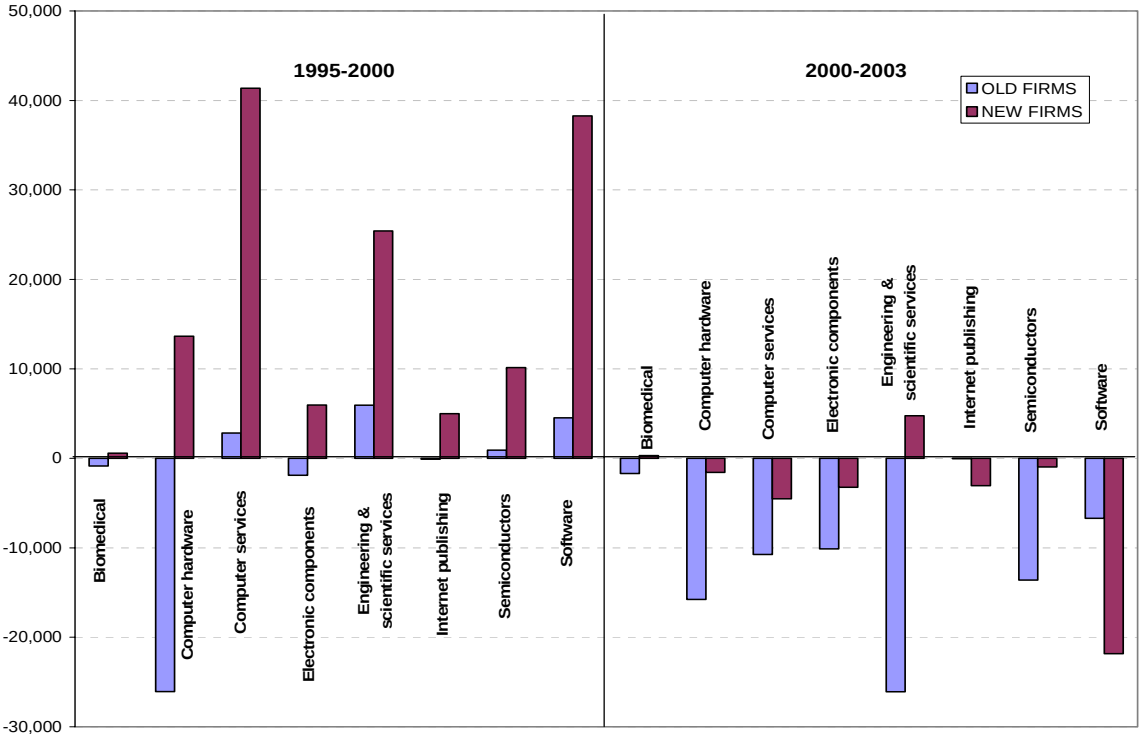
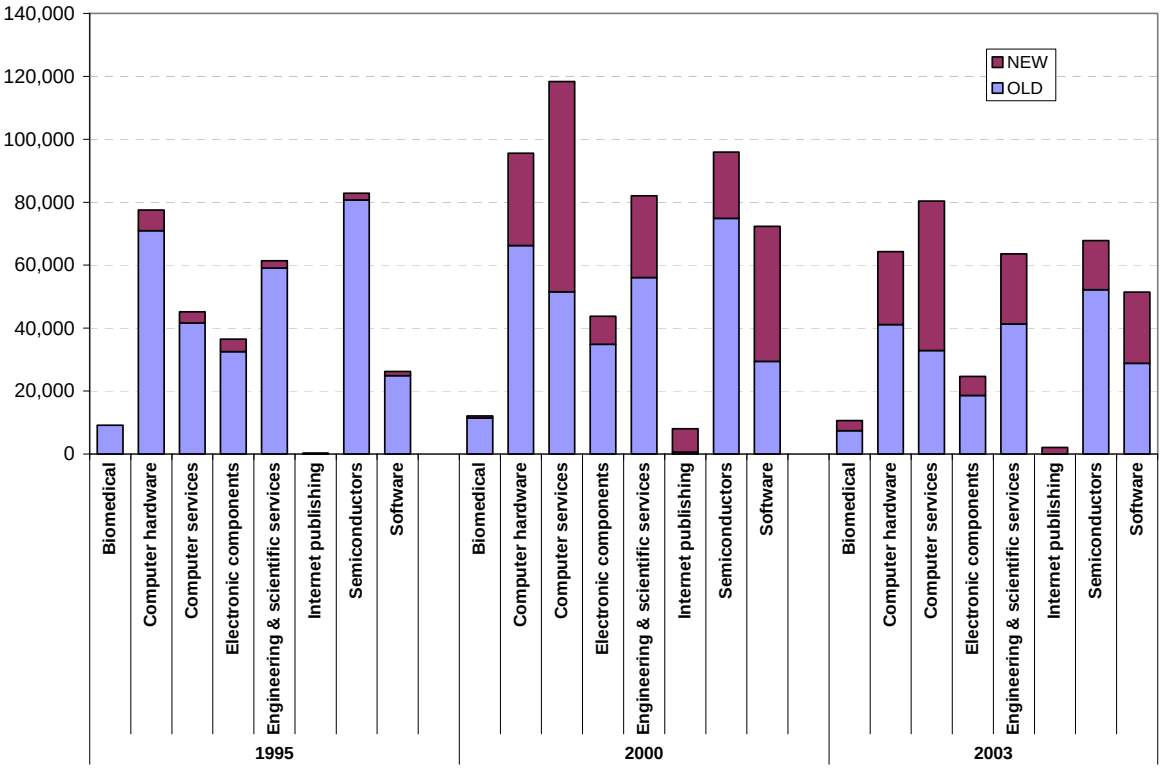


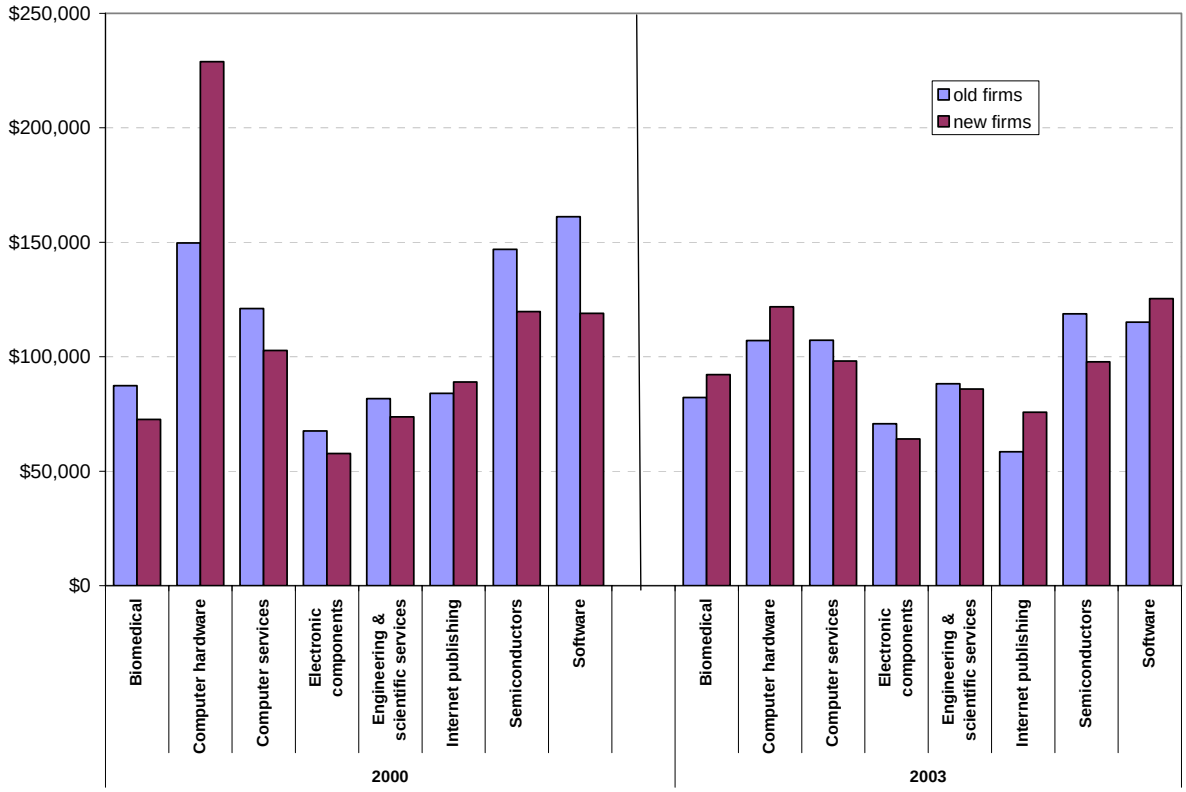
Figure 3.21 Employment by High-Tech Industry Category of Old and New Firms



3.4. Wages

Comparing wages of new and old firms, new firms are now paying slightly more than older firms. Wage data include base salary, bonuses, and any stock options. The bars in Figure 3.22 represent average wage levels for old and new firms by industry in 2000 and 2003. In 2000, old firms were paying slightly more than new firms. The most extreme exception is seen in Computer Hardware, where new firms out paid old firms by a considerable margin. By 2003, wage differences between old and new firms decreased in general and wages in new firms increased slightly over old firms.

Figure 3.22 Average Wages of Old and New Firms, San Francisco Bay Area



Mean wages in new firm Computer Hardware establishments peaked in 2000, twice as high as other high-tech industries, and subsequently fell the most dramatically in 2001. Software and Semiconductors also experienced decreases, while mean wages leveled out for the most part in Computer Services, Electronic Components, Engineering & Scientific Services, Internet Publishing, and Biomedical. By 2003, mean wages were up again in all areas except Internet Publishing. (However, numbers of observations for Internet Publishing are often small and are therefore suppressed.)

4 Worker Dynamics in Boom and Bust

The core aim of this study is to determine what happened to tech workers after the rapid decline in Silicon Valley's labor market. Since we commonly count these employment losses relative to the peak, we focus our analysis of individual workers on the cohort that was employed in California's high-tech sector in the first quarter of 2000.[17] We examine the employment histories of these almost one million workers from 1995 to 2003. In addition to their wage records, we also analyze unemployment claims for workers in this cohort. As before, we examine not just high tech as a whole, but also the eight industry categories introduced earlier. The eight industry categories varied in terms of inter-industry linkages, turnover, and the fates of their workers through 2003.

4.1. Tech Worker Sample

In order to identify what happened to the tech workers after the downturn and avoid confounding the results with the influence of tech jobs held before or after the peak in 2000, we focused most of our analysis of individual workers on the cohort that was employed in California's high-tech sector in the first quarter of 2000. Given the quarterly nature of the wage data, workers can only be unambiguously defined as far as their industry of employment in a given quarter. By defining our cohort as those employed in a tech industry in the first quarter of 2000, we have a consistent group of workers to follow.[18] We define a worker's industry as that of the worker's "primary employer." In any given quarter, a significant share of workers is paid by more than one employer. To precisely define workers' industry, we define a worker's primary employer as the firm that paid the most wages to that worker.

We began the wage analysis with any worker who had ever had wages from California firms in our definition of the tech industry between the first quarter of 1995 and the fourth quarter of 2003. This broad definition ensured that we had all workers with any connection to the industry, but left a population that included many workers with a very tangential relationship to the industry. We next applied a series of filters to narrow the group of workers being analyzed to those with at least a year of employment in the tech industry (as well as other technical adjustments).[19]

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[17] As explained earlier, wage records are linked to the employer, and one cannot link a worker's wage record to a specific establishment within a multi-establishment firm. Since multi-establishment firms are commonly located in more than one region, wage records for such a firm cannot be unambiguously linked to a particular region. For this reason, the core tech worker analysis covers tech wages from firms for the entire state. Regional comparisons are made in Chapter 5.

[18] Slight differences in the cohort's definition were examined, such as all of 2000 or later quarters within that year, and the summary statistics were little altered.

[19] To correct for erroneous personal identifiers, we omitted all records that showed more than 10 employers in any one quarter. And to filter out summer internships and other intermittent work, records with fewer than four quarters of wages were dropped as well as records with fewer than four quarters of tech wages. Those who never earned more than $3000 in a quarter, the equivalent of below minimum wage for full-time, full-quarter workers were dropped from our sample. Those who earned more than $100,000 on an average across all of their employed quarters were likewise not included, mainly due to confidentiality issues.

The table in Figure 4.1 lists the exclusion rules used to define our core tech worker sample and the number of workers affected by each rule. The filtering rules brought the sample of those with California tech earnings between 1995 and 2003 to two million. Once we further restricted the analysis to those with tech-firm earnings in the first quarter of 2000, we obtained a final sample of just under a million California tech workers. Most of the analysis discussed in the remainder of the report concerns this group. The wage records used in this analysis report earnings that include all wages and bonuses, and some stock options, by each employer within the quarter.[20] The employer link allows us to describe the worker's industry as well as age and size of primary employer. See Methodology for a more detailed discussion of file construction and specific methodology employed. The approach used here closely follows the methodology used in prior studies by the author(s) of displaced aerospace industry workers and a profile of the entertainment industry's workforce.

Figure 4.1 Exclusion Rules for Tech Worker Sample

Original sample – anyone with California tech wages between 1995 and 2003	**3,327,966**
EXCLUDE THOSE WITH	
>10 employers in any quarter	**-8,166**
<4 quarters of wages	**-277,970**
<4 quarters of tech industry wages	**-952,660**
Never earned >$3000 in a quarter	**-14,748**
Earned >$100,000 in average quarter	**-13,616**
Those with tech earnings, 1995-2003	**2,060,806**
Those with tech earnings in Quarter 1, 2000	**972,552**

[20] We attempted to get a more specific definition of the types of stock options that were and were not covered, but were unable to get sufficient clarity to describe any further than the fact that "some" of the exercised stock options are included in the wage records reported by employers.

4.2. Inter-Industry Flows

The patterns of inter-industry employment flows help to explain the wage and employment outcomes of tech workers after 2000. The three bars in Figure 4.2 illustrate these inter-industry flows. The center bar represents the nearly million-worker sample, all employed in tech in 2000. By 2003 only half of the 2000 tech workforce remained in tech in California (blue represents those remaining in their 2000 industry and red, those remaining in tech but in a different tech category). As the top portion of the left bar shows, over 30 percent of our peak tech workforce was not in the California workforce in 1995 – meaning they had either come from out-of-state or just entered the workforce – and almost as many left California wage records again in the downturn (top portion of right bar). This was also so for tech workers entering and leaving non-tech industries. Similar shares of the 2000 tech workforce had worked in non-tech (yellow) in 1995 as entered non-tech industries in 2003.

Figure 4.2 Inter-Industry Flows of Tech Worker Sample

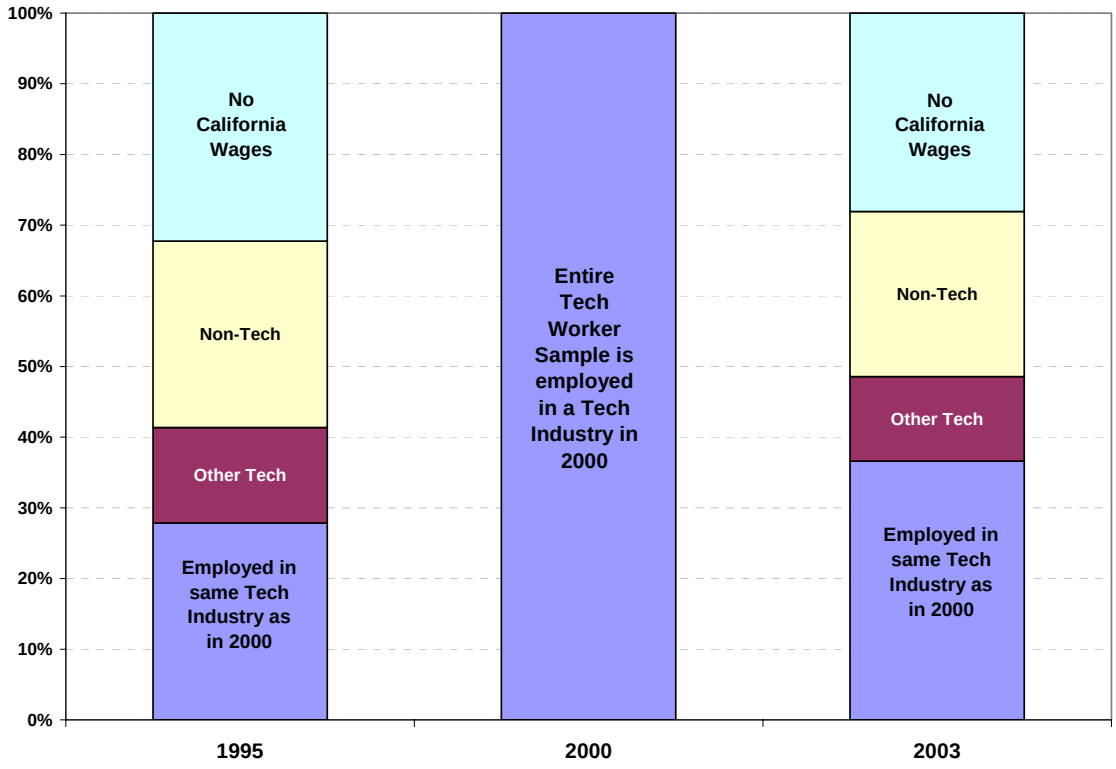
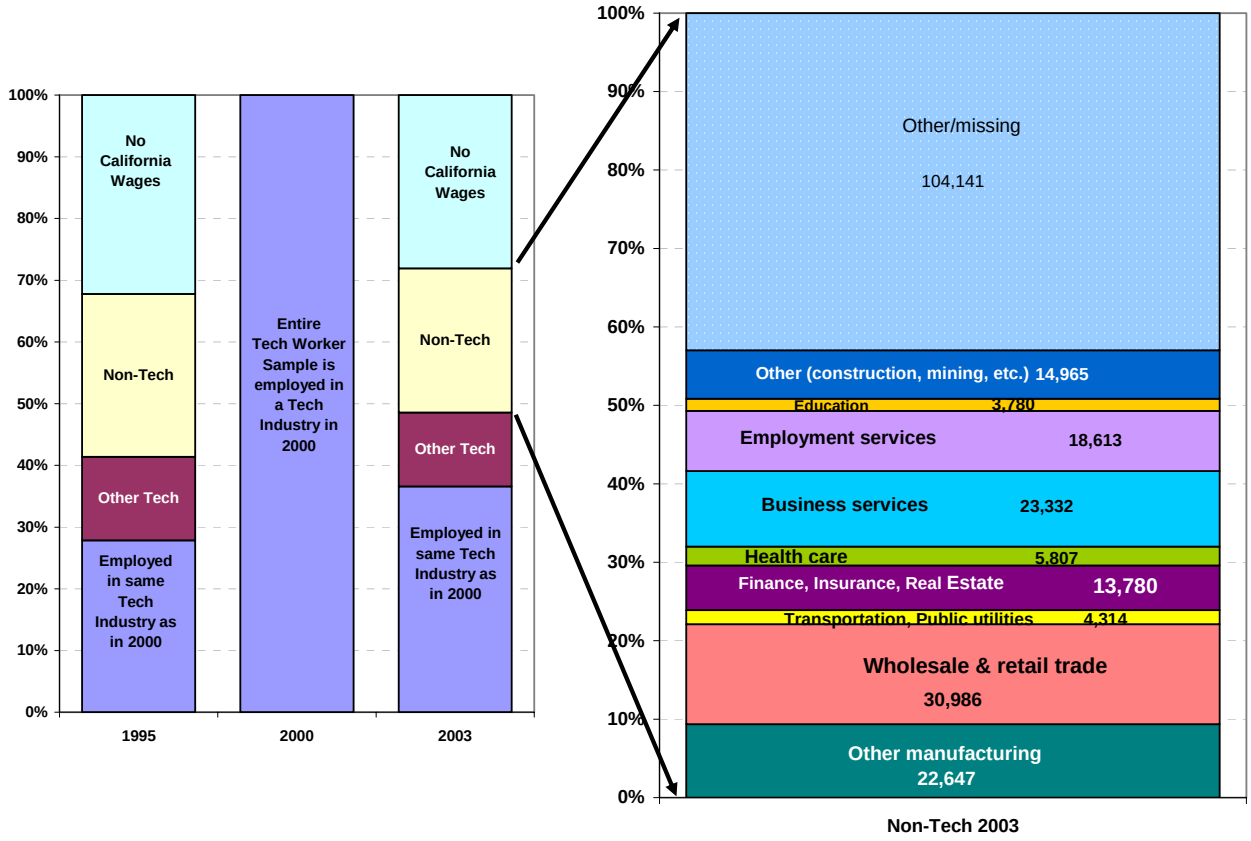


Figure 4.3 shows the breakdown of employment flows into non-tech industries (the yellow portion of the 2003 bar of the preceding figure).[21] The largest share of these flows was in Wholesale and Retail trade, followed by Business Services, Other Manufacturing, and Employment Services. Relatively few tech workers went into the fields of Health or Education.

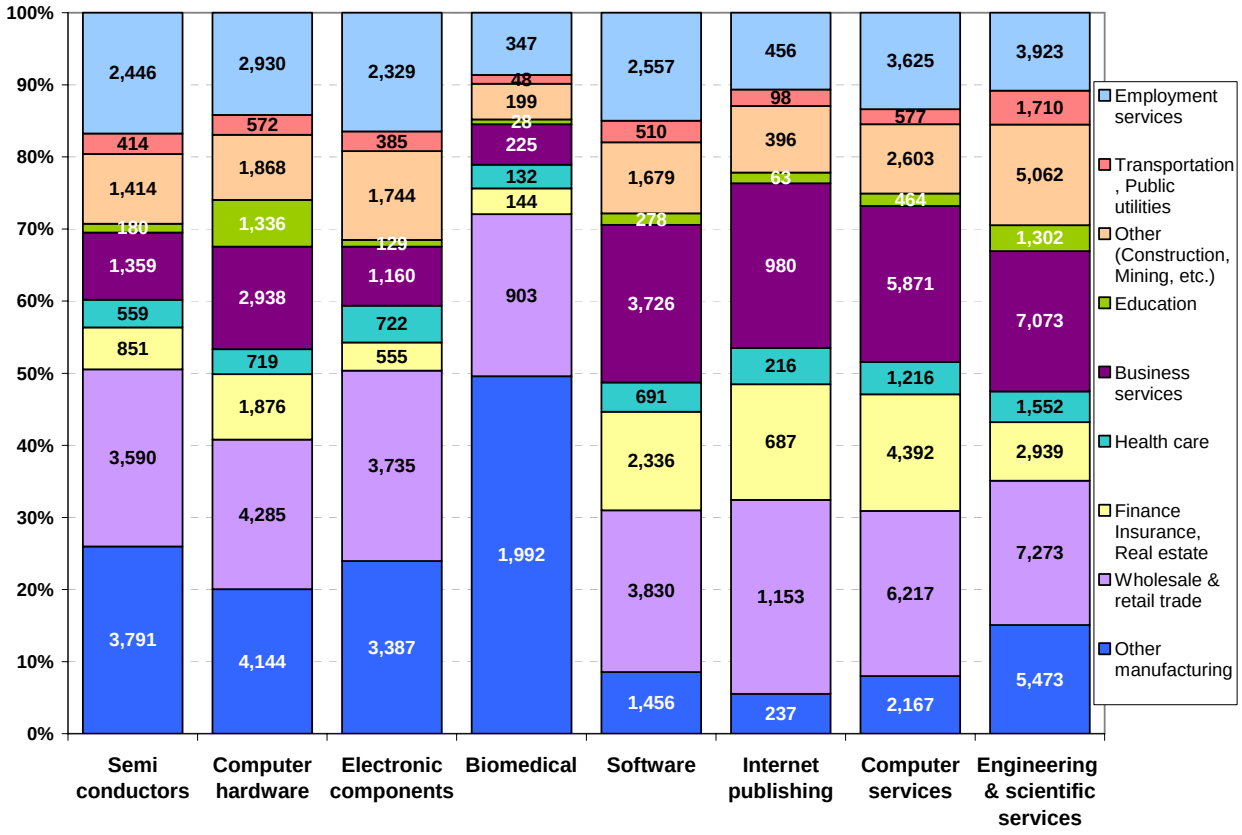
Figure 4.3 Inter-Industry Flows of Tech Worker Sample, with Non-Tech Industries



[21] The largest portion of this bar represents the wage records that were identifiably in non-tech industries, but had Social Security numbers either without Unemployment Insurance account numbers or linked to non-existent NAICS codes. Such irregularities are common when using administrative data.

Flows into non-tech industries varied according to where one had worked in 2000, as is visible in Figure 4.4. Workers from Semiconductors, Computer Hardware, Electronic Components and Biomedical were more likely to enter Other Manufacturing. The more service-oriented tech industries were more likely to enter Business Services or Finance, Insurance & Real Estate. Looking at flows into Education, Computer Hardware had the largest share and largest number of workers enter this field. Astoundingly, 10 to 17 percent of peak tech employment in all tech industries had primary earnings in Employment Services[22] in 2003. The relatively large share of 50 percent of Biomedical workers transferring into Other Manufacturing likely reflects this sector's close link to the pharmaceutical industry.

Figure 4.4 Inter-Industry Flows of Tech Worker Sample by 2000 Industry, into Non-Tech Industries



[22] The NAICS industry group, Employment Services (NAICS 5613), includes establishments classified in the following NAICS industries: Employment Placement Agencies (56131), Temporary Help Services (56132), and Employee Leasing Services (56133) (U.S. Census Bureau. *Economic Census 2002*).

Wage Changes Remaining in High-Tech Industries

What were the wage outcomes resulting from these employment flows? Those who remained in tech did well, those who entered non-tech did not do well, and those who left the hardware industries (Semiconductors, Computer Hardware, and Electronic Components) for non-tech suffered formidable wage losses. Running down the side of the table in Figure 4.5 is the 2000 industry of employment, across the top is the industry in 2003 to which a worker transferred. The values are median percent changes in inflation adjusted wages from 2000 to 2003. The green diagonal shows the median percent changes in wages from 2000 to 2003 for workers who remained in their 2000 industry. In general, tech workers who remained in a tech industry at all did well, increasing their wages by more than the rate of inflation. However, all workers who entered non-tech suffered wage losses, except in Biomedical. Most severe was the median 27 percent drop in wages for Semiconductor workers entering non-tech industries. While wages in Software and Internet Publishing experienced median drops of 10 percent, it is worth noting that more workers from these two industries entered non-tech in 2003 than remained in their 2000 industry. (See Appendix Figure 9 for a similar table depicting person-flows.)

Figure 4.5 Median Percent Change in Wages from 2000 to 2003

2000 Industry \ 2003 Industry	Semi conductors	Computer hardware	Electronic components	Biomedical	Software	Internet publishing	Computer services	Engineering & scientific services	NON- TECH
Semiconductors	8%	6%	-3%	-2%	2%	2%	1%	6%	-27%
Computer hardware	11%	10%	11%	2%	3%	5%	3%	18%	-17%
Electronic components	18%	14%	6%	13%	0%	15%	4%	13%	-16%
Biomedical	6%	15%	0%	8%	22%	-10%*	7%	10%	2%
Software	14%	8%	17%	17%	13%	19%	4%	20%	-10%
Internet publishing	2%	11%	-24%	0%	20%	12%	11%	18%	-10%
Computer services	15%	11%	16%	12%	14%	13%	11%	20%	-4%
Engineering & scientific services	11%	0%	19%	12%	12%	13%	8%	14%	-1%

** represents less than 20*

Wage Changes Entering Non-Tech Industries

The table in Figure 4.6 shows the largely negative wage outcomes for the workers who entered various non-tech sectors. As in the previous table, the 2000 industry of employment is along the side and the industry entered in 2003 runs across the top. Tech workers entering Other Manufacturing, and Finance, Insurance and Real Estate (FIRE) sectors generally did well. Tech workers whose primary earnings were in Employment Services experienced the greatest median wage losses. Workers from Semiconductors fared the worst with a 43 percent drop in median wages. The largest shares of tech worker flows into non-tech industries, twenty-eight percent, came from Engineering & Scientific Services. Computer Services (20%), Computer Hardware (14%), and Software (13%) followed. (See Appendix Figure 10 for person-flows into non-tech industries.)

Figure 4.6 Percent Change in Median Wages from Tech to Non-Tech, 2000 to 2003

	2003 Industry							
2000 Industry	Other manufacturing	Wholesale & Retail Trade	Transportation & public utilities	Finance, Insurance & Real Estate	Healthcare	Business services	Employment services	Education
Semiconductors	-4%	-26%	-26%	-22%	-31%	-26%	-43%	-21%
Computer hardware	2%	-24%	-16%	-5%	-16%	-8%	-36%	19%
Electronic components	2%	-15%	-11%	-6%	-14%	-16%	-31%	25%
Biomedical	22%	-3%	-20%	-16%	-1%	-1%	-38%	-20%
Software	4%	-11%	2%	3%	-7%	-2%	-28%	-36%
Internet publishing	-1%	-1%	-20%	4%	-25%	0%	-36%	-17%
Computer services	11%	-4%	-7%	11%	-4%	8%	-18%	-25%
Engineering & scientific services	14%	-10%	-13%	2%	-8%	8%	-27%	11%

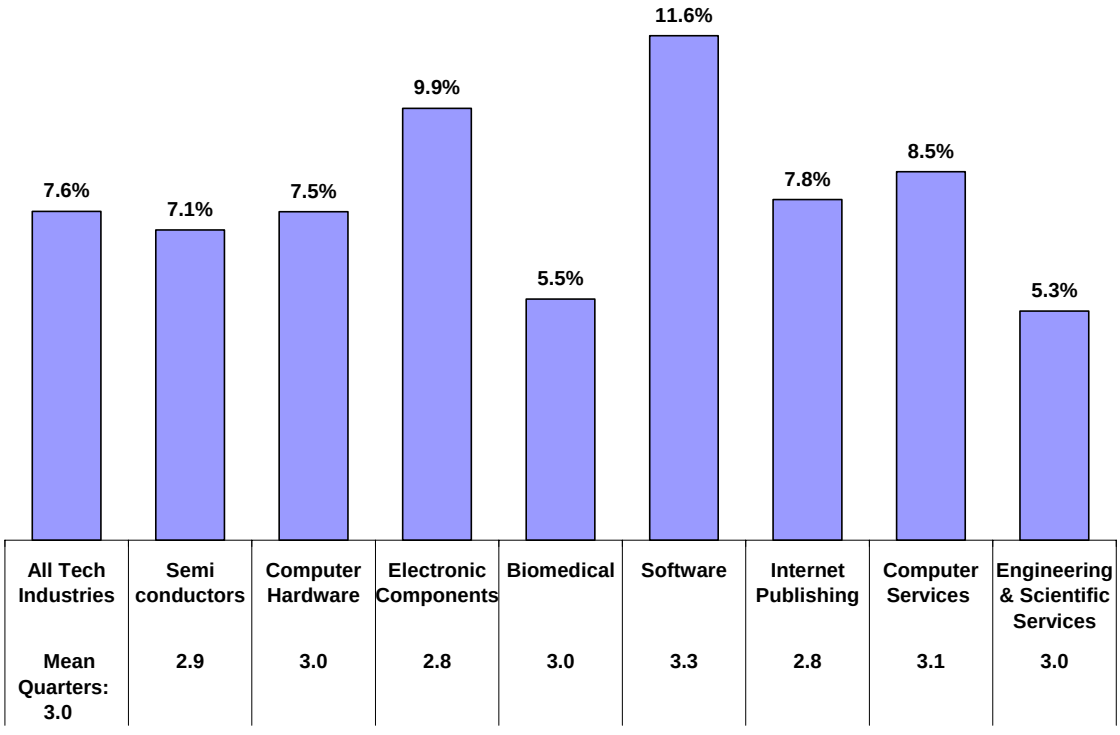
Typically, workers entering non-tech industries had earned below the industry median in 2000. Only those leaving Semiconductors and Computer Hardware for non-tech and who had been employed in tech in 1995 earned above the industry median in 2000. For all tech categories, workers entering non-tech who had worked in tech in 1995 experienced the largest wage declines. To varying degrees, tech workers entering non-tech from Semiconductors, Computer Hardware, Electronic Components and Biomedical were more likely to have been working in tech in 1995. This was not the case for workers leaving Software, Internet Publishing and Computer Services for non-tech. These workers were more likely to have worked in non-tech or not been in the state's workforce in 1995. Workers entering non-tech from Engineering & Scientific Services were equally likely in 1995 to have been working in tech, working in non-tech, or not existing in the California workforce.

Positive wage changes were experienced by a few groups entering non-tech. Workers from Biomedical, Engineering & Scientific Services, and Computer Services who were not in the California workforce in 1995 experienced wage gains of 15, 14, and six percent respectively. Workers from Biomedical and Engineering & Scientific Services who had been employed in non-tech in 1995 increased earnings by three and four percent.

Employment Services, 2000Q1-2003Q4

Over seven percent of the peak tech workforce had at least one quarter with primary wages from a temp agency after the downturn. Considering the wage outcomes described in the previous table (Figure 4.6), these workers suffered severe income losses. The bars in Figure 4.7 represent the shares of 2000 employment of each industry that had primary earnings from a temporary employment agency at some point between 2000 and 2003. Across the eight industry categories, there was little variance in the length of time spent in Employment Services, on average, three quarters. Even at the 25th, 50th and 75th percentiles, there was no difference across industries. The median was two quarters, the 25th and 75th percentiles were one and four quarters respectively. (See Appendix 2, Figure 14.)

Figure 4.7 Share of 2000 Tech Workforce employed in Employment Services at some Point from 2000 Q1 to 2003 Q4



During the years that followed the employment peak, Software workers were most likely of tech workers to have primary earnings in Employment Services. Eleven percent of Software's peak workforce averaged 3.3 quarters working primarily for temp agencies, slightly longer than other tech workers. Electronic Components had the second largest share of its 2000 workforce, 9.9 percent, enter Employment Services. Although Engineering & Electronic Services saw the smallest share of its 2000 workforce enter Employment Services, its share represents 15,841 workers. Likewise, Electronic Components had the second largest workforce share earning mainly from temp agencies consisting of 8,698 workers. Computer Services followed with 14,735, Software with 11,774, and Computer Hardware with 11,202 workers with one or more quarters of primary employment with a temp agency.

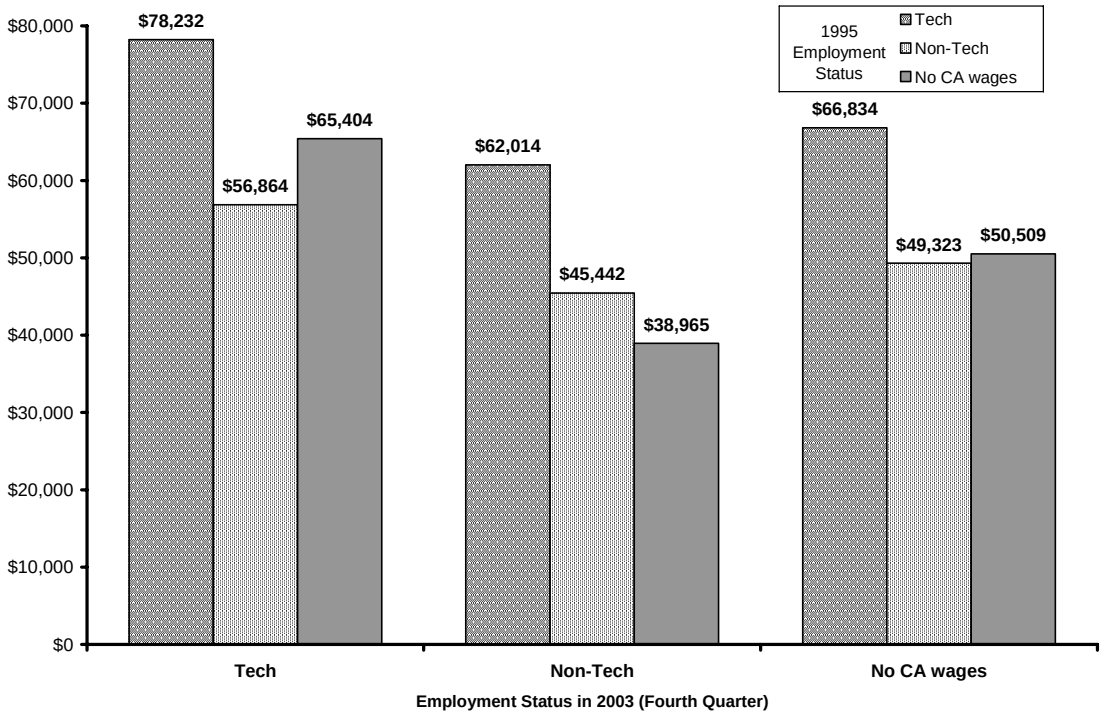
Tech Workers leaving California Workforce

By 2003, 28 percent of the state's 2000 tech workforce was no longer represented in California's wage records.[23] These workers had either left the state, become self-employed, or remained unemployed by this time. The distribution of these workers across industries is roughly proportional to the distribution of all workers across tech industries in 2000. Engineering & Scientific Services (30%) and Computer Services (20%) combined, accounted for half of all leavers. Leavers from Semiconductors, Computer Hardware, Electronic Components, Biomedical, and Engineering & Scientific Services were more likely (42-49%) to have worked in tech in 1995. At a greater propensity (46-50%), tech workers from Computer Services, Internet Publishing, and Software who left the workforce were more likely to have not been in California's workforce in 1995 (i.e. they had come from out-of-state or they had been new entrants to the labor market during the build-up to the peak).

As depicted in Figure 4.8, within each of the 1995 employment categories, the tech workers who left California's workforce after the economic downturn had been higher earners than those who entered non-tech industries. In general, tech workers who had been in tech in 1995 earned better in 2000 than tech workers who had been in non-tech or who had not been present in the state's workforce in 1995. Outside of this 1995 tech group, tech workers who remained in tech in 2003 had had higher 2000 earnings than those who entered non-tech or who left the California workforce in 2003.

[23] California's Employment Development Department Base Wage File records all wages earned, that are covered by Unemployment Insurance, at all establishments (of single and multi-establishment firms) in the state.

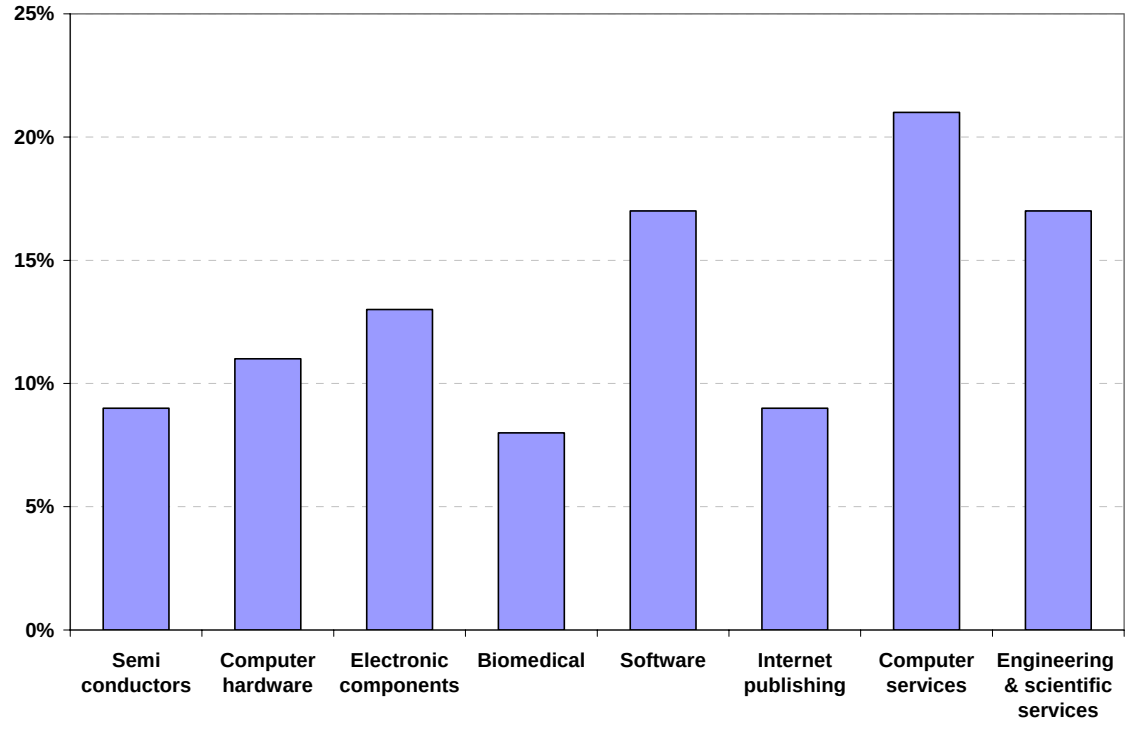
Figure 4.8 Annualized Median Real Wages in 2000 Q1 by Employment Status in 2003



4.3. Wage Gaps

The odds of experiencing a gap in wages varied widely by industry and depended on industry switches made between 2000 and 2003. A wage gap is defined as a period of at least one quarter with zero wages between quarters with wages. About 23 percent of all tech workers had a gap in wages, and workers entering non-tech were twice as likely to have wage gaps of one or more quarters than those leaving the state's workforce and almost three times as likely than those remaining in tech industries. About 15 percent of those remaining in tech had a wage gap. However, 40 percent of those moving into non-tech and 23 percent of those no longer in the California workforce had a gap in wages. Figure 4.9 shows the shares of workers with one or more wage gaps between 2000 and 2003. Workers in Computer Services, Software, and Engineering & Scientific Services were most likely to have one or more wage gaps. Workers in Biotech and Internet Publishing were least likely. There is little difference between industries in the likelihood of wage gaps experienced by workers who left the California workforce or within industries by employment status in 1995. (See Appendix 2, Figure 16.)

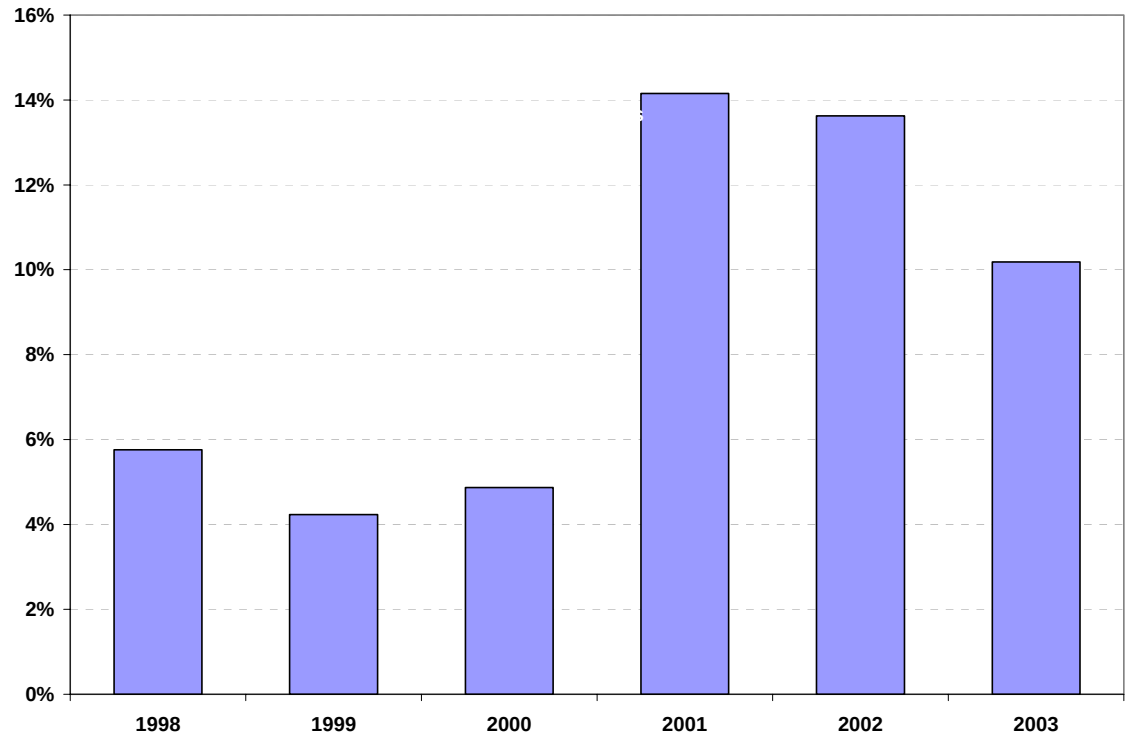
Figure 4.9 Share of Workers with one or more Wage Gaps, 2000 - 2003



4.4. Unemployment

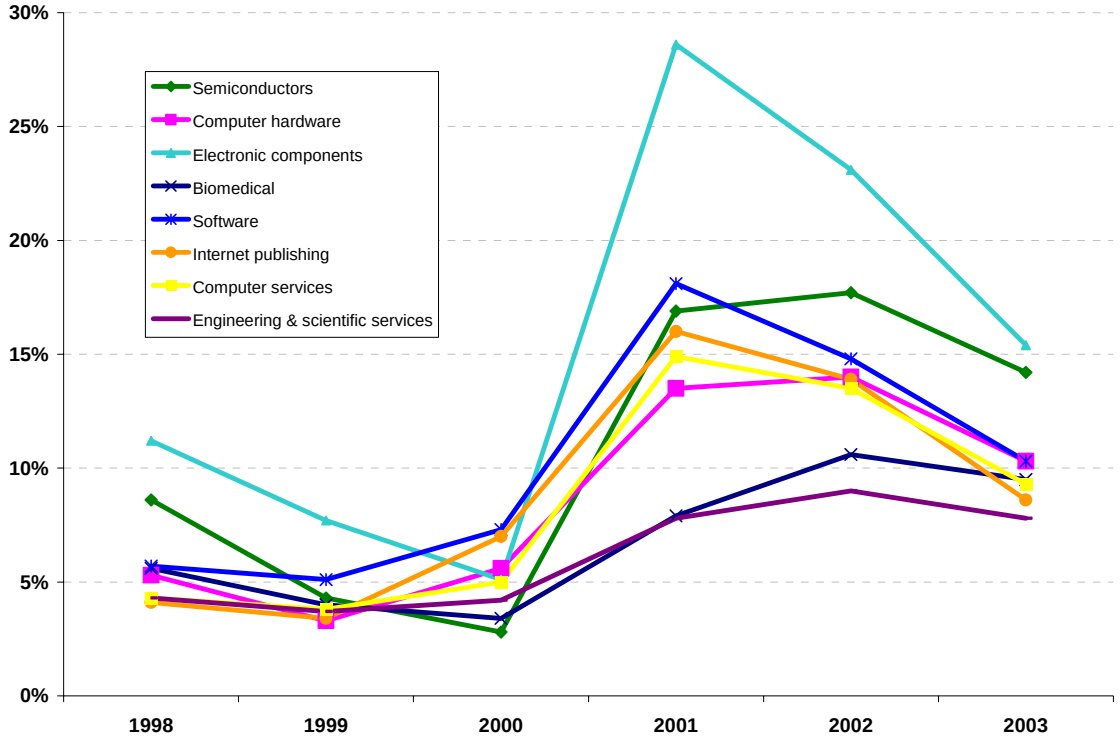
Unemployment insurance (UI) claims filed by California's tech workforce soared in 2001, and although the claims rate slowed in 2003 it remains high.[24] Unemployment claims are defined by the year the claim began, regardless of which calendar year the benefits were actually paid in. So a claim that began on December 15, 2002, and lasted for 26 weeks would be counted as a 2002 claim with a duration of 26 weeks, even though almost all the weeks claimed were actually paid in 2003. Figure 4.10 tracks new unemployment claims filed from 1998 to 2003. In 2001, the UI claims rate among the year 2000 cohort of tech workers almost tripled from 2000 to 2001 and did not improve much in the following years. In 2003, the rate was still double the rate in 2000. The unemployment claims rate varied slightly by industry, peaking higher for workers from Electronic Components (Figure 4.11), but sharp increases are apparent for all industries.

Figure 4.10 New Unemployment Claims (Rate), All Tech Industries



[24] Since our UI records end in the fourth quarter of 2003, there is a downward bias in our estimates for the length of claims filed in 2003. Many claims filed in the latter half of 2003 may be ongoing and would ultimately show a longer duration if we could have observed them to completion. The decline in claims rate, as well as a decline in the mean length of claims statewide, supports the notion that the trend for duration is clearly down – but the exact magnitude of that decline is probably overstated in the reported 2003 figures. This is also true for the regional comparisons discussed in Chapter 5 (Figure 5.3) below.

Figure 4.11 Unemployment Insurance Claims Rate by Industry



The length of unemployment spells has not dropped much since 2001. Figure 4.12 shows an increase in 2001 for all tech industries in mean number of weeks on unemployment for the period 1998 to 2003.[25] There appears to be a slight drop in 2003. While high in all industries, Semiconductors, Computer Hardware, and Internet Publishing had the longest unemployment spells. Figure 4.13 depicts the mean number of weeks of unemployment claims by industry in 2000, the year with the highest claims rates. The mean number of claimed weeks for all tech industries in this year was 27.5 weeks.

[25] Part of this increase reflects the Unemployment Insurance extensions offered retroactively after the terrorist attacks in September 2001.

Figure 4.12 Mean Weeks on Unemployment, All Tech Industries

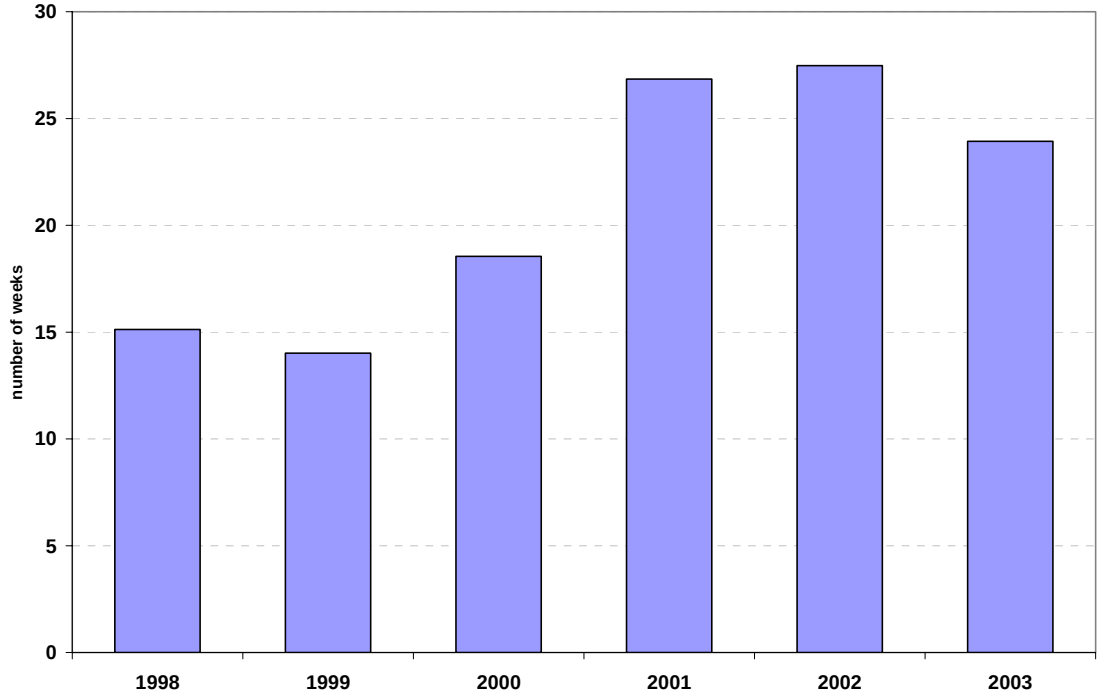
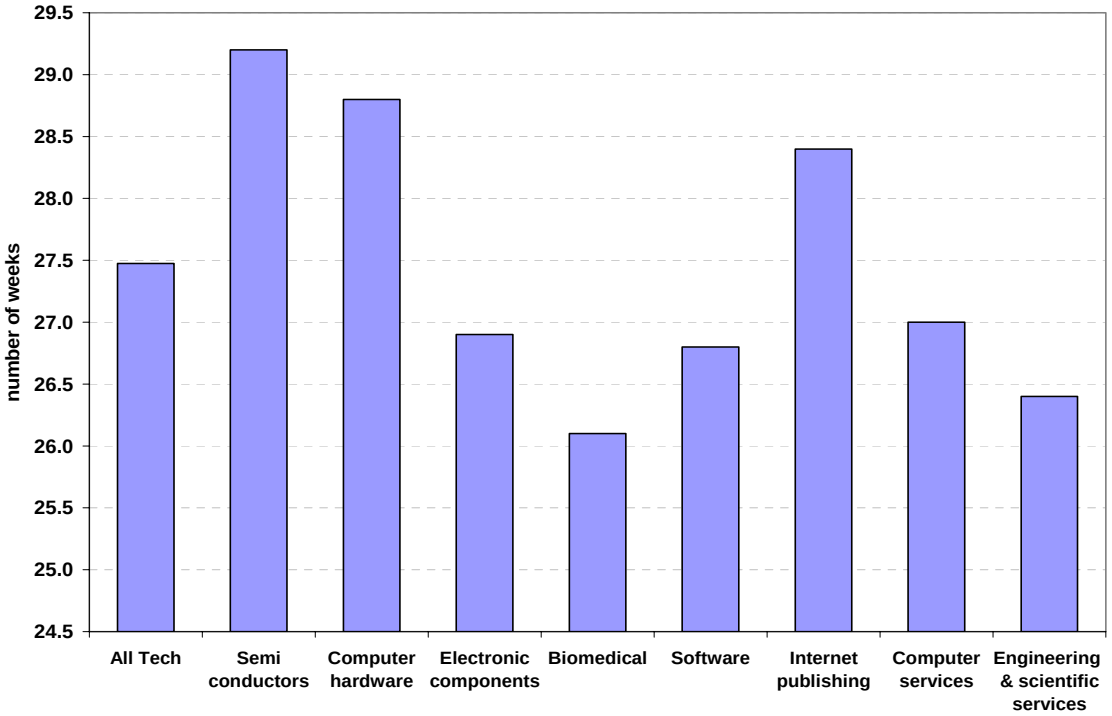


Figure 4.13 Mean Weeks on Unemployment by Industry, 2002



5 Bay Area versus Rest of California

The recent downturn hit California hard, but its impact has been felt most severely in the San Francisco Bay Area. This chapter compares the experiences of the tech workforce in the Bay Area to that in the rest of California in terms of tech worker flows, wages, and unemployment over the last business cycle. The wage records used to track individual employment histories in the prior chapter links each worker to the firm that paid his or her wages. In order to conduct this regional comparison, workers need to be identified with a specific geographic location, i.e., an establishment. For single-establishment firms and for those multi-establishment firms that have all of their establishments located within the same geographic region we can unambiguously assign each worker to one region at any point in time. For workers in multi-establishment firms with establishments scattered across California, it is not possible to assign them correctly to a given region. Reflecting this, we divided the universe of tech employers into three groups of firms: those firms with all of their establishments located within the San Francisco Bay Area[26], those firms with all of their establishments located outside of the San Francisco Bay Area but elsewhere in California, and firms with establishments located both within and outside of the Bay Area. This sorting of our year-2000 tech worker cohort[27] resulted in three similarly sized tech-worker groups: approximately 360,000 Bay Area tech workers, 320,000 tech workers located throughout the rest of California in 2000, and 310,000 workers for whom it was impossible to specify their employment location in 2000. Those workers missing a specific location for their 2000 place of employment were not included in the regional comparisons.

By 2003, Bay Area tech workers were more likely to leave the California workforce (Base Wage File) than tech workers in the rest of the state. This means that they either remained in the state with no reported wage earnings, became self-employed, or left the state entirely. Otherwise, as the table in Figure 5.1 indicates, the share of workers remaining in tech industries compared to the share who moved into non-tech industries did not vary significantly between the Bay Area and the rest of the state.

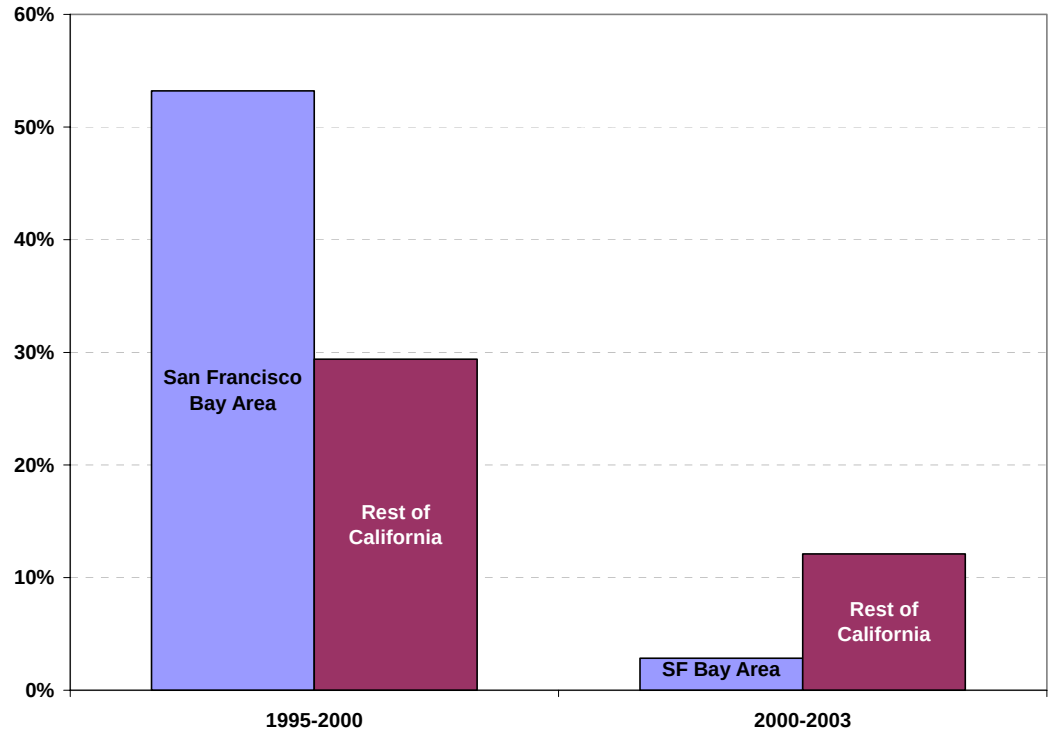
Figure 5.1 Distribution of Tech Worker Sample in 2003, Bay Area compared to Rest of California

	SF Bay Area	Rest of CA
No CA Wages	**30%**	**26%**
Still in Tech	**46%**	**47%**
In Non-Tech	**24%**	**26%**

[26] As in the preceding analyses, the Bay Area consists of the San Francisco, San Jose, and Oakland MSAs.
[27] This is described in Chapter 4 and again in the section on Methodology.

Bay Area tech workers enjoyed huge wage increases in the expansion, much greater than those in the rest of the state. Figure 5.2 illustrates how differently wages behaved during the boom and bust periods in the Bay Area and the rest of the state. Tech workers in the Bay Area received median wage gains that were almost twice as large as those in the rest of California during the boom. In contrast, during the bust period (2000-2003), the median wage change in the rest of the state was 12 percent compared to only three percent in the Bay Area.

Figure 5.2 Median Wage Changes, Bay Area and Rest of California



Bay Area tech workers were more likely to file unemployment claims and had longer spells on unemployment than tech workers elsewhere. From 2000 to 2001, while unemployment claims doubled in the rest of the state, claims increased five-fold in the Bay Area (Figure 5.3). At the peak of tech employment in 2000, claim rates were about thirty percent higher in the rest of California. In 2001 and 2002, that situation reversed as unemployment claim rates in the Bay Area rose to roughly thirty percent higher; the Bay Area's relative claims rate appeared to be moderating in 2003. In terms of the duration of those unemployment spells, Figure 5.4 shows that, before the downturn, the mean number of weeks on unemployment was slightly higher outside the Bay Area. From 2000 to 2001, the mean number of weeks on unemployment jumped by ten weeks in the Bay Area and by seven in the rest of the state. By the end of the study period in 2003, mean unemployment duration had dropped in both regions, although the average duration remains longer in the Bay Area.[28]

[28] See footnote 24 for a discussion of the downward bias in duration for claims filed in the latter half of 2003.

Figure 5.3 Unemployment Claim Rates in Bay Area and Rest of California

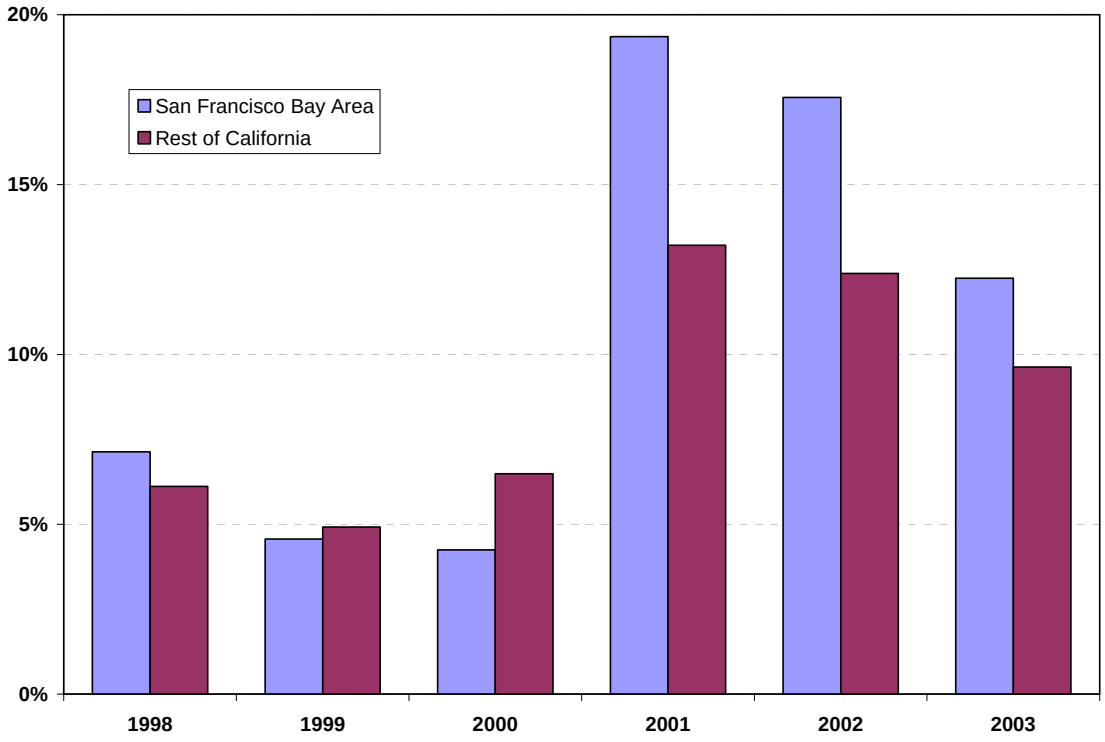
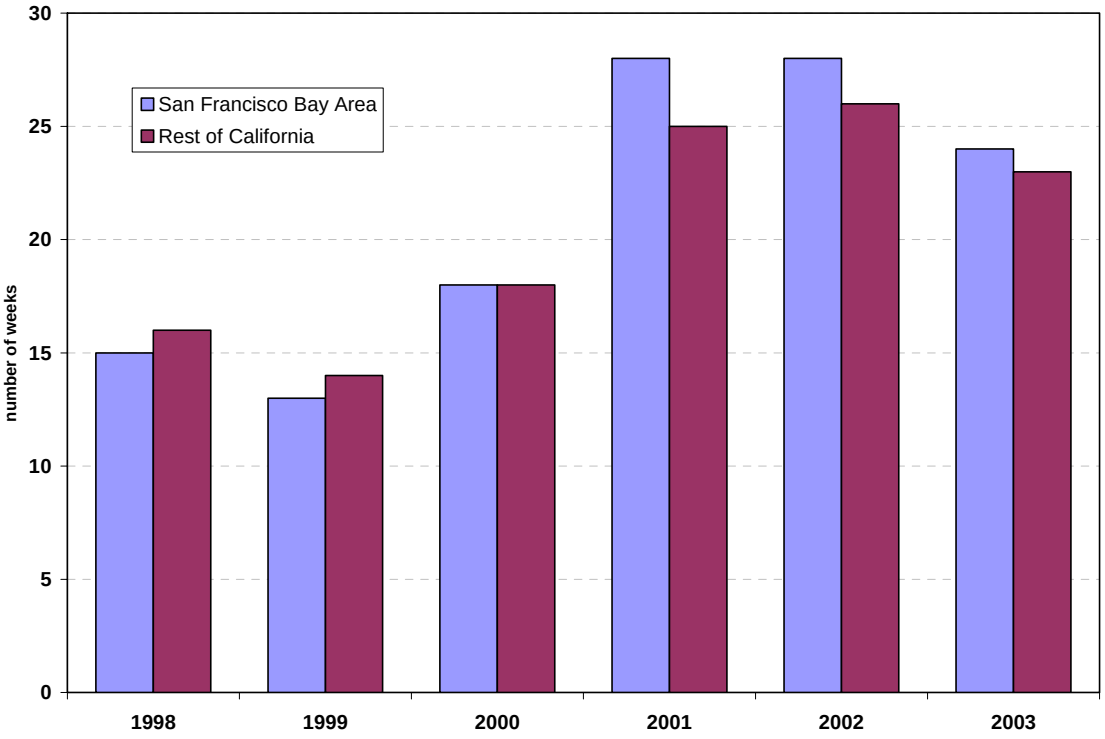


Figure 5.4 Duration of Unemployment Claims (Weeks), Bay Area and Rest of California



6 Conclusions

The sharp reversal in the high-tech sector that began in 2000 led to the largest relative employment declines in decades for any metro area. An industry that for a few years had an insatiable demand for skilled labor suddenly displaced more than 100,000 workers within two years. Workers once used to being courted with stock options, cars, and fun working conditions found themselves facing extensive jobless spells with no interviews in sight. The state's workforce investment boards, particularly those in the San Francisco Bay Area, were faced with large numbers of highly skilled workers looking for job interviews or retraining. In an effort to put their experiences in the larger context and to provide a more systematic examination of the plight of tech workers, SPHERE was asked to track the state's tech workers through this unprecedented boom and bust.

One of the important insights to come out of this analysis was that growth in new firms, while volatile, powered much of the expansion period and that this was especially the case in the Internet Publishing, Computer Services, and Software industries. Contrary to common impressions, new firms continue to represent a large share of the remaining employment in the high-tech sector. This argues against the view that the boom and bust primarily reflected the fortunes of a group of startup firms that came and went within a few years. New firms as a group remain a large and important source of employment for tech workers in California.

Turning to the workers themselves, we found that by 2003, only half of the state's workers who had been employed in high-tech firms during the first quarter of 2000 remained employed in high-tech firms by the end of 2003. Of those no longer employed by high-tech firms, many may have left the California workforce by leaving the state entirely, although population estimates from the California Department of Finance do not show a very large flow of out-migrants from the state. Some of the remaining may be still unemployed but no longer eligible to receive unemployment benefits; others may have become self-employed and therefore not captured in the wage records used for this study. Of those still employed in California but outside of the high-tech sector, most suffered wage losses and a significant fraction faced one or more quarters without recorded earnings. The experience of other displaced workers, such as the aerospace workers displaced in the aftermath of defense cutbacks in the early 1990s, suggests that their wage declines are likely to be permanent. Additionally, a significant fraction of the tech workforce in 2000 spent an average of three quarters employed by temp agencies sometime between 2000 and 2003.

In comparing the San Francisco Bay Area and the rest of California, it is clear that both the expansion and the downturn of the last business cycle were more dramatic in the Bay Area. Although the Bay Area prospered greatly during the boom, and workers there who retained their jobs remained well ahead of their positions in 1995, local tech workers who lost their tech jobs were more likely to fare poorly and to exit the state workforce entirely.

In terms of policy implications, better understanding about the region's firm and worker dynamics can help in our thinking about how to help workers keep pace with structural change. Knowing that the region's high-tech industry is increasingly made up of small, relatively young firms will help the local Workforce Investment Boards effectively guide their efforts. Services for displaced workers must encompass the needs of lower-skilled as well as higher-skilled tech

workers. Certainly maintaining accessible avenues for workers to acquire new skills must be a central component in any discussions on how to sustain the talent of our region's workforce.

Bibliography

Daly, Mary C., and Robert G. Valletta. 2004. "Performance of Urban Information Technology Centers: The Boom, the Bust, and the Future." *FRBSF Economic Review* 2004.

Dardia, Michael. 2004. "Signs of Recovery Appear-But Job Gains Are Still Missing," *Bay Area Economic Pulse*, Vol. 9, Issue 2, Spring 2004.

Faberman, Jason R. 2004. "Gross Job Flows Over the Past Two Business Cycles: Not all 'Recoveries' are Created Equal." BLS Working Paper 372, U.S. Bureau of Labor Statistics.

Groshen, Erica L. and Simon Potter. 2003. "Has Structural Change Contributed to a Jobless Recovery?" *Current Issues in Economics and Finance*, August 2003, Federal Reserve Bank of New York.

Hurd, J. 2004. "The Forecast for California: The Worst is Over and the Economy is Improving – but Really Good Times are Still Down the Road and a Repeat of the Nineties isn't in Sight at All," in UCLA Anderson Forecast, March 2004, Californian 1.1-1.8.

Saxenian, AnnaLee. 1994. *Regional Advantage: Culture of Competition and Competition in Silicon Valley and Route 128*. Cambridge, Mass.: Harvard University Press.

U.S. Census Bureau. *American Community Survey*. "Using the Data: Subject Definitions."http://www.census.gov/acs/www/UseData/Def/Income.htm (Accessed March 10, 2005).

U.S. Census Bureau. *1997 Economic Census*. "Manufacturing – Industry Series." http://www.census.gov/prod/www/abs/97ecmani.html (Accessed March 10, 2005).

U.S. Census. "California County Population Estimates and Population Change: April 1, 2000 to July 1, 2002." http://www.census.gov/popest/archives/2000s/vintage_2002/CO-EST2002-02/CO-EST2002-02-06.html. (Accessed April 17, 2005)

U.S. Census Bureau. *2002 Economic Census*. "Industry Statistics Sampler: NAICS 5613 Employment Services." http://www.census.gov/epcd/ec97/industry/E5613.HTM (Accessed March 15, 2005).

U.S. Department of Labor. Bureau of Labor Statistics. "Table A-1. Employment status of the civilian population by sex and age."http://www.bls.gov/news.release/empsit.t01.htm (Accessed July 28, 2004).

Zhang, Junfu. 2003. *High-Tech Start-Ups and Industry Dynamics in Silicon Valley*. San Francisco: Public Policy Institute of California.

Methodology

Building on prior work done on aerospace workers, entertainment industry workers, and on a study of proposed eligibility changes to the unemployment insurance system, SPHERE wrote statistical programs for administrative data maintained by the California Employment Development Department (EDD). Staff at the Labor Market Information Division of EDD then ran these programs on the actual wage and firm records in order to generate the results that are reported here. The data used in this report ran from the first quarter of 1995 to the fourth quarter of 2003.

Firm Data

Information on firms came from the ES-202 employer records for all firms covered under the unemployment insurance system (approximately 96% of all workers). These records report industry (NAICS) code, employment and wages by firm and establishment on a quarterly basis.

When reporting information about firms, the industry code for the entire firm is used. When reporting information about establishments, the industry code for each individual establishment is used so there can be tech industry establishments within large, non-tech firms. When describing firms and establishments, we included all establishments identified as having a tech industry code. "New firms" are defined as those that have an initial liability date for UI coverage on January 1, 1995 or later.

Worker Data

Information on workers came from two sets of files: quarterly wage records and unemployment claim records. When workers are identified by the industry they were in for a given quarter, they are assigned to the industry code for their "primary employer." Their primary employer is defined as the firm that provided the greatest amount of wages in that quarter. There is a wage record for every worker with UI-covered wages that lists all wages received in each calendar quarter, by employer. These records are linked to the employer file so one can identify firms' attributes with each employee's wages. It is important to note that one cannot link a worker's wage record to a specific establishment within a multi-establishment firm. Whenever a worker files an unemployment claim, a series of weekly records are created that identify the date the claim ("benefit year") began and the benefits paid, or reason for non-payment. These records can be linked to the firms whose wages are supporting the claim. Unemployment claims are defined by the year the claim began, regardless of what calendar year the benefits were paid in. So a claim that began on December 15, 2002 and that lasted for 26 weeks would be counted as a 2002 claim with a duration of 26 weeks, even though almost of all the weeks were actually paid in 2003.

When selecting workers to analyze, we omitted workers from primarily non-tech firms that had a small (<10% of employment) share of total employment in tech establishments. This was due to the fact that we cannot separate workers by establishment in the wage records – if we took all the employees in a financial services firm just to get those in its data processing center, we would seriously dilute our results. In fact, we lose very few tech workers with this exclusion rule.

Table of Filtering Rules

Original sample – anyone with California tech wages between 1995 and 2003	**3,327,966**
EXCLUDE THOSE WITH	
>10 employers in any quarter	**-8,166**
<4 quarters of wages	**-277,970**
<4 quarters of tech industry wages	**-952,660**
Never earned >$3000 in a quarter	**-14,748**
Earned >$100,000 in average quarter	**-13,616**
Those with tech earnings, 1995-2003	**2,060,806**
Those with tech earnings in Quarter 1, 2000	**972,552**

We started with wage records for over 3 million California workers who had ever had tech wages as their primary wages between the first quarter 1995 and the fourth quarter 2003. The above table lists the filters utilized to identify the state's core tech employment. To correct for erroneous Social Security numbers, we omitted all records that indicated more than 10 employers in any one quarter. And to exclude summer internships and other intermittent work, records with less than four quarters of wages were dropped as well as records with less than four quarters of tech wages. Also, those that never earned more than $3000 in a quarter, those earning minimum wage in unskilled, non-tech specific positions were dropped from our sample. Those who earned more than $100,000 in an average quarter were likewise not included, mainly because of confidentiality issues.

This filtering brought the sample of tech wage records between 1995 and 2003 to two million. The aim of the study was to track the peak tech workforce, the tech workers employed in the first quarter of 2000, in order to identify where they had been employed before the boom in 1995 and where they ended up in 2003. This resulted in a final sample of nearly 1 million California tech workers for our analysis.

Appendix 1: North American Industry Code System (NAICS) Definitions

TECH Categories

Aggregate Category	code range		NAME	AEA	JV-SV
1	**Semiconductors**				
	31-333295	31-333295	Semiconductor machinery manufacturing	*	*
	31-333314	31-333314	Optical instrument & lenses	*	*
	31-334413	31-334413	Semiconductors and related device mfg.	*	*
	31-334513	31-334513	Industrial process variable instruments	*	*
	31-334515	31-334515	Electricity and signal testing instruments	*	*
	31-334519	31-334519	Misc. electronic instrument mfg.	*	*
2	**Computer hardware**				
	31-334111	31-334113	Electronic computer manufacturing	*	*
	31-334119	31-334119	Computer storage device manufacturing	*	*
	31-334210	31-334210	Computer terminal manufacturing	*	*
	31-334220	31-334220	Other computer peripheral equipment mfg.	*	*
	31-334290	31-334290	Communications equipment manufacturing	*	*
	31-334511	31-334511	Search, detection, and navigation instruments	*	*
	31-334611	31-334613	Magnetic media manufacturing and reproducing	x	*
3	**Electronic components**				
	31-334411	31-334411	Electron Tube Manufacturing	*	*
	31-334412	31-334412	Bare printed circuit board manufacturing	*	*
	31-334414	31-334414	Electronic capacitor manufacturing	*	*
	31-334415	31-334415	Electronic resistor manufacturing	*	*
	31-334416	31-334416	Electronic coils & other inductors	*	*
	31-334417	31-334417	Electronic connector manufacturing	*	*
	31-334418	31-334418	Printed circuit assembly manufacturing	*	*
	31-334419	31-334419	Misc. electronic component manufacturing	*	*

4	**Biomedical**				
	31-334510	31-334510	Electromedical apparatus manufacturing	*	*
	31-334516	31-334516	Analytical lab instruments	*	*
	31-334517	31-334517	Irradiation apparatus manufacturing	*	*
5	**Software**				
	50-511210	50-511210	Software publishers	*	*
	50-518111	50-518112	ISPs and web search portals	*	*
	50-518210	50-518210	Data processing and related services	*	*
6	**Internet publishing**				
	50-516110	50-516110	Internet publishing and broadcasting	x	x
7	**Computer services**				
	60-541511	60-541511	Custom computer programming services	*	*
	60-541512	60-541512	Computer systems design services	*	*
	60-541519	60-541519	Other computer related services	*	*
8	**Engineering & scientific services**				
	60-541330	60-541330	Engineering services	*	*
	60-541380	60-541380	Testing laboratories	*	*
	60-541690	60-541690	Other technical consulting services	*	*
	60-541710	60-541710	Physical, engineering and biological research	*	*

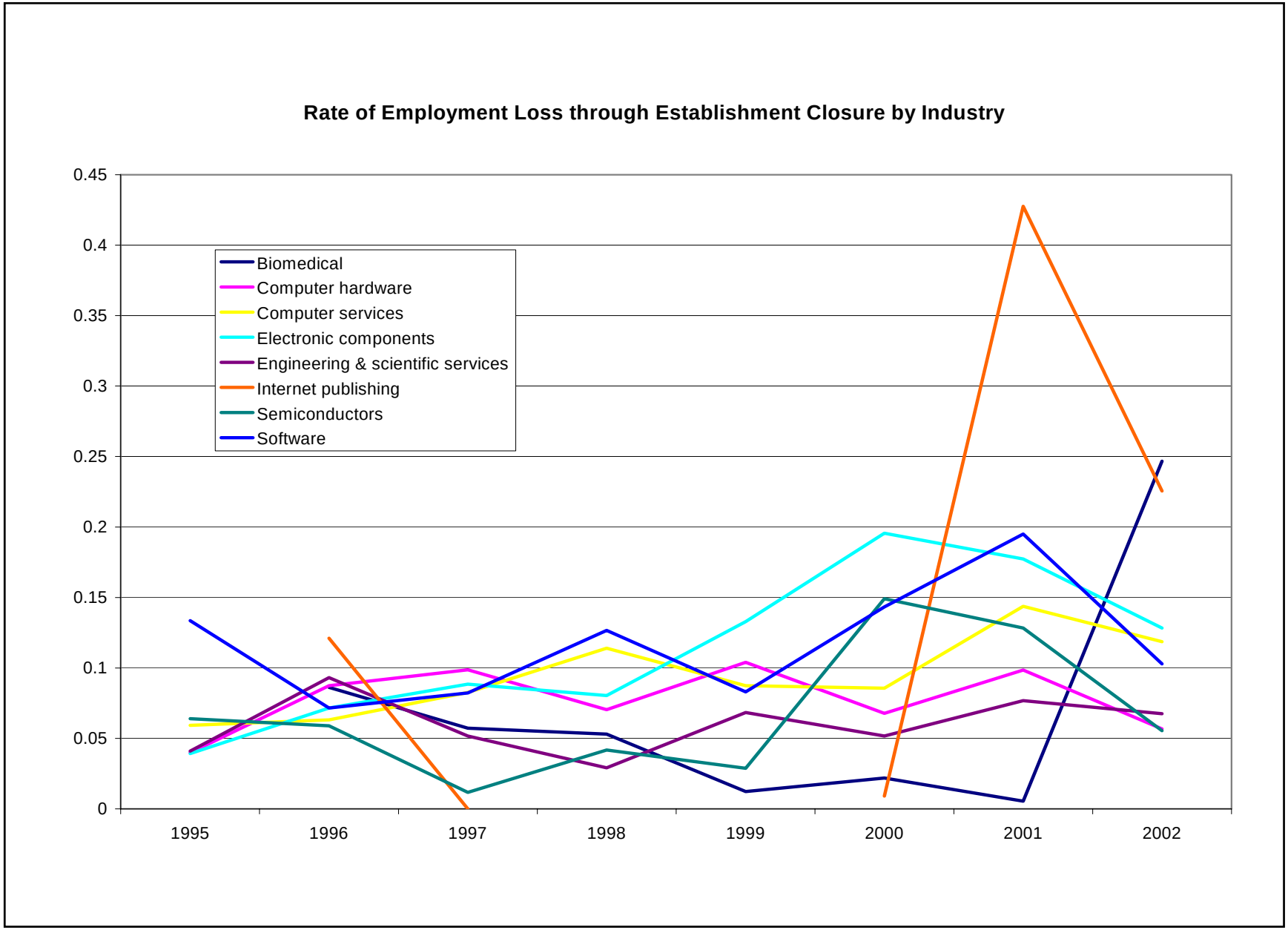
NON-TECH Categories

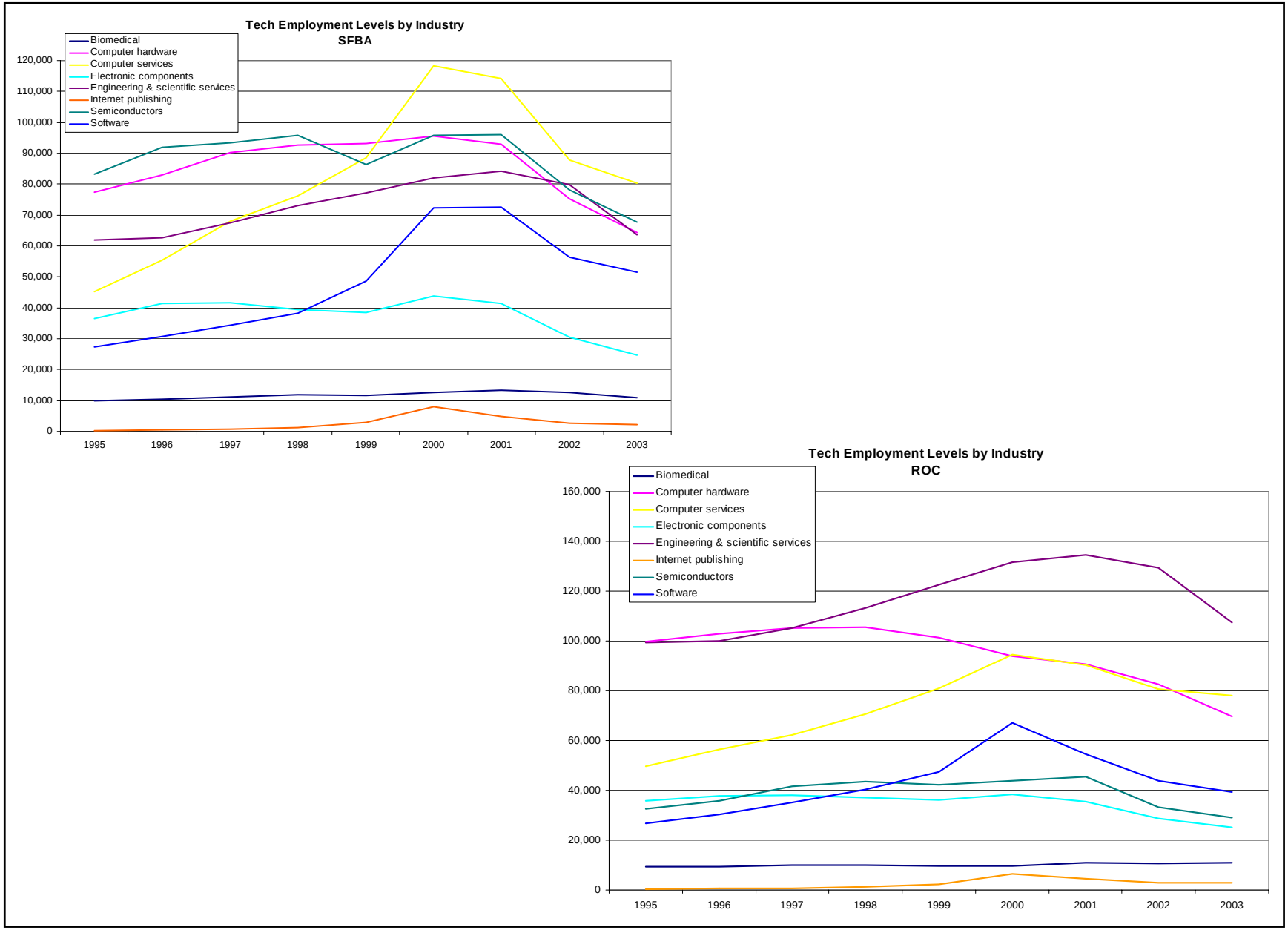
Aggregate Category	code range		NAME
11	**Other manufacturing**		
	32-311000	31-333294	Food, textile, chemical manufacturing
	31-333298	31-333313	Misc. Industrial Machinery Manufacturing; Misc. Commercial and Service Industry Machinery Manufacturing
	31-333315	31-333999	Photographic and Photocopying Equipment Manufacturing, Other Commercial and Service Industry Machinery Manufacturing
	31-334300	31-334399	Audio and Video Equipment Manufacturing
	31-334512	31-334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
	31-334514	31-334514	Totalizing Fluid Meter and Counting Device Manufacturing
	31-334518	31-334518	Watch, clock, and part manuf.
	31-335000	31-339999	Elect., transport., furniture, misc, machinery manuf.
12	**Wholesale and Retail trade**		
	42-423000	42-454999	Wholesale & Retail trade,
13	**Finance, Insurance and Real Estate**		
	52-520000	53-533999	Fin. & ins and Real Estate
14	**Healthcare**		
	65-620000	65-699999	Health care and social assistance
15	**Business services**		
	50-511000	50-511199	Publishing industries (except internet)
	50-512000	50-515999	Motion picture & sound recording industries; Broadcasting industries (except internet)
	50-517000	50-517999	Telecommunications
	54-540000	54-541329	Professional, scientific & technical services
	54-541340	54-541379	Professional, scientific & technical services
	54-541400	54-541499	Professional, scientific & technical services
	54-541600	54-541629	Management and technical consulting
	54-541720	54-541999	Research and Development in the Social Sciences and Humanities; Advertising and Related Services; Other Professional, Scientific, and Technical Services
	55-550000	60-561299	Management of Companies and Enterprises; Office Administrative Services; Facilities Support Services

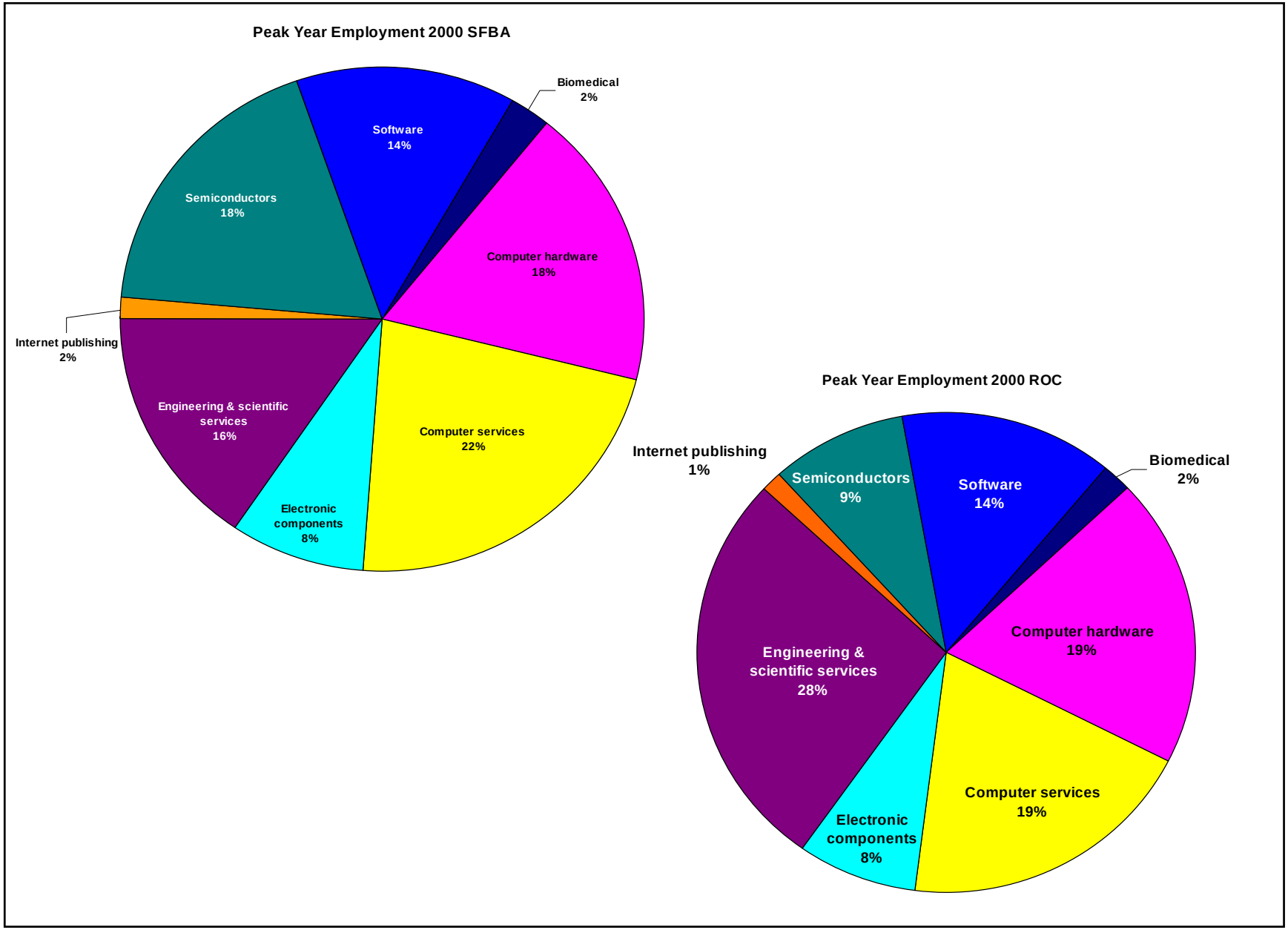
	60-541513	60-541513	Computer Facilities Management Services
	60-561400	56-562999	Business support services and waste collection
	65-611400	65-619999	Other schools and training
16	**Education**		
	65-610000	65-611399	Elementary, secondary, junior colleges, universities
	90-931611	90-931699	Public education
17	**Government**		
	90-910000	90-929999	Government (Fed, State & Local)
	90-931150	90-931150	Tribes
	90-932000	90-939999	Government (county, city, special)
18	**Other (Construction, Mining, etc. and Missing)**		
	71-710000	72-799999	Arts, Entertainment, & Recreation; Accommodation and food services
	81-811000	81-899999	Other services
	50-519000	50-519999	Other information services
	11-110000	11-119999	Agriculture & logging
	21-210000	21-219999	Mining
	23-230000	23-239999	Construction
19	**Transportation & public utilities**		
	22-220000	22-229999	Utilities
	43-481000	48-488999	Transportation & warehousing
	43-492000	43-493999	Couriers & Messengers
20	**Employment services**		
	60-561300	60-561399	Employment services

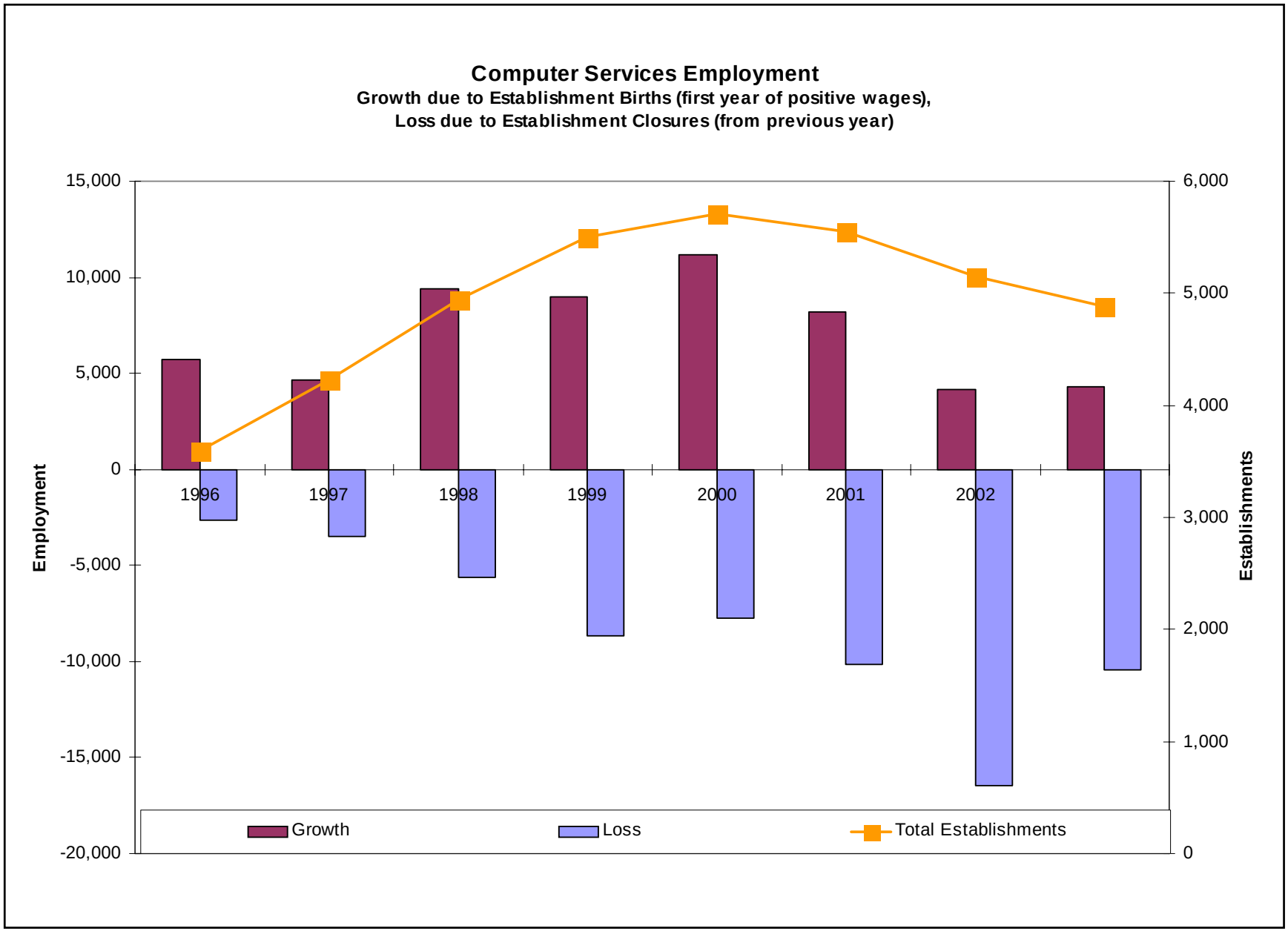
Appendix 2: Figures from Firm and Worker Data

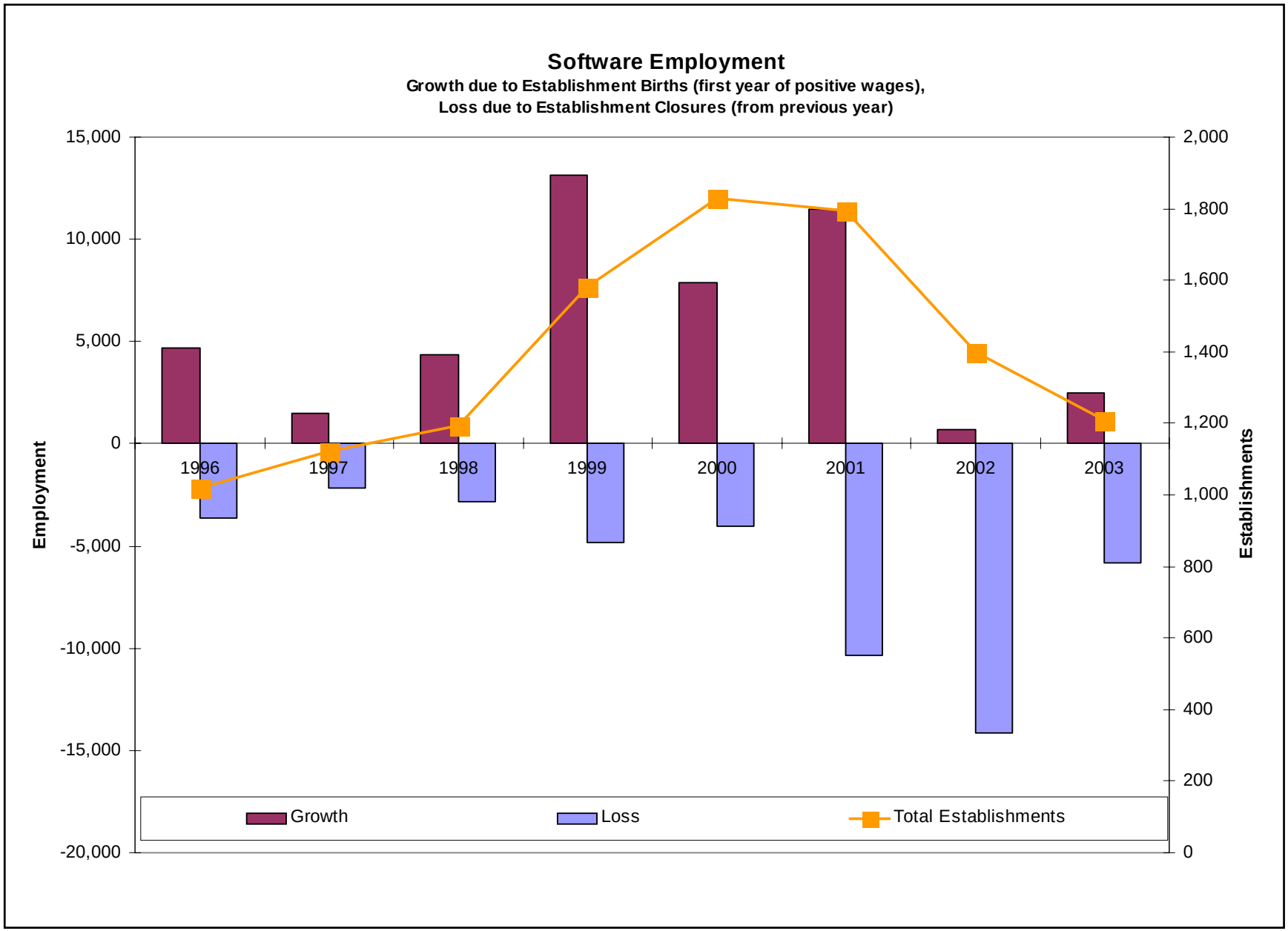
1. Employment Loss through Establishment Closures by Industry
2. Longitudinal Employment Levels by Industry, 1995-2003
3. Employment Shares by Tech Industry, 2000 Q1
4. Employment Gains/Losses from Establishment Birth/Deaths: Computer Services
5. Employment Gains/Losses from Establishment Birth/Deaths: Software
6. Employment Gains/Losses from Establishment Birth/Deaths: Electronic Components
7. Employment Gains/Losses from Establishment Birth/Deaths: Engineering & Scientific Services
8. Employment Gains/Losses from Establishment Birth/Deaths: Semiconductors
9. Person Flows, 2000 to 2003: Tech Industries
10. Person Flows, 2000 to 2003: Non-Tech Industries
11. Employment Flows by 1995 Status, Employment distribution in 2003, Median quarterly 2000 wage, Portion of workers with wage gaps
12. Employment Flows by 1995 Status, Employment distribution in 2003, Median quarterly 2000 wage, Portion of workers with wage gaps
13. California Tech Worker Flows into Non-Tech Industries
14. California Tech Workforce that ever had Primary Wages in Employment Services 2000Q1-2003Q4
15. Tech Workers Who left CA Workforce
16. Wage Gaps
17. Wages Relative to 2000 Quarterly Median Wage in Semiconductors
18. Wages Relative to 2000 Quarterly Median Wage in Computer Hardware
19. Wages Relative to 2000 Quarterly Median Wage in Electronic Components
20. Wages Relative to 2000 Quarterly Median Wage in Biomedical
21. Wages Relative to 2000 Quarterly Median Wage in Software
22. Wages Relative to 2000 Quarterly Median Wage in Internet Publishing
23. Wages Relative to 2000 Quarterly Median Wage in Computer Services
24. Wages Relative to 2000 Quarterly Median Wage in Engineering & Scientific Services Industry
25. Santa Cruz County Annual Unemployment Rate
26. Santa Cruz County Employment Decline by Month after Pre-Recession Peak
27. Santa Cruz County High-Tech Employment
28. Santa Cruz County Residents and Place of Employment in 2000
29. Santa Cruz County Residents employed in San Francisco Bay Area MSAs in 2000

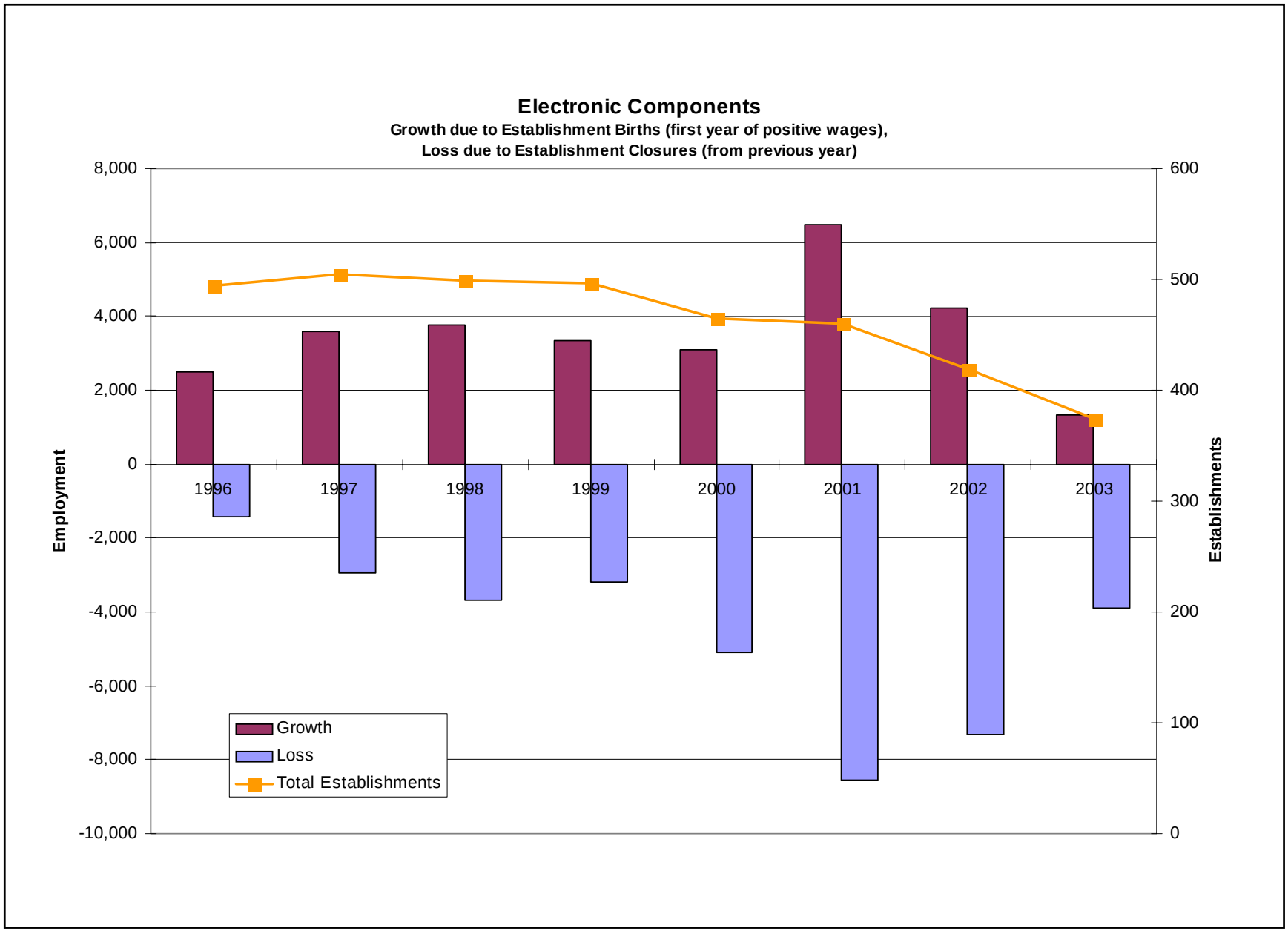

Rate of Employment Loss through Establishment Closure by Industry
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1995
1996
1997
1998
1999
2000
2001
2002
Biomedical
Computer hardware
Computer services
Electronic components
Engineering & scientific services
Internet publishing
Semiconductors
Software

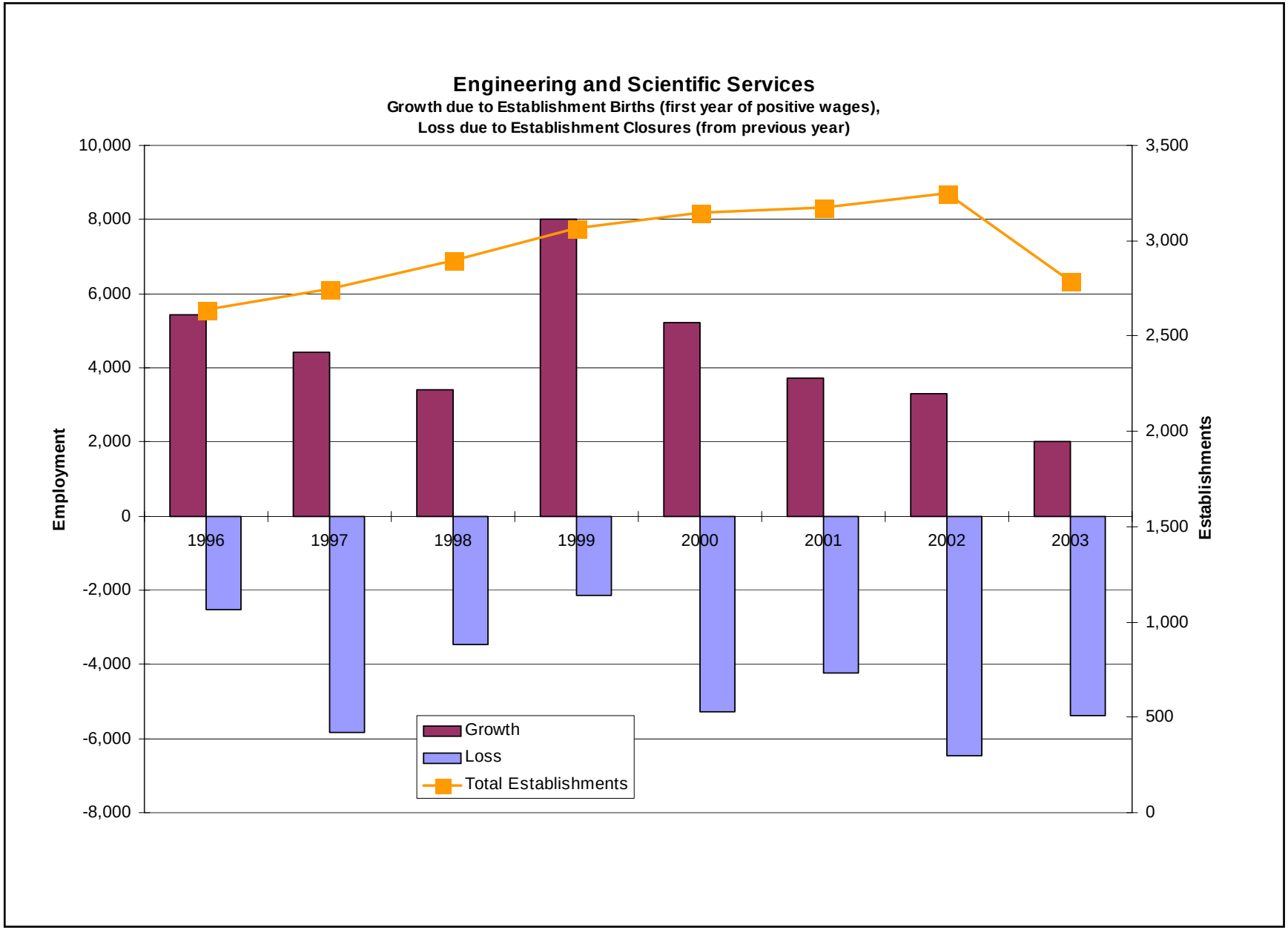

Tech Employment Levels by Industry
SFBA
Biomedical
Computer hardware
Computer services
Electronic components
Engineering & scientific services
Internet publishing
Semiconductors
Software
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
Tech Employment Levels by Industry
ROC
Biomedical
Computer hardware
Computer services
Electronic components
Engineering & scientific services
Internet publishing
Semiconductors
Software
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1995
1996
1997
1998
1999
2000
2001
2002
2003

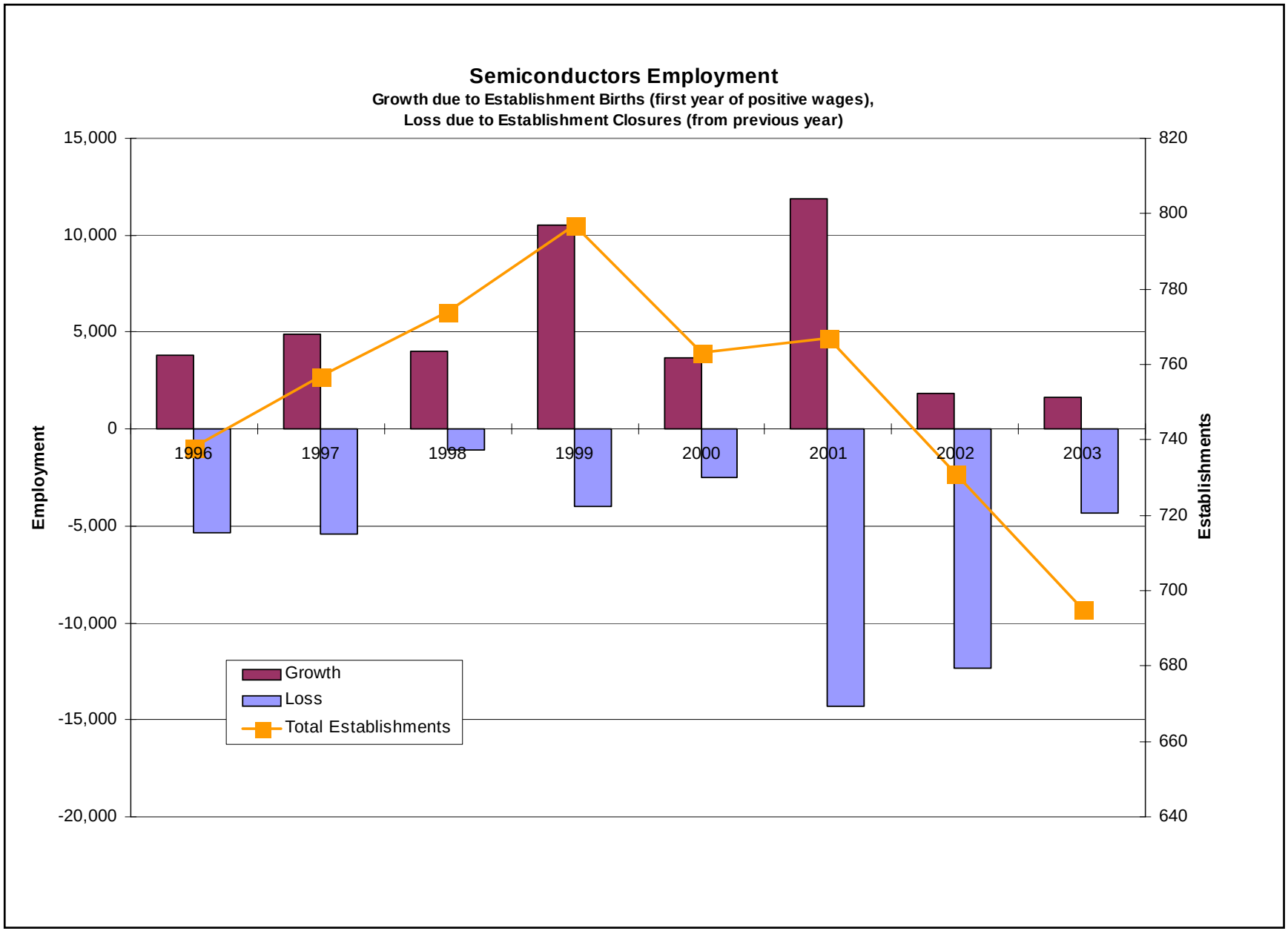

Peak Year Employment 2000 SFBA
Biomedical 2%
Software 14%
Semiconductors 18%
Computer hardware 18%
Internet publishing 2%
Engineering & scientific services 16%
Computer services 22%
Electronic components 8%
Peak Year Employment 2000 ROC
Internet publishing 1%
Semiconductors 9%
Software 14%
Biomedical 2%
Computer hardware 19%
Engineering & scientific services 28%
Computer services 19%
Electronic components 8%


Computer Services Employment
Growth due to Establishment Births (first year of positive wages),
Loss due to Establishment Closures (from previous year)
Employment
Establishments
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1996
1997
1998
1999
2000
2001
2002
Growth
Loss
Total Establishments


Software Employment
Growth due to Establishment Births (first year of positive wages),
Loss due to Establishment Closures (from previous year)
Employment
Establishments
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1996
1997
1998
1999
2000
2001
2002
2003
Growth
Loss
Total Establishments


Electronic Components
Growth due to Establishment Births (first year of positive wages),
Loss due to Establishment Closures (from previous year)
Employment
Establishments
8,000
6,000
4,000
2,000
0
-2,000
-4,000
-6,000
-8,000
-10,000
600
500
400
300
200
100
0
1996
1997
1998
1999
2000
2001
2002
2003
Growth
Loss
Total Establishments


Engineering and Scientific Services
Growth due to Establishment Births (first year of positive wages),
Loss due to Establishment Closures (from previous year)
Employment
Establishments
10,000
8,000
6,000
4,000
2,000
0
-2,000
-4,000
-6,000
-8,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1996
1997
1998
1999
2000
2001
2002
2003
Growth
Loss
Total Establishments


Semiconductors Employment
Growth due to Establishment Births (first year of positive wages),
Loss due to Establishment Closures (from previous year)
Employment
Establishments
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
820
800
780
760
740
720
700
680
660
640
1996
1997
1998
1999
2000
2001
2002
2003
Growth
Loss
Total Establishments

Tech Worker Flows 2000 to 2003

2000 Industry \ 2003 Industry	Semi conductors	Computer hardware	Electronic components	Biomedical	Software	Internet publishing	Computer services	Engineering & scientific services
Semiconductors	47,852	2,924	1,358	473	868	473	2,107	4,016
Computer hardware	2,346	56,849	1,991	421	2,039	231	6,031	10,067
Electronic components	1,669	3,143	34,098	251	419	39	551	1,527
Biomedical	395	189	98	10,145	103	14*	250	887
Software	529	1,770	294	145	26,511	787	6,554	4,644
Internet publishing	120	299	55	51	806	6,784	1,053	638
Computer services	1,836	3,842	490	302	7,382	1,486	50,934	6,651
Engineering & scientific services	2,927	6,353	981	715	13,338	553	6,681	122,942

** represents less than 20*

Tech Worker Flows to Non-Tech Industries, 2000 to 2003

2000 Industry	2003 Industry: Other manufacturing	Wholesale & Retail Trade	Transport- ation & public utilities (TPU)	Finance, Insurance, Real Estate (FIRE)	Healthcare	Business services	Employment services	Education
Semiconductors	3,791	3,590	414	851	559	1,359	2,446	180
Computer hardware	4,144	4,285	572	1,876	719	2,938	2,930	1,336
Electronic components	3,387	3,735	385	555	722	1,160	2,329	129
Biomedical	1,992	903	48	144	132	225	347	28
Software	1,456	3,830	510	2,336	691	3,726	2,557	278
Internet publishing	237	1,153	98	687	216	980	456	63
Computer services	2,167	6,217	577	4,392	1,216	5,871	3,625	464
Engineering & scientific services	5,473	7,273	1,710	2,939	1,552	7,073	3,923	1,302

Worker Flows of 2000 California Tech Workforce, from 1995 to 2003

		2003											
		Semiconductors			Computer hardware			Electronic components			Biomedical		
		Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA
Tech 1995	Employment Distribution in 2003	33062	9750	14829	42164	12557	16065	25351	8536	10991	6956	2352	2050
		57%	17%	26%	60%	18%	23%	56%	19%	24%	61%	21%	18%
	Median quarterly wage in 2000	$20,190	$9,985	$16,146	$22,405	$12,185	$17,267	$13,645	$7,448	$9,481	$16,757	$14,841	$14,368
	Portion of workers with wage gap of one quarter or more	10%	46%	19%	11%	42%	22%	12%	48%	22%	6%	32%	22%
Non-Tech 1995	Employment Distribution in 2003	11852	6347	6212	18038	10325	8610	7314	5655	4755	2935	1768	1157
		49%	26%	25%	49%	28%	23%	41%	32%	27%	50%	30%	20%
	Median quarterly wage in 2000	$16,098	$8,740	$12,073	$17,297	$9,492	$12,058	$10,642	$6,826	$7,461	$14,742	$12,033	$11,906
	Portion of workers with wage gap of one quarter or more	11%	44%	22%	12%	43%	25%	17%	46%	26%	7%	28%	21%
No CA wages 1995	Employment Distribution in 2003	15070	5771	9018	19589	8482	11566	8990	7074	8687	2,177	1,347	1401
		50%	19%	30%	49%	21%	29%	36%	29%	35%	44%	27%	28%
	Median quarterly wage in 2000	$20,938	$8,237	$12,855	$21,331	$8,856	$13,065	$8,342	$5,475	$5,676	$15,886	$12,653	$12,517
	Portion of workers with wage gap of one quarter or more	11%	46%	19%	12%	44%	22%	17%	52%	26%	9%	28%	19%

Worker Flows of 2000 California Tech Workforce, from 1995 to 2003

		2003											
		Software			Internet publishing			Computer services			gineering & scientific servi		
		Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA
Tech 1995	Employment Distribution in 2003	12891	4868	6276	4096	1868	1952	24959	9630	13320	81083	19927	35097
		54%	20%	26%	52%	24%	25%	52%	20%	28%	60%	15%	26%
	Median quarterly wage in 2000	$25,094	$13,993	$21,800	$19,793	$14,193	$18,131	$24,745	$17,719	$22,303	$21,333	$13,995	$16,929
	Portion of workers with wage gap of one quarter or more	16%	47%	25%	8%	35%	18%	19%	43%	24%	14%	33%	21%
Non-Tech 1995	Employment Distribution in 2003	12885	12575	9969	2857	2930	2234	18868	17437	14130	34306	22274	18623
		36%	35%	28%	36%	37%	28%	37%	35%	28%	46%	30%	25%
	Median quarterly wage in 2000	$18,642	$10,943	$13,731	$16,042	$11,851	$14,529	$18,679	$12,749	$15,128	$15,868	$11,643	$11,500
	Portion of workers with wage gap of one quarter or more	18%	42%	28%	12%	39%	25%	19%	41%	25%	14%	34%	22%
No CA wages 1995	Employment Distribution in 2003	15404	11439	14997	2845	2592	3527	28953	17868	27955	38841	19721	29052
		37%	27%	36%	32%	29%	39%	39%	24%	37%	44%	23%	33%
	Median quarterly wage in 2000	$21,833	$10,156	$13,914	$19,036	$11,551	$14,544	$21,684	$14,027	$15,408	$18,785	$10,756	$11,597
	Portion of workers with wage gap of one quarter or more	20%	46%	25%	18%	44%	20%	21%	42%	23%	20%	38%	22%

Tech Worker Flows into Non-Tech Industries

2000 industry workforce	Tech workers who entered non-tech industries by 2003	% of 2000 industry workforce	share of non-tech	Industry Median 2000-1	2000 median wage of non-tech entrants	2003 median wage of non-tech entrants	percent change	2000 wages relative to 2000 industry median	2003 wages relative to 2000 industry median	Gap 2000 2003 mean
972,552	**223,354**	**23%**		**$15,155**	**$12,179**	**$11,000**	**-10%**	**80%**	**73%**	**41%**
	69488	7%	31%		$15,665	$12,321	-21%	103%	81%	41%
	79311	8%	36%		$11,445	$10,775	-6%	76%	71%	40%
	74294	8%	33%		$9,837	$10,101	3%	65%	67%	43%
112,248	**21,893**	**20%**	**10%**	**$15,932**	**$12,431**	**$9,107**	**-27%**	**78%**	**57%**	**45%**
	9750	9%	4%		$14,989	$9,985	-33%	94%	63%	46%
	6347	6%	3%		$10,987	$8,740	-20%	69%	55%	44%
	5771	5%	3%		$9,603	$8,237	-14%	60%	52%	46%
148,567	**31,409**	**21%**	**14%**	**$16,483**	**$12,416**	**$10,272**	**-17%**	**75%**	**62%**	**43%**
	12557	8%	6%		$16,029	$12,185	-24%	97%	74%	42%
	10325	7%	5%		$10,901	$9,492	-13%	66%	58%	43%
	8482	6%	4%		$9,031	$8,856	-2%	55%	54%	44%
87,716	**21,277**	**24%**	**10%**	**$9,138**	**$7,744**	**$6,533**	**-16%**	**85%**	**71%**	**49%**
	8536	10%	4%		$9,801	$7,448	-24%	107%	82%	48%
	5655	6%	3%		$7,742	$6,826	-12%	85%	75%	46%
	7074	8%	3%		$5,647	$5,475	-3%	62%	60%	52%
22,194	**5,468**	**25%**	**2%**	**$14,000**	**$13,137**	**$13,345**	**2%**	**94%**	**95%**	**30%**
	2352	11%	1%		$15,563	$14,841	-5%	111%	106%	32%
	1768	8%	1%		$11,667	$12,033	3%	83%	86%	28%
	1347	6%	1%		$11,023	$12,653	15%	79%	90%	28%
101,667	**28,912**	**28%**	**13%**	**$16,000**	**$12,213**	**$11,013**	**-10%**	**76%**	**69%**	**45%**
	4868	5%	2%		$18,896	$13,993	-26%	118%	87%	47%
	12575	12%	6%		$12,032	$10,943	-9%	75%	68%	42%
	11439	11%	5%		$10,251	$10,156	-1%	64%	63%	46%
24,983	**7,399**	**30%**	**3%**	**$15,326**	**$13,706**	**$12,359**	**-10%**	**89%**	**81%**	**40%**
	1868	7%	1%		$16,641	$14,193	-15%	109%	93%	35%
	2930	12%	1%		$13,179	$11,851	-10%	86%	77%	39%
	2592	10%	1%		$11,990	$11,551	-4%	78%	75%	44%
174,124	**45,004**	**26%**	**20%**	**$17,396**	**$14,620**	**$14,085**	**-4%**	**84%**	**81%**	**42%**
	9630	6%	4%		$21,421	$17,719	-17%	123%	102%	43%
	17437	10%	8%		$13,263	$12,749	-4%	76%	73%	41%
	17868	10%	8%		$13,227	$14,027	6%	76%	81%	42%
301,059	**61,992**	**21%**	**28%**	**$15,043**	**$12,078**	**$12,011**	**-1%**	**80%**	**80%**	**35%**
	19927	7%	9%		$16,215	$13,995	-14%	108%	93%	33%
	22274	7%	10%		$11,147	$11,643	4%	74%	77%	34%
	19721	7%	9%		$9,444	$10,756	14%	63%	72%	38%

California Tech Workforce that ever had Primary Earnings in Employment Services between 2000Q1-2003Q4

	2000 Employment	With Quarters in Employment Services (>0Qs)	Share of 2000 Workforce	Number of Quarters in Employment Services			
				Mean	25th %	50th %	75th %
All Tech Industries	972,552	73,429	7.55%	3.033	1	2	4
Semiconductors	112,248	7,997	7.12%	2.87	1	2	4
Computer Hardware	148,567	11,202	7.54%	2.954	1	2	4
Electronic Components	87,716	8,698	9.92%	2.842	1	2	4
Biomedical	22,194	1,228	5.53%	2.977	1	2	4
Software	101,661	11,774	11.58%	3.317	1	2	4
Internet Publishing	24,983	1,954	7.82%	2.848	1	2	4
Computer Services	174,124	14,735	8.46%	3.1	1	2	4
Engineering & Scientific Services	301,059	15,841	5.26%	3.02	1	2	4

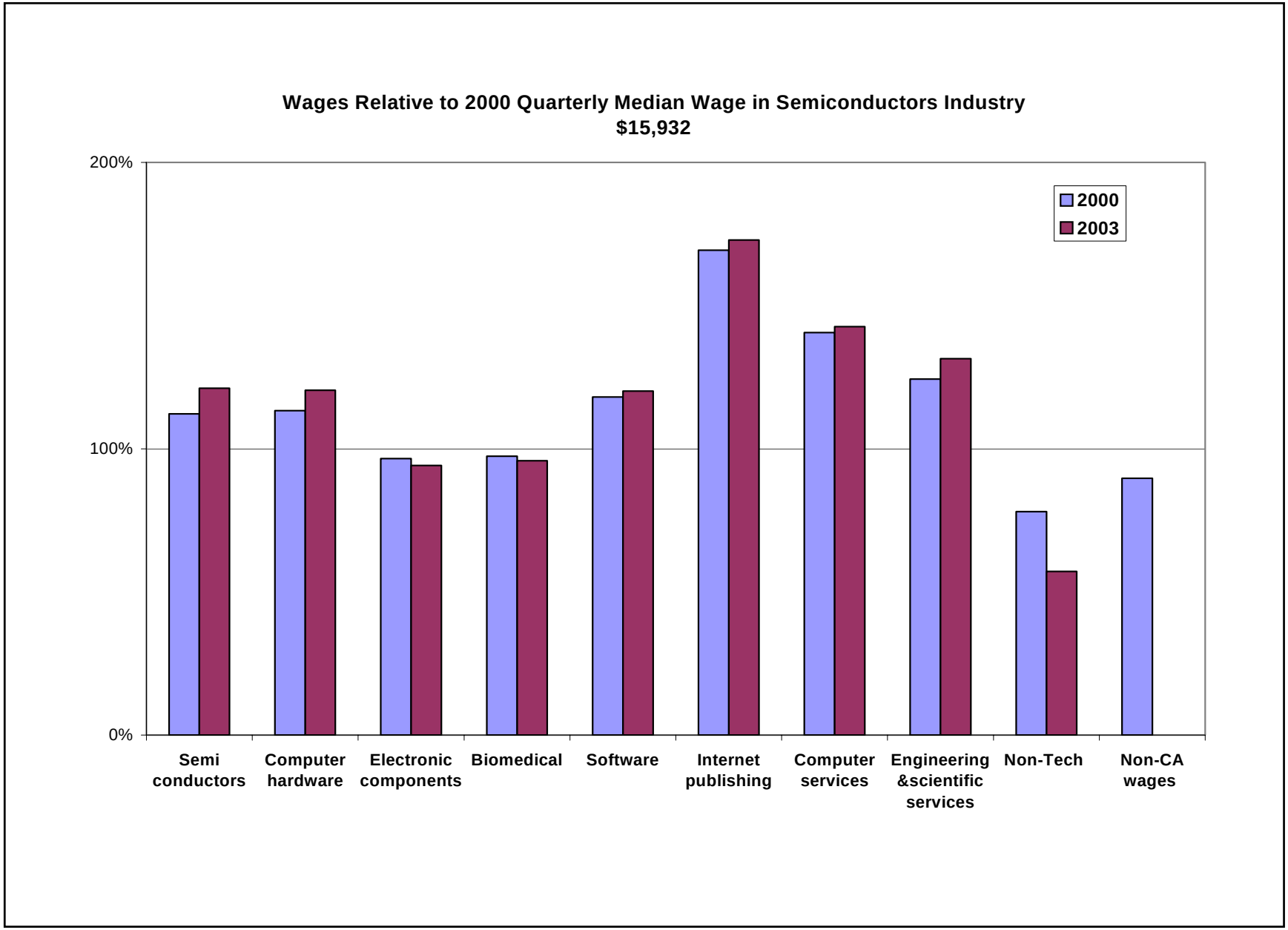
Tech Workers Who left CA workforce

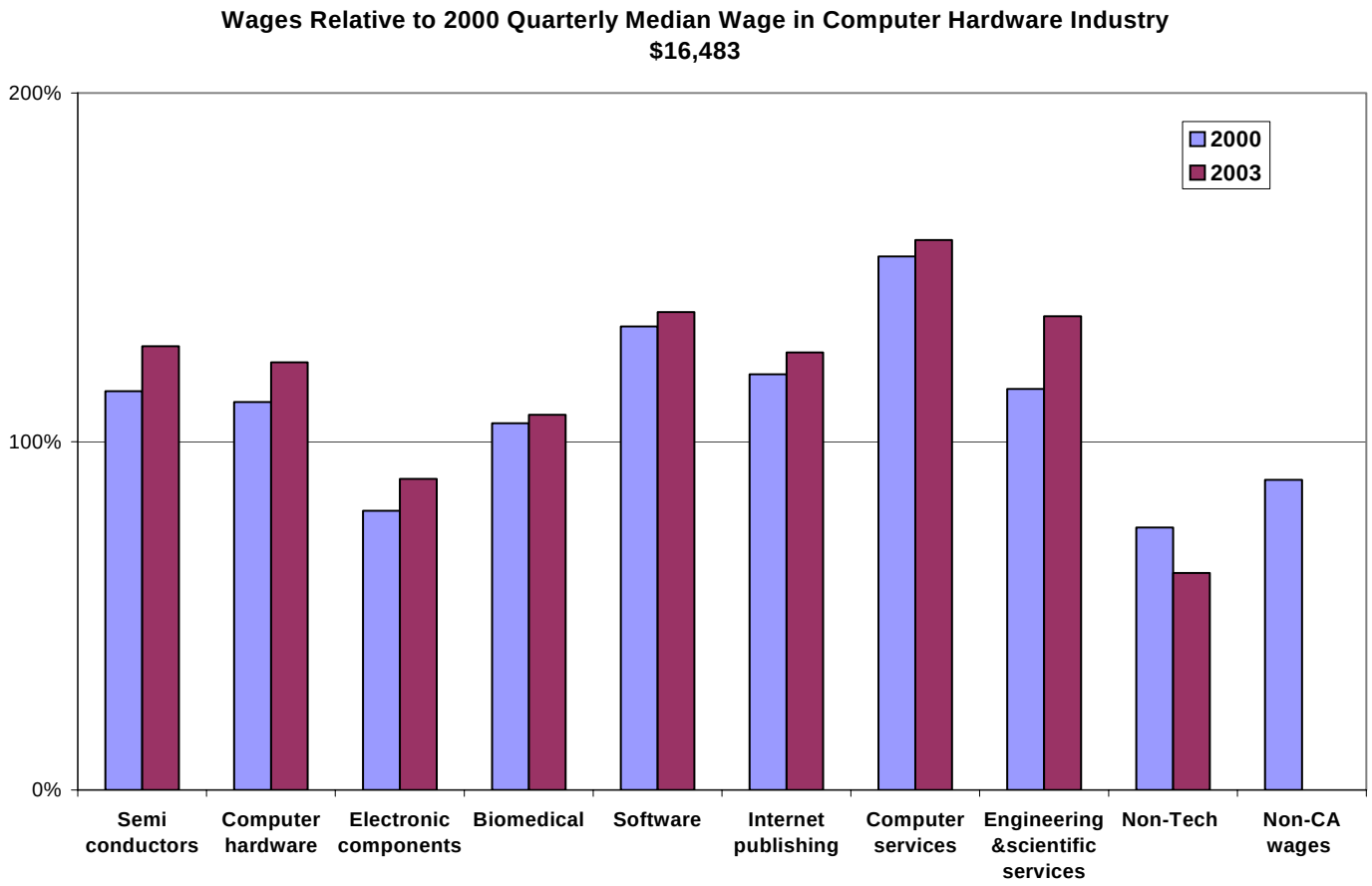
	Tech workers who left by 2003	Where had they been in 1995?			Median quarterly earnings in 2000	Percentage experiencing wage gap of one quarter or more
All tech workers	**272,473**	No_Wages	106,203	39%	$12,627	23%
% of 2000 tech workforce	**28%**	Tech	100,580	37%	$16,709	22%
		Non_Tech	65,690	24%	$12,331	24%
Semiconductors	**30,059**	No_Wages	9,018	30%	$12,855	19%
% of all leavers	**11%**	Tech	14,829	49%	$16,146	19%
		Non_Tech	6,212	21%	$12,073	22%
Computer hardware	**36,241**	No_Wages	11,566	32%	$13,065	22%
% of all leavers	**13%**	Tech	16,065	44%	$17,267	22%
		Non_Tech	8,610	24%	$12,058	25%
Electronic components	**24,433**	No_Wages	8,687	36%	$5,676	26%
% of all leavers	**9%**	Tech	10,991	45%	$9,481	22%
		Non_Tech	4,755	19%	$7,461	26%
Biomedical	**4,608**	No_Wages	1,401	30%	$12,517	19%
% of all leavers	**2%**	Tech	2,050	44%	$14,368	22%
		Non_Tech	1,157	25%	$11,906	21%
Software	**31,242**	No_Wages	14,997	48%	$13,914	25%
% of all leavers	**11%**	Tech	6,276	20%	$21,800	25%
		Non_Tech	9,969	32%	$13,731	28%
Internet publishing	**7,713**	No_Wages	3,527	46%	$14,544	20%
% of all leavers	**3%**	Tech	1,952	25%	$18,131	18%
		Non_Tech	2,234	29%	$14,529	25%
Computer services	**55,405**	No_Wages	27,955	50%	$15,408	23%
% of all leavers	**20%**	Tech	13,320	24%	$22,303	24%
		Non_Tech	14,130	26%	$15,128	25%
Engineering & scientific services	**82,772**	No_Wages	29,052	35%	$11,597	22%
		Tech	35,097	42%	$16,929	21%
% of all leavers	**30%**	Non_Tech	18,623	22%	$11,500	22%

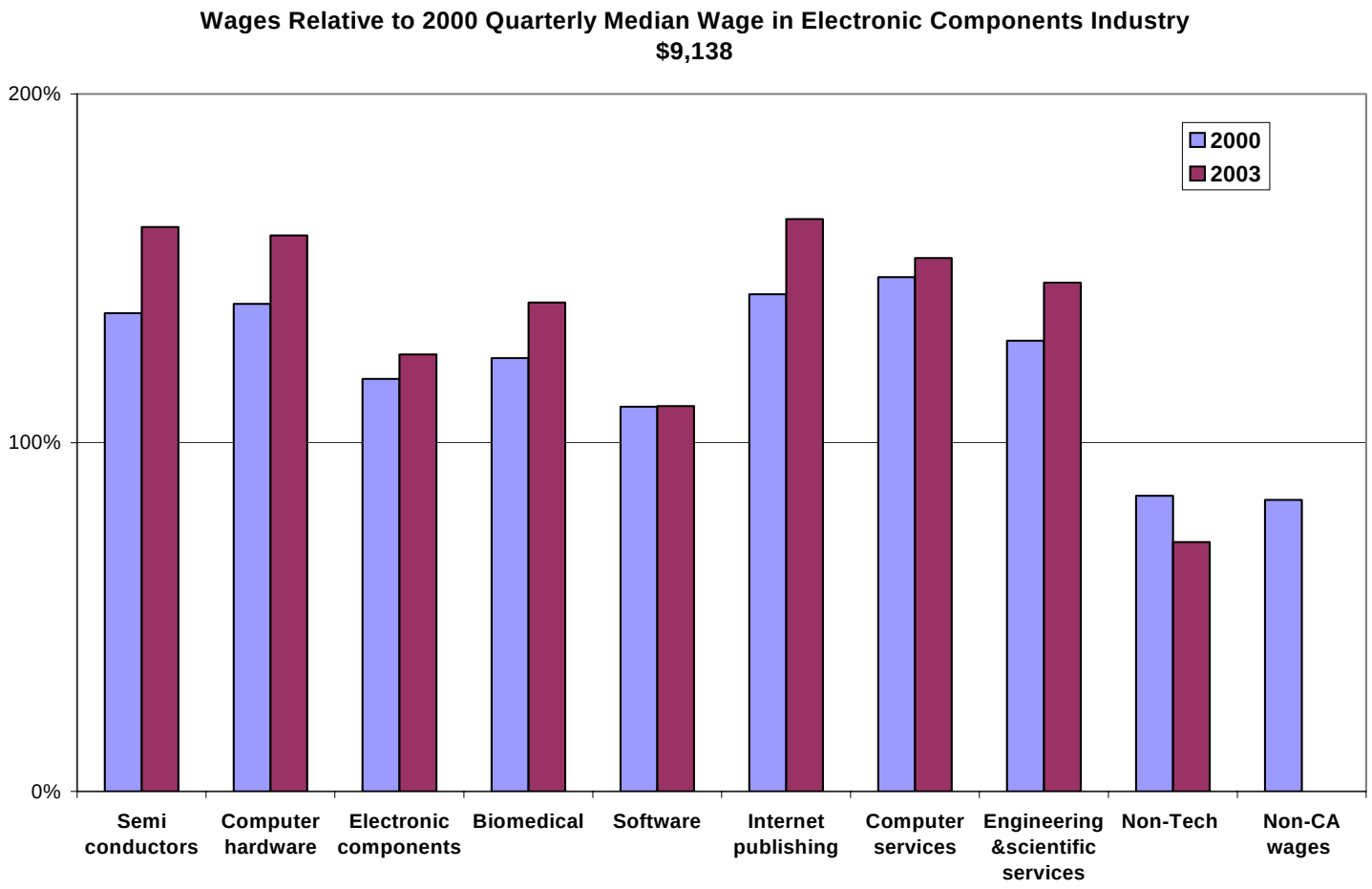
Wage gaps
2003

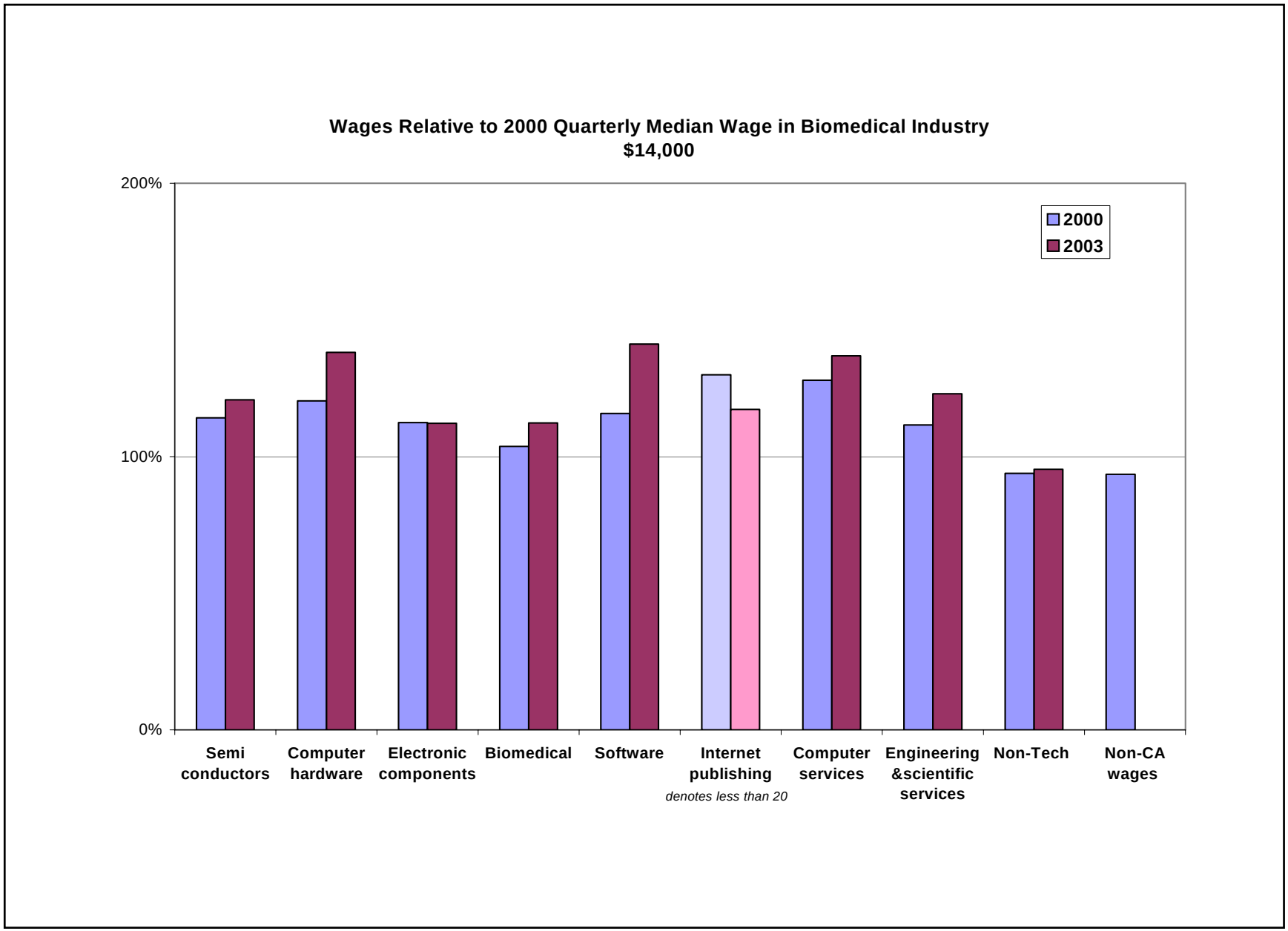
1995	Semiconductors			Computer hardware			Electronic components			Biomedical		
	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA
Tech	10%	46%	19%	11%	42%	22%	12%	48%	22%	6%	32%	22%
Non-Tech	11%	44%	22%	12%	43%	25%	17%	46%	26%	7%	28%	21%
No CA wages	11%	46%	19%	12%	44%	22%	17%	52%	26%	9%	28%	19%

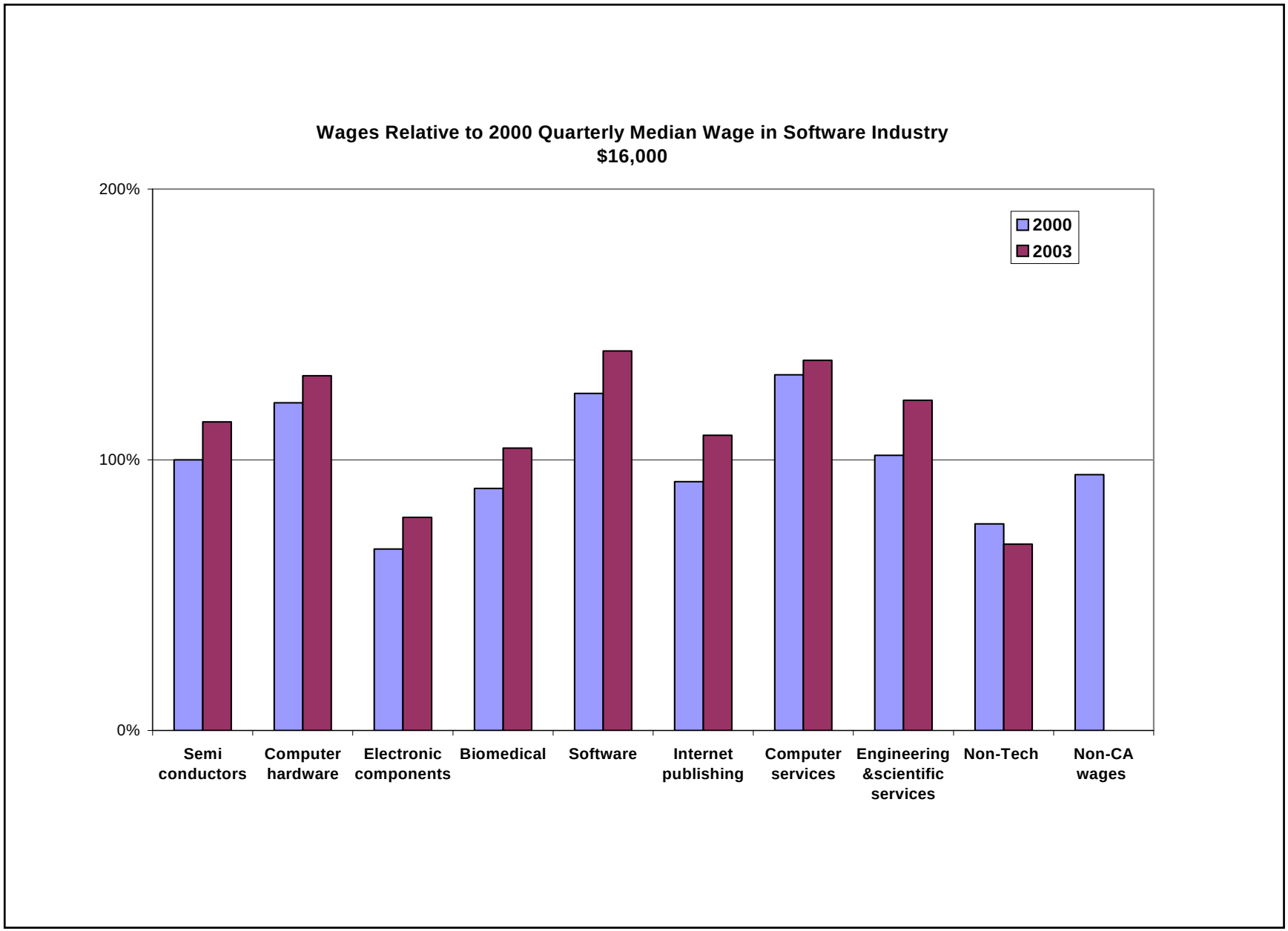
1995	Software			Internet publishing			Computer services			Engineering & scientific services		
	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA	Tech	Non-Tech	No CA
Tech	16%	47%	25%	8%	35%	18%	19%	43%	24%	14%	33%	21%
Non-Tech	18%	42%	28%	12%	39%	25%	19%	41%	25%	14%	34%	22%
No CA wages	20%	46%	25%	18%	44%	20%	21%	42%	23%	20%	38%	22%

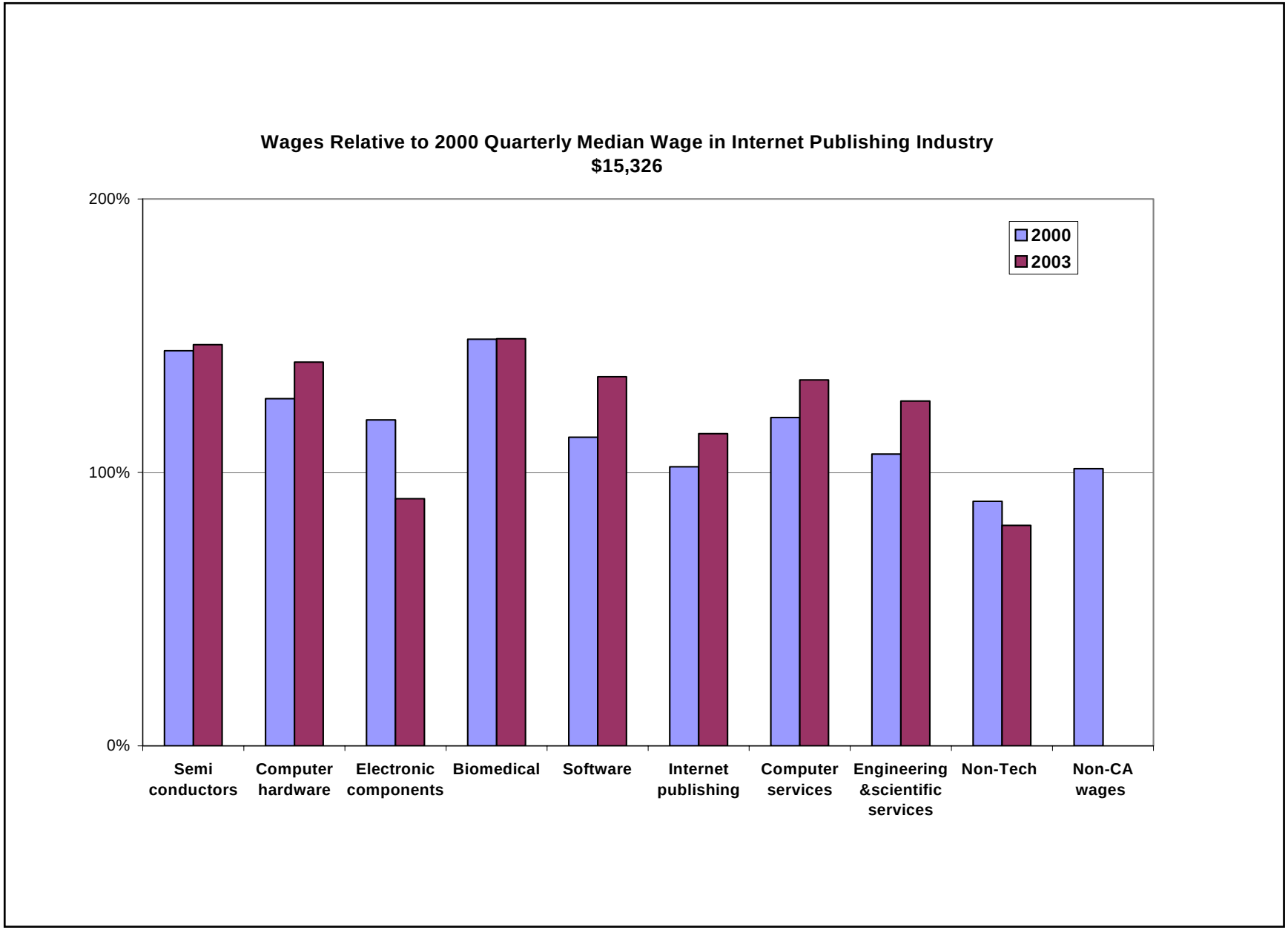

Wages Relative to 2000 Quarterly Median Wage in Semiconductors Industry
$15,932
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages

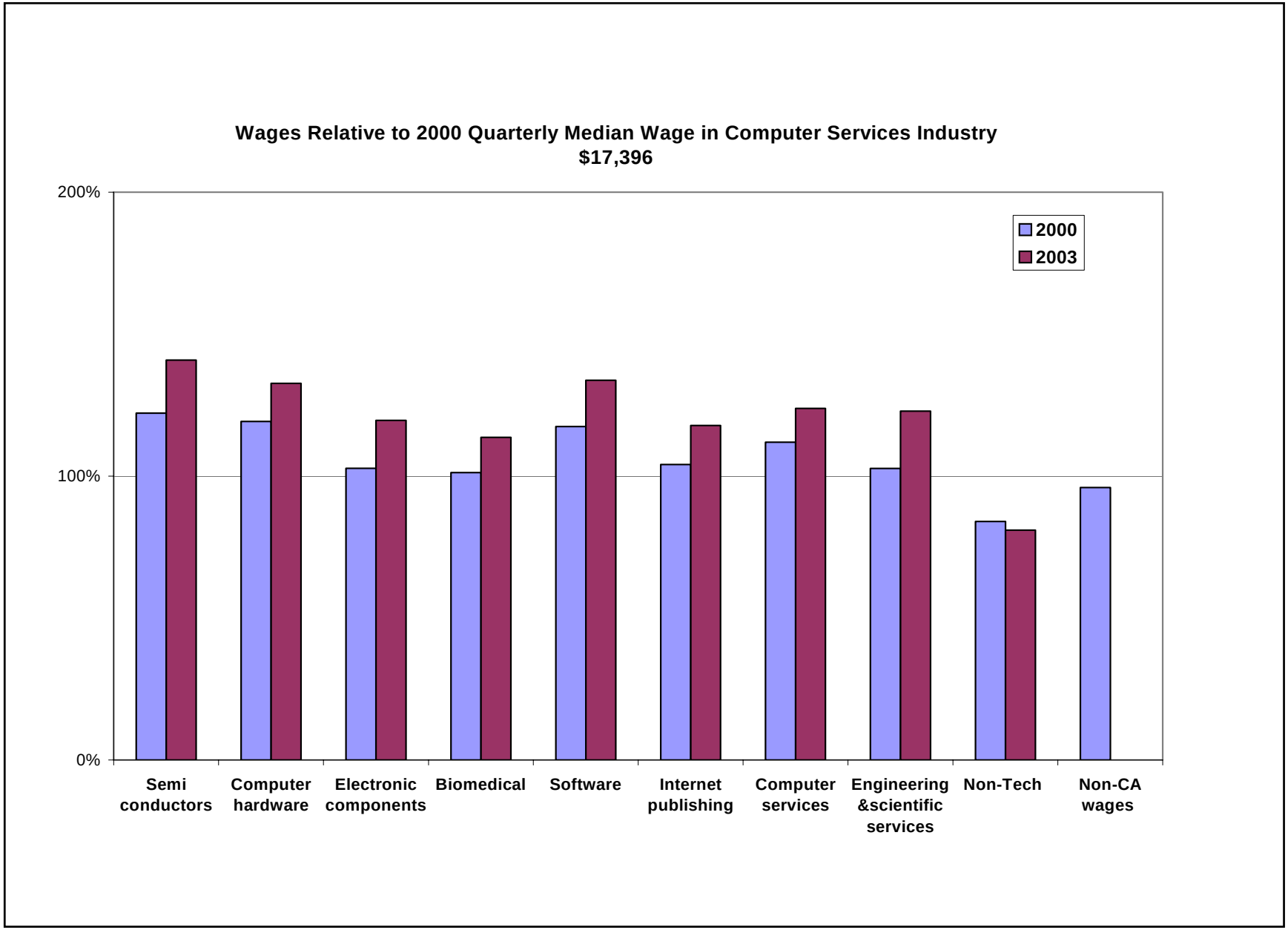

Wages Relative to 2000 Quarterly Median Wage in Computer Hardware Industry
$16,483
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages

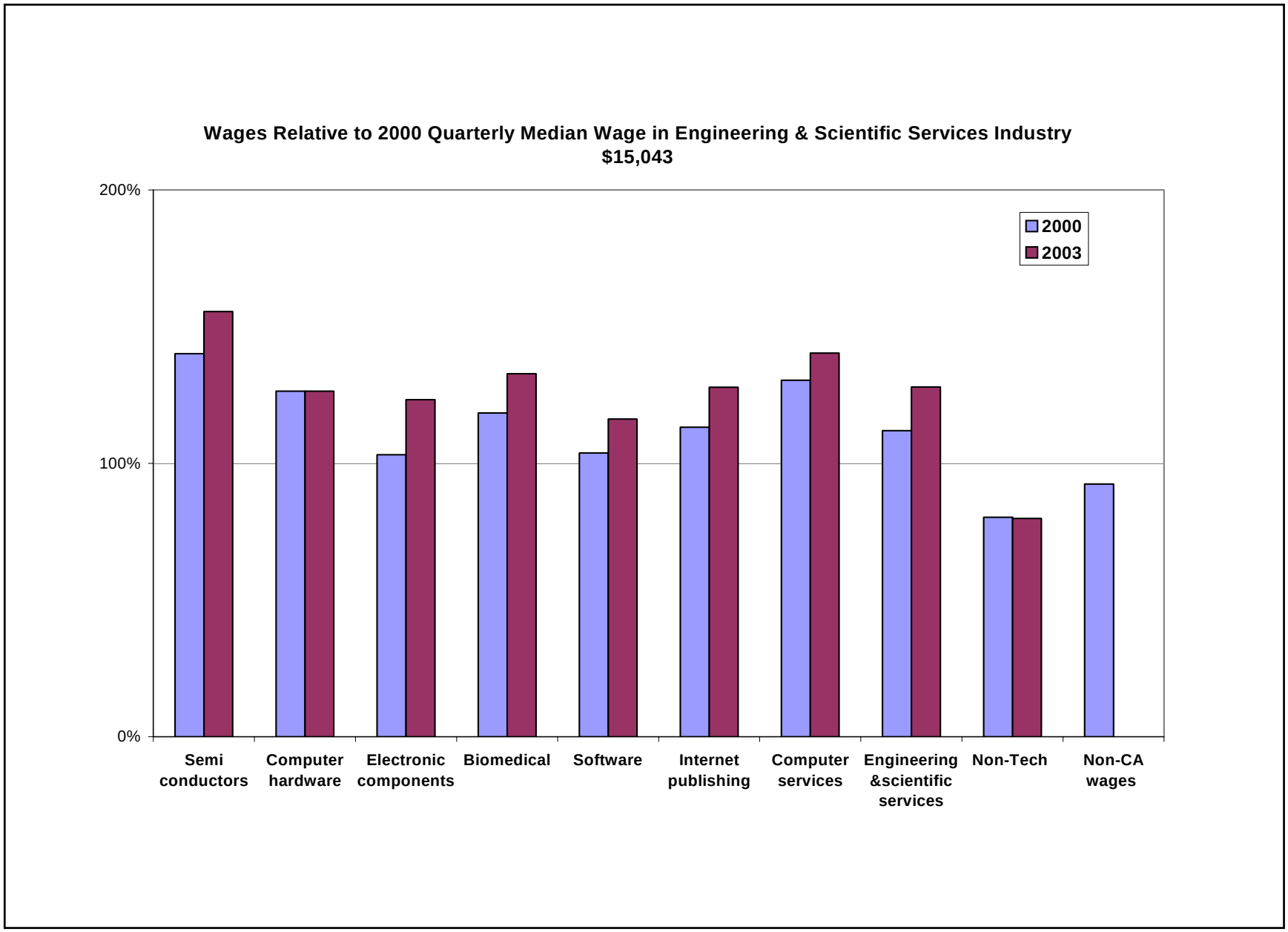

Wages Relative to 2000 Quarterly Median Wage in Electronic Components Industry
$9,138
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages

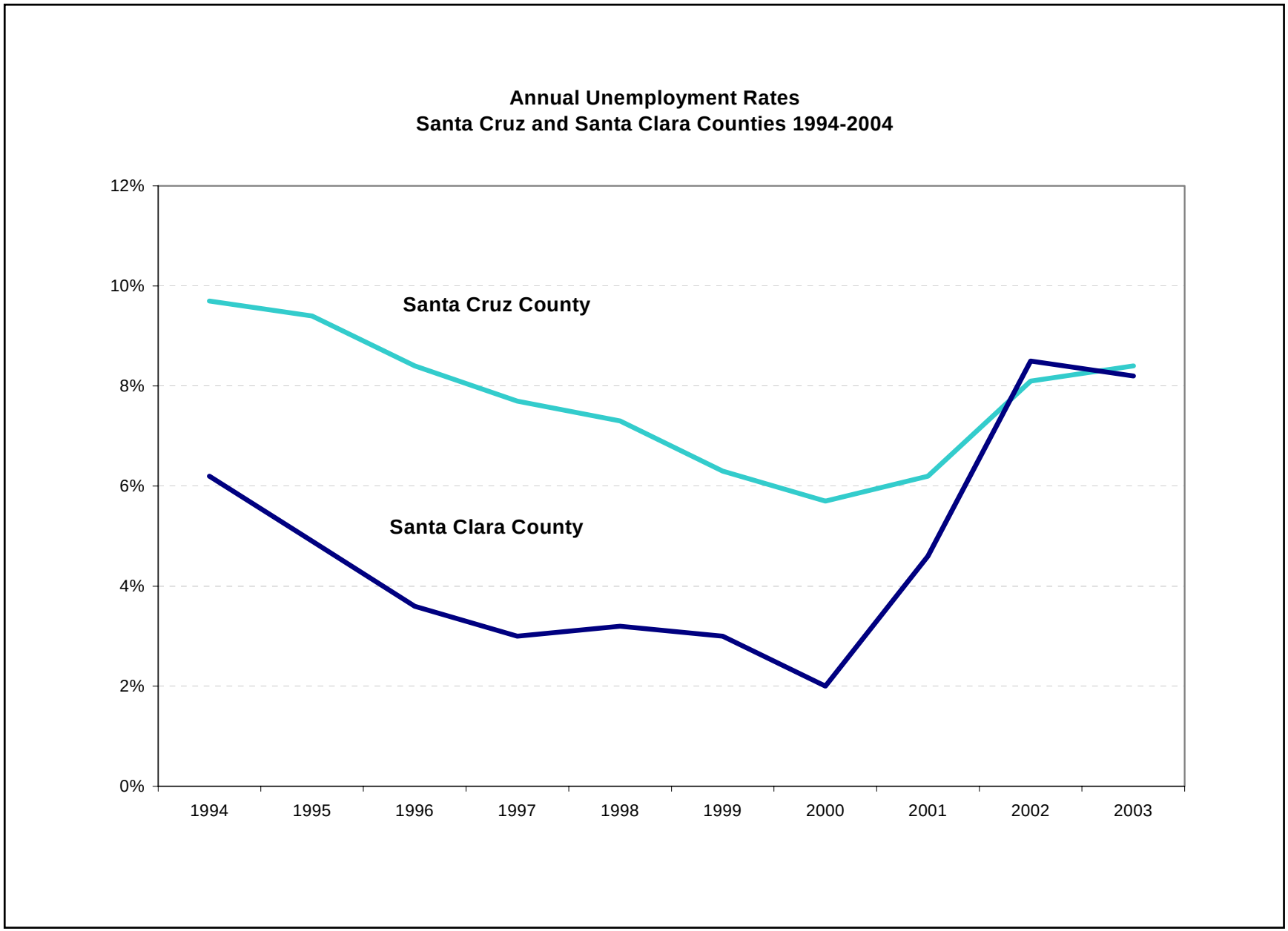

Wages Relative to 2000 Quarterly Median Wage in Biomedical Industry
$14,000
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages
denotes less than 20

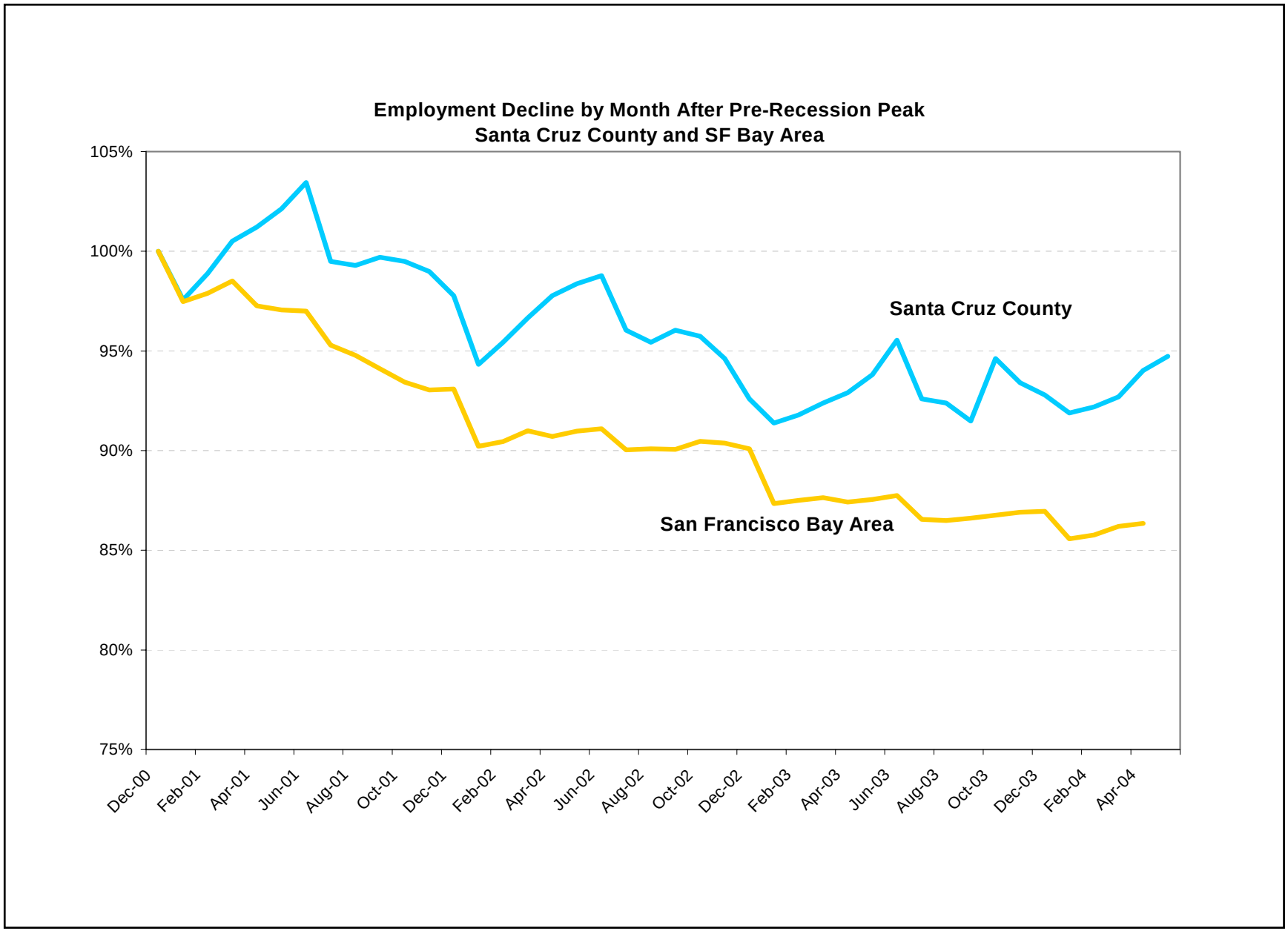

Wages Relative to 2000 Quarterly Median Wage in Software Industry
$16,000
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages

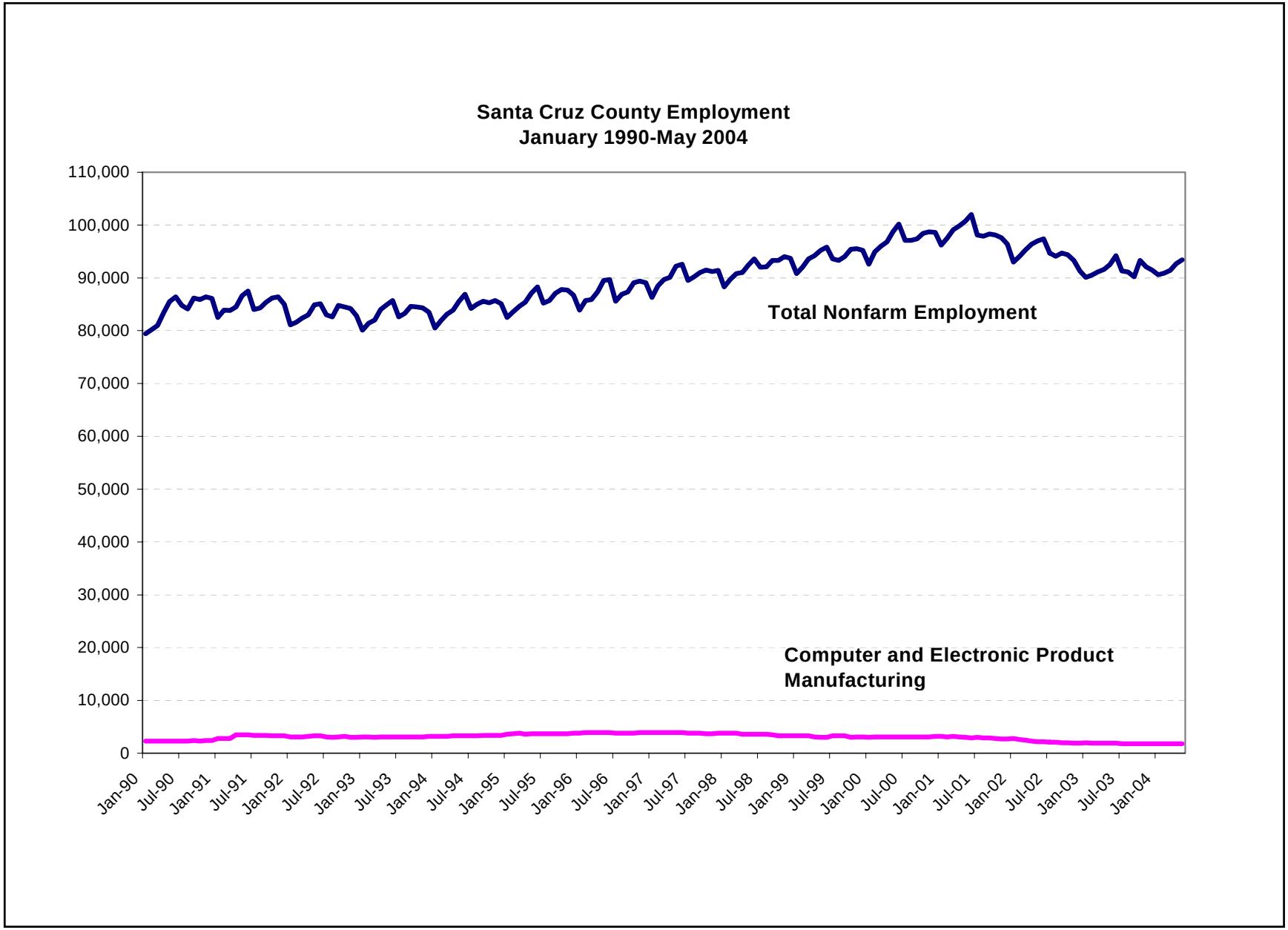

Wages Relative to 2000 Quarterly Median Wage in Internet Publishing Industry
$15,326
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages


Wages Relative to 2000 Quarterly Median Wage in Computer Services Industry
$17,396
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages


Wages Relative to 2000 Quarterly Median Wage in Engineering & Scientific Services Industry
$15,043
200%
100%
0%
2000
2003
Semi conductors
Computer hardware
Electronic components
Biomedical
Software
Internet publishing
Computer services
Engineering &scientific services
Non-Tech
Non-CA wages


Annual Unemployment Rates
Santa Cruz and Santa Clara Counties 1994-2004
12%
10%
8%
6%
4%
2%
0%
Santa Cruz County
Santa Clara County
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


Employment Decline by Month After Pre-Recession Peak
Santa Cruz County and SF Bay Area
105%
100%
95%
90%
85%
80%
75%
Santa Cruz County
San Francisco Bay Area
Dec-00
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04


Santa Cruz County Employment
January 1990-May 2004
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Total Nonfarm Employment
Computer and Electronic Product Manufacturing
Jan-90
Jul-90
Jan-91
Jul-91
Jan-92
Jul-92
Jan-93
Jul-93
Jan-94
Jul-94
Jan-95
Jul-95
Jan-96
Jul-96
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
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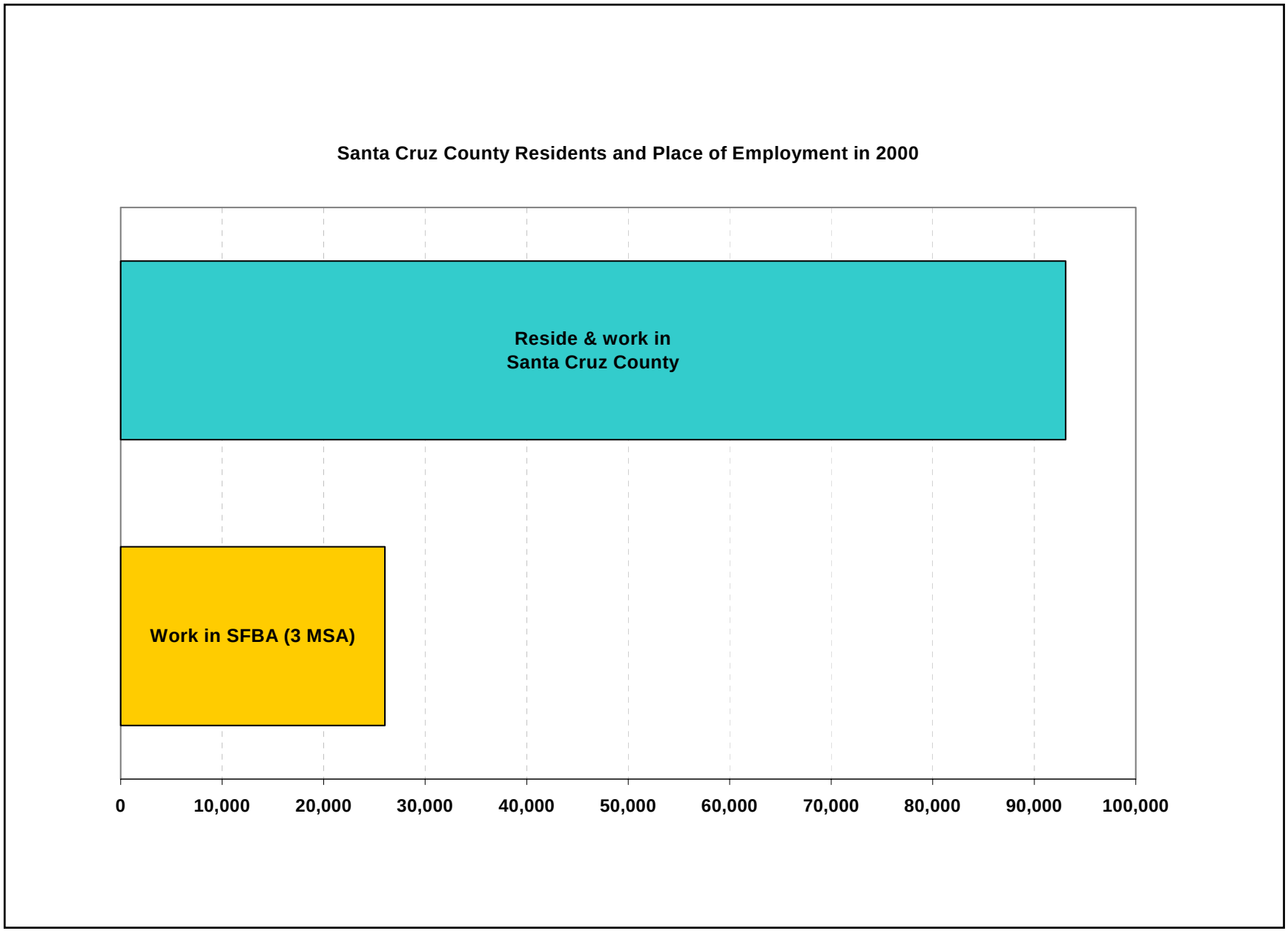
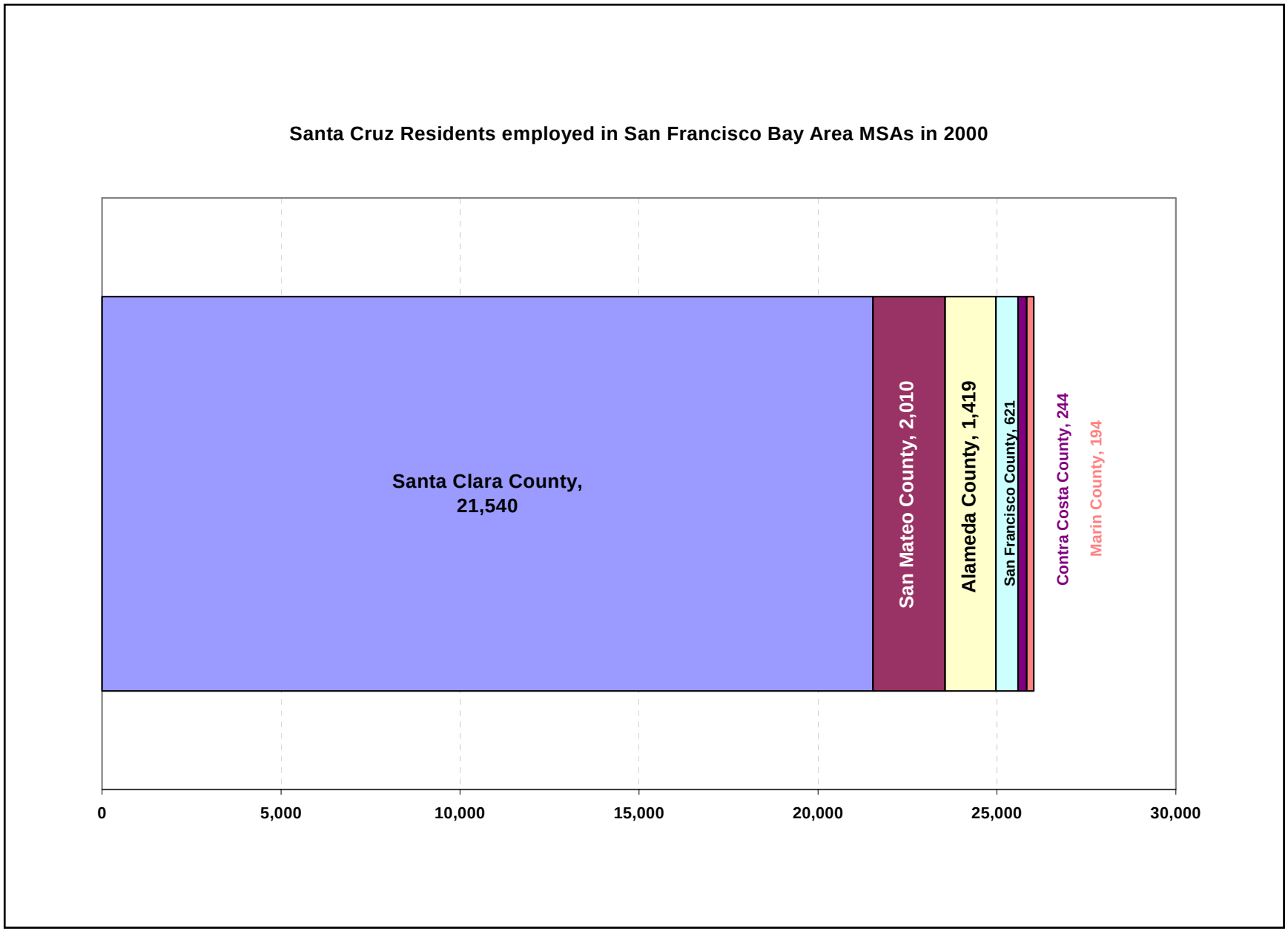
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04


Santa Cruz County Residents and Place of Employment in 2000
Reside & work in
Santa Cruz County
Work in SFBA (3 MSA)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000


Santa Cruz Residents employed in San Francisco Bay Area MSAs in 2000
Santa Clara County, 21,540
San Mateo County, 2,010
Alameda County, 1,419
San Francisco County, 621
Contra Costa County, 244
Marin County, 194
0
5,000
10,000
15,000
20,000
25,000
30,000

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SPHERE's research portfolio covers a wide range of issues such as projects on welfare caseloads; tradeoffs between health benefits and other compensation; health care evaluation such as Medicare program analyses; forecasting tobacco and property taxes; career ladders for low-skill workers; and analyses of the California and regional economies and business climates. In conjunction with its for-profit affiliate, Acumen LLC, SPHERE has completed projects on behalf of a large number of federal, state, and local governments, as well as foundations and other public policy organizations. SPHERE also publishes the California Policy Review, a publication exploring economic and social policy issues for a broad audience.