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After the Dot-Com Bubble: Silicon Valley High-Tech Employment and Wages in 2001 and 2008

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Between 2001 and 2008, the Silicon Valley underwent a transformation. Following the peak of the high-tech boom, employment in Silicon Valley high-tech industries declined by about 17 percent, representing a loss of slightly more than 85,000 jobs; however, average wages grew by nearly 36 percent in these industries during the same period.¹ Moreover, some

industries grew in terms of their relative concentration in the local economy, while other industries shrunk.

Of the 11 industries analyzed in this report, 8 experienced employment declines and 3 industries—pharmaceuticals, aerospace, and scientific research—exhibited employment growth during the 2001 to 2008

period. Although the total number of high-tech jobs was down in Silicon Valley, the local concentration of jobs in a majority of its high-tech industries rose relative to the Nation as a whole.

For this report, 11 industries have been identified as “high-tech” using the 2007 North American Industry Classification

System (NAICS)² codes. An industry is considered high-tech if “technology-oriented workers” within an industry, as identified by occupational staffing patterns, account for approximately 25 percent or more of total jobs within the selected industry.³

Due to recent revisions in the 2007 NAICS codes, employees in Internet publishing and Web search portals, data processing, cable and program distribution, and telecommunications have been aggregated under one industrial classification. Applying this methodology, 11 industries are identified as high-tech.

Recent Economic History

“Silicon Valley” has been a globally recognized center of technological innovation since the 1970s, when technology firms engaged in semiconductor manufacturing, computer design, and computer programming and services symbiotically clustered in the southern portion of the San Francisco Bay Area. The silicon in Silicon Valley refers to the key ingredient of semiconductors, which formed the technical basis for the computer-based high technology economic climate that grew up surrounding San Jose, California, which is in Santa Clara County. This area and that industrial base attracted venture capitalists, computer technologists, and entrepreneurs to create a regional agglomeration of high-tech firms

that spread into neighboring Bay Area counties (specifically, Alameda, Contra Costa, San Francisco, San Mateo, and Santa Cruz) and made Silicon Valley synonymous with technology-driven growth. (See map 1.)

From the mid-1990s to 2001, the new Internet sector, along with its related high-tech industries, rapidly grew, due in large part to widely available venture capital, and created a new wave of growth in Silicon Valley. Stock markets, such as the NASDAQ on which many high-tech corporations are listed, experienced huge run-ups in stock prices. In March 2000, the NASDAQ reached a peak of 5,132.52.

By December 2000, the NASDAQ had dropped by more than 50 percent and stood below 2,500. Despite such a massive hit to the market capitalizations and financial projections for high-tech firms, employment in the Silicon Valley was stalwart in the early part of 2001. Santa Clara County’s unemployment rate stood at just 3.0 percent in January 2001. Nevertheless, the aftershocks of the 2000 stock market crash and the onset of economic recession in March 2001 resulted in a sudden contraction of the Silicon Valley economy. As the bubble burst, Santa Clara County’s unemployment rate jumped to

7.0 percent by the end of 2001, and the region’s future as a crucible of innovation appeared in doubt.

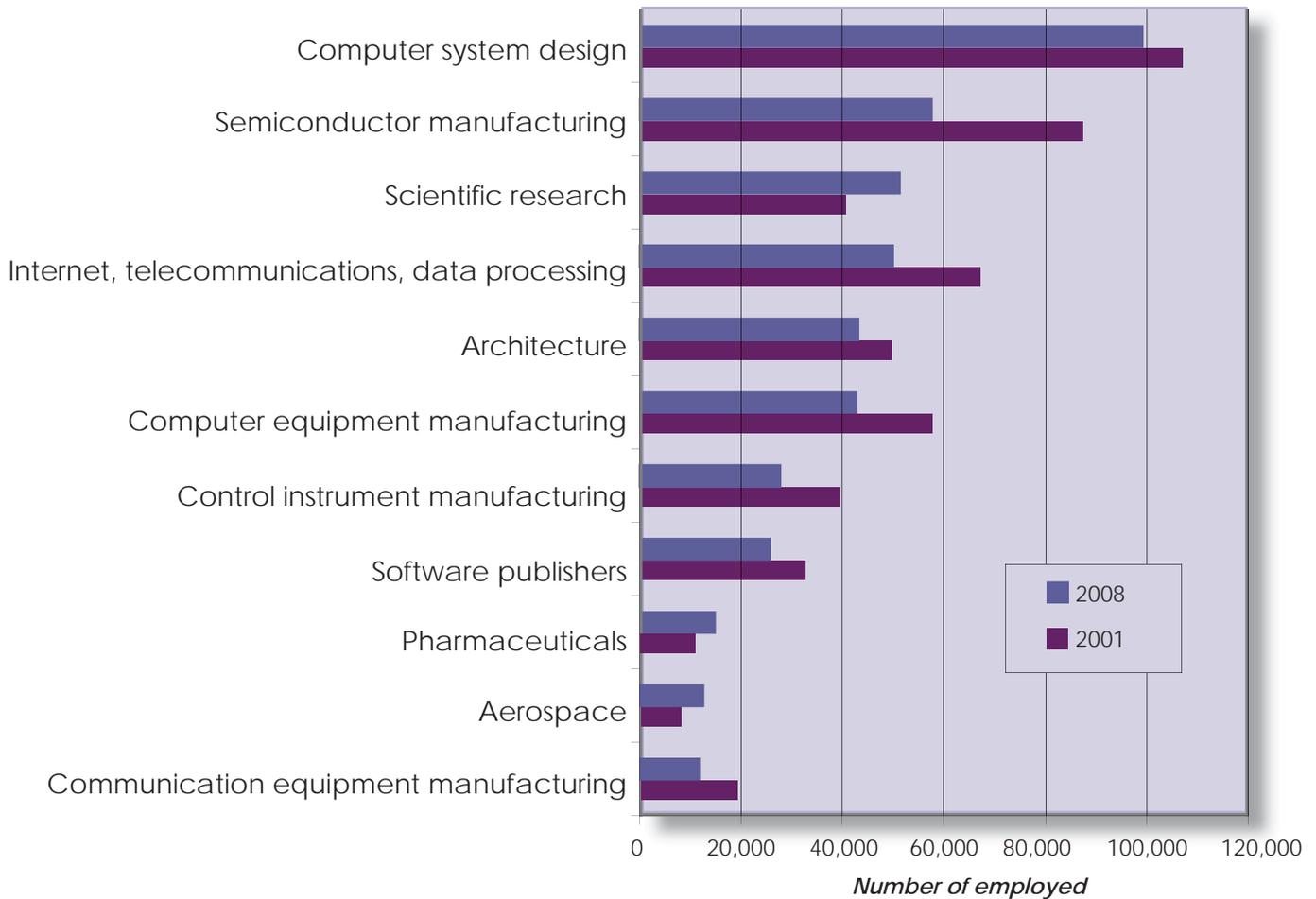
Following the 2001 economic downturn, high-tech industries in the Silicon Valley recovered at a slower rate than in the rest of the Nation. Some high-tech companies responded by relocating certain phases of production elsewhere or moving from the Silicon Valley altogether to areas with lower commercial rents and housing costs.⁴ By 2004, though, high-tech employment began to rebound in the Silicon Valley, and by 2008, some high-tech industries like aerospace, pharmaceuticals, and scientific research had added enough jobs to exceed their pre-recession employment levels. Despite the signs of growth in recent years, Silicon Valley high-tech industries overall employed 17 percent fewer workers in 2008 compared with 2001. Nationally, high-tech jobs grew by 4 percent from 2001 through 2008.

Still, the Silicon Valley has remained important in terms of not only the number of jobs, but also the number of jobs paying high wages. During 2008, the high-tech industries generated \$57.7 billion dollars in wages in the Silicon Valley. That amount was nearly 14 percent greater than the total wages earned in these industries

MAP 1. Distribution of high-tech employment in Silicon Valley by county, in 2008



CHART 1. Employment in Silicon Valley high-tech industries, 2001 and 2008



in 2001. Furthermore, the concentration of workers in high-tech industries remained at high levels, and average wages rose in every high-tech industry examined between 2001 and 2008. Silicon Valley also continues to be at the cutting edge of innovation. According to the U.S. Patent and Trademark Office, in 2008, 11 of the top 20 U.S. cities with the most registered patents were in the Silicon Valley.

Today, the six Silicon Valley counties⁵ encompass clusters of high-tech innovators and are home

to large concentrations of businesses in the interconnected fields of computers, electronics, multimedia, and biotechnology. Although six counties are identified as part of the Silicon Valley high-tech corridor, more than half of all high-tech jobs were located in Santa Clara County alone.

Employment

All high-tech industries had significant representation in the local area: employment ranged from 99,224 jobs in the computer system design industry down to 11,583 jobs in the communication

equipment manufacturing industry in 2008.

Although 8 of the 11 industries analyzed experienced employment declines, 3 industries—scientific research, pharmaceuticals, and aerospace—exhibited employment growth from 2001 to 2008. (See chart 1.) During this period, overall Silicon Valley high-tech employment fell by around 85,000 jobs to 435,826 jobs.

Employment Concentration

Several Silicon Valley high-tech industries expanded between

TABLE 1. Employees and location quotients by industry, Silicon Valley, 2001 and 2008

Industry	Employment 2001	Employment 2008	Change from 2001 to 2008		Location quotient (LQ)	
			Number	Percent	2001	2008
Silicon Valley high-tech industries	521,963	435,826	-86,137	-16.5	3.2	2.8
Computer system design	107,163	99,224	-7,939	-7.4	3.4	3.0
Semiconductor manufacturing	87,424	57,490	-29,934	-34.2	5.5	5.9
Scientific research	40,756	51,361	10,605	26.0	3.1	3.7
Internet, telecommunications, data processing	67,317	49,810	-17,507	-26.0	3.1	1.9
Architecture	49,897	43,032	-6,865	-13.8	1.6	1.3
Computer equipment manufacturing	57,833	42,893	-14,940	-25.8	8.1	10.4
Control instrument manufacturing	39,710	27,541	-12,169	-30.6	3.4	2.8
Software publishers	32,801	25,661	-7,140	-21.8	4.9	4.3
Pharmaceuticals	11,189	14,728	3,539	31.6	1.6	2.3
Aerospace	8,349	12,503	4,154	49.8	0.7	1.1
Communication equipment manufacturing	19,524	11,583	-7,941	-40.7	3.3	4.0

2001 and 2008 in terms of employment concentration and significance in the Silicon Valley economy. One statistical measure of the concentration of a local industry is the location quotient. Location quotients (LQs) are ratios that compare the concentration of industry employment in a defined area to that of a larger area or base. For example, LQs can be used to compare the proportion of the Silicon Valley workforce employed in high-tech with the proportion of the national workforce employed in high-tech. An industry with an LQ greater than 1.0 employs a greater concentration of workers locally relative to the national share.⁶ The LQ for high-tech employment in the Silicon Valley was 3.2 in 2001, indicating that high-tech employment was concentrated at more than three times the national average.

Although the Valley's high-tech LQ declined to 2.8 in 2008, 6 of the 11 high-tech industries actually had increased their LQ since 2001. (See table 1.)

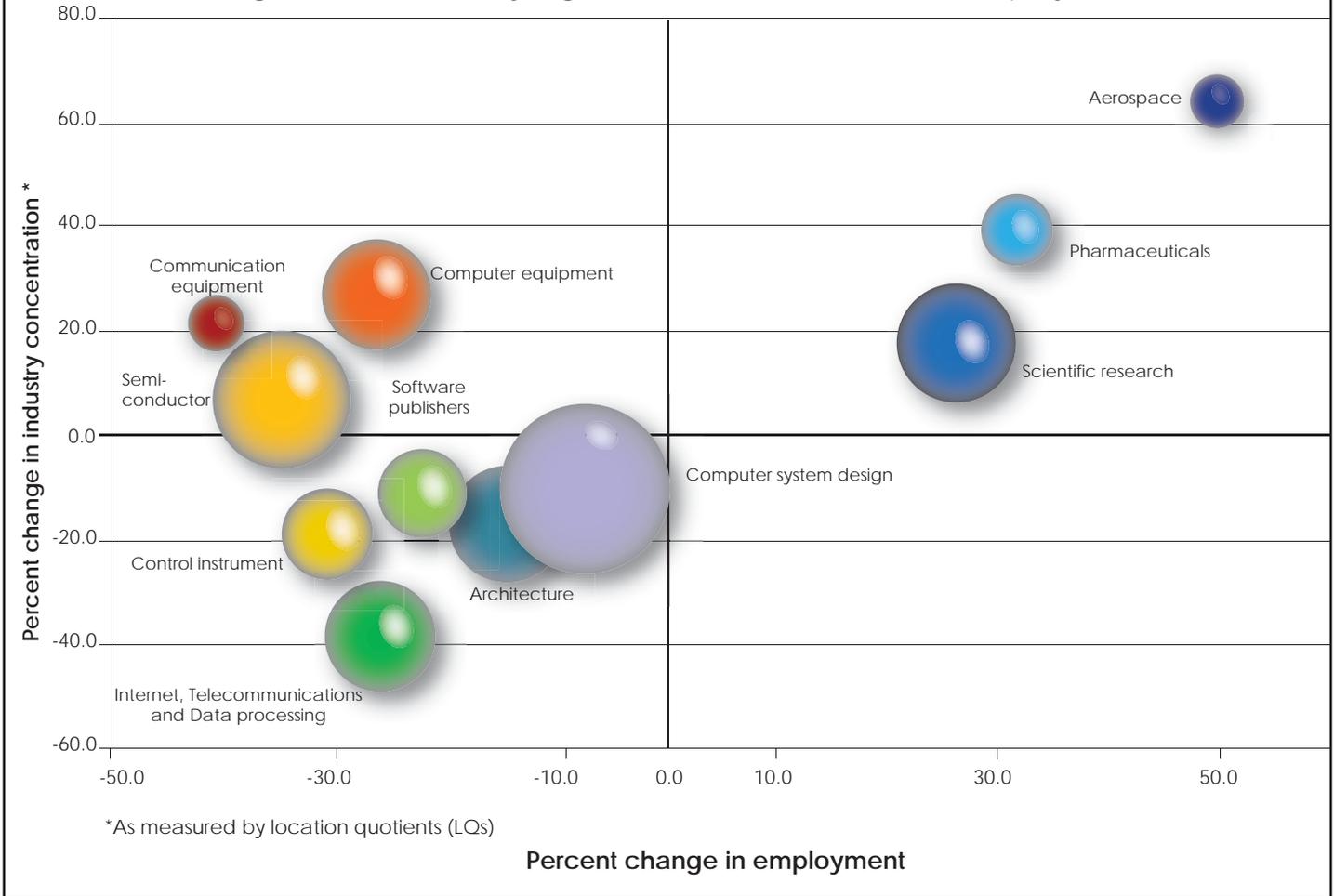
Of the 6 industries with increased LQs in 2008, 3 actually lost jobs over the 6-year period. LQs rose for manufacturing of computer equipment, communications equipment, and semiconductors in the Silicon Valley, as job losses in these industries were less severe in the local area than the rest of the Nation.

Employment concentrations and trends can also be demonstrated visually using a bubble chart. (See chart 2.) The size of each bubble represents the industry's 2008 employment level—a larger bubble indicates more employment. Industries in the upper right quadrant are growing both in employment

and in relative concentration in Silicon Valley and thus are the potential “emerging leaders” of the area's economy. Those in the upper left-hand quadrant, while declining in terms of jobs, are growing in terms of relative local importance. These might be labeled the “survivors” from the original hardware-oriented Silicon Valley. In the lower left quadrant are industries that have lost both employment and relative share. Most notable among these “sliders” is the Internet, telecommunications, and data processing cluster of industries. (Note that location quotients range from about 1 for aerospace, architecture, and the Internet, telecommunications, and data processing cluster to more than 10 for computer equipment manufacturing.)

Among the top four high-tech industries in terms of

CHART 2. Changes in Silicon Valley high-tech concentration and employment, 2001 to 2008



employment in Silicon Valley in 2001—computer system design; semiconductor manufacturing; Internet, telecommunications, and data processing; and computer equipment manufacturing—more than 70,000 jobs had disappeared by 2008. However, the concentration of employment in two of these industries—computer equipment and semiconductor manufacturing—increased locally relative to the Nation.

Wages

Average annual wages in high-tech rose sharply between 2001

and 2008 compared with overall average wages in the Valley. For the Silicon Valley, the average annual wage in high-tech industries rose from \$97,344 in 2001 to \$132,351 in 2008, an increase of 36.0 percent. (See table 2.) In comparison, average annual wages rose only 21.7 percent across all establishments in the area. All high-tech industries experienced strong average wage growth over the period including scientific research (72.1 percent) and aerospace (72.0 percent) and pharmaceuticals (47.0 percent). Widespread productivity gains

coupled with larger job losses among middle-wage workers than among higher wage workers were partially responsible for the considerable increase in average high-tech wages.⁷

In 2001, total private-sector wages generated in the Silicon Valley were \$156.9 billion. At that time, the high-tech industries represented about 32.4 percent of all Silicon Valley private-sector wages and 19.2 percent of private employment. During 2008, the Silicon Valley private-sector economy generated approximately

TABLE 2. Average annual wages and total wages by industry, Silicon Valley, 2001 and 2008

Industry	Average annual wages (dollars)		Percent change 2001 to 2008	Total annual wages (thousands of dollars)		Percent change 2001 to 2008
	2001	2008		2001	2008	
Silicon Valley high-tech industries	\$97,344	\$132,351	36.0	\$50,809,724	\$57,681,857	13.5
Software publishers	128,790	163,972	27.3	4,224,425	4,207,687	-4
Computer equipment manufacturing	122,864	157,402	28.1	7,105,603	6,751,453	-5.0
Scientific research	90,347	155,511	72.1	3,682,185	7,987,214	116.9
Internet, telecommunications, data processing	84,899	143,713	69.3	5,715,137	7,158,324	25.3
Pharmaceuticals	94,100	138,348	47.0	1,052,889	2,037,593	93.5
Communication equipment manufacturing	98,529	132,469	34.4	1,923,677	1,534,393	-20.2
Computer system design	105,504	127,296	20.7	11,306,172	12,630,841	11.7
Aerospace	71,799	123,497	72.0	599,447	1,544,085	157.6
Control instrument manufacturing	87,202	120,952	38.7	3,462,774	3,331,137	-3.8
Semiconductor manufacturing	93,049	113,092	21.5	8,134,731	6,501,664	-20.1
Architecture	72,202	92,895	28.7	3,602,684	3,997,465	11.0

\$179.4 billion in private-sector wages, 14.3 percent more than the wages in 2001. Within the area, high-tech industries accounted for 32.2 percent of these wages and 17.1 percent of private employment.

Among the 11 high-tech industries, the largest share of total annual wages in 2008 were in computer system design (21.9 percent), followed by scientific research (13.8 percent) and the Internet, telecommunications, and data processing cluster (12.4 percent). These three industries accounted for 48.2 percent of all high-tech industry wages in 2008. They accounted for more than 200,000 jobs or 7.8 percent of total Silicon Valley employment.

In 2001, the same three industries had less thoroughly dominated the high-tech industry scene in terms of total wages. The three

combined represented 40.7 percent of total wages, with computer system design making up the largest share, 22.3 percent. At that time, they accounted for more than 215,000 jobs or 8.4 percent of total Silicon Valley employment.

Conclusions

Despite net employment losses between 2001 and 2008, Silicon Valley continued as a region of innovation. Recent years, for example, have seen a new investment boom in the emerging area of clean environment technology.⁸

Following the economic slowdown of 2001, some industries recovered quickly and had reached new heights in employment by 2008. Most high-tech industries in the Silicon Valley grew more concentrated in the local economy relative to the

United States from 2001 to 2008. Large industries, such as computer system design and semiconductor manufacturing, remained important in terms of employment and wages for the Silicon Valley and the Nation. Furthermore, average wages for high-tech industries in the Silicon Valley rose at a faster rate (36.0 percent) than those of all Silicon Valley industries (21.7 percent) and those of the United States (25.5 percent). The combination of rising wages and more concentrated high-tech employment has kept incentives for innovation and creativity high. The Silicon Valley thus continues to evolve as it reinvents itself as a breeding ground for technological advancement and ingenuity.

Note on Recent Employment and Wages

Despite the overall economic recession that began in December

2007,⁹ Silicon Valley high-tech employment actually grew by 2.5 percent during 2008; however, average wages fell by 1.5 percent during this period. Recent

data trends from less detailed sample-based data and anecdotal evidence suggest that high-tech employment in the Silicon Valley has declined thus far in 2009. For

more detailed nonsample-based data, visit the BLS Quarterly Census of Employment and Wages Web site at www.bls.gov/cew. ■

—Notes—

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¹ This report uses Bureau of Labor Statistics data from the Quarterly Census of Employment and Wages (QCEW) dataset for California to examine

employment and wage trends in Silicon Valley high-tech industries between 2001 and 2008, the most current year for which data are available. QCEW data include information at the most detailed industry level on annual employment and wages and are the timeliest data available at the county level.

² NAICS or the North American Industry Classification System groups establishments into industries based on the activities in which they are primarily engaged.

³ Daniel Hecker, "High-tech Employment: A NAICS-Based Update," *Monthly Labor Review* July, 2005, pp. 57–72.

⁴ Mark Larson, "More companies leave Silicon Valley for El Dorado Hills," *Sacramento Business Journal*, Sept. 7, 2001.

⁵ The six counties are: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, and Santa Cruz Counties.

⁶ Location quotients are calculated

with the following equation: $LQ = (\text{local industry employment} / \text{local total employment}) / (\text{national industry employment} / \text{national total employment})$. Also see Donald Lyons and Bill Luker, Jr., "Employment in R&D-intensive high-tech industries in Texas," *Monthly Labor Review*, November 1996, pp. 15–25.

⁷ Joint Venture of Silicon Valley, "Index of Silicon Valley, 2008" and John Markoff "Silicon Valley Losing Middle-Wage Jobs," *The New York Times*, Feb. 19, 2008.

⁸ Laurie Flynn, "Silicon Valley Rebounds, Led by Green Technology," *The New York Times*, Jan. 29, 2007 and Katie Fehrenbacher, "Green Investing is Tops in Silicon Valley," *Business Week*, Nov. 11, 2008.

⁹ See National Bureau of Economic Research, "Determination of the December 2007 Peak in Economic Activity," on the Internet at <http://www.nber.org/cycles/dec2008.html> (visited June 24, 2009).

