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Silicon Valley Technology Industries

CONTRACT WORKFORCE ASSESSMENT

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SILICON VALLEY TECHNOLOGY INDUSTRIES
CONTRACT WORKFORCE ASSESSMENT

EXECUTIVE SUMMARY[1]

Income inequality in Silicon Valley has been growing dramatically in recent years. One factor contributing to this inequality is the conditions of contract workers to high-tech firms. While prominent Silicon Valley companies are experiencing records revenues and profits, and wages of their direct employees are generally above average, many contract employees are excluded from these benefits. Janitors, security guards, shuttle drivers, landscape workers, cafeteria workers and others who provide direct services to these high-tech firms through contracting arrangements often experience low-wages and insecure working conditions.

Recent labor and community organizing efforts, along with a few highly visible high-tech firms implementing new contracting policies, has led to significant media coverage and increased the visibility of these contract employees. But little is known about the true size and scope of contracting work to high-tech firms in Silicon Valley, or the overall socio-economic circumstances of contract employees. How many workers are actually involved in contract work for high-tech firms, who are they, and what are their wages and socio-economic circumstances? Contributing to answering these questions is the goal of this report.

Studying the largely invisible contract workforce is difficult, given the lack of direct data on the nature of employment contracts. We instead develop an indirect methodology to identify what we call the potentially contracted workforce to high tech firms. While only an approximation, we believe this provides a reasonable estimate of the overall size and scope of this workforce, and provides a good picture of the demographic characteristics, wages, and socio-economic circumstances of this population. Key highlights of what we found include:

- There are an estimated 19,000-39,000 people in low and medium wage occupations who contract directly with high-tech firms in the valley, and up to 78,000 of what we call potentially contracted workers—people in low and medium wage occupations who could be contracted to high-tech firms and who's labor market experiences are thus indirectly influenced by contracting practices of those firms.
- These potentially contracted workers are not-just in service or blue-collar occupations, but include many white-collar occupations as well, including secretaries, sales representatives, couriers and messengers, software developers and computer programmers.
- Potentially contracted workers are dis-proportionately people of color. While 7% of high-tech direct employees are Hispanic or African-American, 26% of white collar potentially contracted workers, and 58% of blue-collar potentially contracted workers are Hispanic or African-American
- Wages for these potentially contracted workers are significantly below comparable wages for direct-hire employees. Potential contractors in both white-collar and blue-collar occupations earn on average less than 70% of what comparable direct-hire employees of high-tech firms earn.

1 *Research for this report was made possible by a grant from the Institute for Research on Labor and Employment at the University of California, Berkeley, and we are deeply grateful for their support. Annette Bernhardt (UC Berkeley), Bob Brownstein, Louise Auerhahn and Derecka Mehrens (Working Partnerships) all provided valuable input and feedback, and we are grateful for their advice. The authors remain fully responsible for the results and findings.*

- For blue-collar potential contract employees, socio-economic circumstances are particularly bad. Even though 57% are renters, still 59% spend more than 30% of their household income on housing costs, and 30% spend more than half of their income on housing costs. Many are living in crowded housing circumstances—more than 26% live with more than one family in the household, and another 43% live in three-generations and/or extended family households. Nearly 35% fall below 200% of the Federal Poverty Level (a reasonable poverty threshold in Silicon Valley). Some 10% of these workers rely on nutrition assistance, through the Supplemental Nutrition Assistance Program (SNAP), and 30% of them completely lack health insurance.

- Even many white-collar potential contract employees are in difficult socio-economic circumstances. More than one out of three (37%) spend more than 30% of their income on housing, and 11% spend more than half of their income on housing. Nearly one in five (19%) live with more than one family in the household, and another 31% live in three-generations and/or extended family households. Despite somewhat higher incomes than blue-collar potential contract workers, still 6% of these white-collar contract employees fall below the 200% of Federal Poverty Level threshold, and 2% still rely on SNAP assistance, while 10% lack any form of health insurance.

Our research here can only point to broad patterns of disparity, and can't identify all the causes of low-wages and poor socio-economic circumstances. These findings, however, show clear evidence that contract workers to high-tech firms face substantially lower wages, and have substantially worse socio-economic circumstances, than comparable workers who are directly employed by high-tech firms. It also shows that the size of this workforce is substantial. Efforts to improve working conditions for contracted workers, including through more responsible contracting policies of high-tech firms and improved voice for these workers in the labor market, could substantially address an important dimension of inequality in Silicon Valley.

INTRODUCTION

On May 1, 2015, the giant social networking company Facebook launched an initiative requiring that all of their contractors pay their employees a $15/hour minimum wage, offer 15 paid days off, and, for employees who don't receive paid parental leave, $4,000 for new child benefits to new parents.[2] Facebook's policy came amidst a growing concern about inequality in Silicon Valley. It also came in the wake of organizing efforts that have helped highlight the plight of contracted service workers of high-tech firms. Contract service workers have been organizing in the Valley since at least the early 1990s, when janitors, with the help of the Service Employees International Union, were successful in gaining union contracts in part by applying pressure to the high-profile firms that contracted for their services (Rudy 2004; Zlolniski 1994). More recent organizing by security guards have led companies like Apple and Google to replace a number of their contract security positions with direct hires, thereby raising their wages and improving working conditions.[3] Shuttle bus drivers, facing challenging hours and low pay, have turned to the Teamsters union for help and gained union representation in transport firms that have service agreements with a wide range of tech firms, including Apple, Yahoo, eBay, Zynga and Facebook amongst others.[4] Silicon Valley Rising[5], a campaign driven by a coalition of labor organizations, faith leaders, community-based organizations and workers to address Silicon Valley's inequality crisis, has focused on the contract workforce and poor contracting policy by many high-tech firms, in an effort to ensure that Silicon Valley's tech economy works for everyone, including contract workers.

This increasing attention to Silicon Valley's 'invisible workforce' raises a number of important questions. How large is the work force in Silicon Valley that does contract work for information technology firms? To what extent is it a significant source of low-wage work in the region? Beyond the relatively well-understood categories of janitors, security guards, landscape workers, shuttle drivers and cafeteria workers, are there significant numbers of other types of contracted workers?

The goal of this research project was to help try to answer these questions. We aimed to understand how large the sub-contracted service work force of high-tech firms in Silicon Valley is, and what are the economic circumstances of people working in these sub-contracted occupations. We also wanted to understand the types of occupations that are potentially sub-contracted to high-tech firms, and particularly to understand the circumstances of people not just in low-wage occupations, but also those that may be in somewhat more highly-paid occupations—those that would be considered part of the broad middle class in the valley.

It is difficult to answer these questions because there is no comprehensive data-source for contract employees. Individual companies obviously have information about the specific service contracts they have, but there are a wide range of challenges for researchers trying to gather such information on a company-by-company basis, including: companies may not want to share this proprietary information; even if they are willing to share this information; different service contracts are often held in different divisions of the company so gathering the data for a single company can be a complicated and time-consuming

2 http://www.mercurynews.com/news/ci_28104961/quinn:-facebook-embraces-its-contract-workers
3 http://www.mercurynews.com/news/ci_27630873/apple-to-make-many-security-guards-fulltime-employees
4 http://www.mercurynews.com/news/ci_27696259/google-shuttle-drivers-to-see-pay-hike-better-benefits
http://www.mercurynews.com/news/ci_28311778/quinn:-occupy-silicon-valley-style
http://www.mercurynews.com/news/ci_27673431/apple-gives-shuttle-bus-drivers-a-raise
5 http://siliconvalleyrising.org/

task; and in many cases, contracts are based on service agreements, not on number of employees, so the high-tech firms themselves don't necessarily know how many people are employed in their contracted workforce.

What we have done instead is develop a methodology for estimating *potential contracted workers* to high-tech firms using publically available labor market data. Using this methodology, which is described briefly below and in much more detail in the technical appendix, we can develop estimates for the overall size of the contract workforce, and examine the demographic characteristics and socio-economic circumstances of people identified as potential contract employees.

Overall, we estimate that there are between 19,000 and 39,000 people in low and middle-income occupations who are likely employed in direct contracts to high-tech firms in Silicon Valley.[6] We estimate a total of nearly 78,000 people who are in what we call the potential contract workforce—those in occupations and industries with likely some direct service contracts to high-tech firms, and thus influenced directly or indirectly by contracting policies and practices. On average, these workers earn just under $40,000 a year, earning approximately 70% as much as what people in similar occupations who are direct high-tech employees earn. These contract workers are disproportionately Latino and African-American. Almost 18% of them are in poor households--earning below 200% of the Federal Poverty Level—despite working an average of 39 hours a week. These low wages also are associated with worse housing circumstances. Over 47% of these potential contract workers are renters—including 57% in the lowest-paid occupational categories—compared to only 34% of direct high-tech workers. Over 22% are sharing housing with other families, and another 36% are living in extended family households (at least three generations, or with other adult relatives) compared to only 13% and 20% for direct high-tech workers. Perhaps most disturbingly, more than 46% of these potential contract workers have unaffordable housing circumstances—spending more than 30% of their income on housing. More than 1 in every 6 spend more than half of their total income on housing, leaving little left for other basic necessities of life.

In what follows, we first outline the methodology for our analysis. We then turn to a discussion of the overall estimates and occupational characteristics of the potentially contracted workforce, and how it compares to direct-hire employees of high-tech firms in the valley. We then turn to a discussion of the demographic characteristics of these potential contract employees. We then examine their socio-economic circumstances. We then turn to a discussion of their housing circumstance. We conclude with a discussion of the limitations of this analysis and then discuss some of the future research needs and potential implications of this analysis for strategies and policies that could improve working conditions for these contract employees.

METHODOLOGY

The source of data we used for this analysis is the Integrated Public-Use Microdata Series (IPUMS) of the U.S. Census American Community Survey. This data source provides individual records of respondents to the annual American Community Survey, and constitutes the richest source of quantitative data on the American population and work-force. For our dataset, we selected all people identified as actively employed in San Mateo and Santa Clara County, the core of Silicon Valley. This includes self-employed workers and independent contractors, as well as regular employees. We used the 2012 5-year ACS sample, the most recent 5-year sample available[7] when we began this analysis. The advantage of using the 5-year sample is that the data set is larger, giving us more reliable estimates, but it does mean that we are looking at averages across a period (2008-2012) that includes both the depths of the Great Recession, as well as the first few years of the recovery. All salary and income figures are reported in 2012 dollars.

6 *For the purposes of this analysis, we define Silicon Valley as Santa Clara and San Mateo Counties.*
7 *IPUMS-USA, University of Minnesota,* www.ipums.org.

Our primary analysis involves comparing potential contract employees to direct hires of high tech firms. Direct-hire employees are easily identified as those indicating they work in any of the industries included in our definition of 'high-tech' (see Appendix for detailed industries).

To identify potential contract employees to these high-tech industries, we conducted the following steps:

1. Identified all the occupations of people employed in high-tech industries, which includes both self-employed high-tech workers, and employees of high-tech firms (this list is shown in the appendix);

2. Identified all the industries outside of high-tech that employ people in these 'high-tech' occupations. In this step, we are assuming that there are no occupations that are *only* hired as contract employees of Silicon Valley high-tech firms (i.e. with no one employed as a direct hire). Since many of the included occupations are not obviously 'high-tech' occupations (e.g. dishwashers, childcare workers, massage therapists, parking lot attendants), and because our list included all the occupations we are aware of as being contracted (including high-skilled occupations such as software developers and computer programmers), we are confident this list is a reasonably comprehensive list of potentially contract-able occupations.

3. Identified 'potential contract industries', which are a small sub-set of the industries identified in step 2. This step required some informed judgment of identifying those industries where a substantial portion of employees would be working for other firms as part of a service contract or direct contract/consulting position (see appendix for detailed industry list).

4. Potential contract workers are all those non-governmental employees working in the 'high-tech' occupations identified in step 1 and the potential contract industries identified in step 3, along with the people identified as self-employed high-tech employees.

5. For our estimates of the actual contract employees of high-tech firms, we assume that the proportion of these potential contract workers who are actually contracted to high-tech firms is somewhere between the proportion of total employment accounted for by high-tech firms (24%) and the proportion of gross regional product (GRP) accounted for by high-tech firms (49%)[8].

In analyzing the demographic characteristics and socio-economic circumstances of workers in Silicon Valley, we clustered occupations into four broad categories based on work-systems. As described in *New Rules for a New Economy: Employment and Opportunity in Post-Industrial America* (Herzenberg, Alic, and Wial 1998), work-systems are distinguished by two broad sets of characteristics: the extent to which people are expected to exercise significant independent judgment and decision-making on the job (autonomy), and the extent to which technological advances have a direct influence on the nature of that work. The four broad occupational categories we use are:

- *High-Skill Autonomous:* These are generally well-paid positions that require a significant amount of specialized skills and high-levels of employee autonomy in determining their work activities. This includes CEOs, Managers, Engineers and similar types of occupations. These occupations make up approximately 64% of all positions in high tech industries. We did not include any of these occupations in our 'potential contract employees' category, since these are generally quite high-paid occupations, even in contract positions.

- *Semi-Autonomous:* These are what might be considered mid-level positions. They require a certain amount of skill and autonomy, but generally in a context where employees are under the direction

8 *This figure was calculated from the Bureau of Economic Analysis Gross Domestic Product by Metropolitan Area Series. It includes the average contribution of Durable Goods Manufacturing, Information industries and Professional & Technical Services in the San Jose-Santa Clara Metropolitan Area from 2008-2012.*

of higher-level managers and supervisors in their firm. In the high-tech industry, this includes occupations such as software developers, computer programmers, sales representatives, secretaries and administrative assistants, engineering technicians, and similar occupations. These occupations make up approximately 30% of positions in high-tech industries, and 60% of our potential contract employees.

- *Labor-Intensive:* These are those occupations, like janitors, security guards, packagers and shippers, which are highly labor intensive, with only limited potential for automation or significant impacts of new technologies. These occupations make up only 3% of high-tech direct employees, but they constitute 38% of potential contract employees.
- *Tightly Constrained:* These are occupations that can be thought of as traditional assembly-line jobs, including assemblers, fabricators, inspectors, data entry keyers, and other production workers. These occupations make up only 2% of high-tech direct employees, and also only 2% of potential contract employees.

Note that some occupations are divided across more than one of these work-systems, with higher-paid people in these occupations assumed to have higher levels of autonomy. A full description of the division of these occupational categories is in the appendix.

SCALE AND SCOPE OF CONTRACT WORKFORCE

Overall, we estimate there are a total of approximately 78,000 people in low and medium income occupations who are potential contract employees working in San Mateo and Santa Clara Counties (see Table 1) These are people in occupations and industries who are likely to be influenced by the service contracting policies and practices of high-tech firms in the Valley. This is approximately 24% as large as the total direct-hire workforce of high-tech industries. Of this total of potential contract employees, it is difficult know how many actually are contracted to high-tech firms. Overall, high-tech employment accounts for approximately 25% of total employment in the Valley in our data-set. Given that many of the potentially contracted occupations, such as janitors and security guards, are already largely outsourced by high-tech firms, we think it is a reasonable low-estimate to expect that 25% of the potentially contract employees are actually contracted to high-tech firms. This would be approximately 19,000 people. High-tech industries account for approximately 49% of total regional Gross Domestic Product, so a reasonable high-estimate of the actually contracted workforce would be based on this measure of industry resources. This would result in an estimate of 39,000 people in low and medium wage occupations who are actually contracted to high tech firms.

It is important to stress that this is not a direct count, but rather an indirect estimate based on our analysis of patterns of occupation by industry, as described in our methodology. There are undoubtedly people identified in our potential contract workforce who are not actually contract employees of high-tech firms. At the same time, there are also undoubtedly people in industries that we have completely excluded from our analysis that could also be contract employees of high tech firms (for example, we excluded the entire restaurant and food service industry, even though we know some food services are contracted by high-tech firms). Thus, we think this is a reasonable estimate of people who are either contract employees providing services to high-tech firms, or are potentially contract employees providing those services, and thus influenced by the wages and working conditions associated with those contracts.

Table 1: High-Tech Direct Hire and Contract Employees (2008-2012)

JOB TYPE	DIRECT HIRE #	DIRECT HIRE %	POTENTIAL CONTRACT #	POTENTIAL CONTRACT %
High-Skill Autonomous	208,730	64%	NA	NA
Semiautonomous	99,720	31%	46,688	60%
Unrationalized Labor-Intensive	8,251	3%	29,592	38%
Tightly Contrained	7,490	25%	1,431	25%
Mean (or total count)	***324,191***	***100%***	***77,711***	***100%***

Source: Authors Analysis of U.S. Census ACS Data

The low-wage service employees that are typically associated with contract employment, such as janitors, security guards, shuttle drivers and package handlers, account for almost 30,000, or 38% of this estimated potential contract workforce. People in semi-autonomous occupations, including positions such as secretaries, sales representatives, software developers and the like, make up 60% of this potential contract workforce, or over 46,000 people. Table 2 shows the top occupations in each category, with an approximate number of potential contract workers in that occupation.[9]

Table 2: Top Occupations of Potential Contract Workers

SEMI-AUTONOMOUS		LABOR-INTENSIVE		TIGHTLY CONSTRAINED	
Occupation	*# of Workers*	*Occupation*	*# of Workers*	*Occupation*	*# of Workers*
Managers, not else where classified (nec)	7,700	Janitors and Building Cleaners	8,200	Data Entry Keyers	500
Driver/Sales Workers and Truck Drivers	3,900	Security Guards and Gaming Surveillance	5,400	Assemblers and Fabricators, nec	300
Secrataries and Administrative Assistants	3,200	Maids and Houskeeping Cleaners	3,400	Inspectors, Testers, Sorters, Samplers and Weighers	200
Managers in Marketing, Advertising and Public Relations	1,900	Driver/Sales Workers and Truck Drivers	2,900	Other Production workers including semiconductor processors and cooling and freezing equipment operators	100
Sales Representatives, Services, All Other	1,900	Laborers and Freight, Stock, and Material Movers, Hand	2,700	Financial Clerks, nec	100
Chief Executives and Legislators/Public Administration	1,800	Secrataries and Administrative Assistants	1,100	Electrical, Electronics and Electromechanic Assemblers	70
Human Resources, Traning and Labor Relations Specialists	1,700	Bookkeeping, Accounting and Auditing Clerks	1,000	Retail Salespersons	60
Software Developers, Applications and Systems Software	1,700	Packers and Packagers, Hand	700	Cashiers	50

9 *It is worth noting that the positions listed as 'Managers' of various types might not be often thought of as potentially contracted positions. But we are including here only those managers in lower-paying positions in these potentially contracted industries—positions that would be direct-hire positions if the services were performed in-house, rather than contracted.*

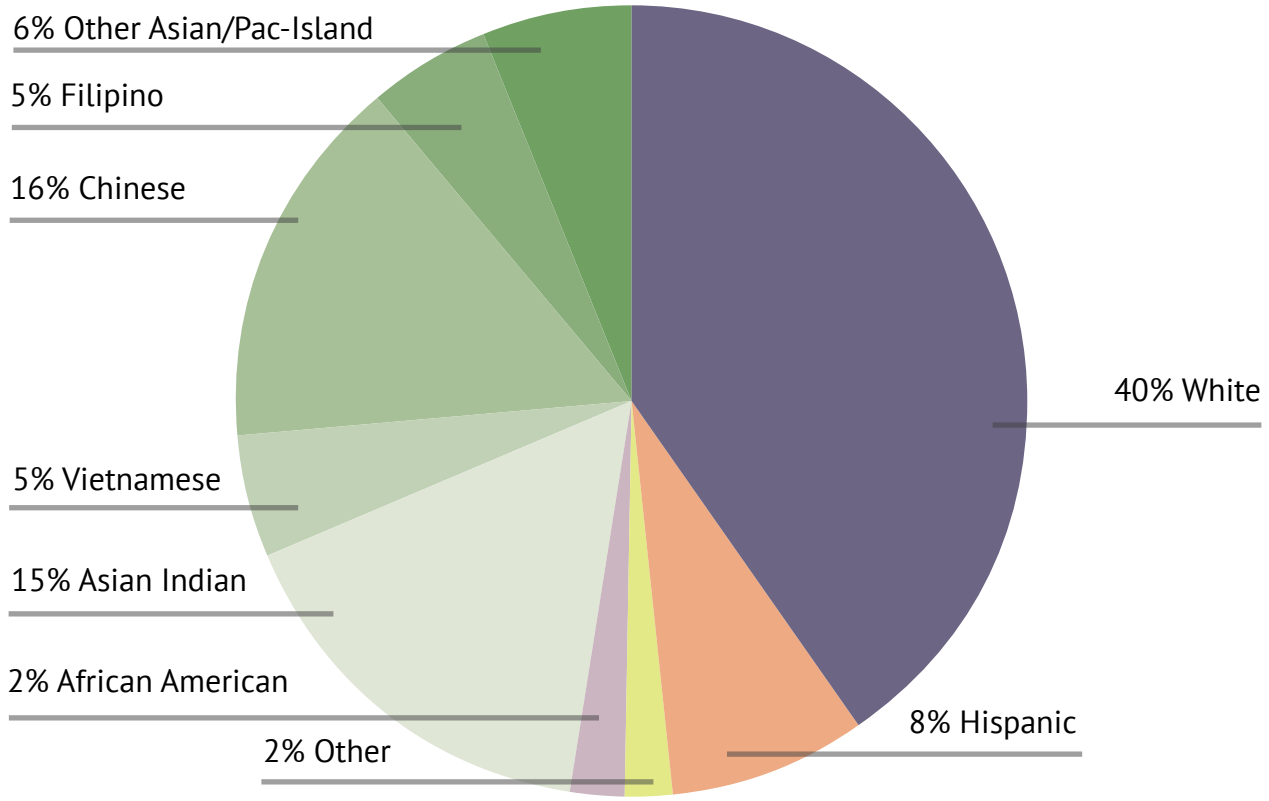
SEMI-AUTONOMOUS		LABOR-INTENSIVE		TIGHTLY CONSTRAINED	
Couriers and Messengers	1,500	Office Clerks, General	400	Photographic Process Workers and Processing Machine Operators	40
First-Line Supervisors of Office and Administrative Support Workers	1,200	Couriers and Messengers	300		
Bookkeeping, Accounting and Auditing Clerks	1,200	Office and Administrative Support Workers, nec	300		
General and Operations Managers	1,100	Other Production workers including semiconductor processors and cooling and freezing equipment operators	300		
Receptionists and Information Clerks	1,000	Assemblers and Fabricators, nec	300		
Tax Preparers	900	Cleaners of Vehicles and Equipment	200		
Office Clerks General	900	Interviewers, Except Eligibility and Loan	200		
Supervisors of Transportation and Material Moving Workers	700	Dispatchers	200		
Computer Programmers	700	Transportation, Storage and Distribution Managers	200		
Paralegals and Legal Assistants	700	Industrial Truck and Tractor Operators	100		
Computer and Information Systems Managers	700	Receptionists and Information Clerks	100		

Source: Authors Analysis of U.S. Census ACS Data

DEMOGRAPHIC CHARACTERISTICS

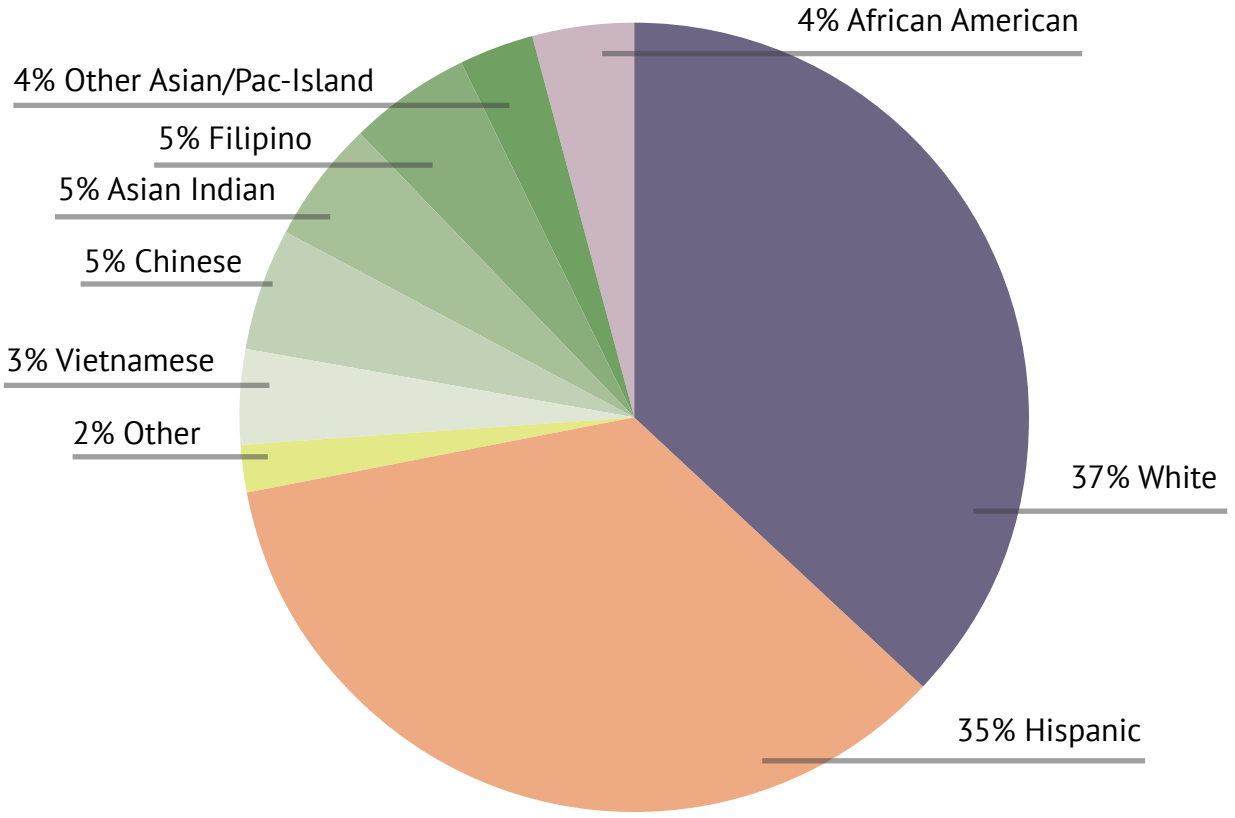
Employees in the high tech industry are disproportionately Asian and Non-Hispanic White, with an underrepresentation of Latinos and African-Americans. While representing 24% of all employed workers in the Valley, Latinos are only 8% of high-tech employees (see Chart 1), and only 6% of employees in the high-skill autonomous occupations.

Chart 1: Race/Ethnicity of High-Tech Direct Employees



In contrast, Latinos are disproportionately represented in the potential contracted employees workforce, accounting for a full 35% of contracted employees (See Chart 2). Hispanics and African-Americans together account for only 10% of the high-tech workforce, but 39% of the potentially contracted workforce.

Chart 2: Race/Ethnicity of Potential Contract Employees



These patterns differ by occupational category. In the labor-intensive service occupations Hispanics and African-Americans account for 35% of the direct-hire employees, and a full 59% of the potentially contracted labor-intensive service workforce (See Table 3). In the more semi-autonomous white collar occupations, Hispanics and African-Americans account for 12% of direct-hire employees, and 26% of the potentially contracted workforce.

Table 3: Demographic Characteristics by Race/Ethnicity, Direct Hire and Potential Contracted Employees

DEMOGRAPHICS	WHITE	HISPANIC	AFRICAN AMERI-CAN	CHINESE	FILIPINO	ASIAN INDIAN	VIETAN-MESE	OTHER ASIAN/ PACIFIC ISLAND	OTHER
Direct Hire									
High-Skill Autonomous	41%	6%	1%	19%	3%	17%	5%	6%	2%
Semi-autonomous	41%	10%	2%	12%	7%	15%	5%	7%	2%
Unrationalized Labor-Intensive	23%	29%	6%	7%	15%	1%	12%	6%	1%
Tightly Constrained	11%	17%	3%	12%	20%	5%	22%	6%	2%
All Categories	40%	8%	2%	16%	5%	15%	5%	6%	2%
Potential Contracted Employees									
High-Skill Autonomous	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-autonomous	46%	23%	3%	7%	5%	6%	3%	4%	3%
Unrationalized Labor-Intensive	23%	54%	5%	2%	6%	2%	3%	3%	2%
Tightly Constrained	21%	20%	5%	14%	6%	1%	18%	10%	5%
All Categories	***37%***	***35%***	***4%***	***5%***	***5%***	***5%***	***3%***	***4%***	***2%***

Source: Authors Analysis of U.S. Census ACS Data

SOCIO-ECONOMIC CIRCUMSTANCES

Being part of a contract or potentially contracted workforce might not be a big problem if wages, working conditions, and people's socio-economic circumstances were similar to those in direct-hire positions. Our research shows, however, that the socio economic circumstances for people in the potentially contracted workforce are substantially worse than for comparable people who are directly hired by high-tech firms. Key differences include the following (see Table 4):

- *Lower wages across comparable occupations.* Potentially contracted employees in semi-autonomous occupations earned an average of approximately $53,000 a year, which is nearly $28,000 a year less than people in similar occupations who were hired directly by high-tech firms, who earned an average of $81,000 a year. Potentially contracted employees in labor-intensive service occupations earned $19,000, nearly $3,500 less than people in similar occupations who were directly hired.

- *Lower access to health insurance.* Overall, only 82% of the potentially contracted workforce had access to health insurance of any kind, compared to 97% of directly hired employees. People employed in the labor-intensive service occupations had the least access to health insurance: only 68% of potentially contracted workers in these occupations had health insurance, compared to 74% of direct-hire employees in these occupations.

- *Higher poverty levels:* A substantially higher portion of potentially contracted employees earned below 200% of the Federal Poverty Level (FPL), which is a more reasonable measure of poverty than the official poverty level, especially in the high-cost area of Silicon Valley. Overall more than 18% of potentially contracted employees fell below this threshold, compared to only 4% of directly hired employees. A full 36% of potentially contracted workers in the labor-intensive occupational categories are living below 200% of the FPL. It is important to emphasize that this high-level of poverty exists *despite employees working a full-time schedule!* On average, the potentially contracted workforce worked 39 hours a week, and even in the labor-intensive service jobs, the average was 34 hours a week.

- *Greater reliance on food stamps*: Facing these low earnings and high poverty levels, potentially contracted employees relied more frequently on public assistance. A full 5% of the potentially contracted workforce were using the Supplemental Nutrition Assistance Program (SNAP, also known as food stamps), compared to only 1% of direct-hire employees.

Table 4: Select Socio-Economic Characteristics of Direct Hire and Potential Contract Employees

	DIRECT HIRE EMPLOYEES				POTENTIAL CONTRACT EMPLOYEES			
	Average Earnings	*% Using SNAP*	*% with Health Ins.*	*% below 200% FPL*	*Average Earnings*	*% Using SNAP*	*% with Health Ins.*	*% below 200% FPL*
High-Skill Autonomous	$134,977	1%	98%	2%	NA	NA	NA	NA
Semi-autonomous	$81,157	1%	96%	5%	$53,216	2%	90%	6%
Unrationalized Labor-Intensive	$22,664	6%	74%	29%	$19,184	11%	68%	36%
Tightly Contrained	$38,248	3%	92%	12%	$35,623	3%	85%	8%
All Occupations	***$113,329***	***1%***	***97%***	***4%***	***$39,933***	***5%***	***82%***	***18%***

Source: Authors Analysis of U.S. Census ACS Data

We examined how these socio-economic conditions differed for those people who are both working and living in Silicon Valley, compared to those who are commuting into the area from further away. This is important, given the particularly high-housing costs in Silicon Valley. We were interested in understanding how different socio-economic circumstances might be associated with these different residential patterns. We included those living in San Francisco along with those living in San Mateo and Santa Clara Counties, because of proximity and similar housing conditions.

Those potentially contracted employees both living and working in Silicon Valley generally had lower average earnings when compared with those potentially contracted employees living elsewhere (see Table 5). On average, those living in Silicon Valley earned just under $39,000, only 83% as much as the average of nearly $46,500 of those living elsewhere. Despite these higher incomes, however, those living in other places and commuting in to Silicon Valley has quite similar patterns of low socio-economic circumstances, and in fact seemed to rely on SNAP to a slightly greater degree. This raises important questions about their housing circumstances, which we turn to next.

Table 5: Select Socio-Economic Characteristics of Potential Contract Employees by Place of Residence

	LIVING IN SAN MATEO, SANTA CLARA OR SAN FRANCISCO COUNTY				LIVING IN ANY OTHER COUNTY			
	Average Earnings	*% Using SNAP*	*% with Health Ins.*	*% below 200% FPL*	*Average Earnings*	*% Using SNAP*	*% with Health Ins.*	*% below 200% FPL*
High-Skill Autonomous	NA	NA	NA	NA	NA	NA	NA	NA
Semi-autonomous	$51,516	2%	91%	6%	$61,764	2%	89%	6%
Unrationalized Labor-Intensive	$18,758	11%	68%	35%	$22,472	11%	74%	40%
Tightly Contrained	$34,363	1%	85%	6%	$42,412	15%	88%	21%
All Occupations	***$38,726***	***5%***	***82%***	***17%***	***$46,446***	***6%***	***83%***	***19%***

Source: Authors Analysis of U.S. Census ACS Data

HOUSING SITUATION

In examining the housing circumstances of potentially contracted employees, it is clear that they are in substantially more difficult circumstances than direct-hired employees, including fewer of them able to purchase homes, living in more crowded circumstances, and a substantially higher portion of them paying unaffordable amounts for their housing costs, even despite the more crowded circumstances. Specifically we found the following (see Table 6):

- *More likely to be renters:* Home-ownership in the U.S. is an important path to economic security for working families. It is one of the only ways poor and middle-class families accumulate any substantial assets. Overall, nearly half (47%)of all potentially contracted workers were renters, compared to only 34% of direct-hire employees. A large part of this difference is that we didn't include people in the highest paying highly skilled occupations in our potential contract workforce, and people in these occupations rent at the lowest rates. But even when looking at comparable occupations, potential contract employees have higher levels of renting. Amongst people working in semi-autonomous occupations, 40% of potential contract workers were renters, compared to 37% of direct hire employees. A full 59% of potentially contracted people in labor-intensive jobs were renters, compared to 52% of direct hire employees in labor-intensive jobs.

- *Higher levels of crowded living circumstances:* We looked at two different measures of potential crowding in housing circumstances. One has to do with the percent of households with more than one family living in it. We also looked at extended family households (with 3 or more generations, or related adults but not parent/child). In both cases, the potential contract employees had higher levels of crowded living circumstances. Amongst people in semi-autonomous occupations, for example, 19% of people in the potential contracted workforce lived in households with more than 1 family, and another 30% living in extended family households, compared to 17% and 22% for direct hire employees.

- *Higher proportion with unaffordable housing:* Spending 30% of total household income is considered an affordable amount to spend on housing, with anything over this considered unaffordable. Spending more than 50% of total household income on housing is considered extremely unaffordable. Overall, 46% of the potentially contracted employees spend more than 30% of their house-

hold income on housing, and 19% spend more than half of total household income on housing, both of which are substantially higher than the direct-hire workforce. Amongst people working in labor-intensive potentially contracted positions, 59% had unaffordable housing costs (above 30% of household income) and 31% had extremely unaffordable housing costs.

Table 6: Select Housing Circumstance of Direct Hire and Potential Contract Employees

	DIRECT HIRE EMPLOYEES					POTENTIAL CONTRACT EMPLOYEES				
	Renters	*>1 Family in House-hold*	*Extended Family in House-holds*	*>30% of HH Income spent on housing*	*>50% of HH Income spent on housing*	*Renters*	*>1 Family in House-hold*	*Extended Family in House-holds*	*>30% of HH Income spent on housing*	*>50% of HH Income spent on housing*
High-Skill Autonomous	32%	12%	17%	20%	4%	NA	NA	NA	NA	NA
Semi-autonomous	37%	17%	22%	31%	11%	40%	19%	30%	38%	11%
Unrationalized Labor-Intensive	52%	23%	46%	59%	31%	59%	27%	43%	59%	31%
Tightly Contrained	33%	16%	56%	47%	14%	32%	19%	40%	58%	13%
All Occupations	***34%***	***13%***	***20%***	***25%***	***6%***	***47%***	***22%***	***36%***	***46%***	***19%***

Source: Authors Analysis of U.S. Census ACS Data

Again, we also compared these housing circumstances for those potential contract workers living in Silicon Valley (and San Francisco), compared to those commuting into the Valley from farther away. The most significant difference is in the percentage of homeowners versus renters, with far more people who live in Silicon Valley renting, and with slightly higher percentages of people living in crowded living circumstances and having unaffordable housing costs. Specifically:

- *Local potentially contracted workers are more likely to be renters:* 49% of potential contracted workers living in Silicon Valley (and San Francisco) are renters, compared to 36% living in other counties. Amongst people working in labor-intensive positions, 60% of local residents are renters, and 50% of people living in other counties are renters.

- *Local potentially contracted workers live in more crowded housing:* Overall, of the potentially contracted workers living in Silicon Valley, 22% live in households with more than one family, and 35% live in extended family households, compared to 21% and 36% of those potentially contracted workers living elsewhere. The highest rates are amongst people employed in labor-intensive positions living in Silicon Valley, where 27% living in multi-family households, and 44% live in extended family households.

- *Higher levels of unaffordable housing costs for local residents:* Overall, 46% of potentially contracted employees living in Silicon Valley have unaffordable housing costs (higher than 30% of their household income) and 19% have extremely unaffordable housing costs (greater than 50% of household income). A slightly lower percentage of those living in other counties have unaffordable housing costs.

Table 7: Select Socio-Economic Characteristics of Potential Contract Employees by Place of Residence

	LIVING IN SAN MATEO, SANTA CLARA OR SAN FRANCISCO COUNTY					LIVING IN ANY OTHER COUNTY				
	Renters	*>1 Family in Household*	*Extended Family in Households*	*>30% of HH Income spent on housing*	*>50% of HH Income spent on housing*	*Renters*	*>1 Family in Household*	*Extended Family in Households*	*>30% of HH Income spent on housing*	*>50% of HH Income spent on housing*
High-Skill Autonomous	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-autonomous	43%	19%	30%	37%	11%	27%	17%	35%	39%	14%
Unrationalized Labor-Intensive	60%	27%	44%	60%	33%	50%	26%	39%	53%	21%
Tightly Contrained	30%	16%	44%	63%	11%	43%	36%	17%	38%	21%
All Occupations	***49%***	***22%***	***35%***	***46%***	***19%***	***36%***	***21%***	***36%***	***44%***	***17%***

Source: Authors Analysis of U.S. Census ACS Data

CONCLUSION

The contracted workforce is clearly an important part of the Silicon Valley regional economy. Media reports, union organizing, and changing company contracting policies make clear that there is a large population of contract employees in the region, and that there working conditions are an important issues of concern. Quantifying the exact size of this contract workforce, and getting realistic estimates of their wages and working conditions is a less clear proposition. With no direct public data on the nature of employment contracts, all estimates of the size and characteristics of this sector of the labor market must be considered just that—estimates.

Nonetheless, the methodology we've developed here provides what we believe is a reasonable estimate of the overall size of the contracted workforce, and the data on the wages and socio-economic circumstances of what we are calling the potentially contracted workforce should be considered completely reliable for that population, since they are based on U.S Census data, the best and most comprehensive available data for addressing these issues.

With an estimate that between 19,000 and 39,000 people are in low and medium income positions directly contracted to high-tech firms in Silicon Valley, and as much as 78,000 people in positions whose wages and working conditions could be potentially effected by contracting practices of high-tech firms, it is clear that the contract workforce is a substantial part of the regional economy. Furthermore, it is clear that potential contract workers are more likely to be Latino and are also disproportionately African-American. They also earn substantially less than people directly hired by high-tech firms in similar positions—for people in middle-wage, semi-autonomous positions this is as much as 35% less than direct hire employees. It is also clear that these potential contract workers have substantially worse socio-economic conditions and housing circumstances along a wide-range of measures, including ability to own versus rent, levels of over-crowding, dependence on public assistance, access to health insurance, and overall poverty levels.

While this report wasn't specifically intended to explore policy implications or potential solutions to the challenges facing contract workers in the region, it is worth noting a few key issues that emerge from this research.

First, the number of contractors and potential contractors differ quite significantly by the type of occupation they are in. Potential contractors in labor-intensive service positions substantially out-number the people who are directly hired in those occupations (29,592 versus 8,251), while the number of potential contractors in semiautonomous positions is less than half as large as those who are directly hired (46,688 versus 99,720). This is likely due to two factors. First, there is likely a higher prevalence of high-tech firms using contract workers in those labor-intensive occupations. Second, the occupations in that semiautonomous category are more specialized in high-tech occupations, and thus there are fewer that are working in other industries.

Second, the disparities in wages and socio-economic circumstances between direct hires and potential contract workers also differs quite substantially by the broad occupational category. There are quite dramatic differences between wages for potential contract employees in semiautonomous occupations, who earn nearly 35% less than there counterparts who are directly hired ($53,216 versus $81,157). For people in labor-intensive occupations, the wage disparity is smaller, as potential contractors in these occupations earn 15% less than people directly hired ($19,184 versus $22,664. The differences in other measures of socio-economic circumstances are not quite as dramatic, but still reinforce the impression that contract employment status is likely to be at least as important, if not more important, for people in mid-wage occupations as it is for people in low-wage labor-intensive occupations.

Finally, given these differences in scale of contracting and disparity in wages between labor-intensive and semi-autonomous, it is likely that different strategies would have to be pursued to address concerns for these different sets of workers. Developing more responsible contracting policies, for example, or converting contracted positions to direct-hires, is likely to be more appropriate in occupations with longer, more stable demands. In other occupations where there is already a higher percentage of people employed directly, and likely to be fewer large-scale contracts, it might be better to focus more on building occupational associations that cross both permanent and contract positions and that help people improve their skills, find better positions, and negotiate higher salaries.[10]

Clearly it will take more research and experimentation to determine whether new laws, improved company contracting practice, or exploring new forms of labor organizations are likely to be most effective for any particular group of workers. But what is clear from this research is that the contract workforce is a substantial portion of the region's labor market, and the worse employment and economic conditions they face should clearly be of broad concern.

10 *See for example the associations profiled in: Benner, Chris (2003) "'Computers in the Wild': Guilds and Next Generation Unionism in the Information Revolution" International Review of Social History 48:S11. http://www.researchgate.net/publication/231743467_Computers_in_the_Wild_Guilds_and_Next-Generation_Unionism_in_the_Information_Revolution*

APPENDIX A: DETAILED METHODOLOGY

The following provides details of the methods used to generate the labor market data analyzed in this report. The data used to generate this comes from the Integrated Public Use Micro-Data Sample (IPUMS) from the U.S. Census American Community Survey 2012 5-year data set, downloaded from the IPUMS website (usa.ipums.org). The results are derived from a variety of subsets of this original data set and are described in detail below. Data analysis was conducted primarily in the statistical program Stata. A file of repeatable commands is available upon request.

Silicon Valley Subset

Data used to generate the Silicon Valley Subset come from the IPUMS 5-year ACS 2012 data set, downloaded from the IPUMS website (usa.ipums.org). This data set includes a balanced sample of people over each of the years 2008-2012. Once downloaded, the data were restricted to only those observations indicating a place of work in the Silicon Valley – based on the place of work Public Use Microdata Area (PUMA) code. To define the Silicon Valley's geographic region, we wanted to approximate as closely as possible the geographic definition of Silicon Valley used by Joint Venture Silicon Valley (http://siliconvalleyindicators.org/pdf/index2015.pdf). While place of residence PUMA codes are available at a sub-county level, place of work PUMA codes are only available at the county level. As such, the Silicon Valley Subset includes only those who live in the two counties fully encompassed in the Joint Venture definition: Santa Clara and San Mateo counties. Our Silicon Valley dataset is not limited based on location of residence, so people who indicate they work in Silicon Valley could be living anywhere.

We developed two main levels of categorization related to industry and occupation of employment:

Industry Type

Industries in the data set are identified as falling into one of three broad categories: Tech Products and Services, Potentially Contracted Industries, and All Other Industries. The first of these is identified based on the industry categorization developed by Joint Venture Silicon Valley in their Silicon Valley Index. This list of industries is provided in Appendix B.

Potentially Contracted Industries were identified in a two stage process. First, industries outside of the Tech Products and Services industry that employed people in the same occupations as the high-tech industry were identified. From this list we excluded industries in which the majority of employment were not in contract work for other industries. From this reduced list, we then selected a sub-set that seemed to be the most likely to contract to high-tech firms. This final list of Potentially Contracted Industries is provided in Appendix C. All remaining industries are identified as All Other Industries. Technically, the specific industries falling under these broad categories were separated using the alpha-numeric NAICS classification codes provided in the IPUMS data set. Respondents are limited to indicating at most one industry of employment.

Occupation Type

Occupations in the data set are identified as falling into one of four broad categories: High-Skill Autonomous, Semiautonomous, Unrationalized Labor-Intensive, and Tightly Constrained. These categorizations are based on guidelines and definitions found in New Rules for a New Economy. In some cases a single occupation is split across more than one of the preceding categories based on the relative income of the individual in the occupation. In such occasions, the data set was first limited only to those that indicated working in the Silicon Valley (Santa Clara and San Mateo counties). Within any given occupation, individuals were given a percentile rank based on their annual income. The IPUMS variable used to identify income was *incwage*, an individuals' "pre-tax and salary income" (usa.ipums.org/usa-action/variables/INCWAGE#description_section). Specific occupations are identified based on the six-digit occupation

classification codes provided in the IPUMS data. Appendix D shows the specific occupations and income percentiles included in each work-system.

Tech Occupations Outside of Tech

As the occupation codes are not industry specific, it is possible for the same occupation, say *Designers*, to appear in multiple industries, say *Software Publishing* or *Electrical Goods*. Due to this, we are able to identify respondents employed by industries outside of the broad Tech Products and Services categorization, but with the same occupation as someone employed by an industry within Tech Products and Services. It is these people that we thus identify as being a part of the group called Tech Occupations Outside of Tech. This group does, however, exclude those workers identified as being in High-Skill Autonomous occupations

Potentially Contracted

From the subset of Tech Occupations Outside of Tech, we created a more specific subset of potentially contracted workers. This subset consists of all the observations in the Tech Occupations Outside of Tech subset that are employed by any of the industries highlighted in the List of Potentially Contracted Industries listed in Appendix C. The industries identified as potentially contracted were chosen by the researchers of this project. In addition to those falling under these industries, workers in the following occupations were also included in the Potentially Contracted Workers subset: Grounds Maintenance Workers (occsoc: 373010), Human Resources Assistants Except Payroll and Timekeeping (occsoc: 434161), Interviewers, Except Eligibility and Loan (occsoc: 434111), and Proofreaders and Copy Markers (occsoc: 439081).

The following variables from the IPUMS data-set were analyzed to produce the tables in the document:

- Number of workers: the total number of people in the region that fall under the indicated category. The total number of people that each observation in the data represents is given by the variable *perwt*. All reported statistics are calculated as a weighted average, using *perwt* as a weight.
- Earnings: measured as the "total pre-tax wage and salary income" of the reporting individual. IPUMS variable *incwage*.
- Race:
    - Hispanic: anyone who indicated being "of Hispanic/Spanish/Latino origin" under the IPUMS variable *hispan*.
    - White, African-American, Chinese: anyone who indicated being "White", "Black", or "Chinese", respectively, under the *race* variable and did not identify as being Hispanic.
    - Filipino, Indian, Vietnamese: anyone who indicated being "Filipino", "Asian Indian", or "Vietnamese", respectively, under the detailed race variable (*raced*) and did not identify as being Hispanic.
    - Other Asian/Pacific Islander: anyone who indicated being "Other Asian/Pacific Islander" or "Japanese" under the variable *race* and is not Filipino, Indian, Vietnamese, nor Hispanic.
    - Other: anyone who does not fall under the previously listed categories. Includes Native Americans and those of mixed race.
- % in Poverty: the percentage of people whose family reported a total income of less than 200% of the local poverty line. Percentage of the poverty line is calculated by IPUMS and reported under the variable *poverty*.
- %>1 Family: the percentage of people who report living in a residence with more than one family. People are considered as living with multiple families if the variable *nfam* has a value greater than one.
- % w/ Extended Family: the percentage of people who reported living in something other than the following situations: one generation or 2 adjacent generations, adult-child. These two situations

relate to values of 10 and 21, respectively, for the detailed variable *multgend*. Extended family thus includes those living in a household with 2 non-adjacent generations (i.e. grandparent and grandchild), 3 (or more) generations, or 2 adjacent generations, adult-adult.

- Share of Income: these values aim to illustrate the how much of a household's income is spent on living costs. However, because the value is calculated as a fraction, some (potentially) miscoded incomes lead to extreme measures of cost share of income. As a result, observations with a cost share of income less than zero or beyond five are excluded from these tables. Additionally, values are reported based on averages as well as based on median values. In the case of median values, Costs/Inc is given as the median value of cost share of income, not a division of the median cost and median income.
    - Costs: in the case of renters, costs are "the gross monthly rental cost of the housing unit, including contract rent plus additional costs for utilities (water, electricity, gas) and fuels (oil, coal, kerosene, wood, etc.)", as reported under IPUMS variable *rentgrs*. In the case of non-renters, costs are "sum of payments for mortgages, deeds of trust, contracts to purchase, or similar debts on the property (including payments for the first mortgage, second mortgages, home equity loans, and other junior mortgages); real estate taxes; fire, hazard, and flood insurance on the property; utilities (electricity, gas, and water and sewer); and fuels (oil, coal, kerosene, wood, etc.)". Non-renters' costs are reported in the IPUMS variable *owncost*.
    - Household Income: total annual income of all people living in the household. IPUMS variable *hhincome*.
    - Cost/Inc: the cost share of income. This is annual costs (Costs*12) divided by annual household income.

APPENDIX B: INDUSTRIES INCLUDED IN "TECH PRODUCTS AND SERVICES"

INDUSTRY	NAICS CODES
Software	5112, 334611
Computer Hardware Design & Manufacturing	3341, 5415
Semiconductors & Related Equipment Manufacturing	3344
Internet & Information Services	519, 518
Telecommunications Manufacturing & Services	517, 3342, 3343, 3346 (-334611)
Instrument Manufacturing (navigation, measuring & electromedical)	3345
Other Media & Broadcasting, including Publishing	5111, 512, 515
I.T. Repair Services	8112
Technical Research & Development (Include Life Sciences)	5417
Medical Devices (LS)	3391
Biotechnology (LS)	32518, 32519, 32522, 325613
Phamaceuticals (LS)	3254

Note: This definition follows that developed by Joint Venture Silicon Valley in their Silicon Valley Index

APPENDIX C: POTENTIALLY SUBCONTRACTED INDUSTRIES

INDUSTRY	NAICS CODES
Services to buildings and dwellings	5617Z
Investigation and security services	5616
Management, scientific and technical consulting services	5416
Legal services	5411
Truck transportation	484
Couriers and messengers	492
Accounting, tax preparation, bookkeeping and payroll	5412
Services incidental to transportation	488
Employment services	5613
Architectual, engineering and related services	5413
Business support services	5614
Advertising and related services (2003-2012)	5418
Waste management and remediation services	562
Not specified industries	3MS
Other professional, scientific and technical services	5419Z
Other administrative, and other support services	561M
Warehousing and storage	493
Landscaping services	56173
Management of companies and enterprises	55

APPENDIX D: LIST OF POTENTIAL CONTRACTED OCCUPATIONS BY WORK-SYSTEM

All Industries Outside of "Information and Innovation Products and Services"

TIGHT	
2010 Occupation	*Total*
Data Entry Keyers	493
Assemblers and Fabricators, nec	303
Inspectors, Testers, Sorters, Sampler	223
Other production workers including semiconductor processors and cooling and freezing equipment operators	100
Financial Clerks, nec	77
Electrical, Electronics, and Electromechanical Assemblers	65
Retail Salespersons	62
Cashiers	47
Photographic Process Workers and Processing Machine Operators	40
Telephone Operators	13
Chemical Processing Machine Setters, Operators, and Tenders	8

LABOR INTENSIVE	
2010 Occupation	*Total*
Janitors and Buliding Cleaners	8,177
Security Guards and Gaming Surveillance	5,443
Maids and Housekeeping Cleaners	3,403
Driver/Sales Workers and Truck Drivers	2,919
Laborers and Freight, Stock, and Material Movers, Hand	2,709
Secrateries and Administrative Assistants	1,053
Bookkeeping, Accounting, and Auditing Clerks	1,013
Packers and Packagers, Hand	663
Office Clerks, General	358
Couriers and Messengers	322
Office and Administrative support workers	267
Other production workers including semiconductor processors and cooling and freezing equipment operators	264
Assemblers and Fabricators, nec	257
Cleaners of Vehicles and Equiptment	238
Interviewers, Except Eligibility and Loan	214
Dispatchers	201
Transportation, Storage and Distribution	167
Industrial Truck and Tractor Operators	137
Recpetionists and Information Clerks	133

LABOR INTENSIVE	
Human Resources Assistants, Except Payroll and Timekeeping	128
Word Processors and Typists	110
Nursing, Psychiatric, and Home Health Aides	105
Stock Clerks and Order Fillers	100
Billing and Posting Clerks	99
Childcare Workers	96
Welding, Soldering, and Brazing Workers	89
Models, Demonstrators, and Product Promoters	85
Payroll and Timekeeping Clerks	83
Shipping, Receiving, and Traffic Clerks	75
Electrical, Electronics, and Electromechanical Assemblers	73
Production, Planning, and Expediting Clerks	71
Medical Assistants and Other Healthcare Support Occupations, nec	69
File CLerks	66
Photographic Process Workers and Processing Machine Operators	52
Statistical Assistants	40
Weighers, Measurers, Checkers, and Samplers, Recordkeeping	39
Helpers-Production Workers	35
Mail Clerks and Mail Machine Operators, Except Postal Service	33
Chefs and Cooks	32
Bill and Account Collectors	31
Food Servers, Nonrestaurants	26
Correspondent clerks and order clerks	24
Packaging and Filling Machine Operators and Tenders	23
Office Machine Operators, Except Computer	15
Door-to-Door Sales Workers, News and Street Vendors, and Related Workers	14
Ushers, Lobby Attendants, and Ticket Takers	13
Painting Workers and Dyers	13

SEMIAUTONOMOUS	
2010 Occupation	*Total*
Managers, nec (including Postmater)	7,738
Driver/Sales Workers and Truck Drivers	3,927
Secrateries and Administrative Assistants	3,182
Managers in Marketing, Advertising, and Public Relations	1,927
Sales Representatives, Services, All Other	1,872
Chief executives and legislators/public administration	1,826
Human Resources, Training, and Labor Relations Specialists	1,746

SEMIAUTONOMOUS	
Software Developers, Applications and Systems Software	1,693
Couriers and Messengers	1,453
First-Line Supervisors of Office and Administrative Support Workers	1,238
Bookkeeping, Accounting, and Auditing Clerks	1,237
General and Operations Managers	1,132
Receptionists and Information Clerks	964
Tax Preparers	858
Supervisors of Transportation and Material Moving Workers	714
Computers Programmers	705
Paralegals and Legal Assistants	701
Computer and Information Systems	691
Financial Managers	649
First-Line Supervisors of Housekeeping and Janitorial Workers	594
Office and administrative support workers, nec	535
Interviewers, Except Eligibility and Loan	530
Human Resources Managers	484
Shipping, Recieving and Traffic Clerks	484
File Clerks	427
Public Relations and Specialists	423
Architectural and Engineering Managers	406
Sales and Related Workers, All Other	398
Other Business Operations and Management Specialists	387
Purchasing Agents, Except Wholesale, Retail, and Farm Products	386
Word Processors and Typists	359
Stock Clerks and Order Fillers	345
Human Resources Assistants, Except Payroll and Timekeeping	324
Payroll and Timekeeping Clerks	315
Personal Financial Advisors	314
Drafters	306
Inspectors, Testers, Sorters, Samplers, and Weighers	305
Meeting and Convention Planners	272
Mail Clerks and Mail Machine Operators, Except Postal Service	259
Dispatchers	248
Transportation, Storage, and Distribution Managers	236
Billing and Posting Clerks	222
Production, Planning and Expediting	214
Assemblers and Fabricators, nec	197
Other production workers including semiconductor processors and cooling and freezing equipment operators	176
Construction and Building Inspectors	166

SEMIAUTONOMOUS	
Sales Representatives, Wholesale and Manufacturing	161
Law enforcement workers, nec	160
Industrial Production Managers	159
Bill and Account Collectors	146
Weighers, Measurers, Checkers, and Samplers, Recordkeeping	126
Broadcast and Sound Engineering Technicians and Radio Operators, and media and communication equipment workers, all other	118
Purchasing Managers	116
Engineering Technicians, Except Drafters	111
Agents and Business Managers of Artists, Performers, and Athletes	109
Life, Physical, and Social Science Technicians, nec	104
Computer Operators	85
Industrial Truck and Tractor Operators	71
Office Machine Operators, Except Computer	69
Painting Workers and Dyers	63
Information and Record Clerks, All Other	49
Constructions Managers	46
Administrative Services Managers	42
Cost Estimators	41
Financial Specialists, nec	33
Welding, Soldering, and Brazing Workers	30
Compliance Officers, Except Agriculture	30
Procurement Clerks	27
Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	21
Photographic Process Workers and Processing Machine Operators	20
Healthcare Practitioners and Technical Occupations, nec	19
Biological Technicians	16
Aircraft Pilots and Flight Engineers	14
Budget Analysis	13
Financial Analysts	12
Cashier	12
Models, Demonstrators, and Product Promoters	11
Metal workers and plastic workers, nec	10
Natural Science Managers	9

APPENDIX E: OCCUPATIONS BY WORK-SYSTEMS

Note that all references to income percentiles are within the occupational category within Silicon Valley.

Tightly Constrained (1990 Standard Occupational Code):

- All income earners: Telephone operators (348), Bank tellers (383), Data entry keyers (385)
- Bottom 75% of income earners: Retail sales clerks (275), Cashiers (276)

FROM 25TH TO 50TH PERCENTILE EARNERS	
Lathe, milling, and turning machine operatives (703)	Laundry workers (748)
Punching and stamping press operatives (706)	Misc textile machine operators (749)
Rollers, roll hands, and finishers of metal (707)	Cementing and gluing maching operators (753)
Drilling and boring machine operators (708)	Packers, fillers, and wrappers (754)
Grinding, abrading, buffing, and polishing workers (709)	Extruding and forming machine operators (755)
Forge and hammer operators (713)	Mixing and blending machine operatives (756)
Molders, and casting machine operators (719)	Separating, filtering, and clarifying machine operators (757)
Metal platers (723)	Painting machine operators (759)
Heat treating equipment operators (724)	Roasting and baking machine operators (food) (763)
Wood lathe, routing, and planing machine operators (726)	Washing, cleaning, and pickling machine operators (764)
Sawing machine operators and sawyers (727)	Paper folding machine operators (765)
Nail and tacking machine operators (woodworking) (729)	Furnace, kiln, and oven operators, apart from food (766)
Other woodworking machine operators (733)	Slicing and cutting machine operators (769)
Winding and twisting textile/apparel operatives (738)	Motion picture projectionists (773)
Textile sewing machine operators (744)	Photographic process workers (774)
Shoemaking machine operators (745)	Machine operators, n.e.c. (779)
Pressing machine operators (clothing) (747)	

- From 25th to 75th percentile earners: Assemblers of electrical equipment (785)
- From 50th to 75th percentile earners: Graders and sorters in manufacturing (799)

Unrationalized Labor Intensive:

ALL INCOME EARNERS	
Door-to-door sales, street sales, and news vendors (277)	Crossing guards and bridge tenders (425)
Housekeepers, maids, butlers, stewards, and lodging quarters cleaners (405)	Guards, watchmen, doorkeepers (426)
Protective services, n.e.c. (427)	Public transportation attendants and inspectors (463)
Bartenders (434)	Baggage porters (464)
Waiter/waitress (435)	Welfare service aides (465)
Cooks, variously defined (436)	Child care workers (468)
Kitchen workers (439)	Personal service occupations, nec (469)

ALL INCOME EARNERS	
Waiter's assistant (443)	Drywall installers (573)
Misc food prep workers (444)	Helpers, constructions (865)
Health aides, except nursing (446)	Helpers, surveyors (866)
Nursing aides, orderlies, and attendants (447)	Construction laborers (869)
Supervisors of cleaning and building service (448)	Production helpers (874)
Janitors (453)	Garbage and recyclable material collectors (875)
Elevator operators (454)	Machine feeders and offbearers (878)
Pest control occupations (455)	Freight, stock, and materials handlers (883)
Supervisors of personal service jobs, n.e.c. (456)	Garage and service station related occupations (885)
Recreation facility attendants (459)	Vehicle washers and equipment cleaners (887)
Guides (461)	Packers and packagers by hand (888)
Ushers (462)	Laborers outside construction (889)

BOTTOM 25% OF INCOME EARNERS	
Office supervisors (303)	Other telecom operators (349)
Secretaries (313)	Postal clerks, excluding mail carriers (354)
Typists (315)	Mail carriers for postal service (355)
Interviewers, enumerators, and surveyors (316)	Mail clerks, outside of post office (356)
Hotel clerks (317)	Messengers (357)
Transportation ticket and reservation agents (318)	Dispatchers (359)
Receptionists (319)	Shipping and receiving clerks (364)
Correspondence and order clerks (326)	Stock and inventory clerks (365)
Human resources clerks, except payroll and timekeeping (328)	Meter readers (366)
Library assistants (329)	Weighers, measurers, and checkers (368)
File clerks (335)	Material recording, scheduling, production, planning, and expediting clerks (373)
Records clerks (336)	Eligibility clerks for government programs; social welfare (377)
Bookkeepers and accounting and auditing clerks (337)	Bill and account collectors (378)
Payroll and timekeeping clerks (338)	General office clerks (379)
Billing clerks and related financial records processing (344)	Proofreaders (384)
Mail and paper handlers (346)	Statistical clerks (386)
Office machine operators, n.e.c. (347)	Administrative support jobs, n.e.c. (389)
Barbers (457)	Shoemaking machine operators (745)
Hairdressers and cosmetologists (458)	Pressing machine operators (clothing) (747)
Lathe, milling, and turning machine operatives (703)	Laundry workers (748)
Punching and stamping press operatives (706)	Misc textile machine operators (749), Cementing and gluing maching operators (753)
Rollers, roll hands, and finishers of metal (707)	Packers, fillers, and wrappers (754)
Drilling and boring machine operators (708)	Extruding and forming machine operators (755)
Grinding, abrading, buffing, and polishing workers (709)	Mixing and blending machine operatives (756)

BOTTOM 25% OF INCOME EARNERS	
Forge and hammer operators (713)	Separating, filtering, and clarifying machine operators (757)
Molders, and casting machine operators (719)	Painting machine operators (759)
Metal platers (723)	Roasting and baking machine operators (food) (763)
Heat treating equipment operators (724)	Washing, cleaning, and pickling machine operators (764)
Wood lathe, routing, and planing machine operators (726)	Paper folding machine operators (765)
Sawing machine operators and sawyers (727)	Furnace, kiln, and oven operators, apart from food (766)
Nail and tacking machine operators (woodworking) (729)	Slicing and cutting machine operators (769)
Other woodworking machine operators (733)	Motion picture projectionists (773)
Winding and twisting textile/apparel operatives (738)	Photographic process workers (774)
Knitters, loopers, and toppers textile operatives (739)	Machine operators, n.e.c. (779)
Textile cutting machine operators (743)	Assemblers of electrical equipment (785)
Textile sewing machine operators (744)	

BOTTOM 50% OF INCOME EARNERS	
Sales demonstrators / promoters / models (283)	Truck, delivery, and tractor drivers (804)
Painters, construction and maintenance (579)	Bus drivers (808)
Welders and metal cutters (783)	Taxi cab drivers and chauffeurs (809)
Supervisors of motor vehicle transportation (803)	Parking lot attendants (813)

BOTTOM 75% OF INCOME EARNERS	
Farm workers (479)	Graders and sorters of agricultural products (488)
Supervisors of agricultural occupations (485)	Inspectors of agricultural products (489)
Gardeners and groundskeepers (486)	Timber, logging, and forestry workers (496)
Animal caretakers except on farms (487)	Fishers, hunters, and kindred (498)

Semiautonomous

All income earners: Dental assistants (445)

BOTTOM 75% OF INCOME EARNERS	
Chief executives and public administrators (4)	Purchasing agents and buyers, of farm products (28)
Financial managers (7)	Buyers, wholesale and retail trade (29)
Salespersons, n.e.c. (274)	Purchasing managers, agents and buyers, n.e.c. (33)
Human resources and labor relations managers (8)	Business and promotion agents (34)
Managers and specialists in marketing, advertising, and public relations (13)	Construction inspectors (35)
Managers in education and related fields (14)	Inspectors and compliance officers, outside construction (36)
Managers of medicine and health occupations (15)	Management support occupations (37)

BOTTOM 75% OF INCOME EARNERS	
Managers of food-serving and lodging establishments (17)	Supervisors of guards (415)
Managers of properties and real estate (18)	Supervisors of cleaning and building service (448)
Funeral directors (19)	Supervisors of personal service jobs, n.e.c. (456)
Managers of service organizations, n.e.c. (21)	Supervisors of mechanics and repairers (503)
Managers and administrators, n.e.c. (22)	Supervisors of construction work (558)
Other financial specialists (25)	Production supervisors or foremen (628)
Personnel, HR, training, and labor relations specialists (27)	Ship crews and marine engineers (829)

BOTTOM 25% OF INCOME EARNERS	
Clinical laboratory technologies and technicians (203)	Biological technicians (223)
Dental hygenists (204)	Chemical technicians (224)
Health record tech specialists (205)	Other science technicians (225)
Radiologic tech specialists (206)	Airplane pilots and navigators (226)
Licensed practical nurses (207)	Air traffic controllers (227)
Health technologists and technicians, n.e.c. (208)	Broadcast equipment operators (228)
Engineering technicians, n.e.c. (214)	Computer software developers (229)
Drafters (217)	Programmers of numerically controlled machine tools (233)
Surveyors, cartographers, mapping scientists and technicians (218)	Legal assistants, paralegals, legal support, etc (234)

BOTTOM 50% OF INCOME EARNERS	
Graders and sorters in manufacturing (799)	Crane, derrick, winch, and hoist operators (848)
Railroad conductors and yardmasters (823)	Excavating and loading machine operators (853)
Locomotive operators (engineers and firemen) (824)	Misc material moving occupations (859)
Railroad brake, coupler, and switch operators (825)	Computer and peripheral equipment operators (308)
Operating engineers of construction equipment (844)	

Between 25th and 50th percentile of income earners: Office supervisors (303),

BOTTOM 50% OF INCOME EARNERS	
Secretaries (313)	Postal clerks, excluding mail carriers (354)
Typists (315)	Mail carriers for postal service (355)
Interviewers, enumerators, and surveyors (316)	Mail clerks, outside of post office (356)
Hotel clerks (317)	Messengers (357)
Transportation ticket and reservation agents (318)	Dispatchers (359)
Receptionists (319)	Shipping and receiving clerks (364)
Correspondence and order clerks (326)	Stock and inventory clerks (365)
Human resources clerks, except payroll and timekeeping (328)	Meter readers (366)

BOTTOM 50% OF INCOME EARNERS	
Library assistants (329)	Weighers, measurers, and checkers (368)
File clerks (335)	Material recording, scheduling, production, planning, and expediting clerks (373)
Records clerks (336)	Eligibility clerks for government programs; social welfare (377)
Bookkeepers and accounting and auditing clerks (337)	Bill and account collectors (378)
Payroll and timekeeping clerks (338)	General office clerks (379)
Billing clerks and related financial records processing (344)	Proofreaders (384)
Mail and paper handlers (346)	Statistical clerks (386)
Office machine operators, n.e.c. (347)	Administrative support jobs, n.e.c. (389)
Other telecom operators (349)	

Between 25th and 75th percentile of income earners: Barbers (457), Hairdressers and cosmetologists (458)

TOP 50% OF INCOME EARNERS	
Sales demonstrators / promoters / models (283)	Drilling and boring machine operators (708)
Lathe, milling, and turning machine operatives (703)	Grinding, abrading, buffing, and polishing workers (709)
Punching and stamping press operatives (706)	Forge and hammer operators (713)
Rollers, roll hands, and finishers of metal (707)	Molders, and casting machine operators (719)
Metal platers (723)	Separating, filtering, and clarifying machine operators (757)
Heat treating equipment operators (724)	Painting machine operators (759)
Wood lathe, routing, and planing machine operators (726)	Roasting and baking machine operators (food)(763)
Sawing machine operators and sawyers (727)	Washing, cleaning, and pickling machine operators (764)
Nail and tacking machine operators (woodworking) (729)	Paper folding machine operators (765)
Other woodworking machine operators (733)	Furnace, kiln, and oven operators, apart from food (766)
Winding and twisting textile/apparel operatives (738)	Slicing and cutting machine operators (769)
Knitters, loopers, and toppers textile operatives (739)	Motion picture projectionists (773)
Textile cutting machine operators (743)	Photographic process workers (774)
Textile sewing machine operators (744)	Machine operators, n.e.c. (779)
Shoemaking machine operators (745)	Welders and metal cutters (783)
Pressing machine operators (clothing) (747)	Truck, delivery, and tractor drivers (804)
Laundry workers (748), Misc textile machine operators (749)	Bus drivers (808)
Cementing and gluing maching operators (753)	Taxi cab drivers and chauffeurs (809)
Packers, fillers, and wrappers (754)	Parking lot attendants (813)
Extruding and forming machine operators (755)	
Mixing and blending machine operatives (756)	

Between 50th and 75th percentile of income earners: Supervisors of motor vehicle transportation (803)

TOP 25% OF INCOME EARNERS	
Retail sales clerks (275)	Animal caretakers except on farms (487)
Cashiers (276)	Graders and sorters of agricultural products (488)
Farm workers (479)	Inspectors of agricultural products (489)
Supervisors of agricultural occupations (485)	Timber, logging, and forestry workers (496)
Gardeners and groundskeepers (486)	Fishers, hunters, and kindred (498), Assemblers of electrical equipment (785)

High-Skill Autonomous

ALL INCOME EARNERS	
Accountants and auditors (23)	Management analysts (26)
Insurance underwriters (24)	Architects (43)
Aerospace engineer (44)	Kindergarten and earlier school teachers (155)
Metallurgical and materials engineers, variously phrased (45)	Primary school teachers (156)
Petroleum, mining, and geological engineers (47)	Secondary school teachers (157)
Chemical engineers (48)	Special education teachers (158)
Civil engineers (53)	Teachers , n.e.c. (159)
Electrical engineer (55)	Vocational and educational counselors (163)
Industrial engineers (56)	Librarians (164)
Mechanical engineers (57)	Archivists and curators (165)
Not-elsewhere-classified engineers (59)	Economists, market researchers, and survey researchers (166)
Computer systems analysts and computer scientists (64)	Psychologists (167)
Operations and systems researchers and analysts (65)	Social scientists, n.e.c. (169)
Actuaries (66)	Urban and regional planners (173)
Mathematicians and mathematical scientists (68)	Social workers (174)
Physicists and astronomers (69)	Recreation workers (175)
Chemists (73)	Clergy and religious workers (176)
Atmospheric and space scientists (74)	Lawyers (178)
Geologists (75)	Writers and authors (183)
Physical scientists, n.e.c. (76)	Technical writers (184)
Agricultural and food scientists (77)	Designers (185)
Biological scientists (78)	Musician or composer (186)
Foresters and conservation scientists (79)	Actors, directors, producers (187)
Medical scientists (83)	Art makers: painters, sculptors, craft-artists, and print-makers (188)
Physicians (84)	Photographers (189)
Dentists (85)	Dancers (193)
Veterinarians (86)	Art/entertainment performers and related (194)
Optometrists (87)	Editors and reporters (195)

ALL INCOME EARNERS	
Podiatrists (88)	Announcers (198)
Other health and therapy (89)	Athletes, sports instructors, and officials (199)
Registered nurses (95)	Supervisors and proprietors of sales jobs (243)
Pharmacists (96)	Insurance sales occupations (253)
Dietitians and nutritionists (97)	Real estate sales occupations (254)
Respiratory therapists (98)	Financial services sales occupations (255)
Occupational therapists (99)	Advertising and related sales jobs (256)
Physical therapists (103)	Sales engineers (258)
Speech therapists (104)	Insurance adjusters, examiners, and investigators (375)
Therapists, n.e.c. (105)	Customer service reps, investigators and adjusters, except insurance (376) , (415)
Physicians' assistants (106)	Fire fighting, prevention, and inspection (417)
Subject instructors (HS/college) (154)	Police, detectives, and private investigators (418)
Other law enforcement: sheriffs, bailiffs, correctional institution officers (423)	Farmers (owners and tenants) (473)
Farm managers, except for horticultural farms (475) , (503)	Bus, truck, and stationary engine mechanics (507)
Automobile mechanics (505)	Aircraft mechanics (508)
Small engine repairers (509)	Auto body repairers (514)
Heavy equipment and farm equipment mechanics (516)	Industrial machinery repairers (518)
Machinery maintenance occupations (519)	Repairers of industrial electrical equipment (523)
Repairers of data processing equipment (525)	Repairers of household appliances and power tools (526)
Telecom and line installers and repairers (527)	Repairers of electrical equipment, n.e.c. (533)
Heating, air conditioning, and refigeration mechanics (534)	Precision makers, repairers, and smiths (535)
Locksmiths and safe repairers (536)	Repairers of mechanical controls and valves (539)
Elevator installers and repairers (543)	Millwrights (544)
Mechanics and repairers, n.e.c. (549) , (558)	Masons, tilers, and carpet installers (563)
Carpenters (567)	Electricians (575)
Electric power installers and repairers (577)	Plasterers (584)
Paperhangers (583)	Plumbers, pipe fitters, and steamfitters (585)
Concrete and cement workers (588)	Glaziers (589)
Insulation workers (593)	Paving, surfacing, and tamping equipment operators (594)
Roofers and slaters (595)	Sheet metal duct installers (596)
Structural metal workers (597)	Drillers of earth (598)
Construction trades, n.e.c. (599)	Drillers of oil wells (614)
Explosives workers (615)	Miners (616)
Other mining occupations (617), (628)	Tool and die makers and die setters (634)
Machinists (637)	Boilermakers (643)
Precision grinders and filers (644)	Patternmakers and model makers (645)

ALL INCOME EARNERS	
Engravers (649)	Cabinetmakers and bench carpenters (657)
Furniture and wood finishers (658)	Dressmakers and seamstresses (666)
Upholsterers (668)	Shoe repairers (669)
Hand molders and shapers, except jewelers (675)	Optical goods workers (677)
Dental laboratory and medical appliance technicians (678)	Bookbinders (679)
Butchers and meat cutters (686)	Bakers (687)
Batch food makers (688)	Water and sewage treatment plant operators (694)
Power plant operators (695)	Plant and system operators, stationary engineers (696)
Other plant and system operators (699)	Printing machine operators, n.e.c. (734)
Typesetters and compositors (736)	

TOP 75% OF INCOME EARNERS	
Clinical laboratory technologies and technicians (203)	Chemical technicians (224)
Dental hygenists (204), Health record tech specialists (205), Radiologic tech specialists (206)	Other science technicians (225)
Licensed practical nurses (207)	Airplane pilots and navigators (226)
Health technologists and technicians, n.e.c. (208)	Air traffic controllers (227)
Engineering technicians, n.e.c. (214)	Broadcast equipment operators (228)
Drafters (217)	Computer software developers (229)
Surveyors, cartographers, mapping scientists and technicians (218)	Programmers of numerically controlled machine tools (233)
Biological technicians (223)	Legal assistants, paralegals, legal support, etc (234)

TOP 50% OF INCOME EARNERS	
Painters, construction and maintenance (579)	Operating engineers of construction equipment (844)
Computer and peripheral equipment operators (308)	Crane, derrick, winch, and hoist operators (848)
Railroad conductors and yardmasters (823)	Excavating and loading machine operators (853)
Locomotive operators (engineers and firemen) (824)	Misc material moving occupations (859)
Railroad brake, coupler, and switch operators (825)	

TOP 25% OF INCOME EARNERS	
Chief executives and public administrators (4)	Managers of service organizations, n.e.c. (21)
Financial managers (7)	Managers and administrators, n.e.c. (22)
Human resources and labor relations managers (8)	Other financial specialists (25)
Managers and specialists in marketing, advertising, and public relations (13)	Personnel, HR, training, and labor relations specialists (27)
Managers in education and related fields (14)	Purchasing agents and buyers, of farm products (28)
Managers of medicine and health occupations (15)	Buyers, wholesale and retail trade (29)
Managers of food-serving and lodging establishments (17)	Purchasing managers, agents and buyers, n.e.c. (33)
Managers of properties and real estate (18)	Business and promotion agents (34)

TOP 25% OF INCOME EARNERS	
Funeral directors (19)	Construction inspectors (35)
Inspectors and compliance officers, outside construction (36)	Hairdressers and cosmetologists (458)
Management support occupations (37)	Supervisors of mechanics and repairers (503)
Salespersons, n.e.c. (274)	Supervisors of construction work (558)
Office supervisors (303)	Production supervisors or foremen (628)
Supervisors of guards (415)	Graders and sorters in manufacturing (799)
Supervisors of cleaning and building service (448)	Supervisors of motor vehicle transportation (803)
Supervisors of personal service jobs, n.e.c. (456)	Ship crews and marine engineers (829)
Barbers (457)	