High-Tech Occupations by Metropolitan Statistical Area

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The term *high-tech* has always denoted a very ambiguous and amorphous concept. An industry or an occupational field that is commonly known as high-tech one year could be using technology or skills that are considered to be standard only a few years later. Low-skilled workers can be found in industries known as high-tech, and most people would not consider these workers to be employed in high-tech occupations. Similarly, workers who perform highly skilled functions using the latest technology could be employed in very low-tech, older industries.

However high-tech occupations are defined, practical knowledge would lead us to expect to find these occupations grouped together, either by wage rate, industry, or geographical area. This article uses criteria based on the level of technology utilization to identify high-tech occupations. It then provides a statistical summary by metropolitan statistical area (MSA) of the wage and employment estimates for technologically oriented occupations. According to the 2001 Occupational Employment Statistics (OES) survey, there were dramatic differences in these estimates by MSA.

Defining high-tech

Previous studies have identified high-tech occupations by the level of education that an individual must have in order to be employed in a given field. By this standard, many professional occupations are termed high-tech, even though the incumbents may be performing their duties using technology that has been available for generations. In other words, the educational attainment criterion may be useful for identifying high-wage, or high-potential, jobs but is not directly related to high technology as a concept.

Other researchers have attempted to define high-tech occupations as consisting of workers in industries that utilize new technologies. The logic of this classification is that, because the processes being used in these industries are technically advanced, their employees, to a certain extent, must be also. However, as with all industries, not all of the people employed at firms in these industries are producing technical products or making use of advanced technology to perform their duties. Therefore, many unskilled workers and persons not using any cutting-edge technology in their work would be incorrectly identified as high-tech workers.

Out of consideration for these factors, high-tech occupations are defined for the purposes of this ariticle as consisting of workers who typically or necessarily utilize new technologies—those that are changing the ways in which people live and work—in order to perform their duties. Using this criterion and the occupational definitions from the 2000 Standard Occupation Classification (SOC) system, occupations were selected for inclusion in a high technology subgroup. A list was compiled of the 36 occupations determined to be utilizing new technologies to the greatest extent, and they will be referred to in this article as "high-tech occupations." This list of high-tech occupations, shown below, may change in the future as new technologies become standard, and others are brought into the workplace.

SOC code	SOC title
15-1011	Computer and information scientists, research
15-1021	Computer programmers
15-1031	Computer software engineers, applications
15-1032	Computer software engineers, systems software
15-1051	Computer systems analysts
15-1061	Database administrators
15-1081	Network systems and data communications analysts
17-2011	Aerospace engineers
17-2031	Biomedical engineers
17-2041	Chemical engineers
17-2061	Computer hardware engineers
17-2071	Electrical engineers
17-2072	Electronics engineers, except computer
17-2151	Mining and geological engineers
17-2161	Nuclear engineers
17-2171	Petroleum engineers
17-3021	Aerospace engineering and operations technicians
17-3023	Electrical and electronic engineering technicians
17-3024	Electro-mechanical technicians
19-1021	Biochemists and biophysicists
19-1022	Microbiologists
19-1041	Epidemiologists
19-1042	Medical scientists, except epidemiologists
19-2011	Astronomers
19-2012	Physicists
19-2021	Atmospheric and space scientists
19-2031	Chemists

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Text table 1. **Employment shares and wage rates for the 10 metropolitan areas with the largest shares of high-tech workers, 2001**

(Shares in percent)

MSA	High tech		Non-high-tech wage	Technology group		Non-technology group wage
	Employment share	Annual wage		Employment share	Annual wage	
San Jose, CA PMSA	10.68	$79,800	$45,210	19.92	$73,460	$43,190
Boulder-Longmont, CO PMSA	9.81	68,630	37,750	20.26	60,260	36,080
Melbourne-Titusville-Palm Bay, FL MSA	7.15	48,120	30,780	17.88	49,830	28,390
Huntsville, AL MSA	6.80	62,710	32,800	16.33	56,070	31,310
Lowell, MA-NH PMSA	6.43	71,560	39,120	15.53	62,480	37,410
Raleigh-Durham-Chapel Hill, NC MSA	6.20	65,330	34,730	16.48	55,960	32,900
Washington, DC-MD-VA-WV PMSA	6.16	67,830	41,030	14.72	63,340	39,250
Seattle-Bellevue-Everett, WA PMSA	5.71	69,880	39,830	14.48	63,890	37,910
Boise City, ID MSA	5.67	49,940	31,340	13.69	48,730	29,910
Austin-San Marcos, TX MSA	5.30	66,370	33,650	14.26	55,420	32,140

Text table 2. **Employment shares and wage rates for the 10 metropolitan areas with the smallest shares of high-tech workers, 2001**

(Shares in percent)

MSA	High tech		Non-high-tech wage	Technology group		Non-technology group wage
	Employment share	Annual wage		Employment share	Annual wage	
Yuba City, CA MSA	0.61	$54,980	$32,800	7.41	$55,750	$31,140
McAllen-Edinburg-Mission, TX MSA	.62	39,870	24,410	5.94	44,830	23,230
Jonesboro, AR MSA	.63	38,500	26,120	8.68	41,370	24,770
Brownsville-Harlingen-San Benito, TX MSA	.67	46,610	24,590	6.05	44,550	23,480
Punta Gorda, FL MSA	.68	43,790	27,430	11.86	43,990	25,350
Vineland-Millville-Bridgeton, NJ PMSA	.68	50,220	31,960	6.52	49,430	30,880
Gadsden, AL MSA	.69	40,310	26,180	8.65	43,870	24,620
Jacksonville, NC MSA	.72	41,680	24,620	5.83	42,140	23,680
Stockton-Lodi, CA MSA	.73	51,240	32,400	5.86	54,520	31,190
Yuma, AZ MSA	.73	51,790	24,630	6.19	46,520	23,420

19-2042	Geoscientists, except hydrologists and geographer
19-4021	Biological technicians
19-4031	Chemical technicians
19-4041	Geological and petroleum technicians
19-4051	Nuclear technicians
27-1014	Multi-media artists and animators
29-2011	Medical and clinical laboratory technologists
29-2033	Nuclear medicine technologists
29-2034	Radiologic technologists and technicians

The criterion used in the selection of these occupations does not always lead to a clear stratification according to the SOC. For example, although most of the occupations from the major group Computer and mathematical science occupations (15-0000), are included as high-tech occupations, some, such as Computer support specialists (15-1041), were not included because of the nontechnological aspects of their job duties. Conversely, only one occupation, Multi-media artists and animators (27-1014), was included from the major group Arts, design, entertainment, sports, and media occupations (27-0000). None of the management and supervisory occupations was included in this list because of the OES coding principle that these individuals must spend at least 80 percent of their time supervising workers rather than performing work that might be considered high-tech. Also, residual occupations (those with titles ending in the phrase, "all other") were excluded from this list.

A different method of classifying workers as high-tech is to identify major groups in the SOC among whom the use of technology is prevalent. The four major groups usually considered be the most technologically oriented are: Computer and mathematical science occupations (15-0000), Architecture and engineering occupations (17-0000), Life, physical, and social science occupations (19-0000), and Healthcare practitioner and technical occupations (29-0000). The rationale for including all of the occupations in these groups as high-tech is that even those workers who are not making use of cutting-edge technology to perform their tasks are probably associated with other workers who are, thereby achieving higher productivity in their own occupation. When all of the workers from these major groups are included, the list of high-tech occupations increases from 36 to more than 100. The workers in these groups will be referred to in this article as employed in "technology group occupations."

Metropolitan Statistical Areas (MSAs)

The Occupational Employment Statistics (OES) program collected occupational employment and wage data in 337 metropolitan statistical areas (MSAs) in 2001. Text table 1 shows the 10 MSAs with the largest estimates for high-tech workers as a percentage of total MSA employment, and text table 2 shows the MSAs with the lowest estimates. These tables

list the average annual wages for both the high-tech and technology group occupations, as well as those of all workers outside of these classifications. The map on the following page displays the percentage of high-tech workers for all MSAs.

In text table 1, the wages for high-tech workers is higher than the wages for technology group workers in 9 out of the 10 MSAs with the highest percentages of high-tech workers. Conversely, text table 2 shows that the wage estimate for technology group workers is higher than the wage estimate for high-tech workers in 7 out of the 10 MSAs with the lowest percentages of high-tech workers. Not surprisingly, there is a connection between the percentage of high-tech workers in an area and the percentage of workers in technology group occupations. From these tables, it is also clear that there is a correlation between the percentage of high-tech workers in an area and the level of wages of both high-tech and *non*-high-tech workers in the same area.

Interpreting the results

A correlation coefficient is a number between -1 and 1 that measures the degree to which two variables are linearly related. If there is perfect linear relationship with positive slope between the two variables, we have a correlation coefficient of 1; if there is positive correlation, whenever one variable has a high (low) value, so does the other. For all MSAs, the correlation coefficient between the percentage of high-tech workers in an MSA and the annual wages paid to those workers in that area is 0.658, while the correlation coefficient between the percentage of technology group workers in an MSA and the annual wages paid to those workers in that area is only 0.481. This would seem to indicate that technology-oriented workers tend to be clustered in communities that are, generally speaking, technological centers that are willing to pay more than other areas for workers who possess advanced technical skills. The relationship between the percentage of employment and wages is much stronger for the high-tech workers than for the technology group workers.

The correlation coefficient between the percentage of high-tech workers in an MSA and the annual wages paid to all *other* workers in that MSA is 0.604, while the correlation coefficient between the percentage of technology group workers in an MSA and the annual wages paid to all other workers in that MSA is only 0.418.

This demonstrates that, once again, the more specialized class of technology workers appears to have a greater effect on both their own wages and area wages in general than does the technology group, and that this effect is not accounted for by the relatively higher incomes of the high-tech workers.

A number of empirical studies have documented that unskilled labor and capital are substitutes, while skilled labor and capital are complements. Similarly, high-tech workers, as defined in this article, are performing work that is both highly skilled and capital intensive, which not only leads to increased wages but requires fewer unskilled workers. Because of the relatively lower demand for unskilled workers in high-tech areas, productivity gains and greater demand for tech workers tend to result in a wage distribution that is more positively skewed than those in other areas. This would appear to support the theory of a skill-biased technological difference between MSAs.

According to this theory, technological advancements that are introduced into the workplace decrease the demand for unskilled workers and increase the demand for skilled workers. Because a decrease in the demand for certain workers will lower their relative wages if the supply of workers is held constant, technology improvements result in greater wage inequality between highly skilled and unskilled workers in the labor market. The data presented in this article indicate that the wages paid to non-high-tech workers within high-tech MSAs tend to be higher, possibly caused by rent sharing,[1] increased productivity of non-high-tech workers due to their high-tech environment, or a substitution of higher skilled workers for unskilled labor. ■

[1]The rent-sharing hypothesis of wage behavior applies to situations in which employers, for any of a number of reasons, feel compelled to share some of their profits with their employees.