



## High-tech industries: an analysis of employment, wages, and output

*By Brian Roberts and Michael Wolf*

High-tech industries matter to the U.S. economy because they produce a large share of total output, and from a workforce standpoint, they employ a large numbers of skilled workers and provide higher wages for all types of workers. There are various ways that high-tech industries can be defined, and those definitions can have an impact on analyses. In a 2016 article, the Bureau of Labor Statistics (BLS) defined high-tech industries as those having high concentrations of workers in STEM (Science, Technology, Engineering, and Mathematics) occupations. The study also presented data on historical and projected employment and output.<sup>[1](#)</sup>

This issue of **Beyond the Numbers** applies current data to the high-tech framework defined in previous research.<sup>2</sup> It also presents a new analysis of why wages are higher in high-tech industries, and how productivity differs between high-tech service-producing and high-tech goods-producing industries. This article uses STEM classifications from the 2010 Standard Occupational Classification (SOC) and data from the [National Employment Matrix](#) to identify high-tech industries by calculating the share of jobs in each industry that were held by STEM workers.<sup>3</sup>

## A separate look at high-tech service-providing and goods-producing industries

Overall, STEM occupations accounted for 6.1 percent of wage and salary jobs in 2016, however the overall rate is not reflective of the differences in STEM concentration when industries are split into goods-producing industries and service-providing industries. This analysis differs from the previous analysis by recognizing this difference and treating goods-producing and service-providing industries separately. The STEM share for all service-providing industries is 5.9 percent, but in goods-producing industries, a noticeably higher 7.4 percentage of workers was employed in STEM occupations. This analysis identifies individual goods-producing industries that had a STEM share at least 2–1/2 times the national average for all goods-producing industries (greater than 18.5 percent) and service-providing industries that had a STEM share at least 2–1/2 times the average for all service-providing industries (greater than 14.7 percent).

Once high-tech goods-producing and service-providing industries are identified, this study explores how high-tech industries affect the U.S. economy, such as the number of wage and salary jobs provided by high-tech industries, and the value of high-tech goods and services produced as measured by output. This analysis uses the 200 industry sectors for which BLS produces projections of industry output and employment.<sup>4</sup> Using this set of industries allows for analysis of both historical and projected employment and output data.

Table 1 shows the 27 industries identified as high-tech. Thirteen are goods-producing industries, which tend to have higher concentrations of engineers. Fourteen are service-providing industries, which tend to have higher concentrations of computer and mathematical occupations.

**Table 1. Employment and output in high-tech industries, 2016**

Sector title	NAICS	Type	Employment (in thousands)	Output (in billions)
Oil and gas extraction	211	Goods	180.0	\$257.3
Electric power generation, transmission and distribution	2211	Services	393.6	\$320.7
Basic chemical manufacturing	3251	Goods	147.8	\$270.7
Pharmaceutical and medicine manufacturing	3254	Goods	287.0	\$239.1
Industrial machinery manufacturing	3332	Goods	113.6	\$31.8
Commercial and service industry machinery manufacturing, including digital camera manufacturing	3333	Goods	89.9	\$25.0
Computer and peripheral equipment manufacturing, excluding digital camera manufacturing	3341	Goods	164.1	\$37.0
Communications equipment manufacturing	3342	Goods	85.6	\$52.6
Audio and video equipment manufacturing	3343	Goods	19.9	\$3.9
Semiconductor and other electronic component manufacturing	3344	Goods	367.0	\$115.0

See footnotes at end of table.

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Sector title	NAICS	Type	Employment (in thousands)	Output (in billions)
Navigational, measuring, electromedical, and control instruments manufacturing	3345	Goods	396.1	\$177.7
Manufacturing and reproducing magnetic and optical media	3346	Goods	15.4	\$3.7
Electrical equipment manufacturing	3353	Goods	139.3	\$39.2
Aerospace product and parts manufacturing	3364	Goods	489.0	\$266.5
Pipeline transportation	486	Services	49.5	\$33.5
Software publishers	5112	Services	355.6	\$219.9
Wired telecommunications carriers	5171	Services	588.5	\$366.3
Wireless telecommunications carriers (except satellite)	5172	Services	120.9	\$265.9
Satellite, telecommunications resellers, and all other telecommunications	5174, 5179	Services	85.3	\$42.0
Data processing, hosting, and related services	518	Services	299.6	\$129.5
Other information services	519	Services	259.3	\$95.5
Architectural, engineering, and related services	5413	Services	1,410.8	\$282.6
Computer systems design and related services	5415	Services	1,990.7	\$355.8
Management, scientific, and technical consulting services	5416	Services	1,372.5	\$318.2
Scientific research and development services	5417	Services	682.1	\$219.1
Management of companies and enterprises	55	Services	2,240.7	\$635.5
Federal Government, excluding postal service	NA	Services	2,186.1	\$454.9

Note: Output data is represented in nominal dollars.

Source: U.S. Bureau of Labor Statistics, Employment Projections program.

## High-tech pays

Median wages are higher in high-tech industries than they are in non-high-tech industries, but because STEM workers tend to have higher salaries and are (by definition) more prevalent in high-tech industries, this general trend is expected due to compositional effects. However, a comparison of wages by occupational group shows that workers of all types, not just STEM workers, had higher wages in high-tech industries. (See table 2.) In fact, every major occupational group had higher median wages in high-tech industries than in non-high-tech industries.

**Table 2. Median wage and share of employment by high-tech designation, 2016**

Occupation code	Occupation title	Share of Employment		Median annual wage		High-tech wage premium (percent difference from non-high-tech)
		High-tech industries (in percent)	Non-high-tech industries (in percent)	High-tech industries	Non-high-tech industries	
00-0000	<b>Total, all occupations</b>	100	100	\$70,230	\$34,800	101.8
11-0000	<b>Management</b>	11.2	4.6	\$131,410	\$92,220	42.5
13-0000	<b>Business and financial operations</b>	15.2	4.1	\$76,550	\$62,580	22.3
15-0000	<b>Computer and mathematical</b>	17.5	1.3	\$89,450	\$74,150	20.6
17-0000	<b>Architecture and engineering</b>	11.2	0.7	\$81,900	\$71,640	14.3
19-0000	<b>Life, physical, and social science</b>	3.9	0.5	\$70,400	\$59,100	19.1

See footnotes at end of table.

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		High-tech industries (in percent)	Non-high-tech industries (in percent)	High-tech industries	Non-high-tech industries	
21-0000	<b>Community and social service</b>	0.3	1.9	\$59,350	\$42,740	38.9
23-0000	<b>Legal</b>	0.9	0.7	\$115,600	\$76,010	52.1
25-0000	<b>Education, training, and library</b>	0.5	7.0	\$57,360	\$47,950	19.6
27-0000	<b>Arts, design, entertainment, sports, and media</b>	1.6	1.4	\$65,080	\$44,780	45.3
29-0000	<b>Healthcare practitioners and technical</b>	2.2	6.2	\$75,250	\$63,040	19.4
31-0000	<b>Healthcare support</b>	0.3	3.1	\$38,700	\$27,800	39.2
33-0000	<b>Protective service</b>	1.3	2.5	\$51,460	\$37,720	36.4
35-0000	<b>Food preparation and serving related</b>	0.2	9.9	\$32,970	\$20,810	58.4
37-0000	<b>Building and grounds cleaning and maintenance</b>	0.4	3.7	\$30,000	\$24,640	21.8
39-0000	<b>Personal care and service</b>	0.1	4.1	\$29,520	\$22,690	30.1
41-0000	<b>Sales and related</b>	4.4	10.5	\$64,690	\$25,710	151.6
43-0000	<b>Office and administrative support</b>	14.4	15.7	\$40,490	\$33,410	21.2
45-0000	<b>Farming, fishing, and forestry</b>	0.1	0.8	\$39,050	\$23,390	67.0
47-0000	<b>Construction and extraction</b>	1.1	4.1	\$55,690	\$43,210	28.9
49-0000	<b>Installation, maintenance, and repair</b>	4.6	3.7	\$59,320	\$41,550	42.8
51-0000	<b>Production</b>	6.8	6.2	\$40,920	\$32,260	26.8
53-0000	<b>Transportation and material moving</b>	1.6	7.3	\$39,890	\$30,570	30.5

Note: Wage data cover non-farm wage and salary workers and do not cover household workers.

Source: U.S. Bureau of Labor Statistics, Employment Projections program, and Occupational Employment Statistics program.

Compositional effects could be in play within major occupational groups; for example, most sales workers in high-tech industries are employed as sales representatives and sales engineers, but most sales workers in non-high-tech industries are employed as cashiers and retail salespersons—jobs that have lower education and training requirements, and consequently lower wages. Examining the data for detailed occupations shows that the pattern of higher wages in high-tech industries still holds. Table 3 shows the median annual wages for the 20 occupations with the largest employment in high-tech industries, a selection of occupations that spans multiple occupational groups and levels of education and training. For every occupation in table 3, wages were higher in high-tech industries than non-high-tech industries.



**Table 3. Median annual wage by high-tech designation for selected occupations, 2016**

Occupation code	Occupation title	Share of high-tech employment (in percent)	High-tech industries median wage	Non-high-tech industries median wage	High-tech premium (percent difference from non-high-tech)
15-1132	<b>Software developers, applications</b>	4.0	\$102,560	\$94,560	8.5
11-1021	<b>General and operations managers</b>	2.6	\$136,770	\$92,380	48.1
43-4051	<b>Customer service representatives</b>	2.6	\$36,960	\$31,630	16.9
13-1111	<b>Management analysts</b>	2.5	\$87,880	\$74,610	17.8
15-1121	<b>Computer systems analysts</b>	2.3	\$90,470	\$83,120	8.8
15-1133	<b>Software developers, systems software</b>	2.2	\$108,320	\$102,310	5.9
15-1151	<b>Computer user support specialists</b>	1.9	\$51,540	\$47,810	7.8
43-9061	<b>Office clerks, general</b>	1.8	\$36,010	\$30,160	19.4
13-2011	<b>Accountants and auditors</b>	1.8	\$74,640	\$66,370	12.5
43-6014	<b>Secretaries and administrative assistants, except legal, medical, and executive</b>	1.6	\$39,780	\$34,330	15.9
13-1161	<b>Market research analysts and marketing specialists</b>	1.5	\$68,810	\$59,570	15.5
11-3021	<b>Computer and information systems managers</b>	1.4	\$144,450	\$124,180	16.3
43-3031	<b>Bookkeeping, accounting, and auditing clerks</b>	1.4	\$41,370	\$37,960	9.0
15-1131	<b>Computer programmers</b>	1.2	\$80,880	\$78,080	3.6
17-2051	<b>Civil engineers</b>	1.2	\$84,490	\$82,300	2.7
15-1142	<b>Network and computer systems administrators</b>	1.2	\$85,620	\$75,840	12.9
49-2022	<b>Telecommunications equipment installers and repairers, except line installers</b>	1.1	\$55,900	\$48,600	15.0
17-2141	<b>Mechanical engineers</b>	1.1	\$89,800	\$78,350	14.6
13-1071	<b>Human resources specialists</b>	1.0	\$69,690	\$55,820	24.8
43-1011	<b>First-line supervisors of office and administrative support workers</b>	1.0	\$62,620	\$53,440	17.2

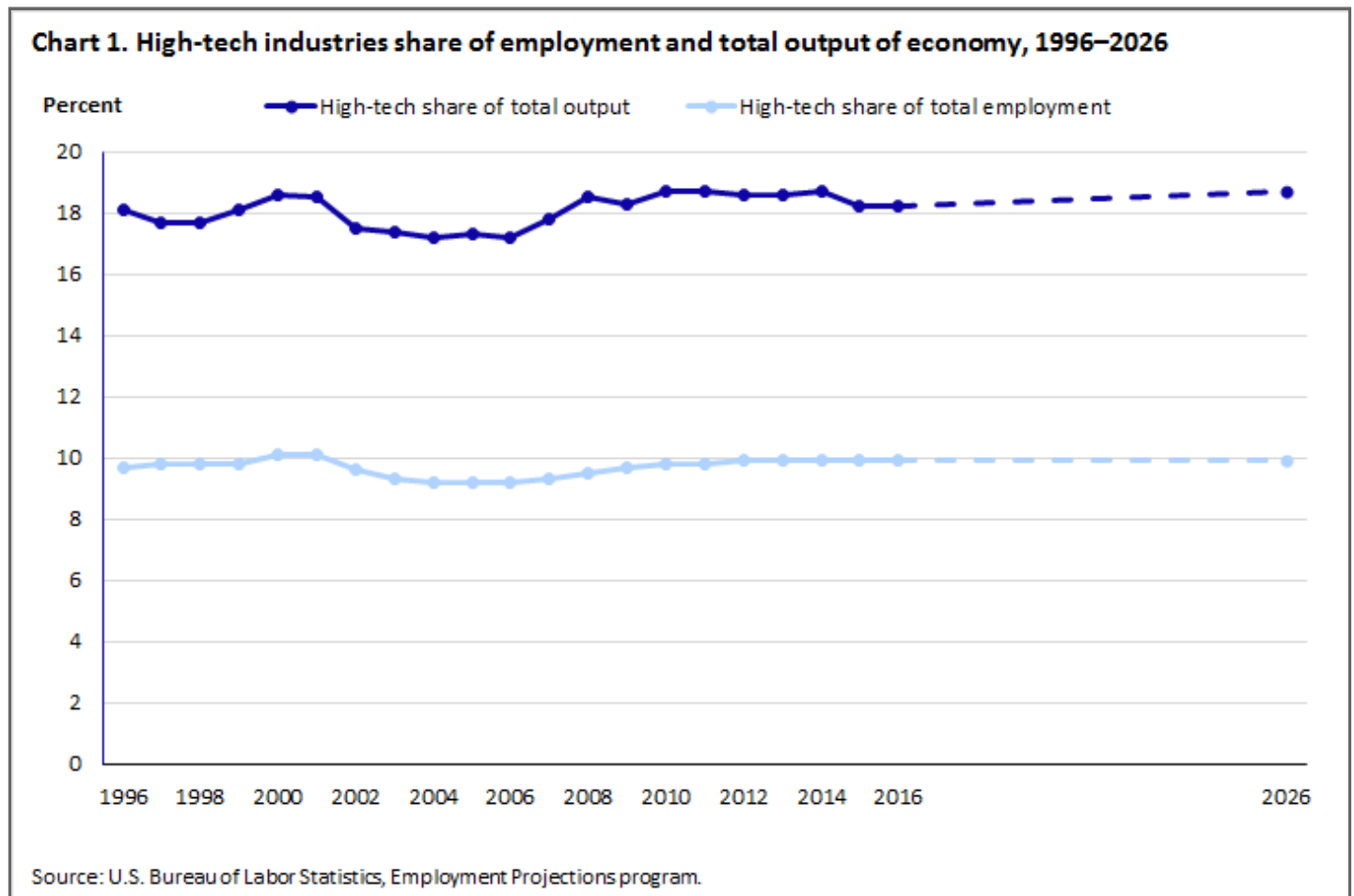
Note: Wage data cover non-farm wage and salary workers and do not cover household workers.

Source: U.S. Bureau of Labor Statistics, Employment Projections program, and Occupational Employment Statistics program.

## High-tech employment and output

High-tech industries accounted for 14.5 million jobs and about 9.9 percent of total wage and salary employment in 2016. (See chart 1.) Between 1996 and 2016, the share of employment in high-tech industries stayed within a narrow range of 9.2 percent to 10.1 percent. Notable during this period was the impact of the two recessions: the dot-com bubble (2001), and the Great Recession (December 2007–June 2009). High-tech employment fell from 13.5 million jobs in 2000, about 10.1 percent of all wage and salary jobs, to 12.3 million jobs in 2003, about 9.3 percent of all wage and salary jobs. The high-tech sector was hit harder by the dot-com recession than other sectors of the economy. The high-tech sector did not surpass its 2000 employment levels until 2013, but non-high-

tech industries had recovered from jobs losses sustained during the dot-com recession by 2004. During the Great Recession, however, the opposite trends played out: the high-tech sector's share of total employment grew from 9.3 percent of jobs in 2007 to 9.8 percent in 2010, losing only 48,600 jobs, while the rest of economy lost almost 7.6 million jobs. By 2011, the high-tech sector had recovered all jobs lost during the recession, but non-high-tech industries did not surpass pre-recession employment levels until 2014.

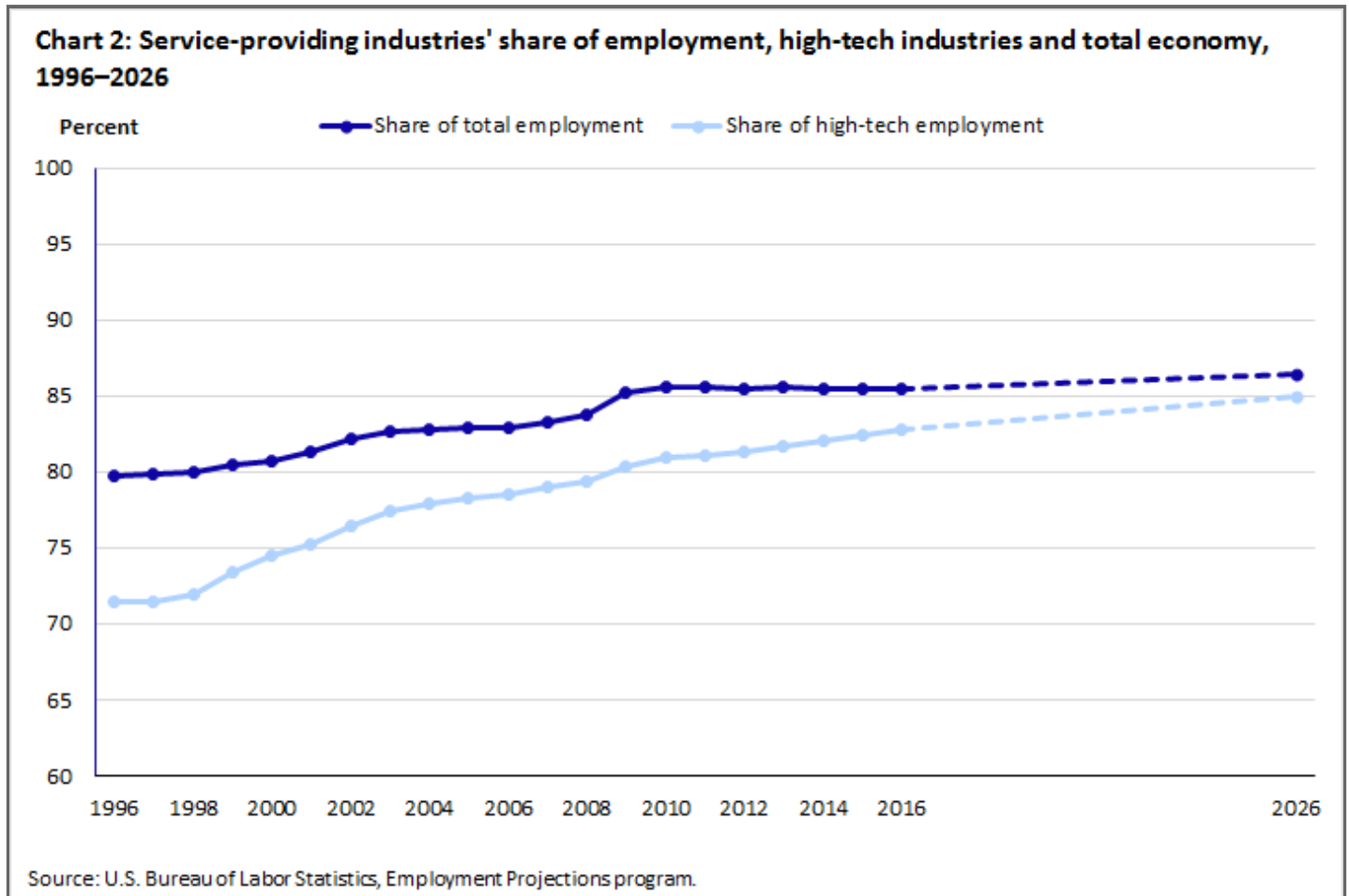


The high-tech sector produced \$5.3 trillion of output in 2016, accounting for 18.2 percent of total output, down slightly from an all-time high of 18.7 percent in 2011. High-tech's share of output endured an extended slump after the dot-com recession in 2001, with the share not exceeding 17.8 percent from 2002 to 2007 after peaking in 2000 at 18.6 percent. However, following the Great Recession, the share recovered and has remained above 18.1 percent since 2008.

From 2016 to 2026, the high-tech sector is projected to gain 1.1 million jobs, maintaining its share of wage and salary employment at 9.9 percent. Output is projected to grow by \$2.1 trillion, increasing its share of total output from 18.2 percent in 2016 to 18.7 percent in 2026.

## High-tech's move to service industries

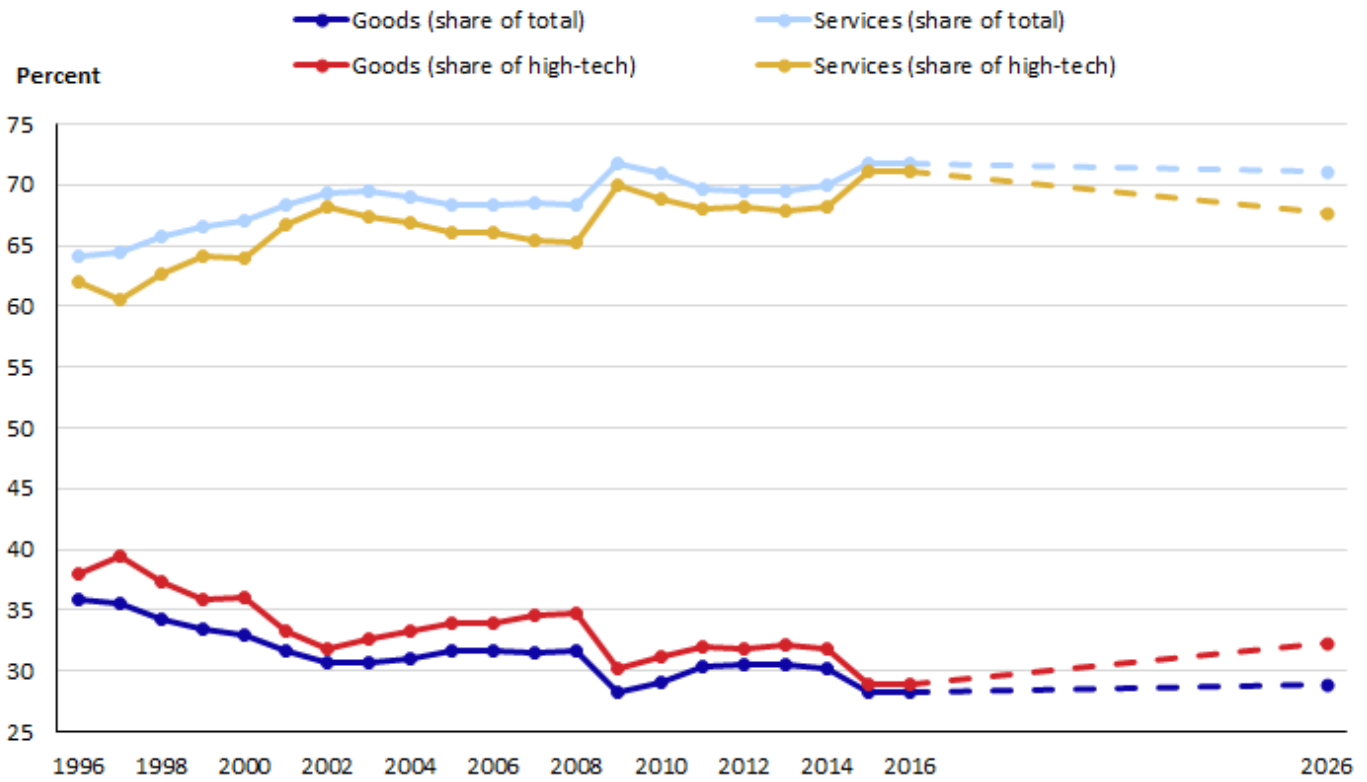
In 2016, 82.8 percent of high-tech employment was in service-providing industries, an all-time high, and 17.2 percent was in goods-producing industries. Employment in high-tech industries, like the economy in general, has been trending towards service industries for many years. (See chart 2.)



This employment trend is projected to continue, with service-providing industries' share of high-tech employment projected to reach 85.0 percent in 2026. Service-providing industries share of output also reached an all-time high in 2016, accounting for 71.1 percent of high-tech output.

Similar to high-tech employment, high-tech output has steadily shifted towards service-providing industries over the years. (See chart 3.) However, goods-producing industries are projected to increase their share of high-tech output from 28.9 percent in 2016 to 32.3 percent in 2026, fueled in large part by increases in oil and gas extraction output.

**Chart 3. Goods-producing and service-providing share of output for high-tech industries and total share for all industries, 1996–2026**

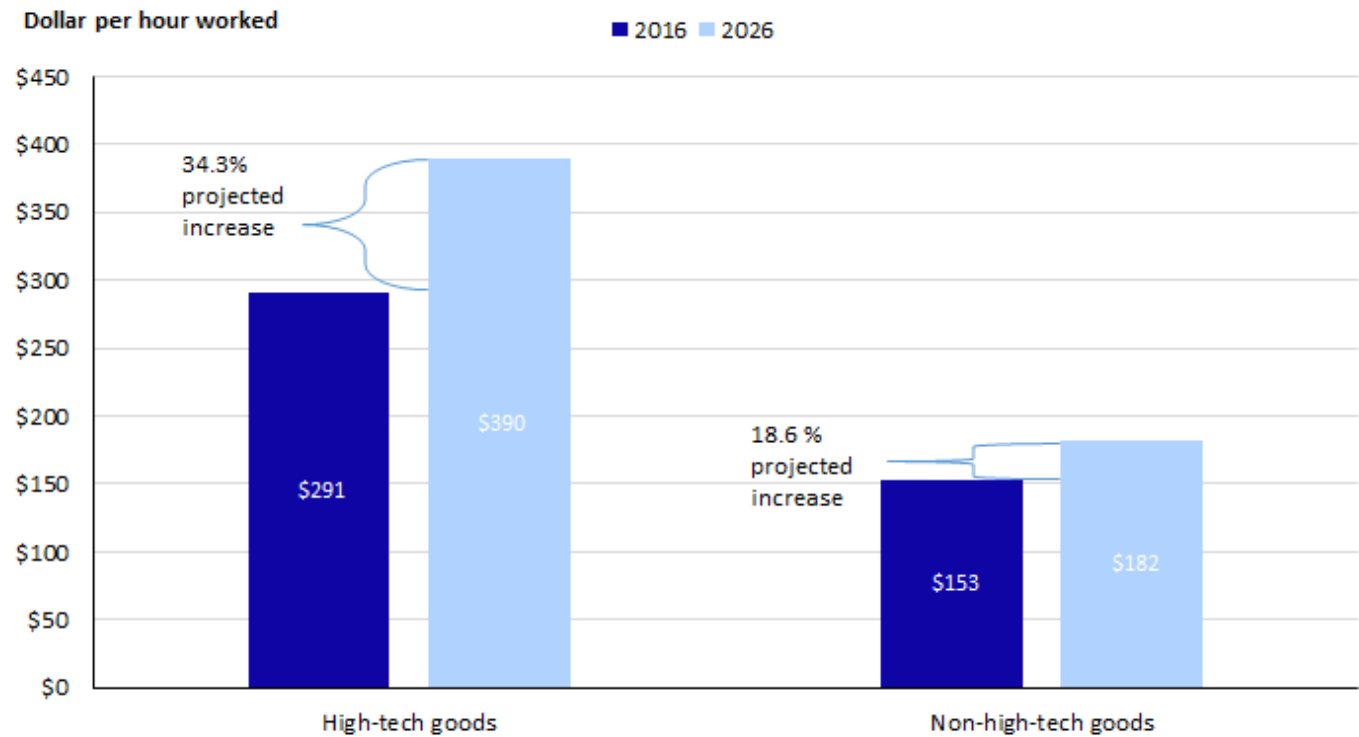


Source: Bureau of Labor Statistics, Employment Projections program.

Within goods-producing industries, high-tech employment is projected to decline by 5.8 percent and non-high-tech employment is projected to increase by 2.0 percent. However, despite a projected decline in employment, faster output growth is projected in high-tech goods-producing industries, 26.7 percent, compared with 20.9 percent in non-high-tech goods producing industries. Faster projected output growth coupled with a projected decline in employment results in faster projected productivity growth in high-tech goods producing industries than in non-high-tech goods producing industries. Productivity in high-tech goods producing industries is projected to increase by 34.3 percent between 2016 and 2026, but productivity in non-high-tech goods producing industries is only projected to increase by 18.6 percent. (See chart 4.)

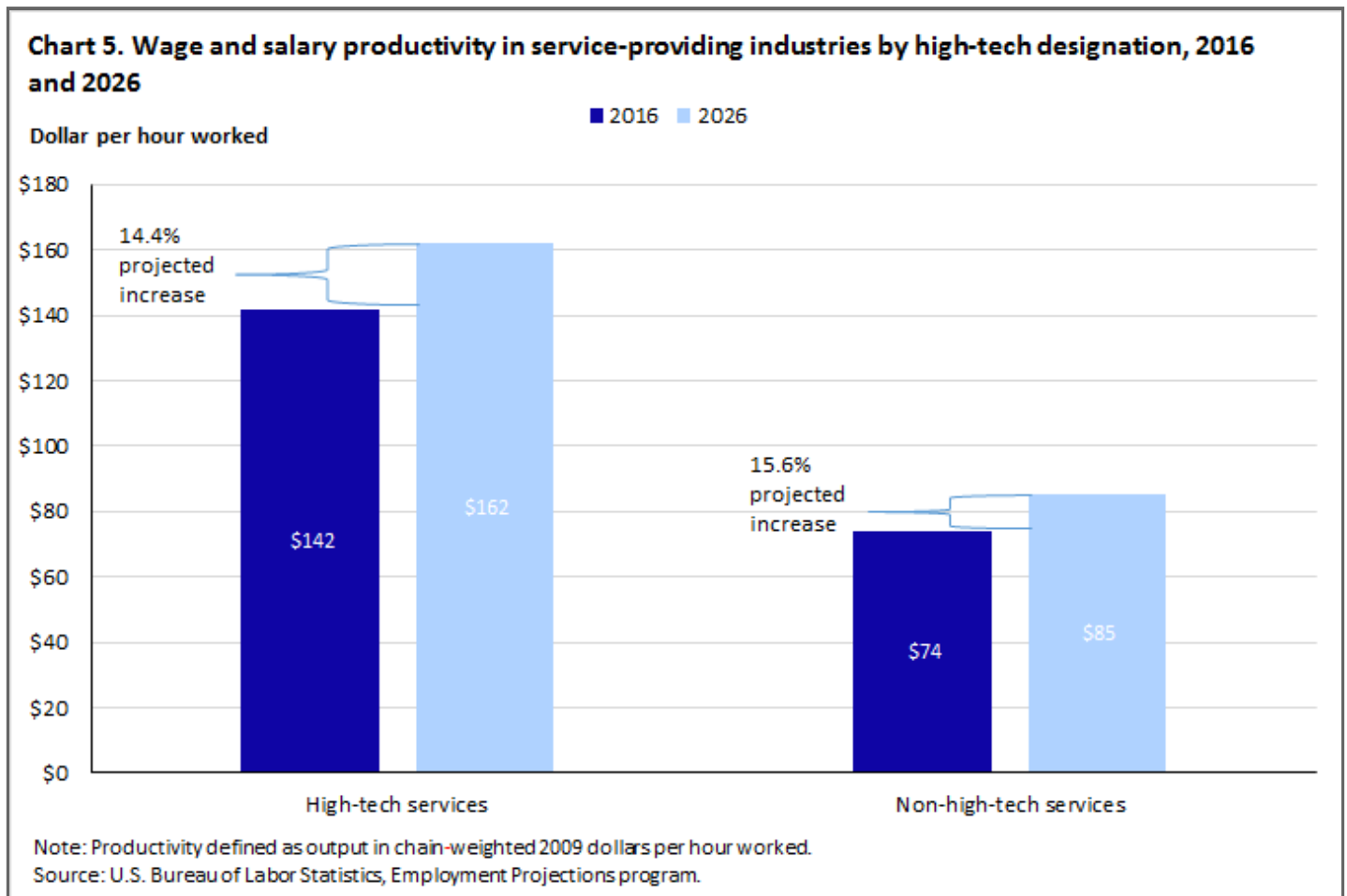


**Chart 4. Wage and salary productivity in goods-producing industries by high-tech designation, 2016 and 2026**



Note: Productivity defined as output in chain weighted 2009 dollars per hour worked.  
Source: U.S. Bureau of Labor Statistics, Employment Projections program.

The differences in projected changes between high-tech and non-high-tech services are not nearly as stark as those in goods production. High-tech and non-high-tech services have similar projected changes in output between 2016 and 2026: a 26.6-percent increase projected in high-tech services giving it a slight edge over non-high-tech services, which is projected to increase by 24.9 percent. Underlying the growth in output, high-tech services have faster projected employment growth, a 10.4 percent increase, compared with an 8.2-percent increase for non-high-tech services. This is expected to result in productivity growing at a slightly faster rate in non-high-tech services, 15.6 percent compared with 14.4 percent, between 2016 and 2026. (See chart 5.)



## Conclusion

High-tech industries are an essential part of the U.S. economy, providing almost 10 percent of all jobs, but producing over 18 percent of output in 2016. This higher output per worker is reflected in wages, which are higher in high-tech industries for nearly every type of occupation. High-tech industries are projected to increase their share of total output through 2026, while maintaining their share of employment. Employment in the high-tech sector is projected to continue to shift towards service-providing industries over the next decade, from 82.8 percent of high-tech employment in 2016 to 85.0 percent in 2026.

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## RELATED ARTICLES

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## NOTES

<sup>1</sup> Michael Wolf and Dalton Terrell, “The high-tech industry, what is it and why it matters to our economic future,” *Beyond the Numbers: Employment & Unemployment*, vol. 5, no. 8 (U.S. Bureau of Labor Statistics, May 2016), <https://www.bls.gov/opub/btn/volume-5/the-high-tech-industry-what-is-it-and-why-it-matters-to-our-economic-future.htm>.

<sup>2</sup> There are alternative methods of defining high-tech industries, based on R&D expenditures, patents, and other metrics. For more information, see <https://www.oecd.org/sti/ind/48350231.pdf> and, <https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-6/worldwide-distribution-of-knowledge--and-technology-intensive-industries>.

<sup>3</sup> For more information about the Standard Occupational Classification system, see <https://www.bls.gov/soc/2010/home.htm>.

See also, Daniel E. Hecker, “High-technology employment: a NAICS-based update,” *Monthly Labor Review*, U.S. Bureau of Labor Statistics, July 20015, <https://www.bls.gov/opub/mlr/2005/07/art6full.pdf>.

<sup>4</sup> For more information on Employment Projection’s employment and output by industry, see <https://www.bls.gov/emp/tables/industry-employment-and-output.htm>.

## SUGGESTED CITATION

Brian Roberts and Michael Wolf, “High-tech industries: an analysis of employment, wages, and output,” *Beyond the Numbers: Employment and Unemployment*, vol. 7, no. 7 (U.S. Bureau of Labor Statistics, May 2018), <https://www.bls.gov/opub/btn/volume-7/high-tech-industries-an-analysis-of-employment-wages-and-output.htm>