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THE EARNINGS OF IT PROFESSIONALS COMPARED WITH OTHER PROFESSIONALS

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EXECUTIVE SUMMARY

U.S. natives who work in a computer-related occupations or have a college degree in a computer-related major earn substantially more than other professional workers or college graduates with other majors, including other science, technology, engineering, and math (STEM) majors. An analysis of data from the Current Population Survey, American Community Survey, and National Survey of College Graduates shows a large premium for information technology (IT) professionals or computer and information systems-related (CIS) majors that has remained stable or risen over time.

An analysis of the data shows:

- Median earnings of IT professionals were 40 percent higher than median earnings of other professionals, according to data on U.S.-born workers from the Current Population Survey for the period 2002 to 2020. There is a sizable earnings premium for all education groups examined here, including workers who have at least a bachelor's degree. The premium would be even larger if computer and information systems managers were classified with IT professionals instead of other professionals.
- IT professionals earn significantly more than other professionals even when controlling for differences in observable demographic characteristics, state of residence, and broad industry. The earnings gap between IT professionals and other professionals as a whole remained fairly stable over the period 2002 to 2020 but rose among college graduates who work full-time, year-round in salaried jobs.
- Median earnings of college graduates with a computer-related major are 35 percent higher than other STEM majors and fully 83 percent higher than non-STEM majors, according to data on U.S.-born college graduates from the American Community Survey for the period 2009 to 2019. The earning gap narrows but remains statistically significant when controlling for differences in observable demographic characteristics, state of residence, and broad industry.
- The earnings gap between college graduates with a major in computer and information systems or another computer-related field and other STEM majors has increased over time. The gap between CIS majors and non-STEM majors has remained stable over time at very high levels.
- Median earnings of recent bachelor's degree recipients with a computer-related major are about 15 to 40 percent higher than other STEM majors, depending on the year, according to an analysis of data on recent U.S.-born bachelor's and master's degree recipients from the National Survey of College Graduates in 2010, 2013, 2015, and 2017. The gap is substantially larger in 2017 than in the other years. Recent bachelor's degree recipients with computer-related majors continue to earn significantly more than other STEM majors when controlling for differences in observable demographic characteristics and region of residence.

- Median earnings of recent master's degree recipients with a computer-related major are about 10 to 40 percent higher than other STEM majors, depending on the year. Like with bachelor's degree recipients, the gap is larger in 2017 than in the other years and remains sizable when controlling for differences in observable demographic characteristics and region of residence.

The stable-to-increasing earnings premium among U.S.-born IT professionals and computer-related majors during a period that critics characterize as high levels of immigration is consistent with a large literature that concludes that highly educated immigrants have not harmed U.S.-born workers. Indeed, studies show that highly educated U.S. natives may even see their earnings increase as a result of highly skilled immigration since it can boost firms' productivity, spur additional innovation, prompt more U.S. natives to move into communications-intensive jobs that are their comparative advantage, and slow offshoring by U.S. firms, among other benefits.

Despite oft-voiced concerns that U.S. IT workers and computer-related majors are disadvantaged by having to compete with foreign-born workers, either via offshoring or immigration, the evidence clearly indicates that IT professionals and computer-related majors have relatively high earnings. IT professionals earn more than other professionals across all education groups examined here, and they earn more, on average, than other professionals who have similar demographics characteristics, live in the same state, and work in the same industry. Workers who have a bachelor's in a computer-related field earn more than their counterparts with a degree in another STEM field or in a non-STEM field. The same is true for recent bachelor's or master's degree recipients.

The substantial earnings premium for IT professionals and computer-related majors is consistent with persistently strong demand for workers with these technical skills. Even during a period of temporary and permanent immigration into the U.S. of skilled foreign-born workers and offshoring of technical jobs outside of the U.S., U.S.-born IT professionals and computer and information systems majors continued to earn, on average, substantially more than other professional workers and other majors.

How Do IT Professionals Stack Up to Other Workers?

About one in every thirty workers in the United States is in a computer-related occupation, and computer-related occupations are projected to outpace total job growth by a factor of three over the next decade.[1] Despite what may appear to be strong demand for information technology (IT) workers, some observers voice concerns that this strong demand does not necessarily translate into a strong job market for U.S.-born workers. Offshoring and immigration fuel many of these concerns. This study therefore examines the earnings of U.S.-born workers who are IT professionals or who majored in a computer-related field, compared with the earnings of other professionals and other majors. The study uses data from three large-scale surveys of the U.S. population – the Current Population Survey, the American Community Survey, and the National Survey of College Graduates – to give a comprehensive picture of the relative earnings in recent years of U.S. natives who work in IT positions or who have a college degree in a computer-related major.

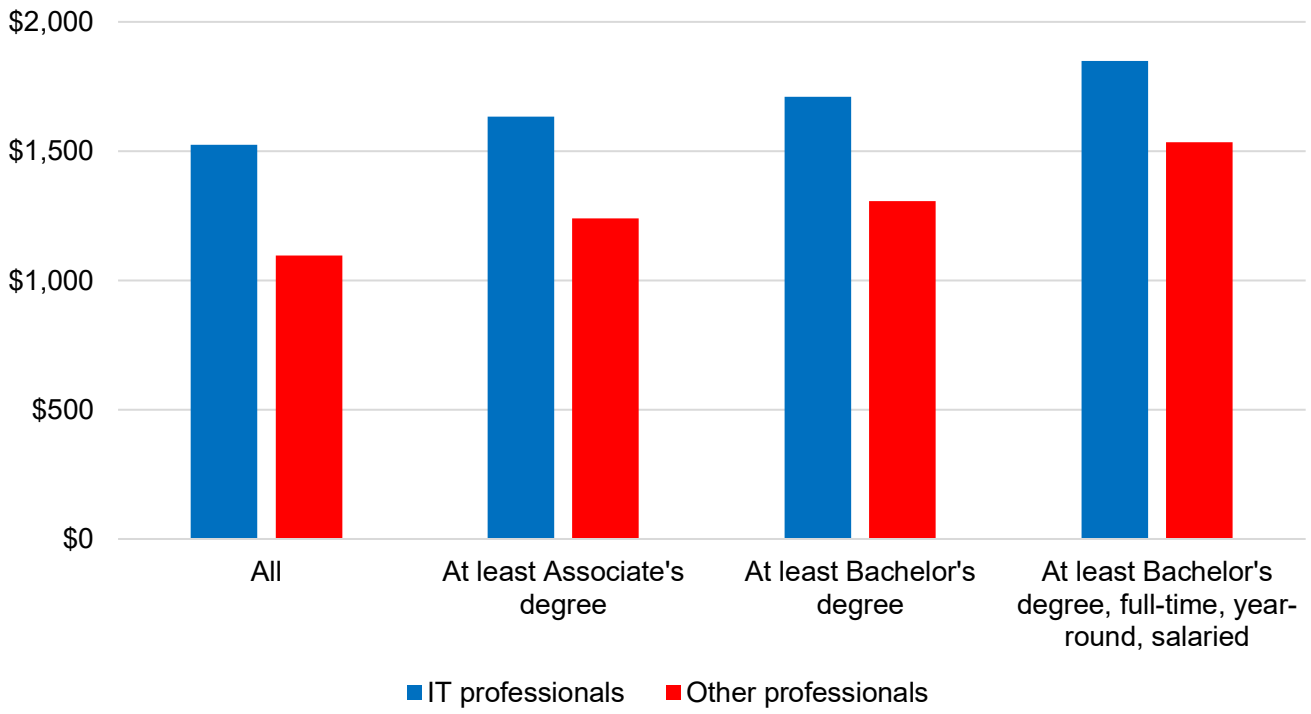
Among U.S.-born workers, IT professionals earn more than other professionals, on average.[2] For the period 2002 to 2020 as a whole, median earnings are 40 percent higher among IT professionals than among other professionals. As Figure 1 shows, IT professionals earn a substantial premium relative to other professional workers when looking at workers of all education levels, workers who have at least an associate's degree, workers who have at least a bachelor's degree, or workers who have at least a bachelor's degree and work in a full-time, year-round salaried job. Median earnings are highest among the last group, but even among this select group, median earnings of IT professionals are 20 percent higher than for other professionals.

The fact that IT professionals tend to earn more than other professionals may be surprising given the relative youth of the IT workforce. A substantially larger share of U.S.-born IT professionals than other professionals is under age 40 (see Table 1 in the Appendix). The relative youth of the IT workforce reflects the pattern that many – but certainly not all – IT workers move into management positions over the course of their careers.[3] The higher earnings of IT professionals also are unlikely to be due to higher educational attainment. IT professionals are more likely to have a bachelor's degree than other professionals, but they are less likely to have a graduate degree. Differences in demographic characteristics (age, education, sex, and race/ethnicity) cannot fully account for the earnings premium for IT professionals. Controlling for differences in demographic characteristics reduces the average earnings

[1] See https://www.bls.gov/opub/btn/volume-10/why-computer-occupations-are-behind-strong-stem-employment-growth.htm.
[2] Occupations classified as IT professionals are computer scientists and systems analysts/network systems analysts/web developers; computer programmers; computer support specialists; database administrators; network and computer systems administrators; and software developers, applications and systems software. Other professionals are all other managerial and professional occupations; it does not include sales or clerical occupations. See the Appendix for details. Unless indicated otherwise, computer and information systems managers are classified here with other professionals, not with IT professionals.
[3] For a discussion of career patterns among U.S. IT workers, see Damien Joseph, Wai Fong Boh, Soon Ang, and Sandra A. Slaughter (2012), "The Career Paths Less (or More) Traveled: A Sequence Analysis of IT Career Histories, Mobility Patterns, and Career Success," *MIS Quarterly* 36: 427-452.

premium among IT professionals by about one-third, but it remains sizable (see Table 2 in the Appendix). For workers who have at least a bachelor's degree and hold full-time, year-round salaried jobs, the average earnings premium falls by only about one-sixth when controlling for differences in demographic characteristics.

Figure 1
Median Weekly Earnings of IT Professionals and Other Professionals, by Education, 2002-2020



Note: Calculations are based on Current Population Survey data for U.S. natives. Earnings are adjusted for inflation. See the Appendix for details.

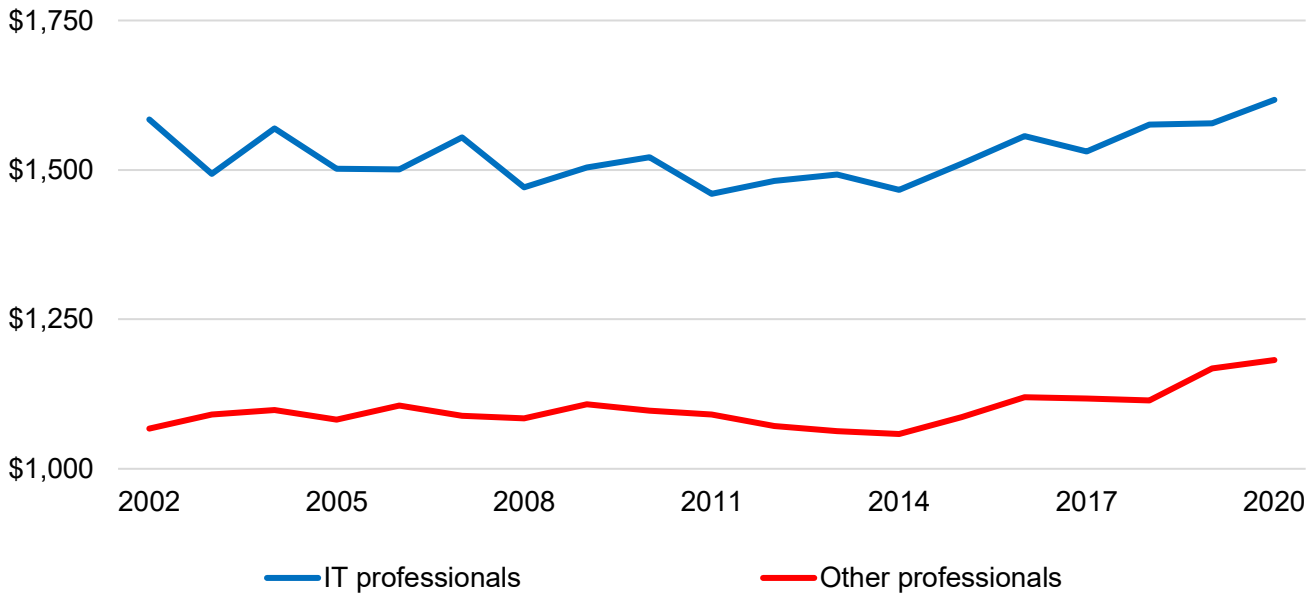
Differences in where workers live and the industries in which they work also cannot fully explain why IT professionals tend to earn more than other professionals. IT professionals are disproportionately concentrated in states with a high cost of living, most notably California, and their higher salaries do partially reflect geographic differences. Nonetheless, IT professionals continue to earn a substantial premium over other professionals when controlling for differences in their distribution across states. IT professionals are also disproportionately concentrated in relatively high-paying industries, namely the IT industry, insurance, and banking. However, IT professionals are also disproportionately employed by colleges and universities, a sector that does not pay high salaries to most employees. Regardless, IT professionals continue to earn a premium over other professionals, on average, after

controlling for differences in the distribution of workers across industries. Controlling for differences in all observable factors – demographics, state, and industry – average earnings of IT professionals are about 13 percent higher than for other professionals as a whole; among workers who have at least a bachelor's degree and work in a full-time, year-round salaried job, the average premium is smaller, at 3 to 4 percent, but still statistically significant.

CHANGES OVER TIME

The premium that IT professionals as a whole earn has been fairly stable over time. Figure 2 shows median earnings of IT professionals and other professionals for each year during the period 2002 to 2020.[4] As the figure shows, the earnings gap between IT professionals and other professionals – the vertical distance between the two series – has changed little over time. Earnings appear to be slightly more sensitive to the business cycle for IT professionals than for other professionals, but both series reflect a general pattern of constant incomes (after adjusting for inflation) from the early 2000s until the mid to late 2010s that has been well documented elsewhere.[5] There is an upward trend in median earnings for both IT professionals and other professionals after 2014.

Figure 2
Median Weekly Earnings of IT Professionals and Other Professionals, All, by Year

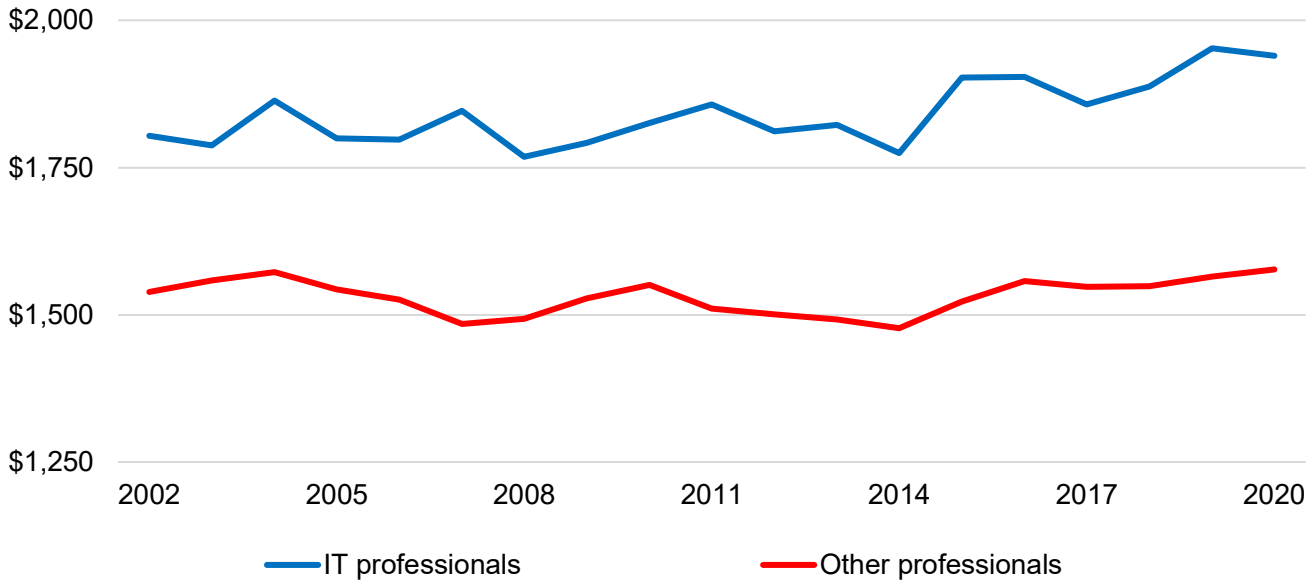


[4] Throughout the analysis, earnings are adjusted for inflation using the Consumer Price Index (CPI) for Urban Wage Earners, the CPI-W (December 2020 = 100). Using a different deflator would slighlty change the pattern of each series over time but would not change differences between the series over time.
[5] See, for example, Drew DeSilver (2018), "For most U.S. Workers, Real Wages Have Barely Budged in Decades," Pew Research Center, https://www.pewresearch.org/fact-tank/2018/08/07/for-most-us-workers-real-wages-have-barely-budged-for-decades/.

Note: Calculations in Figure 2 based on Current Population Survey data for U.S. natives. Earnings are adjusted for inflation. See the Appendix for details.

Among workers who have at least a bachelor's degree and hold full-time, year-round salaried jobs, the premium earned by IT professionals appears to have increased slightly over time. Figure 3 again shows a general pattern of flat earnings through 2014, followed by a general upward trend. More notably, the gap between median earnings of IT professionals and other professionals widens slightly over time.

Figure 3
Median Weekly Earnings of IT Professionals and Other Professionals, at least Bachelor's Degee and Full-Time, Year-Round Salaried Job, by Year



Note: Calculations based on Current Population Survey data for U.S. natives who have at least a bachelor's degree and are employed full-time, year-round in a salaried job. Earnings are adjusted for inflation. See the Appendix for details.

As discussed above, the earnings gap between IT professionals and other professionals partly reflects differences in demographic characteristics. Differential changes over time in demographic characteristics may contribute to the patterns in Figures 2 and 3. For example, the average age of IT professionals may have increased less than the average age of other professionals since many IT workers move into management positions as their careers progress. Alternatively, the share of IT professionals with a graduate degree may have risen over time relative to the share of other professionals with a graduate degree. However, regressions that control for demographic characteristics (age, education, sex, and race/ethnicity) show little change over time in the average earnings

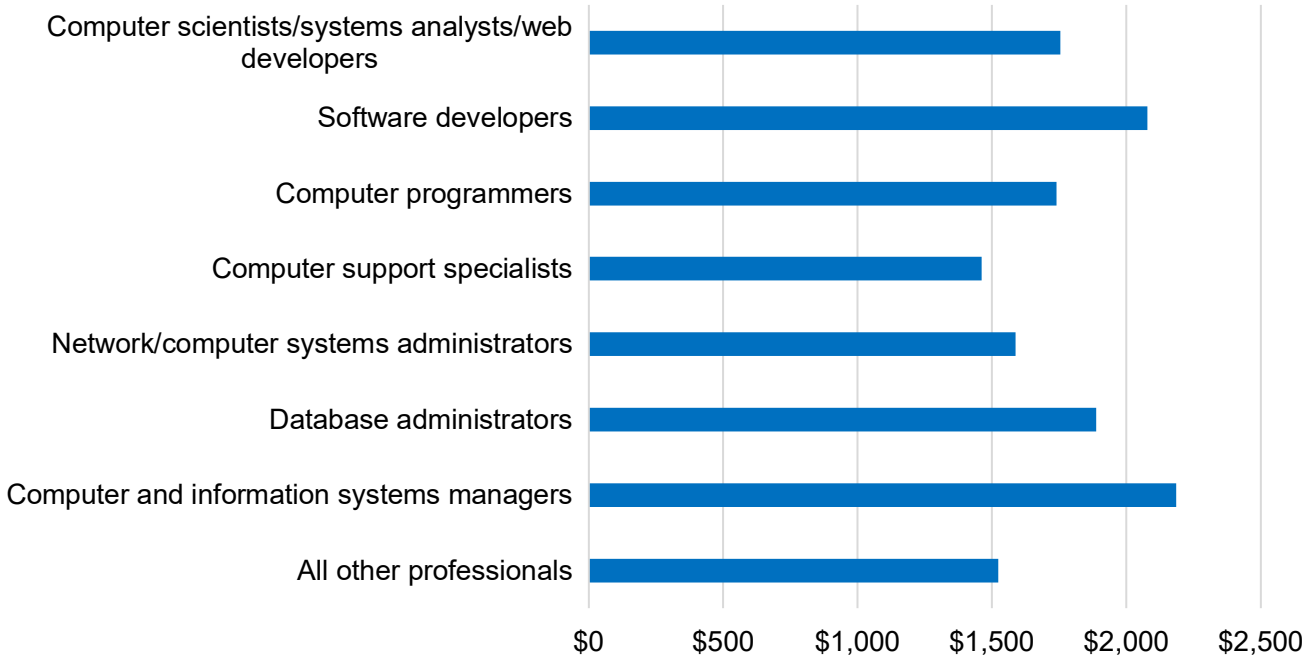
premium for IT professionals relative to other professionals (Figure 11 in the Appendix). For workers with at least a bachelor's degree who hold full-time, year-round salaried jobs, there is a slight upward trend in the premium for IT professionals when controlling for demographics (Figure 12 in the Appendix). Differential changes in demographics thus do not appear to underlie the general pattern of a stable or slightly rising earnings premium over time for IT professionals.

DIFFERENCES ACROSS IT OCCUPATIONS

The above analysis groups together all IT professionals and classifies computer and information systems (CIS) managers together with other professionals. Whether CIS managers should be classified with IT professionals instead of with other professionals (which includes all managerial occupations) is debatable. Figure 4 shows median earnings over 2002 to 2020 for CIS managers and for each IT occupation included in the Current Population Survey data that underlie Figure 1. The figure includes only workers who have at least a bachelor's degree and hold a full-time, year-round salaried job since that characterizes most managers.[6] The figure also shows median earnings for all other professionals (not including CIS managers) with at least a bachelor's degree and a full-time, year-round salaried job. Median weekly earnings are higher for CIS managers than for workers in technical IT occupations, although software developers earn almost as much as CIS managers. Including CIS managers as IT professionals in the analysis therefore would lead to an even larger premium for IT professionals. Figure 4 also reveals that median earnings for five of the six technical IT occupations are higher than for other professionals – computer support specialists are the only exception, and their median earnings are only slightly less than for other professionals.

[6] The pattern is similar if the sample includes all U.S.-born workers in those occupations, not just those with at least a bachelor's degree who hold a full-time, year-round salaried job.

Figure 4
Median Weekly Earnings of IT Professionals, CIS Managers, and Other Professionals, 2002-2020



Note: Calculations based on Current Population Survey data for U.S. natives who have at least a bachelor's degree and are employed full-time, year-round in a salaried job. Earnings adjusted for inflation. Technical IT occupations are shown in descending order by number of workers in the occupation.

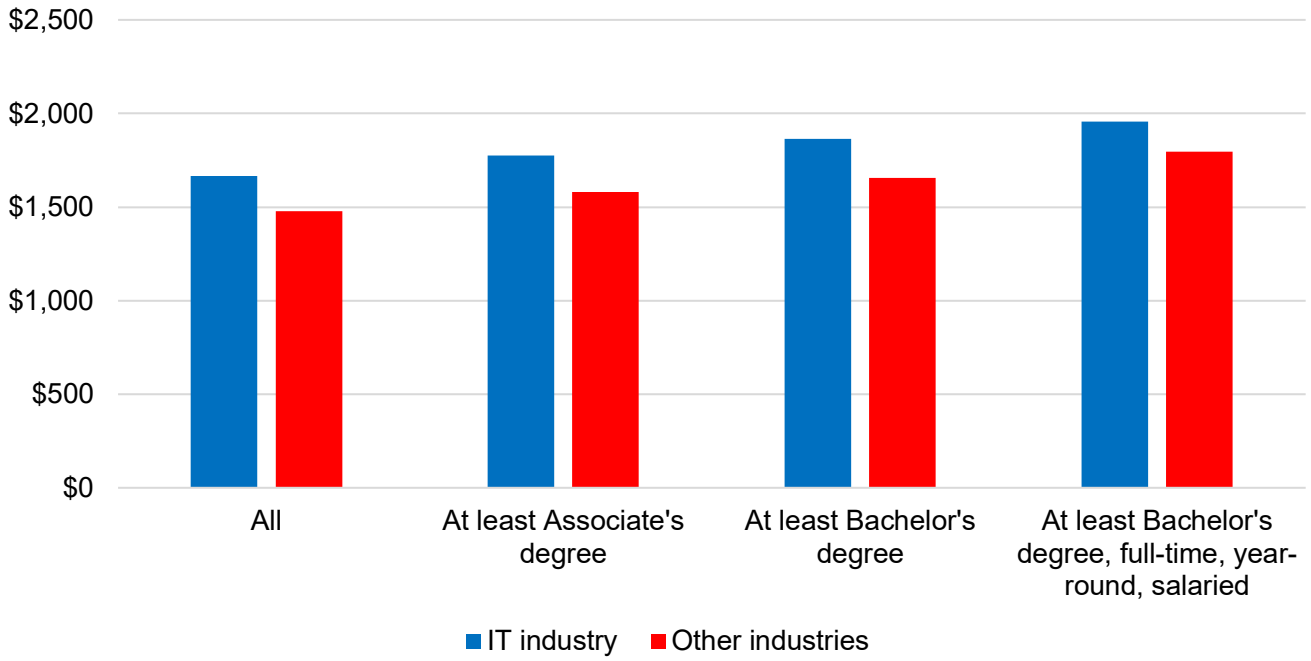
THE ROLE OF THE IT INDUSTRY

Over one-quarter of U.S.-born IT professionals are employed in the IT industry. The rest are spread out across all other industries, with colleges and universities, insurance, and banking the next largest detailed industries employing IT professionals. As Figure 5 shows, IT professionals who work in the IT industry earned more than other IT workers during the period 2002 to 2020. Notably, this period begins right after the 2001 dot-com recession, which was followed by several years of relatively slow growth in the IT industry. The premium for IT professionals in the IT industry over other industries is present for each group shown in the figure. Little of the IT-industry premium can be explained by differences in demographic characteristics or the distribution of workers across states (Table 3 in the Appendix).

Although IT professionals who work in the IT industry tend to out-earn their counterparts in other industries, IT professionals employed in other industries still earn a premium over other professionals. A comparison of Figures 1 and 5 shows that median earnings of IT professionals who work in other industries are still substantially higher

than those of other professionals. This is consistent with the persistence of a premium for IT professionals even when controlling for industry (Table 2 in the Appendix).

Figure 5
Median Weekly Earnings of IT Professionals,
by Industry and Education, 2002-2020



Note: Calculations based on Current Population Survey data for U.S. natives. Earnings adjusted for inflation. See the Appendix for details.

It is likely that the earnings gap between IT professionals and other professionals would be even larger if a more comprehensive measure of compensation was available given the over-representation of IT professionals in salaried jobs and at larger firms, which tend to have more generous fringe benefits and other forms of non-wage compensation. The total compensation differential between IT professionals working in the IT industry and in other industries is also likely larger than in Figure 5 (and Table 3 in the Appendix) given the prevalence of stock options in the IT industry.

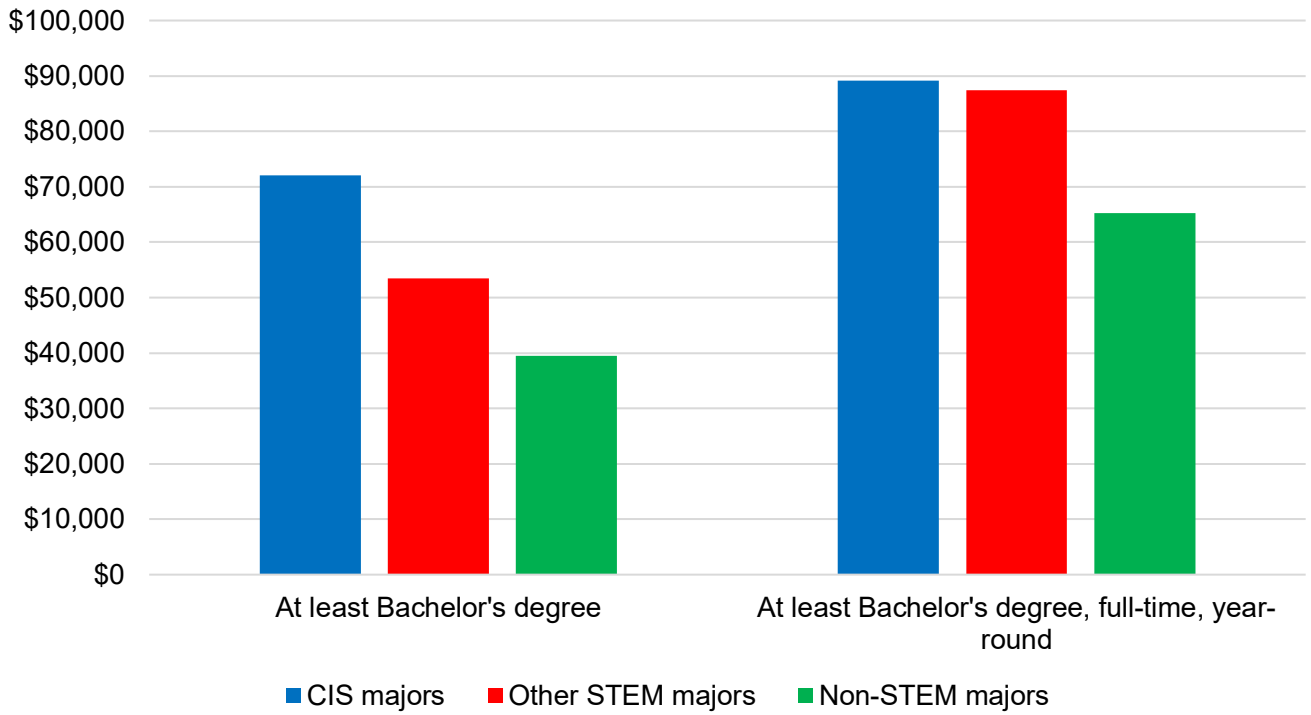
College Graduates with Computer-related Majors

The above analysis focuses on workers who hold technical IT jobs, but what about college graduates whose degree is in a computer-related field? Do they also earn a premium over other STEM-degree holders or college graduates in general? After all, the overlap between IT professionals and college graduates who have a degree in a computer-

related major (for short, CIS major) is substantial but incomplete. Among IT professionals who are college graduates, about one-third have a bachelor's degree in a CIS major, and about two-fifths of workers with a CIS bachelor's degree work in an IT occupation (not including CIS managers).[7]

College graduates with a computer-related major earn more than other college graduates, on average, including other STEM majors. As Figure 7 shows, median annual earnings of CIS majors are much higher than those of other college graduates – 35 percent higher than other STEM majors and 83 percent higher than non-STEM majors during the period 2009 to 2019. Part of the difference is due to CIS majors being more likely to hold full-time, year-round jobs. Among college graduates who work full-time, year-round, median earnings of CIS majors are about 2 percent more than other STEM majors and 37 percent more than non-STEM majors.

Figure 7
Median Annual Earnings of CIS Majors and Other Majors, 2009-2019



Note: Calculations based on American Community Survey data for U.S. natives with at least a bachelor's degree. Earnings adjusted for inflation. See the Appendix for details.

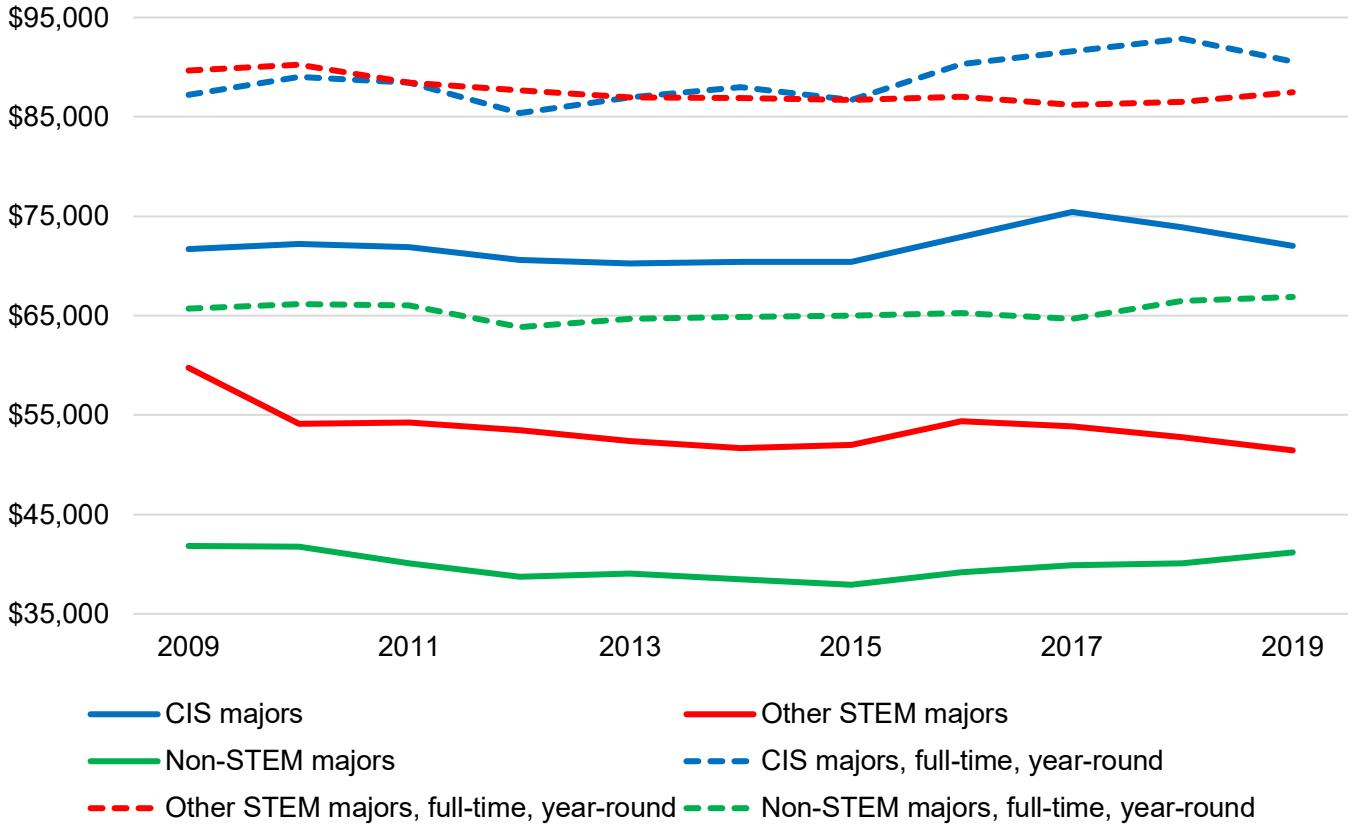
[7] Calculations based on 2009 to 2019 American Community Survey (ACS) data on U.S.-born workers who report positive earnings. Computer-related (or CIS) majors in the ACS data are computer and information systems; computer programming and data processing; computer science; information sciences; computer information management and security; and computer networking and telecommunications.

Differences between computer-related majors and other majors in demographic characteristics, state of residence, and industry contribute to the earnings premium among CIS majors. Differences in demographic characteristics (age, education, sex, and race/ethnicity) can account for about 40 percent of the earnings premium for CIS majors over other college graduates (see Tables 4 and 5 in the Appendix). Differences in state of residence, a proxy for differences in the cost of living that might be reflected in salaries, play a much smaller role in the earnings premium for CIS majors. Differences in industry – namely, the over-representation of CIS majors in relatively high-paying industries, like finance/insurance/real estate and business services – also contribute to the earnings premium for CIS majors. Controlling for differences in demographic characteristics, state, and industry, CIS majors earn 13 to 14 percent more than other college graduates, on average, and about 4 percent more than other STEM majors. The premiums are again smaller but still statistically significantly different from zero when looking only at full-time, year-round workers.

The earnings premium for computer-related majors appears to have increased over time relative to other STEM majors. As Figure 8 shows, the earnings gap between CIS majors and other STEM majors widened between 2009 and 2019, both among all workers and among full-time, year-round workers. The widening gap is largely due to falling median earnings for other STEM majors. The earnings premium for CIS majors over non-STEM majors remains fairly stable at very high levels over time, as Figure 8 shows.[8]

[8] The premium for CIS majors over non-STEM majors rises slightly over time when controlling for changes in demographic characteristics and the distribution of workers across states and industries, while the premium for CIS majors over STEM majors is fairly flat when controlling for those changes (Figure 13 in the Appendix).

Figure 8
Median Annual Earnings of CIS Majors and Other Majors, by Year

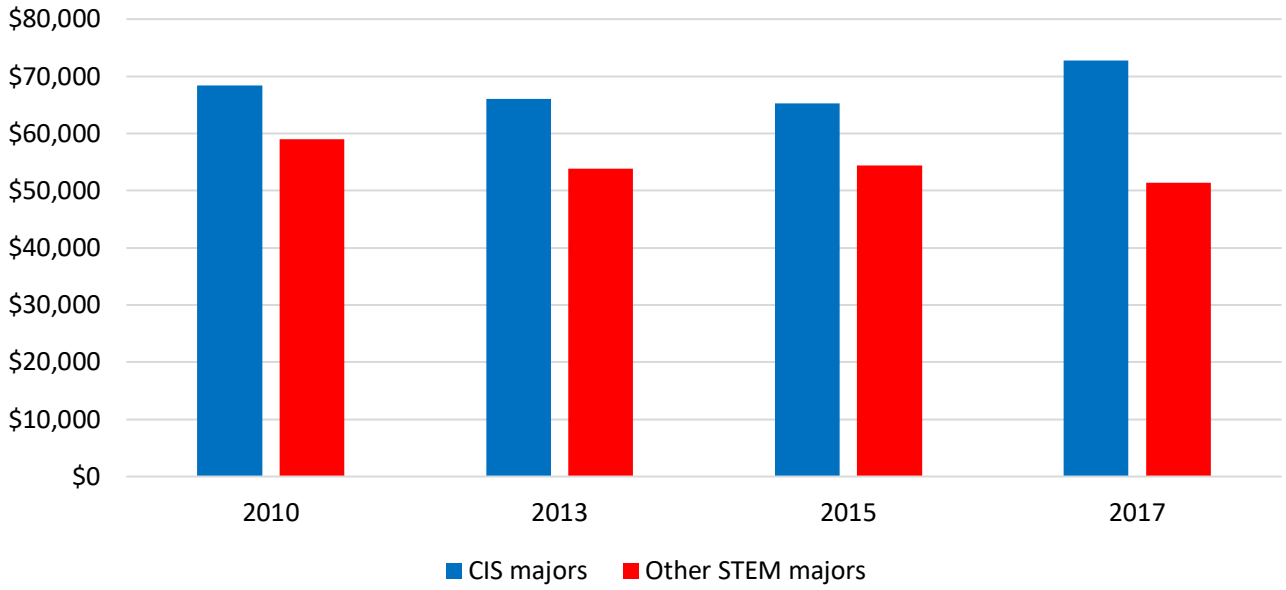


Note: Calculations based on American Community Survey data for U.S. natives with at least a bachelor's degree. Earnings adjusted for inflation. See the Appendix for details.

Figures 7 and 8 are based on U.S.-born workers who hold at least a bachelor's degree, regardless of how long ago they earned their degree. What do earnings patterns look like for recent degree recipients? Among full-time, year-round U.S.-born workers who received a bachelor's degree within the last five years, CIS majors earn a substantial premium over other STEM majors. As Figure 9 shows, median annual earnings of CIS majors are about 15 to 40 percent higher than other STEM majors, depending on the year. (CIS majors earn an even larger premium compared with non-STEM majors, not shown in the figure.) The premium for CIS majors is substantially larger in 2017 than earlier in the 2010s due to an increase in median earnings for CIS majors and a decrease for other STEM majors. The earnings premium for recent CIS majors over other STEM majors persists when controlling for differences in demographic characteristics and region of residence (Table 6 in the Appendix).[9]

[9] State and industry are not available in the public use National Survey of College Graduates data.

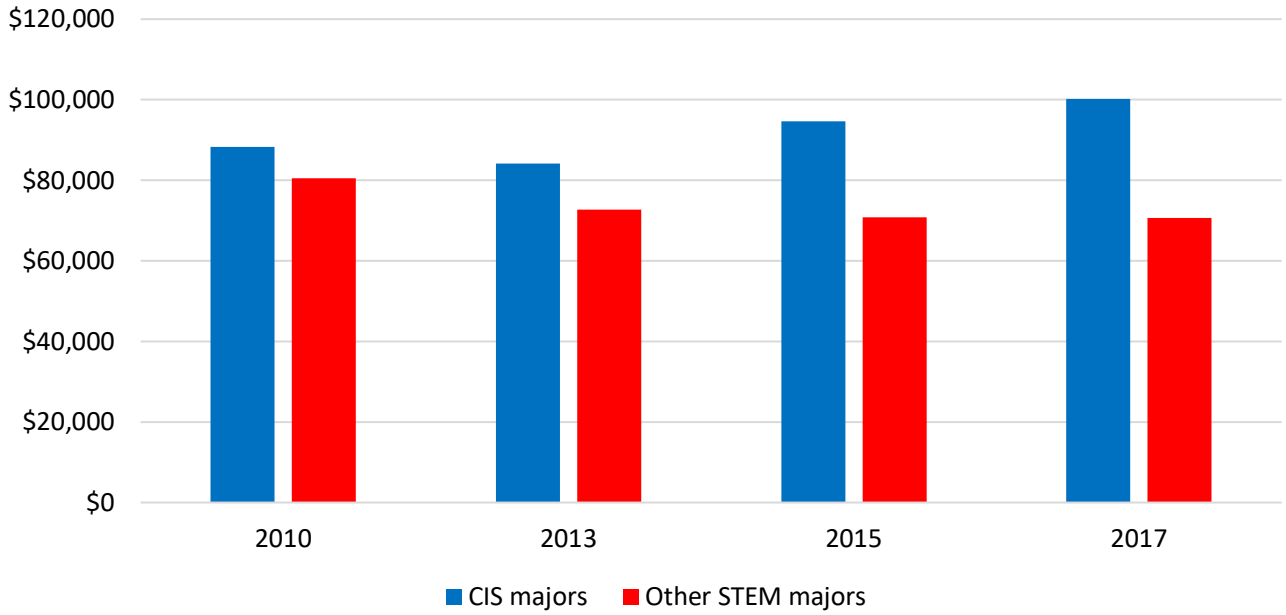
Figure 9
Median Annual Earnings of Recent Bachelor's Degree Recipients, by Major and Year



Note: Calculations based on National Survey of College Graduates data for U.S. natives working full-time, year-round. Earnings adjusted for inflation. See the Appendix for details.

Median annual earnings are also higher among recent U.S.-born recipients of a master's degree in a computer-related field than in other STEM fields. As Figure 10 shows, CIS master's degree recipients earned a substantial premium over other recent STEM master's degree recipients, ranging from 10 to 40 percent across the four years examined. As with bachelor's degree recipients, the earnings gap increases over the 2010s due to both a rise in median earnings for CIS majors and a drop for other STEM majors. The earnings premium again persists when controlling for differences in demographic characteristics and region of residence (Table 6 in the Appendix). Comparing Figures 9 and 10, median earnings are notably higher among CIS master's degree recipients than among bachelor's degree recipients.

Figure 10
Median Annual Earnings of Recent Master's Degree Recipients,
by Major and Year



Note: Calculations based on National Survey of College Graduates data for U.S. natives working full-time, year-round. Earnings adjusted for inflation. See the Appendix for details.

Discussion and Conclusion

Despite oft-voiced concerns that U.S. IT workers and computer-related majors are disadvantaged by having to compete with foreign-born workers, either via offshoring or immigration, the evidence clearly indicates that IT professionals and CIS majors have relatively high earnings. IT professionals earn more than other professionals across all education groups examined here, and they earn more, on average, than other professionals who have similar demographics characteristics, live in the same state, and work in the same industry. Workers who have a bachelor's in a computer-related field earn more than their counterparts with a degree in another STEM field or in a non-STEM field. The same is true for recent bachelor's or master's degree recipients. Part – but not all – of the earnings premium among IT professionals and CIS majors is due to being more likely to work full-time, year-round than other professionals and other college graduates, suggesting that job stability or strong employment prospects may be an additional advantage accruing to IT professionals and CIS majors.

The earnings premium for IT professionals, not including CIS managers, as a whole has remained stable over time relative to other professionals, while the premium rose slightly between 2002 and 2020 when looking only at workers

who have at least a bachelor's degree and hold a full-time, year-round salaried job. The earnings premium for CIS majors over other STEM majors has risen over time as well, and the earnings gap between recent bachelor's and master's degree recipients in CIS majors and other STEM majors was substantially larger in 2017 than earlier in the 2010s. Notably, the United States experienced sizable inflows of highly educated foreign-born workers, many of them IT professionals, during this period. The stable-to-increasing earnings premium among U.S.-born IT professionals and computer-related majors during a period that critics have argued represents high levels of immigration is consistent with a large literature that concludes that highly educated immigrants have not harmed U.S.-born workers. Indeed, studies show that highly educated U.S. natives may even see their earnings increase as a result of highly skilled immigration since it can boost firms' productivity, spur additional innovation, prompt more U.S. natives to move into communications-intensive jobs that are their comparative advantage, and slow offshoring by U.S. firms, among other benefits.[10]

[10] See, for example, William R. Kerr and William F. Lincoln (2010), "The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention," *Journal of Labor Economics* 28: 473-508; Anirban Ghosh, Anna Maria Mayda, and Francesc Ortega (2014), "The Impact of Skilled Foreign Workers on Firms: An Investigation of Publicly Traded U.S. Firms," Institute of Labor Economics Discussion Paper no. 8684. Giovanni Peri and Chad Sparber (2011), "Highly Educated Immigrants and Occupational Choice," *Industrial Relations* 50: 385-411; Peri, Kevin Shih, and Sparber (2015), "STEM Workers, H-1B Visas, and Productivity in US Cities," *Jouranl of Labor Economics* 33: S225-S255; Britta Glennon (2020), "How Do Restrictions on High-Skilled Immigration Affect Offshoring? Evidence from the H-1B Program," National Bureau of Economic Research Working Paper no. 27538. In addition, recent research shows that foreign-born workers in IT and math occupations earn at least as much – as H-1B visa holders more – than similar U.S. natives (see Omid Bagheri (2021), "Are College Graduate Immigrants on Work Visas Cheaper than Natives?" Center for Growth and Opportunity Working Paper, Utah State University).

APPENDIX: ADDITIONAL RESULTS, DATA SOURCES, AND ANALYTICAL METHODS

The Appendix details the empirical methods and regression results underlying the figures and discussion in the report. The analysis uses public use data from the Current Population Survey (CPS) and the American Community Survey (ACS) made available by IPUMS and from the National Survey of College Graduates (NSCG).[11] Each of the data sets and related results is discussed in turn. All of the analysis is restricted to U.S.-born workers who reported wage and salary income.

Current Population Survey: Earnings of IT Professionals and Other Professionals
The report uses data from the outgoing rotation groups of the monthly CPS during 2002 to 2020. Earnings are based on usual weekly earnings, adjusted for inflation using the CPI-W (December 2020 = 100). The earnings data do not include the self-employed.[12] Observations are weighted using the earnings weights throughout.

Table 1 reports descriptive statistics on the demographic characteristics of IT professionals and other professionals, classified based on their occupation (IPUMS variable occ2010). IT professionals are computer scientists and systems analysts/network systems analysts/web developers; computer programmers; computer support specialists; database administrators; network and computer systems administrators; and software developers, applications and systems software. Other professionals are all other managerial and professional occupations; agricultural, production, sales, and clerical occupations are not included. Full-time, full-year salaried status is based on usual hours worked per week of at least 35, weeks worked per year of at least 50, and not being paid on an hourly basis. The IT industry is computer and data processing services (IPUMS variable ind1990).

IT professionals are younger than other professionals, and substantially greater share of them are male. A slightly higher share of IT professionals have an associate's degree (or no college degree at all, which is not shown in Table 1) and a substantially higher share have a bachelor's degree, while a substantially lower share have a graduate degree. IT professionals are slightly more likely to be Asian/Pacific Islander and less likely to be Black or Hispanic than other professionals; again, the analysis is limited to U.S.-born workers only. IT professionals are considerably more likely to hold a full-time, year-round salaried job. Not surprising, they are disproportionately concentrated in the IT industry. Nonetheless, almost three-quarters of IT professionals work outside of the IT industry.

Table 1
Profile of U.S.-born IT Professionals and Other Professionals

	IT professionals	Other professionals
Age distribution:		
Under age 30	21.5%	19.8%
Age 30-39	29.4%	25.1%
Age 40-49	25.3%	24.3%
Age 50+	23.8%	30.8%
Education distribution (highest degree):		
Associate's degree	12.3%	11.5%
Bachelor's degree	48.8%	35.9%

[11] The CPS and ACS data are available at https://ipums.org/, and the NSCG data at https://ncsesdata.nsf.gov/datadownload/.
[12] Self-employed status is reported by the survey respondent, so whether independent contractors report being self-employed or being employees is unclear. Previous research finds no evidence of significant differences in average pay between IT professionals who are independent contractors versus employees (Matthew J. Bidwell and Forrest Briscoe (2009), "Who Contracts?" *Academy of Management Journal* 52: 1148-1168).

Graduate degree	14.6%	26.0%
Male	75.0%	40.7%
Race/ethnicity distribution:		
White, non-Hispanic	81.8%	81.5%
Black, non-Hispanic	7.4%	8.5%
Hispanic	5.5%	6.5%
Asian, non-Hispanic	3.5%	1.7%
Full-time, year-round, salaried	56.9%	40.8%
Work in IT industry	28.1%	1.4%

Note: Calculations based on 2002-2020 Current Population Survey outgoing rotations group data; observations are weighted using earnings weights.

Table 1 thus indicates substantial demographic differences between IT professionals and other professionals. There are also differences in their distribution across states and industries. Since demographic characteristics, state, and industry tend to be systematically related to earnings, some of the analysis controls for these variables in ordinary least squares regressions of the form

$$\ln(\text{Earnings}_i) = \alpha + \beta \text{IT Professional}_i + \gamma \text{Demographics}_i + \delta \text{State}_i + \mu \text{Industry}_i + \varepsilon_i,$$

where the dependent variable is the log of an individual's real (inflation-adjusted) weekly earnings. The right-hand side variables are then progressively added to the regression model. The base model includes only an indicator variable for being an IT professional; the second version adds variables that control for demographic characteristics (fixed effects for age, education level, sex, and race/ethnicity); the next version adds fixed effects for state; and the last version adds fixed effects for broad industry categories. All observations are at the individual level and are weighted using the earnings weights. The regressions are estimated for all professionals, then for progressively narrower (and higher) education groups, and lastly for professionals who have at least a bachelor's degree and work in a full-time, year-round salaried job.

Table 2 reports the estimated coefficients on the IT professional indicator variable. Because the regressions use the natural log of earnings as the dependent variable, the estimated coefficients give approximately the average percentage difference in weekly earnings between IT professionals and other professionals.[13] The estimated coefficients are differences at the mean, while the figures in the main text are median earnings. As Table 2 shows, IT professionals consistently earn more than other professionals. The gap becomes smaller among more highly educated workers and when controlling for more variables, but it is always statistically significantly different from zero.[14]

Table 2
Difference in Earnings between U.S.-born IT Professionals and Other Professionals, Controlling for Individual Characteristics, 2002-2020

	(1)	(2)	(3)	(4)
All	0.322	0.204	0.193	0.114
	(0.004)	(0.003)	(0.003)	(0.004)

[13] Log differences are converted to approximate percentage differences using ($e^x - 1$), where x is the estimated coefficient.
[14] The estimated coefficients should not be interpreted as causal effects because of unobserved differences between IT professionals and other workers even after controlling for observable differences.

At least associate's degree	0.263	0.186	0.175	0.096
	(0.004)	(0.004)	(0.004)	(0.004)
At least bachelor's degree	0.252	0.188	0.176	0.087
	(0.004)	(0.004)	(0.004)	(0.004)
At least bachelor's degree & full-time, year-round, salaried	0.134	0.112	0.100	0.033
	(0.005)	(0.005)	(0.005)	(0.005)
Controlling for:				
Demographics	No	Yes	Yes	Yes
State	No	No	Yes	Yes
Industry	No	No	No	Yes

Note: Shown are estimated differences in log real weekly earnings, with controls as indicated. Demographics controls for age (single years), education (up to 6 categories), sex, and race/ethnicity (5 categories). Industry controls for broad industry (14 categories). Robust standard errors are in parentheses. All differences shown are statistically significant at the 99% confidence level.

Table 2 is based on pooling CPS data across the period 2002 to 2020. Figure 11 shows the estimated coefficients for the IT professional variable (and their 95% confidence interval) if the main regressions are instead run for each single year using the full sample. Specifically, Figure 11 shows the equivalent of Table 2, row 1, columns 1 and 4 for each year. There is a notable dip in the premium between 2002 and 2003 that is likely related to the aftermath of the dot-com bubble, another during the 2007-2009 recession, and perhaps another in 2020. Average weekly earnings thus appear to be more tightly linked to the business cycle for IT professionals than for other professionals.

Figure 12 shows the equivalent estimates for the sample of professionals with at least a bachelor's degree who hold full-time, year-round salaried jobs (the equivalent of Table 2, row 4, columns 1 and 4 for each year). Notably, the estimated earnings premium for IT professionals is statistically significantly different from zero even after controlling for demographic characteristics, state, and industry when pooling all observations during 2002-2020 (Table 2, column 4) but not for some individual years. The smaller sample size when looking at individual years results in less precise confidence intervals. Nonetheless, average earnings among IT professionals are never significantly lower than among other professionals even when controlling for demographic characteristics, state, and industry and are significantly higher in 8 of the 19 years examined here.

Figure 11
Log Wage Differences between IT Professionals and Other Professionals, by Year

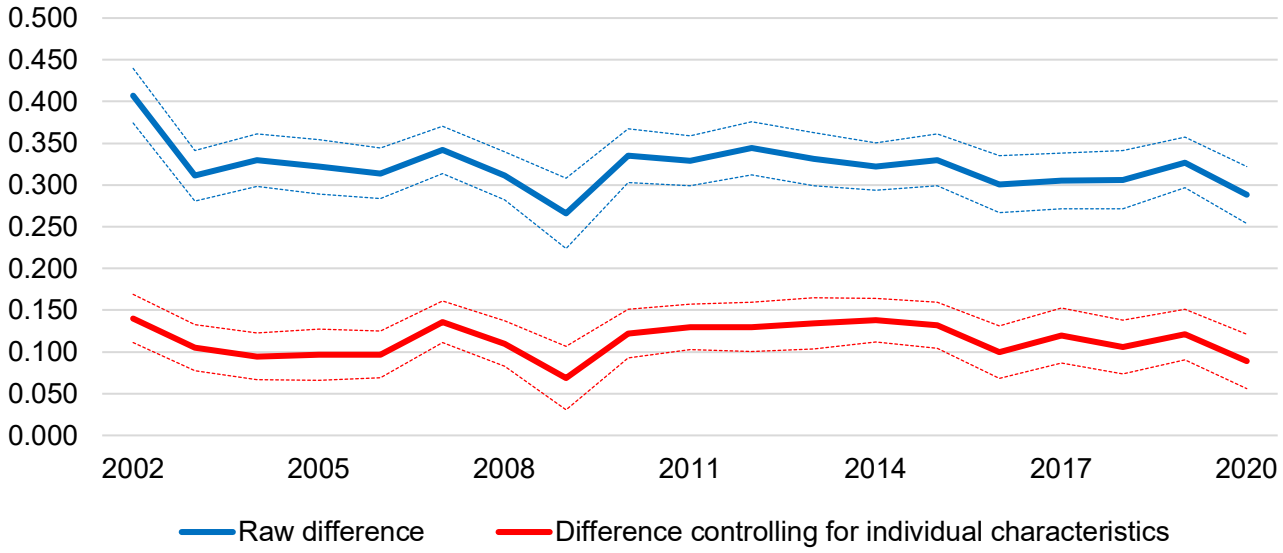
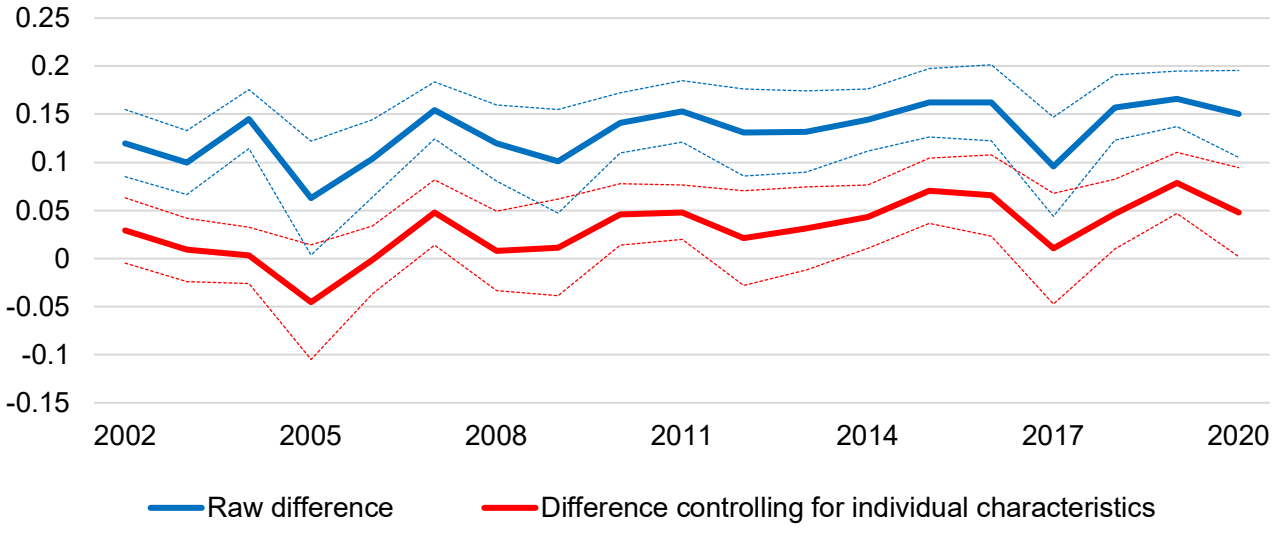


Figure 12
Log Wage Differences between IT Professionals and Other Professionals, at least Bachelor's Degree, FTYR, Salaried, by Year



Because of the outsize importance of the IT industry for IT professionals and relatively high salaries in the IT industry, part of the analysis compares IT professionals who work in the IT industry with those who work in all other industries. Table 3 shows results from estimating regressions of the form

$$\ln(\text{Earnings}_i) = \alpha + \beta \text{IT Industry}_i + \gamma \text{Demographics}_i + \delta \text{State}_i + \varepsilon_i$$

among the sample of IT professionals. Table 3 reports the estimated coefficients for the indicator variable for the IT industry. All of the estimates indicate that IT professionals who work in the IT industry earn more than other IT professionals, although the difference narrows when looking at more highly educated workers.

Table 3
Difference in Earnings between U.S.-born IT Professionals Employed in IT Industry and Other Industries, Controlling for Individual Characteristics, 2002-2020

	(1)	(2)	(3)
All	0.119	0.103	0.089
	(0.008)	(0.007)	(0.007)
At least associate's degree	0.100	0.095	0.083
	(0.008)	(0.008)	(0.008)
At least bachelor's degree	0.095	0.099	0.086
	(0.009)	(0.009)	(0.009)
At least bachelor's degree & full-time, year-round, salaried	0.069	0.080	0.065
	(0.010)	(0.010)	(0.010)
Controlling for:			
Demographics	No	Yes	Yes
State	No	No	Yes

Note: Shown are estimated differences in log real weekly earnings, with controls as indicated. Demographics controls for age (single years), education (up to 6 categories), sex, and race/ethnicity (5 categories). Robust standard errors are in parentheses. All differences shown are statistically significant at the 99% confidence level.

American Community Survey: Earnings of CIS Majors

Since 2009, the ACS has asked respondents who hold a bachelor's degree (or higher) their major(s) for their bachelor's degree. The report uses data from 2009 through 2019, the most recent year available. Bachelor's degree holders with a major (or second major) in a computer-related major (computer and information systems; computer programming and data processing; computer science; information science; computer information management and security; computer networking and telecommunications) are classified here as a CIS major. Other STEM majors here includes majors in engineering; engineering technologies; mathematics and statistics; biology and life sciences; physical sciences; agriculture; and environmental and natural resources. This corresponds to the National Science Foundation's list of science and engineering majors while exempting psychology and the social sciences.

While the CPS reports weekly earnings, the ACS reports annual wage and salary income earned during the last year. Earnings are adjusted for inflation using the CPI-W for the previous calendar year. Workers are classified as full-time, year-round workers if they report usually working at least 35 hours per week and working at least 50

weeks last year. The ACS does not ask about being paid on an hourly or salaried basis. The sample again does not include self-employed workers.

In the sample of workers who have at least a bachelor's degree, the earnings of CIS majors are compared with other majors using ordinary least squares regressions of the form

$$\ln(\text{Earnings}_i) = \alpha + \beta\text{CIS major}_i + \gamma\text{Demographics}_i + \delta\text{State}_i + \mu\text{Industry}_i + \varepsilon_i,$$

where the dependent variable is the log of an individual's real annual earnings. The right-hand side variables are then progressively added to the regression model. The base model includes only an indicator variable for being an CIS major; the second version adds variables that control for demographic characteristics (fixed effects for age, education level, sex, and race/ethnicity); the next version adds fixed effects for state; and the last version adds fixed effects for broad industry categories. All observations are at the individual level and are weighted using the person weights. The regressions are estimated for all workers who have at least a bachelor's degree and then for those who work full-time, year-round. The estimated coefficient on the CIS major indicator variable gives the average (log) earnings difference between CIS majors and other majors, controlling for other variables as indicated.

Table 4
Difference in Earnings between U.S.-born CIS Majors and Other Majors, Controlling for Individual Characteristics, 2009-2019

	(1)	(2)	(3)	(4)
At least bachelor's degree	0.320	0.178	0.172	0.129
	(0.003)	(0.003)	(0.003)	(0.003)
At least bachelor's degree & full-time, year-round	0.172	0.131	0.125	0.091
	(0.002)	(0.002)	(0.002)	(0.002)
Controlling for:				
Demographics	No	Yes	Yes	Yes
State	No	No	Yes	Yes
Industry	No	No	No	Yes

Note: Shown are estimated differences in log real annual earnings, with controls as indicated. Demographics controls for age (single years), education (up to 2 categories), sex, and race/ethnicity (5 categories). Industry controls for broad industry (14 categories). Robust standard errors are in parentheses. All differences shown are statistically significant at the 99% confidence level.

Table 4 reports the estimated coefficients for the CIS major in regressions that include all workers with at least a bachelor's degree, while Table 5 reports results when only STEM majors are included in the sample. The estimated difference between CIS majors and all other majors is substantial, at over 30 percent before including any controls (row 1, column 1) and almost 10 percent after controlling for demographics, state, and industry and limiting the sample to full-time, year-round workers (row 2, column 4). As Table 5 shows, the estimated difference between CIS majors and other majors is smaller when only STEM majors are included in the regressions. CIS majors earn about 7 percent more than other STEM majors as a whole (row 1, column 1), and less than 1 percent more when controlling for demographics, state, and industry and limiting the sample to full-time, year-round workers (row 2, column 4). Controlling for demographics is important when comparing CIS majors with other STEM majors given the greater prevalence of graduate degrees among other STEM majors than among CIS majors (about 45 percent versus 29 percent, respectively).

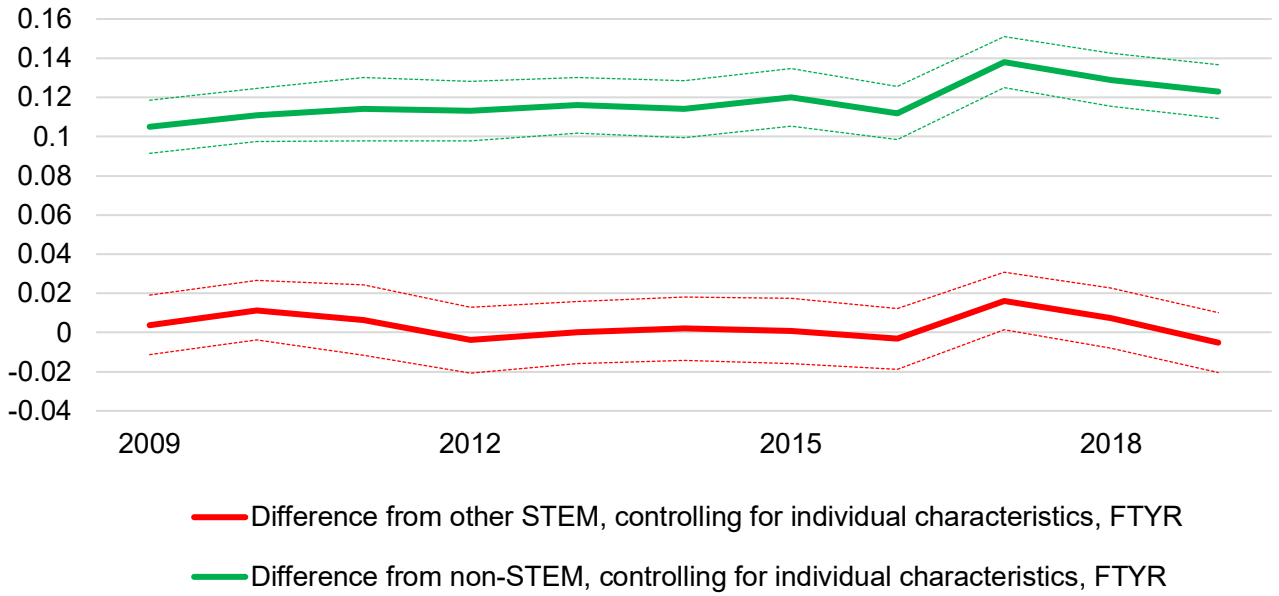
Table 5
Difference in Earnings between U.S.-born CIS Majors and Other STEM Majors, Controlling for Individual Characteristics, 2009-2019

	(1)	(2)	(3)	(4)
At least bachelor's degree	0.072	0.057	0.048	0.037
	(0.003)	(0.003)	(0.003)	(0.003)
At least bachelor's degree & full-time, year-round	-0.033	0.029	0.021	0.005
	(0.003)	(0.002)	(0.002)	(0.002)
Controlling for:				
Demographics	No	Yes	Yes	Yes
State	No	No	Yes	Yes
Industry	No	No	No	Yes

Note: Shown are estimated differences in log real annual earnings, with controls as indicated. Demographics controls for age (single years), education (up to 2 categories), sex, and race/ethnicity (5 categories). Industry controls for broad industry (14 categories). Robust standard errors are in parentheses. All differences shown are statistically significant at the 95% confidence level.

Figures 13 and 14 show the estimated coefficients on the CIS major indicator variable (and their 95% confidence interval) if the regressions controlling for demographics, state, and industry and limiting the sample to full-time, year-round workers are run for each single year. Specifically, Figure 13 shows the equivalent of row 2, column 4 in Table 5 for each year and an equivalent regression with the comparison group limited to non-STEM majors. CIS majors always earn significantly more than non-STEM majors, and the premium increases notably between 2016 and 2017. The earnings of CIS majors relative to other STEM majors also appear to rise that year. The difference between CIS majors and other STEM majors is statistically significant in the pooled sample (Table 5, row 2, column 4) but not when looking at any single year of data, reflecting the smaller sample size.

Figure 13
Log Wage Differences between CIS Majors, Other STEM Majors and Non-STEM Majors, by Year



Shown are estimated regression coefficients for CIS majors relative to other STEM majors or non-STEM majors, controlling for age (single years), education (up to 2 categories), sex, race/ethnicity (5 categories), state, and industry (14 categories). The dotted lines show 95 percent confidence intervals.

National Survey of College Graduates: Earnings of CIS Majors

The report uses data from the 2010, 2013, 2015, and 2017 NSCG, which surveys people with at least a bachelor's degree about their educational backgrounds and labor market outcomes. Unlike the ACS, the NSCG reports field of study (major) for graduate degrees as well as for bachelor's degrees. The NSCG also reports year of degree receipt. This allows the analysis to look at recent recipients of bachelor's and master's degrees in CIS and other STEM majors. The analysis looks at workers who received a bachelor's (master's) degree within the last 5 years whose highest degree is a bachelor's (master's) degree.[15]

The NSCG includes current salary on an annual basis. Salaries are adjusted for inflation using the CPI-W. Only workers who reporting working at least 35 hours a week and 50 weeks a year (full-time, year-round) workers are included in the analysis shown here. The analysis uses the survey weights to make the sample nationally representative. CIS and other STEM majors are defined similar to the ACS analysis; majors in health and science and math teacher education are not classified as STEM majors. The NSCG does not include state or industry, so the regression model used to control for observable differences is

[15] The report does not examine PhD holders since the sample of PhD holders in CIS fields is small.The 2010 NSCG under-samples very recent degree recipients since the NSF fielded its National Survey of Recent College Graduates (NSRCG) that year. This likely accounts for the drop in median earnings between 2010 and 2013 in Figures 9 and 10; the 2010 data under-represent people who finished college within the last 2 years. The public use NSRCG data does not include several of the variables needed for the analysis here, including distinguishing between computer and mathematics majors.

$$\ln(\text{Earnings}_i) = \alpha + \beta\text{CIS major}_i + \gamma\text{Demographics}_i + \delta\text{Region}_i + \varepsilon_i,$$

where region is fixed effects for 9 geographic regions within the U.S.

Table 6 reports the results, which indicate that CIS majors earn substantially more than other STEM majors. The gap narrows when controlling for demographic characteristics (age, sex, and race/ethnicity), mainly because CIS majors are more likely to be male than other STEM majors. Controlling for region increases the CIS premium when looking at recent bachelor's degree recipients and has little effect when looking at recent master's degree recipients.

Table 6
Difference in Earnings between U.S.-born CIS Majors and Other STEM Majors, Controlling for Individual Characteristics, 2010, 2013, 2015, and 2017

	(1)	(2)	(3)
Recent bachelor's degree	0.206	0.176	0.191
	(0.044)	(0.039)	(0.038)
Recent master's degree	0.211	0.160	0.159
	(0.037)	(0.034)	(0.033)
Controlling for:			
Demographics	No	Yes	Yes
Region	No	No	Yes

Note: Shown are estimated differences in log real annual earnings, with controls as indicated. Demographics controls for age (single years), sex, and race/ethnicity (5 categories). Region controls for broad geographic region within the U.S. (9 categories). Robust standard errors are in parentheses. Sample is limited to full-time, year-round workers with a bachelor's or master's degree, as indicated, in a STEM field awarded within the last 5 years. All differences shown are statistically significant at the 99% confidence level.

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