

THE IMPACT OF ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA IN 2018

A Report from the Office of the University Economist

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SUMMARY

Arizona State University (ASU) graduates are employed throughout the world. This paper examines only those graduates employed in Arizona — those contributing to the productivity and prosperity of the state.

Approximately 249,691 ASU graduates were working in Arizona in 2018. More than one-in-four of the state's working individuals who had earned at least a bachelor's degree had graduated from ASU. The aggregate earnings of the ASU graduates were around \$15.9 billion. Based on these earnings, these individuals contributed between \$1.13-and-\$1.35 billion in state and local government taxes, including between \$641 million and \$768 million in state government taxes, depending on the tax rate assumed.

The estimate of the number of ASU graduates working in Arizona in 2018 is based on actual employment and wage data for 164,164 individuals who graduated from ASU between 1990 and 2018 and were covered by the state's unemployment insurance program. Estimates of those who graduated from ASU prior to 1990 and of ASU graduates who were not covered by the unemployment insurance program but were working in Arizona in 2018 were added to the 164,164 figure to reach the total of approximately 249,691.

The impact of ASU graduates working in Arizona increased between 2012 and 2014 and was little changed between 2014 and 2016; it increased again in 2017 and 2018. The share of the Arizona workforce who were ASU graduates was 6.17 percent in 2012 and 6.47 percent in 2018. The share of aggregate wages earned by ASU graduates increased more, from 8.28 percent in 2012 to 8.94 percent in 2018. The average wage of ASU graduates climbed from 134.3 percent of the average wage of all workers in 2012 to 138.2 percent in 2018. In 2012, graduates of ASU accounted for 25.6 percent of all Arizona workers who had earned at least a bachelor's degree. This percentage increased to 26.9 percent in 2014 and 2015, then dropped to 25.9 percent in 2016 and back to 25.6 percent in 2017 and 2018.

DESCRIPTION OF DATA

University Graduates Employed in Arizona

For each year from 2012 through 2018, the Arizona Board of Regents (ABOR) has created a dataset of graduates of Arizona's three public universities who were employed in Arizona during the year. While the ABOR dataset includes the number of "degrees awarded," this number really refers to the number of individuals earning a degree. An individual earning more than one degree is counted only once in this dataset, categorized in the year of the most recent degree. Thus, the dataset's number of "degrees awarded" is less than the official number of degrees awarded.

The ABOR dataset is created by matching Social Security numbers of university graduates to the numbers in the unemployment insurance file maintained by the Arizona Department of Economic Security, which works in conjunction with the U.S. Department of Labor. Reporting from the unemployment insurance file — the Quarterly Census of Employment and Wages (QCEW) — is done quarterly, with annual average figures also produced.

Each quarter, every business that employs workers covered by the state's unemployment insurance program must report (1) employment in each of the three months of the quarter during the pay period that includes the 12th day of the month and (2) total wages paid by the business during the quarter. Federal government civilian workers covered by the comparable federal unemployment insurance program also are included in the reporting.

Various members of the workforce are not included in the QCEW: most agricultural workers on small farms, those self-employed, those in the Armed Forces, and various others. Reporting is by job, not by individual — an individual working more than one covered job will appear in the file more than once.

Since the unemployment insurance records are confidential, ABOR's dataset of graduates employed in Arizona includes only aggregate totals. There are two significant limitations to this dataset. First, the unemployment insurance file does not include a significant number of workers — in 2018, the employment count from the unemployment insurance file was only 73 percent of the total employment in Arizona, as reported by the U.S. Bureau of Economic Analysis (BEA). Second, the dataset of graduates employed in Arizona constructed by the Board of Regents only includes graduates since 1990. Thus, the number of graduates of Arizona's public universities who are working in Arizona is understated significantly. This understatement effectively becomes even larger when the number of *individuals* counted in the Board of Regents dataset is compared to the total number of *jobs* reported in the QCEW.

The dataset constructed by the Board of Regents is subdivided by various characteristics:

- university
- bachelor's degrees versus graduate degrees
- those who attended school as Arizona residents versus nonresidents

The analysis described in this paper uses a dataset specific to Arizona State University (ASU) provided by ASU's Office of the University Provost.

By year of graduation, the following data items are available from the dataset of university graduates employed in Arizona:

- number of graduates
- number employed in Arizona (in any quarter during the year)
- percent of graduates employed in Arizona
- total wages of graduates employed in Arizona
- estimated state taxes paid by graduates employed in Arizona
- number employed in Arizona in all four quarters
- median wage of those employed in Arizona in all four quarters

The number of graduates is reported by academic year — for example, for 2018, the sum of the number graduating in August 2017, December 2017, and May 2018. The employment data are for calendar year 2018.

While the median wage of those employed in all four quarters is a reasonable measure of the typical annual wage of graduates included in the dataset, use of the median wage is arithmetically quite limited. Thus, the average wage of those employed in any quarter during the year also is calculated, as total wages divided by the total number employed.

Employment

The employment figures reported in the QCEW are based on a census of all covered workers and therefore are highly accurate, but as noted above, a large number of workers are not covered by the unemployment insurance program. Thus, focusing only on those covered by the program significantly understates the contribution of university graduates to the Arizona economy.

Employment estimates are available from several sources, but these estimates are not consistent due to definitional differences (certain categories of workers may be excluded by one source but not by another), differences in the way the data are collected (such as a sample of employers versus a census), and timing differences in when the data are collected. In order to provide a more complete picture of the economic activity in Arizona of ASU graduates, more complete employment estimates from the BEA are used in this report.

Most of the employment estimates, including those of the QCEW and BEA, do not differentiate between a person working full time and one working fewer hours. Employment is categorized by the place of work, not by where the worker lives. For example, an Arizona resident of Bullhead City who works across the Colorado River in Laughlin, Nevada is counted in the Nevada employment figures. Further, most of the employment estimates report the number of jobs, not the number of people employed — an individual working two jobs is counted twice in the employment figures. This is an important distinction when comparing the number of ASU graduates (individuals) employed in Arizona to total employment (number of jobs).

Unlike other employment estimates, the employment data reported from the American Community Survey (ACS) reflects the number of individuals working and workers are classified by place of residence. The ACS is an ongoing survey of households conducted by the U.S. Census Bureau that is the source of a wide variety of socioeconomic data. The main shortcoming of the ACS is that it is based on a relatively small number of households. Sampling error can be a

significant concern. The accuracy of self-reporting, particularly for questions related to wages and income, also is an issue. Various ACS tables provide insight on employment in Arizona. The ACS employment figures are based on an individual's employment status at the time the questionnaire is completed.

Educational Attainment

In order to provide context on the contribution of ASU graduates employed in Arizona, the educational attainment of the Arizona workforce is examined. The ACS is the best source of data on educational attainment at a subnational level. In this report, Arizona's educational attainment is compared to the nation using three ACS tables: attainment for the population age 25 and older, attainment in each of five age groups, and attainment by labor force status among those 25-to-64 years old.

While ACS data for five years often are combined to reduce sampling error, the ACS data from 2018 are used in this analysis in order to be consistent with the Board of Regents dataset. For Arizona, sampling error for a single year of ACS data ranges from insignificant for broad measures to significant for small subsets of the population. Thus, the attainment data for the entire population at least 25 years of age is more reliable than the data for each of five age groups.

The Impact of College Graduates on the Workforce

Educational attainment is strongly correlated to an individual's earnings, with a bachelor's degree in particular causing a boost in earnings. The higher earnings realized over a lifetime of work greatly exceeds the costs of attending college.¹ Society also benefits from an educated populace in various ways, such as the lower crime rates of educated individuals.²

One of the benefits of having highly educated individuals in the workforce is to raise the wages of the entire workforce. Enrico Moretti specified this relationship in his 2004 *Journal of Econometrics* paper, "Estimating the Social Return to Higher Education: Evidence From Longitudinal and Repeated Cross-Sectional Data."³ The spillover of benefits to all workers can be traced to the enhanced worker productivity associated with greater educational attainment. Improved productivity results from the sharing of knowledge and skills across workers and from shifts in the industrial mix to knowledge-based activities. These productivity gains translate into higher output and earnings.⁴

¹ See "Has the Return to Investing in a College Education Declined?," December 2013, and earlier papers at <http://economist.asu.edu/p3/education>.

² See "Benefits From Improving Educational Attainment in Arizona," August 2012, and earlier papers at <http://economist.asu.edu/p3/education>.

³ Accessible from <http://economist.asu.edu/p3/education>.

⁴ See "The Economic Impact of Raising the Educational Attainment of Arizona's Workforce; 2019 Update," July 2019, at <https://economist.asu.edu/p3/education>.

ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA IN 2018

Employment

According to the QCEW, annual average Arizona employment in 2018 totaled 2,826,095. The BEA's wage and salary employment estimate was 2,961,477, meaning that 135,382 wage and salary workers were not covered by unemployment insurance. The BEA estimates that the number of proprietors (self-employed, also not included in the QCEW) was 897,660, for a total employment figure of 3,859,137.

According to the ACS, an estimated 3,215,136 Arizonans were employed in 2018 in civilian jobs; an additional 18,984 were members of the armed forces. The total of 3,234,120 is 84 percent of the BEA's total number of jobs, suggesting that many workers (1) are employed by more than one business and/or (2) hold a wage and salary job as well as report self-employment income. Other data from the ACS indicates that 22 percent of employed Arizonans worked less than 35 hours per week.

Educational Attainment

Most commonly, educational attainment is expressed for those at least 25 years old. Though the age of 25 is arbitrary, a high proportion of individuals have completed their educations by that age. In 2018, Arizona's educational attainment in this large cohort was inferior to the nation. The share without either a high school diploma or a GED (general education development) certificate was higher in Arizona: 12.5 percent versus 11.7 percent nationally. Relative to the nation, lesser shares of Arizonans had earned a graduate degree (11.2-versus-12.6 percent nationally) and a bachelor's degree (18.6-versus-20.0 percent).

An examination of educational attainment by age group reveals that Arizona was particularly far below the nation among those younger than 35 in 2018. Arizona also was below average among those 35-to-64 years old. In contrast, the educational attainment of those 65 and older was higher in Arizona than nationally. Since few of those age 65 and older are working, the standard statistics on the entire 25-and-older population understate Arizona's educational disadvantage as it applies to the workforce.

Data on educational attainment by labor force status indicate that among those in the workforce, the educational attainment in Arizona of those 25-to-64 years old was below the national figure in 2018. The proportion of those working in a civilian job who had earned at least a bachelor's degree was 33.9 percent in Arizona and 38.3 percent nationally.

Arizona State University Graduates Employed in Arizona

Detailed figures from the dataset of 1990-through-2018 graduates of Arizona State University who were employed in Arizona during 2018 are provided in the appendix. Data are shown by undergraduate versus graduate degree and by residency status while a student.

ABOR's data for graduates in the most recent academic year need to be interpreted carefully. A significant proportion of those graduating in academic year 2018 graduated in May 2018. The employment and wage information for these individuals in calendar year 2018 may reflect part-time employment prior to graduation and/or full-time employment after graduation. In the latter

case, the wage data are for less than a year of full-time employment. For those graduating in academic year 2018, the average wage and median wage is very low and the percentage employed in all four quarters is very low compared to those graduating in prior years.

The following are among the basic conclusions that can be reached using the dataset of ASU graduates from academic years 1990 through 2018:

- The number of individuals earning a degree has increased significantly over time, by 269 percent overall between 1990 and 2018.
- The increase in the number of individuals earning a degree has been higher for graduate students than undergrads, and much higher for those who were classified as nonresidents while attending school than among those classified as residents.
- In 2018, the shares of the total number of graduates were 41.4 percent for resident undergraduates, 27.5 percent for nonresident undergraduates, 11.8 percent for resident graduate students, and 19.4 percent for nonresident graduate students.
- The percentage of graduates employed in Arizona is much higher for residents than nonresidents.
- The share of graduates employed in Arizona decreases significantly with the number of years since graduation, regardless of residency status while students.
- The percentage employed in all four quarters was less than 80 percent among recent graduates but generally was greater than 80 percent among older graduates.
- The average wage and the median wage increase significantly with the number of years elapsed since graduation, though this effect weakens with the number of years elapsed.
- The median wage and the average wage are somewhat higher for those who were classified as nonresidents.
- The average wage (of all graduates employed at some point during the year) was less than the median wage (of graduates employed in all four quarters) among recent graduates, likely due to those not employed in all four quarters lowering the calculated average wage. Among older graduates, the average wage exceeds the median wage, presumably because of a small number of graduates earning very high wages that boosts the average but not the median.

The number of individuals who graduated from ASU between academic years 1990 and 2018 who worked at jobs in Arizona that were covered by the unemployment insurance program in calendar year 2018 was 164,164. ASU graduates between 1990 and 2018 accounted for 5.8 percent of the QCEW total number employed, but this share is understated since it compares *individuals* with ASU degrees to the *number of jobs*.

The aggregate wages of individuals who graduated from ASU between academic years 1990 and 2018 (\$11.2 billion) accounted for 7.7 percent of the QCEW total. ABOR estimates that “state tax revenue” (really, state and local government tax revenue in Arizona) in 2018 by those who graduated from ASU between 1990 and 2018 — based only on wages earned as part of the unemployment insurance program — was \$798 million: 7.10 percent of aggregate wages.

A summary of the ASU graduates from 1990 through 2018 is provided in the top portion of Table 1. The bottom portion of Table 1 focuses on academic year 2017 graduates.⁵ Table 1 needs to be interpreted carefully. Student characteristics vary by residency status and by undergraduate and graduate programs. For example, the magnitude of the difference in the average wage between undergraduate and graduate degrees in 2017 reflects not only the wage premium of the graduate degree but also the greater number of years of work experience prior to graduation among those with a graduate degree. The differential in the average wage of those with undergraduate and graduate degrees declines with the number of years of work experience. Among graduates from academic year 2017, the average wage in 2018 of those with a graduate degree was 49 percent higher than those with a bachelor's degree, but the differential for graduates over the entire 1990-to-2018 period was 36 percent. According to the 2018 ACS, all Arizona workers with a graduate degree (including those graduating before 1990) earned 28 percent more than those who had earned a bachelor's degree.

Alternative Estimates of Taxes Paid

ABOR estimates state and local government tax payments based on the following income levels and tax rates:

- Less than \$25,001: 12.6 percent
- \$25,001 to \$75,000: 6.8 percent
- \$75,001 to \$100,000: 7.2 percent
- More than \$100,000: 6.9 percent

The average tax rate of ASU graduates between 1990 and 2018 who worked in Arizona in 2018 was 7.10 percent.

ABOR's tax rates come from the 2007 edition of an annual study of tax burdens produced by the government of the District of Columbia.⁶ The latest study is for 2017. Since the tax rates from this study fluctuate from year to year with changes in methodology, it is preferable to use the median rates over several years. The last major tax change in Arizona for individuals was fully implemented in 2008. Based on the 2009-through-2017 reports, the median combined state and local government tax rates in Arizona are higher than used by ABOR for those with incomes of \$50,000 or more. The median rate at each of four incomes between \$50,000 and \$150,000 is between 8.4-and-8.6 percent. Since the District of Columbia study does not measure every state and local tax — though it includes income taxes, sales taxes, property taxes, and automobile-related taxes — the overall tax rate would be slightly higher.

A study by the Institute on Taxation and Economic Policy (ITEP), which includes all taxes, reports a similar state and local government tax burden in Arizona.⁷ The figure is 8.5 percent for those earning between \$55,000 and \$96,400; the average wage of ASU graduates employed in Arizona reported by the ABOR is within this range. Using the 8.5 percent tax rate and the aggregate wage figures from the ABOR dataset, Arizona state and local government taxes paid

⁵ Graduates from 2017 instead of 2018 are used since the statistics for those graduating in May 2018 are affected by part-time wages earned while a student and less than full-year wages after graduation.

⁶ "Tax Rates and Tax Burdens in the District of Columbia — A Nationwide Comparison," Government of the District of Columbia, <http://cfo.dc.gov/node/215912>.

⁷ Institute on Taxation & Economic Policy, *Who Pays? A Distributional Analysis of the Tax Systems in All 50 States*, October 2018, <http://www.itep.org/whopays/>.

TABLE 1
ARIZONA STATE UNIVERSITY GRADUATES

	Total	Total Under- grad Degrees	Resident Under- grad Degrees	Non- resident Undergrad Degrees	Total Graduate Degrees	Resident Graduate Degrees	Non- resident Graduate Degrees
Graduates From 1990 Through 2018:							
Number Graduating From Arizona State University Employed in Arizona and Covered by the Unemployment Insurance Program in 2018:	356,068	253,376	194,316	59,060	102,692	60,057	42,635
Number	164,164	124,299	113,737	10,562	39,865	33,124	6,741
Share of Graduates (Percent)	46	49	59	18	39	55	16
Aggregate Wages (Dollars, Millions)	11,240	7,829	7,176	653	3,412	2,866	546
Average Wage (Dollars)	68,471	62,982	63,091	61,817	85,584	86,525	80,960
Estimated State and Local Government Tax Payments (Dollars, Millions)	798	558	511	47	240	201	39
Graduates From 2017:							
Number Graduating From Arizona State University Employed in Arizona and Covered by the Unemployment Insurance Program in 2018:	21,811	15,037	9,710	5,327	6,774	2,767	4,007
Number	11,411	8,526	7,460	1,066	2,885	2,157	728
Share of Graduates (Percent)	52	57	77	20	43	78	18
Aggregate Wages (Dollars, Millions)	483	321	283	38	162	125	36
Average Wage (Dollars)	42,287	37,620	37,914	35,562	56,080	58,133	50,000
Estimated State and Local Government Tax Payments (Dollars, Millions)	35	24	21	3	12	9	3

Source: Arizona Board of Regents from Arizona State University, Office of the University Provost.

on QCEW wages by those who graduated from ASU between 1990 and 2018 was approximately \$955 million in 2018, compared to ABOR's estimate of \$798 million.

In order to estimate the amount of taxes paid just to state government, U.S. Census Bureau data were used. In fiscal year 2017, state tax collections accounted for 56.8 percent of combined state and local government tax collections in Arizona.⁸ Applying this percentage to the estimates of state and local government taxes paid on QCEW wages by those who graduated from ASU between 1990 and 2018, the result is \$641 million based on ABOR's estimate of state and local government taxes and \$768 million based on the 8.5 percent state and local government tax rate.

Extending the Analysis to Include Those Who Graduated From ASU Before 1990

In order to provide an estimate of the number of individuals who graduated from ASU before 1990 and who were working in Arizona in 2018, actual data on the number of degrees awarded by ASU before 1990 were collected, with the earliest data from 1971. The official graduation data from ASU count number of degrees — individuals with more than one ASU degree are counted more than once. These data are not consistent with the figures used in the Arizona Board of Regents dataset, which counts individuals, not number of degrees. Thus, in order to estimate the number of individuals who had earned a degree from ASU before 1990, the historical graduation data for the years before 1990 were adjusted, using the ratio from the 1990-through-1999 period of the number of graduates counted in the Board of Regents database to the official count of degrees granted. The ratio was 88.8 percent for those with an undergraduate degree, 91.2 percent for those with a graduate degree, and 89.4 percent for all graduates.

In order to estimate the number of ASU graduates from before 1990 who were working in Arizona in 2018 and counted in the unemployment insurance program, a “backward projection” was made of the percentage of ASU graduates who were employed in Arizona in 2018. The percentage drops with the number of years since graduation; the rate of decline is rapid among recent grads but is lower and relatively stable among earlier graduates. The average annual decrease of 1.23 percentage points between 1990 and 1999 was used for the pre-1990 period. Using the adjusted graduation figures and the estimated percentage of graduates employed in Arizona, the number of employed ASU graduates was calculated by year for the pre-1990 period.

The average wage for graduates in the pre-1990 period was backward projected in the same manner as the percentage employed. The average wage rises significantly by the number of years since graduation for relatively recent graduates. Among earlier graduates, the increase in the average wage by year is lower and more stable. The annual average increase from the 1990-through-1999 period was 0.45 percent; this figure was applied to the pre-1990 period.

Using these backward projections, the number of individuals who graduated from ASU through academic year 2018 who worked at jobs in Arizona that were covered by the unemployment insurance program in 2018 is estimated to be 182,852 — 11.4 percent higher than the number of those who graduated from 1990 through 2018. Due to the high average wage of individuals who graduated prior to 1990, the differential in the aggregate wage of the entire set of ASU graduates relative to the 1990-to-2018 group was greater at 16.6 percent.

⁸ U.S. Department of Commerce, Census Bureau, State and Local Government Finance, <https://www.census.gov/programs-surveys/gov-finances.html>.

This methodology does not directly address the increasing share of retirees among older ASU graduates. While the percentage of ASU graduates working in Arizona declines with the number of years since graduation over the 1990-to-2018 period, this decrease presumably occurs mostly due to out-migration. Few ASU graduates since 1990 — most of whom were less than 50 years old in 2018 — are likely to have retired. In contrast, retirement becomes increasingly likely among those who graduated during the 1970s. Thus, the estimates of the numbers employed in Arizona of graduates from this time period may be overstated. However, the results of the methodology that was used results in only 6 percent of 1971 graduates employed in Arizona in 2018. Any overstatement of graduates from the 1970s working in Arizona is partially offset by the exclusion of graduates from before 1971, a few of whom likely were still part of the workforce in 2018. Further, it seems unlikely that the rate of out-migration from Arizona for job-related reasons would be as high among those approaching retirement age as among those who are younger. Thus, the estimated number of older ASU graduates working in Arizona is believed to be reasonable.

Those who have graduated from ASU accounted for 6.5 percent of the QCEW number of jobs in Arizona in 2018, but again this share is understated since it compares *individuals* with ASU degrees to the *number of jobs*. The aggregate wage of individuals who have graduated from ASU accounted for 8.9 percent of the QCEW total. The 2018 average wage of \$71,700 of those who have graduated from ASU was 38.2 percent higher than the average of the rest of the QCEW file (a group that includes those without a bachelor's degree and those who earned a degree from another institution). Based on the 7.10 percent tax rate and estimated QCEW wages, ASU graduates paid \$931 million in state and local government taxes in 2018, of which \$528 million was paid to state government. Using the 8.5 percent tax rate, state and local government taxes paid amounted to \$1.11 billion, of which \$632 million was paid to state government.

Estimates from the ACS for 2018 indicate that 871,887 Arizona residents between the ages of 25 and 64 who had received at least a bachelor's degree were employed in civilian jobs. Based on various data from the ACS, the estimated total number of people working in civilian jobs in Arizona in 2018 who have earned a bachelor's or higher degree is 974,639. The estimated number of ASU graduates employed in the state and covered by the unemployment insurance program accounts for 18.8 percent of the estimated number of civilian workers with at least a bachelor's degree.

Extending the Analysis to Include ASU Graduates Employed in Arizona but Not Covered by the Unemployment Insurance Program

In order to estimate the number of ASU graduates working in Arizona in wage and salary jobs not covered by unemployment insurance or as proprietors (self-employed), the ASU shares of the QCEW total (6.47 percent of employment and 8.94 percent of wages) were applied to the BEA's total employment figure. The result is a total of 249,691 ASU graduates working in Arizona in 2018 (see Table 2). This figure is understated because the 6.47 percent figure is based on individuals with ASU degrees and the number of QCEW jobs.

The estimate of 249,691 ASU graduates working in Arizona accounts for 25.6 percent of the estimated number of employed Arizonans with at least a bachelor's degree in 2018. Thus, more

TABLE 2
ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA IN 2018
COMPARED TO TOTAL EMPLOYMENT IN ARIZONA

	Employment	Aggregate Earnings*	Average Earnings
Employment in Arizona:			
QCEW Wage and Salary	2,826,095	\$146,577	\$51,865
Other Wage and Salary From BEA	135,382	10,014	73,966
Total Wage and Salary From BEA	2,961,477	156,590	52,876
Proprietors From BEA	897,660	21,430	23,874
Total From BEA	3,859,137	178,021	46,130
ASU Graduates Employed in Arizona:			
QCEW Wage and Salary, 1990 Through 2018	164,164	11,240	68,471
Estimate From Before 1990	18,688	1,870	100,063
Total QCEW Wage and Salary	182,852	13,110	71,700
Other Wage and Salary Plus Proprietors	66,839	2,812	42,078
Total	249,691	15,923	63,771
ASU Share of Total Employment in Arizona	6.47%	8.94%	138.2%

* In millions. Consists of wages and salaries and proprietors' Income.

Sources: U.S. Department of Labor, Bureau of Labor Statistics (QCEW: Quarterly Census of Employment and Wages); U.S. Department of Commerce, Bureau of Economic Analysis (BEA); and Arizona Board of Regents from Arizona State University, Office of the University Provost.

than one-in-four working individuals in Arizona who had earned at least a bachelor's degree had graduated from ASU. The aggregate earnings of the ASU graduates were around \$15.9 billion. Based on the 7.10 percent tax rate and \$15.9 billion in earnings, ASU graduates paid \$1.13 billion in state and local government taxes in 2018, of which \$641 million was paid to state government. Using the 8.5 percent tax rate, state and local government taxes paid amounted to \$1.35 billion, of which \$768 million was paid to state government.

The Impacts of ASU Graduates on the Workforce

The estimates of 249,691 ASU graduates working in Arizona, earning \$15.9 billion, and paying between \$1.13 and \$1.35 billion in state and local government taxes do not provide a complete accounting of the impacts of ASU graduates on the Arizona economy. College graduates in the workforce boost the productivity of all workers, which results in an increase in wages for all workers. This is discussed in the May 2019 University Economist Paper, "The Economic Impact of Raising the Educational Attainment of Arizona's Workforce: 2019 Update," <https://economist.asu.edu/p3/education>.

**ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA,
2012 THROUGH 2018**

The estimated number of ASU graduates (including those graduating prior to 1990) working in Arizona and covered by unemployment insurance accounted for 6.17 percent of all workers in the unemployment insurance program in 2012. Except for a dip in 2015, this share has increased, reaching 6.47 percent in 2018 (see Table 3). Similarly, other than a decline in 2015, the share of aggregate wages earned by ASU graduates increased from 8.28 percent in 2012 to 8.94 percent in 2018.

The average wage of ASU graduates climbed from 134.3 percent of the overall average in 2012 to 137.6 percent in 2015. While the 2016 figure dipped to 137.2 percent, the 2017 figure increased back to 137.6 and the 2018 figure rose to 138.2.

The estimated share of Arizona workers holding at least a bachelor's degree who are a graduate of ASU climbed from 25.6 percent in 2012 to 26.9 percent in 2014, held steady in 2015, then fell to 25.9 percent in 2016, and dropped further to 25.6 percent in 2017 and 2018. While the one-year percentage increase in ASU graduates working in Arizona did not vary much across these years, the annual percentage increase in the total number of employed university graduates in Arizona was much bigger in 2016, 2017, and 2018 than in the four previous years, based on ACS data.

TABLE 3
SUMMARY OF ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA, 2012 THROUGH 2018

	Employment		Aggregate Earnings		Average Earnings		Tax Payments Estimated Range for State and Local Governments in Millions of 2018 Dollars		Share of Workforce With a University Degree
	Number	Share of Total	Millions of 2018 Dollars	Share of Total	2018 Dollars	Share of Total			
2012	203,372	6.17%	\$12,068	8.28%	\$59,338	134.3%	\$868	\$990	25.6%
2013	211,576	6.27	12,790	8.55	60,452	136.4	917	1,049	26.4
2014	219,106	6.35	13,324	8.71	60,810	137.2	953	1,093	26.9
2015	223,985	6.31	13,842	8.68	61,804	137.6	989	1,135	26.9
2016	231,010	6.34	14,360	8.70	62,160	137.2	1,025	1,177	25.9
2017	238,834	6.41	15,313	8.82	64,117	137.6	1,091	1,302	25.6
2018	249,691	6.47	15,923	8.94	63,771	138.2	1,130	1,353	25.6

Note: The upper range of the tax payment is based on an 8.2 percent tax rate from 2012 through 2016 and an 8.5 percent rate in 2017 and 2018.

Source: Calculated by authors.

APPENDIX
ARIZONA STATE UNIVERSITY GRADUATES FROM 1990 THROUGH 2018 EMPLOYED IN ARIZONA IN 2018:
DETAIL BY CATEGORY OF DEGREE

Source: Arizona Board of Regents, from Arizona State University, Office of the University Provost.

ALL DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	6,751	1,988	29.4%	\$192.3	\$96,727	\$13.5	1,663	83.7%
1991	7,126	2,345	32.9	233.3	99,467	16.4	1,969	84.0
1992	7,096	2,398	33.8	226.3	94,361	15.9	2,050	85.5
1993	7,655	2,569	33.6	239.4	93,199	16.8	2,164	84.2
1994	7,746	2,722	35.1	268.2	98,533	18.8	2,335	85.8
1995	8,095	3,016	37.3	293.9	97,438	20.6	2,593	86.0
1996	8,054	3,145	39.0	289.9	92,189	20.4	2,689	85.5
1997	8,558	3,401	39.7	315.1	92,662	22.1	2,876	84.6
1998	9,112	3,661	40.2	340.2	92,928	23.9	3,152	86.1
1999	9,228	3,680	39.9	337.5	91,722	23.7	3,147	85.5
2000	9,644	4,030	41.8	372.5	92,439	26.1	3,473	86.2
2001	9,385	3,874	41.3	356.8	92,103	25.0	3,339	86.2
2002	9,897	4,331	43.8	383.6	88,567	26.9	3,753	86.7
2003	10,480	4,605	43.9	405.0	87,942	28.4	3,983	86.5
2004	11,079	5,013	45.2	421.1	84,001	29.6	4,291	85.6
2005	11,327	5,187	45.8	433.1	83,507	30.4	4,508	86.9
2006	11,652	5,463	46.9	444.4	81,343	31.2	4,748	86.9
2007	12,048	5,635	46.8	438.8	77,874	30.8	4,841	85.9
2008	12,729	5,939	46.7	457.7	77,069	32.2	5,134	86.4
2009	13,743	6,289	45.8	458.3	72,879	32.2	5,443	86.5
2010	14,467	7,131	49.3	487.5	68,363	34.3	6,082	85.3
2011	14,945	7,431	49.7	490.0	65,940	34.6	6,338	85.3
2012	15,637	7,968	51.0	483.5	60,678	34.2	6,688	83.9
2013	16,506	8,568	51.9	502.0	58,590	35.6	7,136	83.3
2014	17,476	8,998	51.5	498.4	55,392	35.5	7,455	82.9
2015	18,851	9,669	51.3	494.8	51,173	35.4	7,897	81.7
2016	20,068	10,255	51.1	494.4	48,207	35.6	8,300	80.9
2017	21,811	11,411	52.3	482.5	42,287	35.4	8,892	77.9
2018	24,902	13,442	54.0	399.9	29,746	32.2	7,925	59.0
1990-2018	356,068	164,164	46.1	11,240.5	68,471	797.8	134,864	82.2

ALL UNDERGRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	5,027	1,592	31.7%	\$149.8	\$94,092	\$10.5	1,337	84.0%
1991	5,271	1,875	35.6	184.5	98,412	13.0	1,583	84.4
1992	5,340	1,930	36.1	174.6	90,489	12.3	1,658	85.9
1993	5,648	2,012	35.6	181.1	90,001	12.7	1,702	84.6
1994	5,617	2,144	38.2	206.1	96,120	14.5	1,853	86.4
1995	5,737	2,314	40.3	215.4	93,078	15.1	2,003	86.6
1996	5,786	2,406	41.6	207.4	86,204	14.6	2,064	85.8
1997	6,091	2,596	42.6	232.0	89,380	16.3	2,204	84.9
1998	6,579	2,808	42.7	238.4	84,895	16.7	2,412	85.9
1999	6,595	2,770	42.0	234.8	84,782	16.5	2,389	86.2
2000	7,014	3,097	44.2	264.4	85,377	18.5	2,679	86.5
2001	6,825	3,006	44.0	253.9	84,472	17.8	2,595	86.3
2002	7,111	3,259	45.8	267.5	82,081	18.8	2,857	87.7
2003	7,508	3,448	45.9	275.5	79,904	19.3	2,970	86.1
2004	7,950	3,824	48.1	295.7	77,322	20.8	3,255	85.1
2005	8,471	4,040	47.7	312.1	77,261	21.9	3,495	86.5
2006	8,678	4,279	49.3	319.4	74,634	22.4	3,710	86.7
2007	8,853	4,354	49.2	312.0	71,659	22.0	3,723	85.5
2008	9,266	4,479	48.3	308.5	68,869	21.8	3,858	86.1
2009	9,612	4,602	47.9	301.9	65,604	21.3	3,968	86.2
2010	10,194	5,222	51.2	325.0	62,238	23.0	4,432	84.9
2011	10,448	5,455	52.2	325.6	59,696	23.1	4,608	84.5
2012	11,124	6,005	54.0	328.9	54,779	23.4	5,014	83.5
2013	11,743	6,464	55.0	336.5	52,060	24.0	5,340	82.6
2014	12,310	6,804	55.3	336.7	49,492	24.2	5,584	82.1
2015	12,872	7,245	56.3	330.3	45,596	23.9	5,867	81.0
2016	13,515	7,637	56.5	326.3	42,721	23.8	6,139	80.4
2017	15,037	8,526	56.7	320.7	37,620	23.8	6,613	77.6
2018	17,154	10,106	58.9	263.4	26,062	21.9	6,039	59.8
1990-2018	253,376	124,299	49.1	7,828.7	62,982	557.9	101,951	82.0

RESIDENT UNDERGRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	4,114	1,500	36.5%	\$139.5	\$93,006	\$9.8	1,266	84.4%
1991	4,277	1,762	41.2	173.6	98,513	12.2	1,492	84.7
1992	4,340	1,819	41.9	162.5	89,342	11.4	1,564	86.0
1993	4,498	1,863	41.4	166.8	89,515	11.7	1,584	85.0
1994	4,533	1,994	44.0	188.4	94,463	13.2	1,728	86.7
1995	4,735	2,184	46.1	201.0	92,034	14.1	1,889	86.5
1996	4,845	2,282	47.1	196.0	85,885	13.8	1,956	85.7
1997	4,963	2,416	48.7	211.8	87,654	14.9	2,045	84.6
1998	5,136	2,605	50.7	219.5	84,272	15.4	2,238	85.9
1999	5,123	2,537	49.5	212.9	83,932	15.0	2,192	86.4
2000	5,395	2,824	52.3	237.5	84,103	16.7	2,441	86.4
2001	5,282	2,761	52.3	229.2	83,014	16.1	2,385	86.4
2002	5,672	3,016	53.2	243.8	80,849	17.1	2,656	88.1
2003	5,993	3,180	53.1	251.0	78,935	17.6	2,751	86.5
2004	6,382	3,547	55.6	268.8	75,790	18.9	3,028	85.4
2005	6,747	3,757	55.7	287.5	76,531	20.2	3,255	86.6
2006	6,988	3,990	57.1	294.9	73,903	20.7	3,471	87.0
2007	7,112	4,038	56.8	287.2	71,134	20.2	3,461	85.7
2008	7,371	4,197	56.9	288.3	68,696	20.3	3,629	86.5
2009	7,566	4,280	56.6	279.1	65,209	19.7	3,700	86.4
2010	8,148	4,885	60.0	302.7	61,955	21.4	4,150	85.0
2011	8,353	5,079	60.8	301.6	59,388	21.4	4,308	84.8
2012	8,897	5,592	62.9	304.7	54,491	21.7	4,691	83.9
2013	9,282	6,004	64.7	312.7	52,086	22.3	4,990	83.1
2014	9,331	6,273	67.2	308.9	49,244	22.2	5,165	82.3
2015	9,515	6,536	68.7	297.5	45,515	21.5	5,330	81.5
2016	9,699	6,922	71.4	295.6	42,706	21.5	5,615	81.1
2017	9,710	7,460	76.8	282.8	37,914	21.0	5,884	78.9
2018	10,309	8,434	81.8	229.8	27,245	19.0	5,323	63.1
1990-2018	194,316	113,737	58.5	7,175.7	63,091	511.1	94,187	82.8

NONRESIDENT UNDERGRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	913	92	10.1%	\$10.3	\$111,805	\$0.7	71	77.2%
1991	994	113	11.4	10.9	96,830	0.8	91	80.5
1992	1,000	111	11.1	12.1	109,286	0.8	94	84.7
1993	1,150	149	13.0	14.3	96,081	1.0	118	79.2
1994	1,084	150	13.8	17.7	118,147	1.2	125	83.3
1995	1,002	130	13.0	14.4	110,626	1.0	114	87.7
1996	941	124	13.2	11.4	92,090	0.8	108	87.1
1997	1,128	180	16.0	20.3	112,546	1.4	159	88.3
1998	1,443	203	14.1	18.9	92,891	1.3	174	85.7
1999	1,472	233	15.8	21.9	94,045	1.5	197	84.5
2000	1,619	273	16.9	26.9	98,554	1.9	238	87.2
2001	1,543	245	15.9	24.7	100,899	1.7	210	85.7
2002	1,439	243	16.9	23.7	97,374	1.7	201	82.7
2003	1,515	268	17.7	24.5	91,394	1.7	219	81.7
2004	1,568	277	17.7	26.9	96,939	1.9	227	81.9
2005	1,724	283	16.4	24.6	86,957	1.7	240	84.8
2006	1,690	289	17.1	24.5	84,725	1.7	239	82.7
2007	1,741	316	18.2	24.8	78,362	1.7	262	82.9
2008	1,895	282	14.9	20.1	71,445	1.4	229	81.2
2009	2,046	322	15.7	22.8	70,851	1.6	268	83.2
2010	2,046	337	16.5	22.4	66,333	1.6	282	83.7
2011	2,095	376	17.9	24.0	63,861	1.7	300	79.8
2012	2,227	413	18.5	24.2	58,673	1.7	323	78.2
2013	2,461	460	18.7	23.8	51,715	1.7	350	76.1
2014	2,979	531	17.8	27.8	52,432	2.0	419	78.9
2015	3,357	709	21.1	32.9	46,340	2.4	537	75.7
2016	3,816	715	18.7	30.6	42,865	2.2	524	73.3
2017	5,327	1,066	20.0	37.9	35,562	2.8	729	68.4
2018	6,845	1,672	24.4	33.6	20,092	3.0	716	42.8
1990-2018	59,060	10,562	17.9	652.9	61,817	46.9	7,764	73.5

ALL GRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
						State and Local Government Tax Payments in Millions		
1990	1,724	396	23.0%	\$42.5	\$107,322	\$3.0	326	82.3%
1991	1,855	470	25.3	48.7	103,677	3.4	386	82.1
1992	1,756	468	26.7	51.6	110,327	3.6	392	83.8
1993	2,007	557	27.8	58.3	104,752	4.1	462	82.9
1994	2,129	578	27.1	62.1	107,486	4.4	482	83.4
1995	2,358	702	29.8	78.5	111,809	5.5	590	84.0
1996	2,268	739	32.6	82.5	111,672	5.8	625	84.6
1997	2,467	805	32.6	83.1	103,246	5.8	672	83.5
1998	2,533	853	33.7	101.8	119,372	7.1	740	86.8
1999	2,633	910	34.6	102.7	112,847	7.2	758	83.3
2000	2,630	933	35.5	108.1	115,882	7.6	794	85.1
2001	2,560	868	33.9	102.9	118,531	7.2	744	85.7
2002	2,786	1,072	38.5	116.1	108,282	8.1	896	83.6
2003	2,972	1,157	38.9	129.5	111,896	9.0	1,013	87.6
2004	3,129	1,189	38.0	125.4	105,483	8.8	1,036	87.1
2005	2,856	1,147	40.2	121.0	105,504	8.5	1,013	88.3
2006	2,974	1,184	39.8	125.0	105,591	8.7	1,038	87.7
2007	3,195	1,281	40.1	126.8	99,000	8.9	1,118	87.3
2008	3,463	1,460	42.2	149.2	102,225	10.4	1,276	87.4
2009	4,131	1,687	40.8	156.4	92,725	10.9	1,475	87.4
2010	4,273	1,909	44.7	162.5	85,118	11.4	1,650	86.4
2011	4,497	1,976	43.9	164.4	83,178	11.5	1,730	87.6
2012	4,513	1,963	43.5	154.5	78,722	10.8	1,674	85.3
2013	4,763	2,104	44.2	165.5	78,653	11.6	1,796	85.4
2014	5,166	2,194	42.5	161.7	73,688	11.4	1,871	85.3
2015	5,979	2,424	40.5	164.5	67,844	11.6	2,030	83.7
2016	6,553	2,618	40.0	168.1	64,208	11.8	2,161	82.5
2017	6,774	2,885	42.6	161.8	56,080	11.5	2,279	79.0
2018	7,748	3,336	43.1	136.5	40,909	10.3	1,886	56.5
1990-2018	102,692	39,865	38.8	3,411.8	85,584	239.9	32,913	82.6

RESIDENT GRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	1,110	326	29.4%	\$34.3	\$105,291	\$2.4	266	81.6%
1991	1,327	412	31.0	44.0	106,735	3.1	339	82.3
1992	1,247	427	34.2	48.3	113,228	3.4	358	83.8
1993	1,415	514	36.3	53.6	104,284	3.8	425	82.7
1994	1,535	542	35.3	58.2	107,409	4.1	452	83.4
1995	1,710	653	38.2	72.7	111,363	5.1	545	83.5
1996	1,626	676	41.6	74.8	110,656	5.2	570	84.3
1997	1,715	703	41.0	71.4	101,527	5.0	582	82.8
1998	1,767	751	42.5	87.0	115,856	6.1	649	86.4
1999	1,841	822	44.6	91.7	111,577	6.4	683	83.1
2000	1,775	806	45.4	93.3	115,730	6.5	683	84.7
2001	1,705	763	44.8	90.2	118,228	6.3	643	84.3
2002	1,970	962	48.8	104.3	108,379	7.3	804	83.6
2003	2,044	1,025	50.1	114.4	111,615	8.0	900	87.8
2004	2,006	1,017	50.7	107.8	105,969	7.5	889	87.4
2005	1,977	1,021	51.6	105.3	103,103	7.4	895	87.7
2006	1,881	1,028	54.7	108.2	105,246	7.6	903	87.8
2007	2,043	1,120	54.8	107.3	95,803	7.5	978	87.3
2008	2,317	1,296	55.9	131.3	101,313	9.2	1,137	87.7
2009	2,450	1,437	58.7	129.7	90,276	9.1	1,252	87.1
2010	2,686	1,639	61.0	136.3	83,178	9.5	1,424	86.9
2011	2,761	1,681	60.9	136.0	80,914	9.5	1,478	87.9
2012	2,625	1,627	62.0	124.2	76,364	8.7	1,394	85.7
2013	2,684	1,738	64.8	131.0	75,400	9.2	1,491	85.8
2014	2,657	1,768	66.5	129.2	73,074	9.1	1,521	86.0
2015	2,714	1,873	69.0	123.4	65,872	8.7	1,595	85.2
2016	2,773	1,994	71.9	128.3	64,334	9.0	1,681	84.3
2017	2,767	2,157	78.0	125.4	58,133	8.9	1,790	83.0
2018	2,929	2,346	80.1	104.4	44,495	7.8	1,525	65.0
1990-2018	60,057	33,124	55.2	2,866.1	86,525	201.3	27,852	84.1

NONRESIDENT GRADUATE DEGREES

2018

Academic Year of Graduation	Number Earning a Degree	Number Employed in Arizona	Percent Employed in Arizona	Aggregate Wages in Millions	Average Wage	Estimated State and Local Government Tax Payments in Millions	Number Employed in Arizona During All Four Quarters	Percent Employed in All Four Quarters
1990	614	70	11.4%	\$8.2	\$116,778	\$0.6	60	85.7%
1991	528	58	11.0	4.8	81,952	0.3	47	81.0
1992	509	41	8.1	3.3	80,115	0.2	34	82.9
1993	592	43	7.3	4.7	110,346	0.3	37	86.0
1994	594	36	6.1	3.9	108,643	0.3	30	83.3
1995	648	49	7.6	5.8	117,745	0.4	45	91.8
1996	642	63	9.8	7.7	122,573	0.5	55	87.3
1997	752	102	13.6	11.7	115,091	0.8	90	88.2
1998	766	102	13.3	14.8	145,255	1.0	91	89.2
1999	792	88	11.1	11.0	124,705	0.8	75	85.2
2000	855	127	14.9	14.8	116,846	1.0	111	87.4
2001	855	105	12.3	12.7	120,727	0.9	101	96.2
2002	816	110	13.5	11.8	107,440	0.8	92	83.6
2003	928	132	14.2	15.1	114,083	1.1	113	85.6
2004	1,123	172	15.3	17.6	102,606	1.2	147	85.5
2005	879	126	14.3	15.7	124,961	1.1	118	93.7
2006	1,093	156	14.3	16.8	107,864	1.2	135	86.5
2007	1,152	161	14.0	19.5	121,235	1.4	140	87.0
2008	1,146	164	14.3	17.9	109,433	1.3	139	84.8
2009	1,681	250	14.9	26.7	106,802	1.9	223	89.2
2010	1,587	270	17.0	26.2	96,900	1.8	226	83.7
2011	1,736	295	17.0	28.3	96,076	2.0	252	85.4
2012	1,888	336	17.8	30.3	90,139	2.1	280	83.3
2013	2,079	366	17.6	34.4	94,100	2.4	305	83.3
2014	2,509	426	17.0	32.5	76,236	2.3	350	82.2
2015	3,265	551	16.9	41.1	74,545	2.9	435	78.9
2016	3,780	624	16.5	39.8	63,805	2.8	480	76.9
2017	4,007	728	18.2	36.4	50,000	2.6	489	67.2
2018	4,819	990	20.5	32.1	32,410	2.5	361	36.5
1990-2018	42,635	6,741	15.8	545.8	80,960	38.6	5,061	75.1

