THE IMPACT OF ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA IN 2019

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 259,883 ASU graduates were working in Arizona in 2019. 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 $17.2 billion. Based on these earnings, these individuals contributed between $1.22-and-$1.46 billion in state and local government taxes, including between $721 million and $865 million in state government taxes, depending on the tax rate assumed.

The estimate of the number of ASU graduates working in Arizona in 2019 is based on actual employment and wage data for 172,796 individuals who graduated from ASU between 1990 and 2019 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 2019 were added to the 172,796 figure to reach the total of approximately 259,883.

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, 2018, and 2019. The share of the Arizona workforce who were ASU graduates was 6.17 percent in 2012 and 6.55 percent in 2019. The share of aggregate wages earned by ASU graduates increased more, from 8.28 percent in 2012 to 9.03 percent in 2019. The average wage of ASU graduates climbed from 134.3 percent of the average wage of all workers in 2012 to 137.9 percent in 2019. 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. It slightly increased to 25.7 percent in 2019.

DESCRIPTION OF DATA

University Graduates Employed in Arizona

For each year from 2012 through 2019, 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 2019, 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 2019, the sum of the number graduating in August 2018, December 2018, and May 2019. The employment data are for calendar year 2019.

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 2019 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]

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[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 2019

Employment

According to the QCEW, annual average Arizona employment in 2019 totaled 2,908,826. The BEA's wage and salary employment estimate was 3,048,198, meaning that 139,372 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 921,149, for a total employment figure of 3,969,347.

According to the ACS, an estimated 3,305,302 Arizonans were employed in 2019 in civilian jobs; an additional 24,136 were members of the armed forces. The total of 3,329,438 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 2019, 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: 12.4 percent versus 11.4 percent nationally. Relative to the nation, lesser shares of Arizonans had earned a graduate degree (11.3-versus-12.8 percent nationally) and a bachelor's degree (18.8-versus-20.3 percent).

An examination of educational attainment by age group reveals that Arizona was particularly far below the nation among those younger than 35 in 2019. 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 2019. The proportion of those working in a civilian job who had earned at least a bachelor's degree was 33.8 percent in Arizona and 38.9 percent nationally.

Arizona State University Graduates Employed in Arizona

Detailed figures from the dataset of 1990-through-2019 graduates of Arizona State University who were employed in Arizona during 2019 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 2019 graduated in May 2019. The employment and wage information for these individuals in calendar year 2019 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 2019, 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 2019:

- The number of individuals earning a degree has increased significantly over time, by 290 percent overall between 1990 and 2019.
- 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 2019, the shares of the total number of graduates were 40.4 percent for resident undergraduates, 29.0 percent for nonresident undergraduates, 11.3 percent for resident graduate students, and 19.3 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 2019 who worked at jobs in Arizona that were covered by the unemployment insurance program in calendar year 2019 was 172,796. ASU graduates between 1990 and 2019 accounted for 5.9 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 2019 ($12.3 billion) accounted for 7.9 percent of the QCEW total. ABOR estimates that “state tax revenue” (really, state and local government tax revenue in Arizona) in 2019 by those who graduated from ASU between 1990 and 2019 — based only on wages earned as part of the unemployment insurance program — was $873 million: 7.08 percent of aggregate wages.

A summary of the ASU graduates from 1990 through 2019 is provided in the top portion of Table 1. The bottom portion of Table 1 focuses on academic year 2018 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 2018 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 2018, the average wage in 2019 of those with a graduate degree was 50 percent higher than those with a bachelor's degree, but the differential for graduates over the entire 1990-to-2019 period was 33 percent. According to the 2019 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 2019 who worked in Arizona in 2019 was 7.08 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 2018. 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-2018 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 8.2-and-8.7 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 2018 instead of 2019 are used since the statistics for those graduating in May 2019 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, https://cfo.dc.gov/node/1470246
[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 2019:							
Number Graduating From Arizona State University	380,049	269,620	203,374	66,246	110,429	62,899	47,530
Employed in Arizona and Covered by the Unemployment Insurance Program in 2019:							
Number	172,796	130,837	119,249	11,588	41,959	34,681	7,278
Share of Graduates (Percent)	45	49	59	17	38	55	15
Aggregate Wages (Dollars, Millions)	12,329	8,651	7,904	746	3,679	3,070	609
Average Wage (Dollars)	71,352	66,118	66,285	64,397	87,671	88,512	83,663
Estimated State and Local Government Tax Payments (Dollars, Millions)	873	615	561	53	258	215	43
Graduates From 2018:							
Number Graduating From Arizona State University	24,307	16,611	9,930	6,681	7,696	2,905	4,791
Employed in Arizona and Covered by the Unemployment Insurance Program in 2019:							
Number	11,872	8,883	7,624	1,259	2,989	2,189	800
Share of Graduates (Percent)	49	53	77	19	39	75	17
Aggregate Wages (Dollars, Millions)	530	352	305	47	178	132	46
Average Wage (Dollars)	44,646	39,617	39,998	37,305	59,592	60,164	58,026
Estimated State and Local Government Tax Payments (Dollars, Millions)	39	26	22	4	13	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 2019 was approximately $1.05 billion in 2019, compared to ABOR's estimate of $873 million.

In order to estimate the amount of taxes paid just to state government, U.S. Census Bureau data were used. In fiscal year 2018, state tax collections accounted for 59.2 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 2019, the result is $720 million based on ABOR's estimate of state and local government taxes and $865 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 2019, 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 88.7 percent for those with an undergraduate degree, 91.3 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 2019 and counted in the unemployment insurance program, a "backward projection" was made of the percentage of ASU graduates who were employed in Arizona in 2019. 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 1.28 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 0.19 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 2019 who worked at jobs in Arizona that were covered by the unemployment insurance program in 2019 is estimated to be 190,448 — 10.2 percent higher than the number of those who graduated from 1990 through 2019. 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-2019 group was greater at 14.6 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-2019 period, this decrease presumably occurs mostly due to out-migration. Few ASU graduates since 1990 — most of whom were less than 55 years old in 2019 — 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 4.6 percent of 1971 graduates employed in Arizona in 2019. 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 2019. 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 2019, 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 9.0 percent of the QCEW total. The 2019 average wage of $74,191 of those who have graduated from ASU was 37.9 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 7.08 percent tax rate and estimated QCEW wages, ASU graduates paid $1.00 billion in state and local government taxes in 2019, of which $593 million was paid to state government. Using the 8.5 percent tax rate, state and local government taxes paid amounted to $1.20 billion, of which $711 million was paid to state government.

Estimates from the ACS for 2019 indicate that 891,093 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 2019 who have earned a bachelor's or higher degree is 1,010,818. 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 (6.55 percent of employment and 9.03 percent of wages) were applied to the BEA's total employment figure. The result is a total of 259,883 ASU graduates working in Arizona in 2019 (see Table 2). This figure is understated because the 6.55 percent figure is based on individuals with ASU degrees and the number of QCEW jobs.

The estimate of 259,883 ASU graduates working in Arizona accounts for 25.7 percent of the estimated number of employed Arizonans with at least a bachelor's degree in 2019. Thus, more

TABLE 2
ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA IN 2019 COMPARED TO TOTAL EMPLOYMENT IN ARIZONA

	Employment	Aggregate Earnings*	Average Earnings
Employment in Arizona:			
QCEW Wage and Salary	2,908,826	$156,514	$53,807
Other Wage and Salary From BEA	139,372	10,599	76,049
Total Wage and Salary From BEA	3,048,198	167,113	54,824
Proprietors From BEA	921,149	23,250	25,240
Total From BEA	3,969,347	190,363	47,958
ASU Graduates Employed in Arizona:			
QCEW Wage and Salary, 1990 Through 2019	172,796	12,329	71,352
Estimate From Before 1990	17,652	1,800	101,987
Total QCEW Wage and Salary	190,448	14,130	74,191
Other Wage and Salary Plus Proprietors	69,435	3,056	44,009
Total	259,883	17,185	66,127
ASU Share of Total Employment in Arizona	6.55%	9.03%	137.9%

* 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 $17.2 billion. Based on the 7.08 percent tax rate and $17.2 billion in earnings, ASU graduates paid $1.22 billion in state and local government taxes in 2019, of which $721 million was paid to state government. Using the 8.5 percent tax rate, state and local government taxes paid amounted to $1.46 billion, of which $865 million was paid to state government.

The Impacts of ASU Graduates on the Workforce

The estimates of 259,883 ASU graduates working in Arizona, earning $17.2 billion, and paying between $1.22 and $1.46 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 2019

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 6.55 percent in 2019 (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 9.03 percent in 2019.

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 2019 figure dipped slightly to 137.9 percent.

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. It increased slightly to 25.7 percent in 2019. 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 through 2019 than in the four previous years, reaching 30.3 percent in 2019.

TABLE 3
SUMMARY OF ARIZONA STATE UNIVERSITY GRADUATES EMPLOYED IN ARIZONA, 2012 THROUGH 2019

	Employment		Aggregate Earnings		Average Earnings		Tax Payments Estimated Range for State and Local Governments in Millions of 2019 Dollars		Share of Workforce With a University Degree
	Number	Share of Total	Millions of 2019 Dollars	Share of Total	2019 Dollars	Share of Total			
2012	203,372	6.17%	$12,269	8.28%	$60,329	134.3%	$883	$1,006	25.6%
2013	211,576	6.27	13,004	8.55	61,462	136.4	933	1,066	26.4
2014	219,106	6.35	13,546	8.71	61,826	137.2	969	1,111	26.9
2015	223,985	6.31	14,087	8.68	62,892	137.6	1,007	1,155	26.9
2016	231,010	6.34	14,610	8.70	63,246	137.2	1,043	1,198	25.9
2017	238,834	6.41	15,581	8.82	65,239	137.6	1,110	1,324	25.6
2018	249,691	6.47	16,207	8.94	64,909	138.2	1,150	1,378	25.6
2019	259,883	6.55	17,185	9.03	66,127	137.9	1,217	1,461	25.7

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 through 2019.

Source: Calculated by authors.

APPENDIX
ARIZONA STATE UNIVERSITY GRADUATES FROM 1990 THROUGH 2019 EMPLOYED IN ARIZONA IN 2019: DETAIL BY CATEGORY OF DEGREE

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

ALL DEGREES

		2019						
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	6,755	1,951	28.9%	$196.3	$100,597	$13.8	1,614	82.7%
1991	7,129	2,302	32.3	239.1	103,864	16.8	1,927	83.7
1992	7,098	2,362	33.3	229.4	97,113	16.1	1,996	84.5
1993	7,652	2,548	33.3	248.1	97,383	17.4	2,151	84.4
1994	7,753	2,706	34.9	280.0	103,484	19.7	2,301	85.0
1995	8,094	3,016	37.3	298.4	98,953	21.0	2,528	83.8
1996	8,048	3,117	38.7	302.3	96,987	21.2	2,668	85.6
1997	8,556	3,371	39.4	327.8	97,234	23.0	2,846	84.4
1998	9,116	3,653	40.1	348.2	95,326	24.4	3,135	85.8
1999	9,223	3,646	39.5	348.0	95,441	24.4	3,071	84.2
2000	9,635	4,014	41.7	396.2	98,714	27.7	3,451	86.0
2001	9,371	3,863	41.2	371.7	96,220	26.1	3,287	85.1
2002	9,888	4,311	43.6	402.8	93,443	28.2	3,671	85.2
2003	10,466	4,620	44.1	427.7	92,569	30.0	3,952	85.5
2004	11,071	4,985	45.0	438.8	88,029	30.8	4,234	84.9
2005	11,308	5,138	45.4	443.6	86,342	31.1	4,339	84.4
2006	11,646	5,427	46.6	465.9	85,853	32.7	4,573	84.3
2007	12,031	5,581	46.4	463.3	83,009	32.5	4,758	85.3
2008	12,708	5,881	46.3	478.6	81,379	33.6	5,024	85.4
2009	13,711	6,189	45.1	488.3	78,894	34.3	5,279	85.3
2010	14,419	6,998	48.5	516.4	73,798	36.3	5,970	85.3
2011	14,873	7,259	48.8	517.6	71,299	36.4	6,178	85.1
2012	15,547	7,750	49.8	513.0	66,196	36.2	6,557	84.6
2013	16,383	8,242	50.3	527.2	63,967	37.3	6,938	84.2
2014	17,269	8,627	50.0	532.5	61,723	37.7	7,273	84.3
2015	18,611	9,183	49.3	521.6	56,799	37.1	7,603	82.8
2016	19,701	9,583	48.6	514.8	53,724	36.7	7,810	81.5
2017	21,334	10,471	49.1	516.0	49,282	37.1	8,483	81.0
2018	24,307	11,872	48.8	530.0	44,646	38.6	9,281	78.2
2019	26,346	14,130	53.6	445.5	31,528	35.3	8,645	61.2
1990-2019	380,049	172,796	45.5	12,329.3	71,352	873.2	141,543	81.9

ALL UNDERGRADUATE DEGREES

Academic Year of Graduation	Number Earning a Degree	2019 Number Employed in Arizona	2019 Percent Employed in Arizona	2019 Aggregate Wages in Millions	2019 Average Wage	2019 Estimated State and Local Government Tax Payments in Millions	2019 Number Employed in Arizona During All Four Quarters	2019 Percent Employed in All Four Quarters
1990	5,029	1,577	31.4%	$155.7	$98,715	$10.9	1,314	83.3%
1991	5,271	1,855	35.2	190.0	102,425	13.3	1,575	84.9
1992	5,339	1,908	35.7	180.2	94,458	12.6	1,641	86.0
1993	5,644	2,005	35.5	191.4	95,461	13.4	1,720	85.8
1994	5,615	2,135	38.0	217.4	101,828	15.2	1,843	86.3
1995	5,734	2,328	40.6	219.6	94,326	15.4	1,966	84.5
1996	5,783	2,381	41.2	218.4	91,743	15.3	2,063	86.6
1997	6,089	2,568	42.2	240.2	93,541	16.8	2,177	84.8
1998	6,576	2,802	42.6	251.2	89,661	17.6	2,432	86.8
1999	6,592	2,764	41.9	244.8	88,576	17.2	2,339	84.6
2000	7,008	3,094	44.1	284.7	92,023	19.9	2,680	86.6
2001	6,817	3,007	44.1	268.1	89,160	18.8	2,568	85.4
2002	7,106	3,256	45.8	286.0	87,825	20.1	2,805	86.1
2003	7,496	3,462	46.2	296.5	85,655	20.8	2,988	86.3
2004	7,942	3,798	47.8	311.1	81,904	21.9	3,214	84.6
2005	8,452	4,008	47.4	320.9	80,071	22.5	3,399	84.8
2006	8,663	4,233	48.9	336.6	79,522	23.6	3,577	84.5
2007	8,841	4,331	49.0	334.0	77,123	23.5	3,682	85.0
2008	9,251	4,442	48.0	325.1	73,197	22.9	3,783	85.2
2009	9,592	4,529	47.2	324.5	71,641	22.9	3,869	85.4
2010	10,161	5,138	50.6	349.6	68,037	24.6	4,382	85.3
2011	10,395	5,328	51.3	346.5	65,025	24.5	4,516	84.8
2012	11,054	5,842	52.8	351.4	60,146	24.9	4,923	84.3
2013	11,643	6,202	53.3	357.3	57,609	25.3	5,214	84.1
2014	12,153	6,517	53.6	363.4	55,762	25.8	5,463	83.8
2015	12,684	6,860	54.1	351.9	51,294	25.2	5,664	82.6
2016	13,204	7,109	53.8	343.5	48,322	24.6	5,783	81.3
2017	14,602	7,784	53.3	343.8	44,168	24.9	6,243	80.2
2018	16,611	8,883	53.5	351.9	39,617	26.0	6,893	77.6
2019	18,273	10,691	58.5	294.9	27,588	24.2	6,627	62.0
1990-2019	269,620	130,837	48.5	8,650.7	66,118	614.9	107,343	82.0

RESIDENT UNDERGRADUATE DEGREES

2019

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	4,115	1,484	36.1%	$147.0	$99,062	$10.3	1,235	83.2%
1991	4,277	1,738	40.6	177.2	101,977	12.4	1,475	84.9
1992	4,339	1,801	41.5	167.4	92,959	11.8	1,552	86.2
1993	4,495	1,856	41.3	176.0	94,828	12.3	1,598	86.1
1994	4,531	1,984	43.8	199.3	100,442	14.0	1,720	86.7
1995	4,732	2,199	46.5	204.5	93,019	14.4	1,854	84.3
1996	4,841	2,256	46.6	207.1	91,790	14.5	1,965	87.1
1997	4,961	2,389	48.2	219.6	91,932	15.4	2,023	84.7
1998	5,133	2,595	50.6	231.7	89,269	16.2	2,250	86.7
1999	5,123	2,532	49.4	221.7	87,549	15.6	2,145	84.7
2000	5,392	2,821	52.3	253.0	89,668	17.7	2,446	86.7
2001	5,277	2,764	52.4	241.8	87,492	17.0	2,359	85.3
2002	5,672	3,018	53.2	260.5	86,315	18.3	2,608	86.4
2003	5,983	3,183	53.2	269.3	84,619	18.9	2,754	86.5
2004	6,378	3,530	55.3	284.4	80,566	20.0	2,993	84.8
2005	6,731	3,720	55.3	294.5	79,156	20.7	3,163	85.0
2006	6,977	3,960	56.8	311.2	78,579	21.9	3,345	84.5
2007	7,105	4,031	56.7	306.4	76,020	21.6	3,432	85.1
2008	7,360	4,167	56.6	304.4	73,054	21.4	3,550	85.2
2009	7,547	4,221	55.9	300.4	71,161	21.2	3,610	85.5
2010	8,117	4,807	59.2	325.8	67,785	23.0	4,113	85.6
2011	8,303	4,972	59.9	320.5	64,459	22.6	4,217	84.8
2012	8,832	5,454	61.8	325.6	59,708	23.0	4,603	84.4
2013	9,192	5,769	62.8	331.8	57,506	23.5	4,864	84.3
2014	9,200	6,017	65.4	333.5	55,433	23.7	5,061	84.1
2015	9,345	6,218	66.5	317.6	51,083	22.7	5,152	82.9
2016	9,437	6,480	68.7	312.6	48,241	22.4	5,308	81.9
2017	9,410	6,891	73.2	304.2	44,145	22.1	5,589	81.1
2018	9,930	7,624	76.8	304.9	39,998	22.5	6,024	79.0
2019	10,639	8,768	82.4	250.4	28,561	20.4	5,713	65.2
1990-2019	203,374	119,249	58.6	7,904.5	66,285	561.5	98,721	82.8

NONRESIDENT UNDERGRADUATE DEGREES

2019

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	914	93	10.2%	$8.7	$93,179	$0.6	79	84.9%
1991	994	117	11.8	12.8	109,073	0.9	100	85.5
1992	1,000	107	10.7	12.8	119,691	0.9	89	83.2
1993	1,149	149	13.0	15.4	103,337	1.1	122	81.9
1994	1,084	151	13.9	18.1	120,045	1.3	123	81.5
1995	1,002	129	12.9	15.0	116,601	1.1	112	86.8
1996	942	125	13.3	11.4	90,898	0.8	98	78.4
1997	1,128	179	15.9	20.6	115,015	1.4	154	86.0
1998	1,443	207	14.3	19.6	94,579	1.4	182	87.9
1999	1,469	232	15.8	23.2	99,788	1.6	194	83.6
2000	1,616	273	16.9	31.8	116,360	2.2	234	85.7
2001	1,540	243	15.8	26.3	108,130	1.8	209	86.0
2002	1,434	238	16.6	25.5	106,975	1.8	197	82.8
2003	1,513	279	18.4	27.2	97,483	1.9	234	83.9
2004	1,564	268	17.1	26.7	99,525	1.9	221	82.5
2005	1,721	288	16.7	26.5	91,892	1.9	236	81.9
2006	1,686	273	16.2	25.4	93,194	1.8	232	85.0
2007	1,736	300	17.3	27.6	91,932	1.9	250	83.3
2008	1,891	275	14.5	20.7	75,354	1.5	233	84.7
2009	2,045	308	15.1	24.1	78,229	1.7	259	84.1
2010	2,044	331	16.2	23.7	71,701	1.7	269	81.3
2011	2,092	356	17.0	26.0	72,927	1.8	299	84.0
2012	2,222	388	17.5	25.7	66,297	1.8	320	82.5
2013	2,451	433	17.7	25.5	58,981	1.8	350	80.8
2014	2,953	500	16.9	29.9	59,731	2.1	402	80.4
2015	3,339	642	19.2	34.2	53,336	2.4	512	79.8
2016	3,767	629	16.7	30.9	49,162	2.2	475	75.5
2017	5,192	893	17.2	39.6	44,346	2.9	654	73.2
2018	6,681	1,259	18.8	47.0	37,305	3.5	869	69.0
2019	7,634	1,923	25.2	44.5	23,151	3.8	914	47.5
1990-2019	66,246	11,588	17.5	746.2	64,397	53.4	8,622	74.4

ALL GRADUATE DEGREES

Academic Year of Graduation	Number Earning a Degree	2019 Number Employed in Arizona	2019 Percent Employed in Arizona	2019 Aggregate Wages in Millions	2019 Average Wage	2019 Estimated State and Local Government Tax Payments in Millions	2019 Number Employed in Arizona During All Four Quarters	2019 Percent Employed in All Four Quarters
1990	1,726	374	21.7%	$40.6	$108,531	$2.9	300	80.2%
1991	1,858	447	24.1	49.1	109,835	3.4	352	78.7
1992	1,759	454	25.8	49.2	108,271	3.5	355	78.2
1993	2,008	543	27.0	56.7	104,483	4.0	431	79.4
1994	2,138	571	26.7	62.6	109,675	4.4	458	80.2
1995	2,360	688	29.2	78.9	114,610	5.5	562	81.7
1996	2,265	736	32.5	83.9	113,952	5.9	605	82.2
1997	2,467	803	32.5	87.6	109,045	6.1	669	83.3
1998	2,540	851	33.5	97.0	113,977	6.8	703	82.6
1999	2,631	882	33.5	103.2	116,955	7.2	732	83.0
2000	2,627	920	35.0	111.5	121,214	7.8	771	83.8
2001	2,554	856	33.5	103.6	121,021	7.2	719	84.0
2002	2,782	1,055	37.9	116.9	110,781	8.2	866	82.1
2003	2,970	1,158	39.0	131.1	113,239	9.1	964	83.2
2004	3,129	1,187	37.9	127.8	107,629	8.9	1,020	85.9
2005	2,856	1,130	39.6	122.7	108,585	8.6	940	83.2
2006	2,983	1,194	40.0	129.3	108,298	9.0	996	83.4
2007	3,190	1,250	39.2	129.3	103,403	9.0	1,076	86.1
2008	3,457	1,439	41.6	153.5	106,638	10.7	1,241	86.2
2009	4,119	1,660	40.3	163.8	98,682	11.4	1,410	84.9
2010	4,258	1,860	43.7	166.9	89,711	11.7	1,588	85.4
2011	4,478	1,931	43.1	171.1	88,612	12.0	1,662	86.1
2012	4,493	1,908	42.5	161.6	84,720	11.3	1,634	85.6
2013	4,740	2,040	43.0	169.9	83,296	11.9	1,724	84.5
2014	5,116	2,110	41.2	169.1	80,133	11.9	1,810	85.8
2015	5,927	2,323	39.2	169.7	73,055	11.9	1,939	83.5
2016	6,497	2,474	38.1	171.3	69,248	12.1	2,027	81.9
2017	6,732	2,687	39.9	172.2	64,097	12.1	2,240	83.4
2018	7,696	2,989	38.8	178.1	59,592	12.6	2,388	79.9
2019	8,073	3,439	42.6	150.6	43,778	11.2	2,018	58.7
1990-2019	110,429	41,959	38.0	3,678.6	87,671	258.3	34,200	81.5

RESIDENT GRADUATE DEGREES

2019

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	1,112	304	27.3%	$32.7	$107,532	$2.3	248	81.6%
1991	1,332	389	29.2	44.7	114,906	3.1	309	79.4
1992	1,248	416	33.3	46.0	110,466	3.2	321	77.2
1993	1,417	500	35.3	52.1	104,172	3.7	400	80.0
1994	1,546	534	34.5	58.6	109,737	4.1	426	79.8
1995	1,713	636	37.1	71.8	112,944	5.0	517	81.3
1996	1,624	669	41.2	74.1	110,765	5.2	544	81.3
1997	1,714	698	40.7	75.7	108,413	5.3	577	82.7
1998	1,774	745	42.0	83.2	111,732	5.8	618	83.0
1999	1,839	793	43.1	90.7	114,410	6.3	658	83.0
2000	1,774	796	44.9	97.0	121,922	6.8	669	84.0
2001	1,698	748	44.1	90.6	121,136	6.3	621	83.0
2002	1,971	949	48.1	105.3	110,958	7.3	779	82.1
2003	2,043	1,026	50.2	114.9	111,952	8.0	853	83.1
2004	2,009	1,021	50.8	109.1	106,867	7.6	870	85.2
2005	1,977	1,004	50.8	106.9	106,522	7.5	838	83.5
2006	1,893	1,034	54.6	111.5	107,834	7.8	859	83.1
2007	2,041	1,093	53.6	109.3	99,993	7.6	944	86.4
2008	2,318	1,277	55.1	133.8	104,803	9.3	1,109	86.8
2009	2,441	1,412	57.8	136.2	96,480	9.5	1,200	85.0
2010	2,675	1,603	59.9	139.8	87,214	9.8	1,366	85.2
2011	2,747	1,646	59.9	141.6	86,006	9.9	1,419	86.2
2012	2,615	1,595	61.0	130.3	81,694	9.1	1,366	85.6
2013	2,674	1,692	63.3	135.6	80,125	9.5	1,435	84.8
2014	2,640	1,715	65.0	135.7	79,152	9.5	1,486	86.6
2015	2,691	1,808	67.2	128.3	70,977	9.0	1,531	84.7
2016	2,744	1,907	69.5	132.6	69,512	9.3	1,598	83.8
2017	2,752	2,051	74.5	133.6	65,122	9.4	1,765	86.1
2018	2,905	2,189	75.4	131.7	60,164	9.3	1,810	82.7
2019	2,972	2,431	81.8	116.2	47,800	8.5	1,644	67.6
1990-2019	62,899	34,681	55.1	3,069.7	88,512	215.3	28,780	83.0

NONRESIDENT GRADUATE DEGREES

2019

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%	$7.9	$112,872	$0.6	52	74.3%
1991	526	58	11.0	4.4	75,824	0.3	43	74.1
1992	511	38	7.4	3.2	84,247	0.2	34	89.5
1993	591	43	7.3	4.6	108,097	0.3	31	72.1
1994	592	37	6.3	4.0	108,787	0.3	32	86.5
1995	647	52	8.0	7.0	134,991	0.5	45	86.5
1996	641	67	10.5	9.8	145,769	0.7	61	91.0
1997	753	105	13.9	11.9	113,244	0.8	92	87.6
1998	766	106	13.8	13.8	129,754	1.0	85	80.2
1999	792	89	11.2	12.4	139,639	0.9	74	83.1
2000	853	124	14.5	14.5	116,674	1.0	102	82.3
2001	856	108	12.6	13.0	120,222	0.9	98	90.7
2002	811	106	13.1	11.6	109,198	0.8	87	82.1
2003	927	132	14.2	16.3	123,250	1.1	111	84.1
2004	1,120	166	14.8	18.6	112,315	1.3	150	90.4
2005	879	126	14.3	15.8	125,018	1.1	102	81.0
2006	1,090	160	14.7	17.8	111,294	1.2	137	85.6
2007	1,149	157	13.7	20.0	127,141	1.4	132	84.1
2008	1,139	162	14.2	19.6	121,106	1.4	132	81.5
2009	1,678	248	14.8	27.6	111,215	1.9	210	84.7
2010	1,583	257	16.2	27.1	105,286	1.9	222	86.4
2011	1,731	285	16.5	29.5	103,664	2.1	243	85.3
2012	1,878	313	16.7	31.3	100,140	2.2	268	85.6
2013	2,066	348	16.8	34.4	98,713	2.4	289	83.0
2014	2,476	395	16.0	33.3	84,390	2.3	324	82.0
2015	3,236	515	15.9	41.4	80,352	2.9	408	79.2
2016	3,753	567	15.1	38.8	68,360	2.7	429	75.7
2017	3,980	636	16.0	38.7	60,791	2.8	475	74.7
2018	4,791	800	16.7	46.4	58,026	3.3	578	72.3
2019	5,101	1,008	19.8	34.4	34,079	2.6	374	37.1
1990-2019	47,530	7,278	15.3	608.9	83,663	43.0	5,420	74.5