

THE ECONOMIC IMPACT OF THOSE ATTAINING A GRADUATE DEGREE FROM ARIZONA STATE UNIVERSITY

A Report from the Office of the University Economist

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Arizona State University

SUMMARY

The total worldwide earnings of Arizona State University graduate-degree holders as of March 2020 — based on 2018 earnings data — is estimated at \$11.5 billion.¹ The estimated earnings of those individuals living in one of the 50 U.S. states or the District of Columbia is \$10.4 billion.

Arizona State University graduate-degree holders living in Arizona had earnings of \$5.6 billion — 48.7 percent of the international total and 53.7 percent of the domestic total. These individuals paid taxes of between \$398 million and \$476 million to Arizona state and local governments based on their earnings. Of this amount, Arizona’s state government received between \$226 million and \$270 million.

A highly disproportionate share of ASU graduate-degree holders live in the Phoenix area. Among the metro area’s major cities, the number of ASU graduate-degree holders per 1,000 residents is highest in Tempe. Scottsdale, Chandler, and Gilbert also are popular. A disproportionate share of ASU graduate-degree holders live in the balance of Arizona and in other western states.

The analysis described in this report uses the ASU alumni dataset as of March 4, 2020 that included 142,328 individuals who have earned a graduate degree. The alumni database used for this analysis includes the current age of each individual, their place of residence (country, state/province, city, and postal code), graduation year, and information related to the degree earned (degree level, diploma, academic plan description, school, and campus). However, the workforce status and earnings of the graduate-degree holders are not known.

Based on national earnings data by level of degree earned (doctorate, professional, and master’s) and age, and Arizona earnings data by field of study, an earnings figure was imputed to each individual in the alumni database. The earnings of each graduate was then adjusted to account for the share of individuals not active in the workforce, based on the age of each individual and their degree level. The \$11.5 billion estimate is the aggregate adjusted earnings of the 142,328 individuals.

Earnings increase substantially with educational attainment. Nationally, particularly large increases occur with the completion of professional and doctorate degrees.

¹ Earnings are limited to the amount of compensation received for participation in the workforce. Most individuals also receive income from other sources, such as investments. The impacts estimated in this report are limited to the earnings of the ASU graduate-degree holders.

DATASETS AND DESCRIPTIVE STATISTICS

ASU Alumni Database

As of March 4, 2020, the alumni database of those who have received a graduate degree from Arizona State University contained 142,328 living individuals. These individuals have earned 151,861 graduate degrees from ASU, with some individuals earning as many as four graduate degrees from ASU. For those individuals earning more than one degree, the highest degree (for example, the doctorate degree for an individual earning both a master's degree and a doctorate degree from ASU) is recorded in the database. For those earning more than one master's degree as their highest degree, the most recent degree is recorded in the database.

The version of the alumni database used for this analysis includes the current age of each individual, their place of residence (country, state/province, city, and postal code), graduation year, and information related to their degree (degree level, diploma, academic plan description, school, and campus). From the age and year of graduation, age at graduation was calculated.

The workforce status and earnings of the graduate-degree holders are not known. Though the employer is identified for 26 percent of the alumni and the job title is provided for 21 percent, this information may not be current and provides limited value in assessing the likely earnings of the individual. Based on national earnings data and information from the alumni database, an earnings figure is imputed for each individual in the database, as described later in this paper.

Geography of Residence

The United States, including its territories, is the home of 130,642 (95.7 percent) of the 136,534 ASU graduate-degree holders whose place of residence is known. ASU graduate-degree holders live in 115 other countries. The most common countries of those living outside the United States follow:

- China: 1,796
- India: 1,571
- Canada: 467
- Taiwan: 250
- Mexico: 200
- South Korea: 181
- Japan: 115

Map 1 displays ASU graduate-degree holders by country.

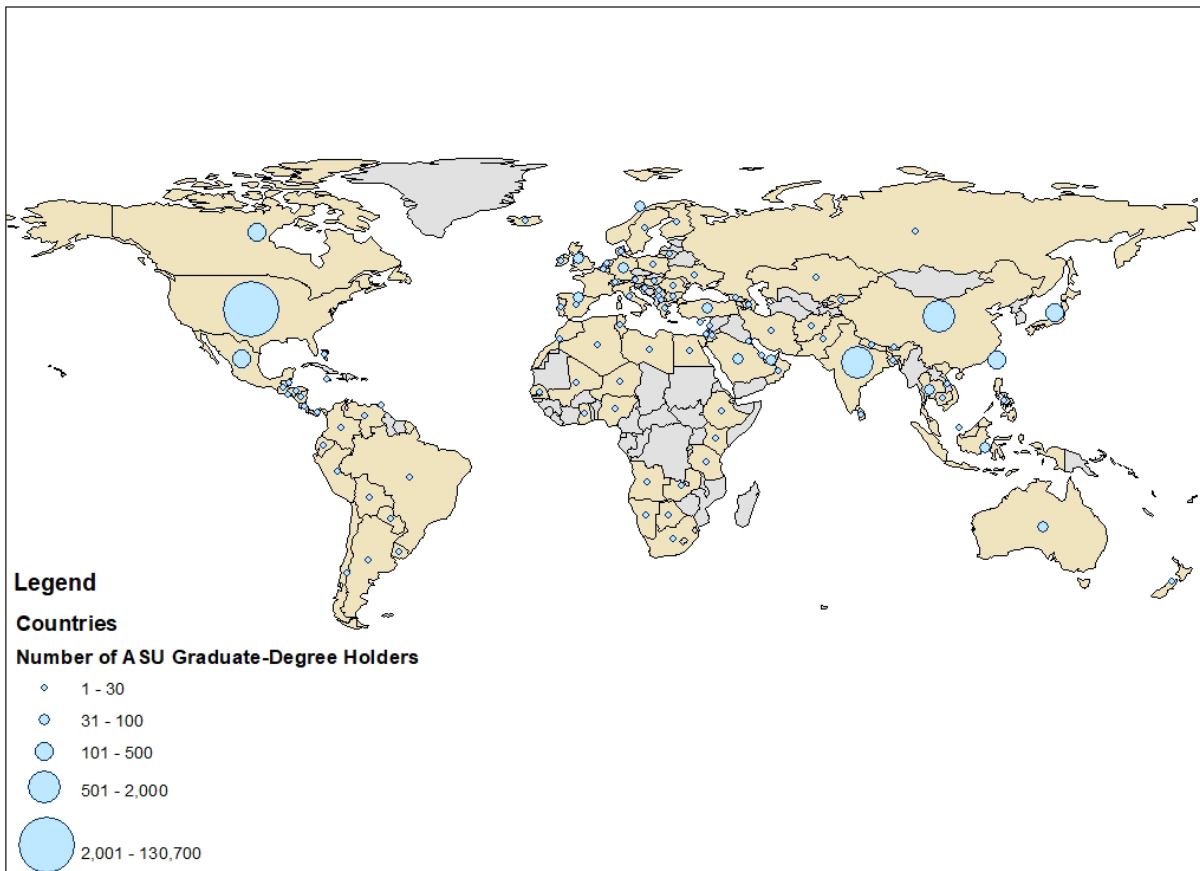
Of the 130,642 U.S. residents, 307 live in U.S. territories or are serving overseas. Of those 130,335 living in one of the 50 states or the District of Columbia, 54.9 percent (71,521) live in Arizona. Nearly 1 percent of the state's residents are ASU graduate-degree holders.

ASU graduate-degree holders live in each of the other states, as seen in Map 2. While the largest number (14,429) live in California, the proportion of the state's population who are ASU graduate-degree holders is higher in six other states than in California. The following figures are the number of ASU graduate-degree holders per 1 million residents:

- New Mexico: 657
- Utah: 528
- Colorado: 515
- Oregon: 484
- Washington: 439
- Idaho: 377
- California: 365
- District of Columbia: 360
- Nevada: 345

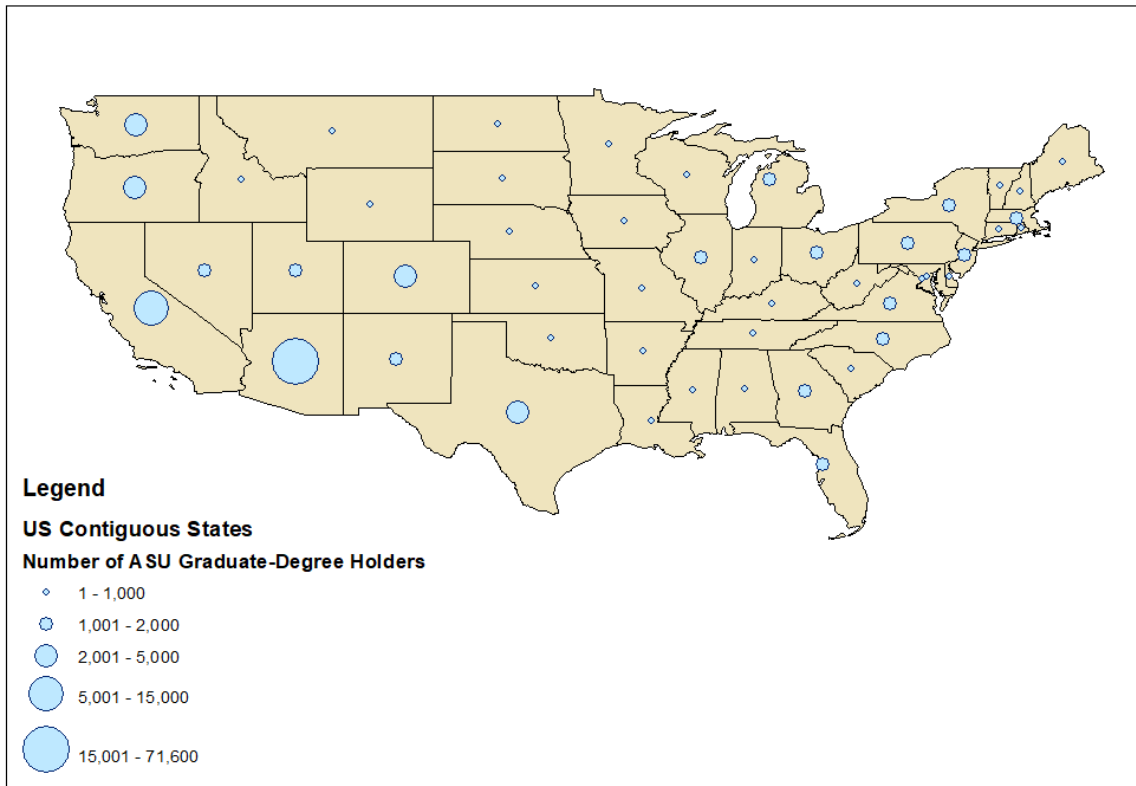
The only other states with more than 200 ASU graduate-degree holders per 1 million residents are Alaska, Montana, Wyoming, and Hawaii.

**MAP 1
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY COUNTRY**



Source: Calculated from ASU alumni database as of March 4, 2020.

**MAP 2
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY U.S. STATE**

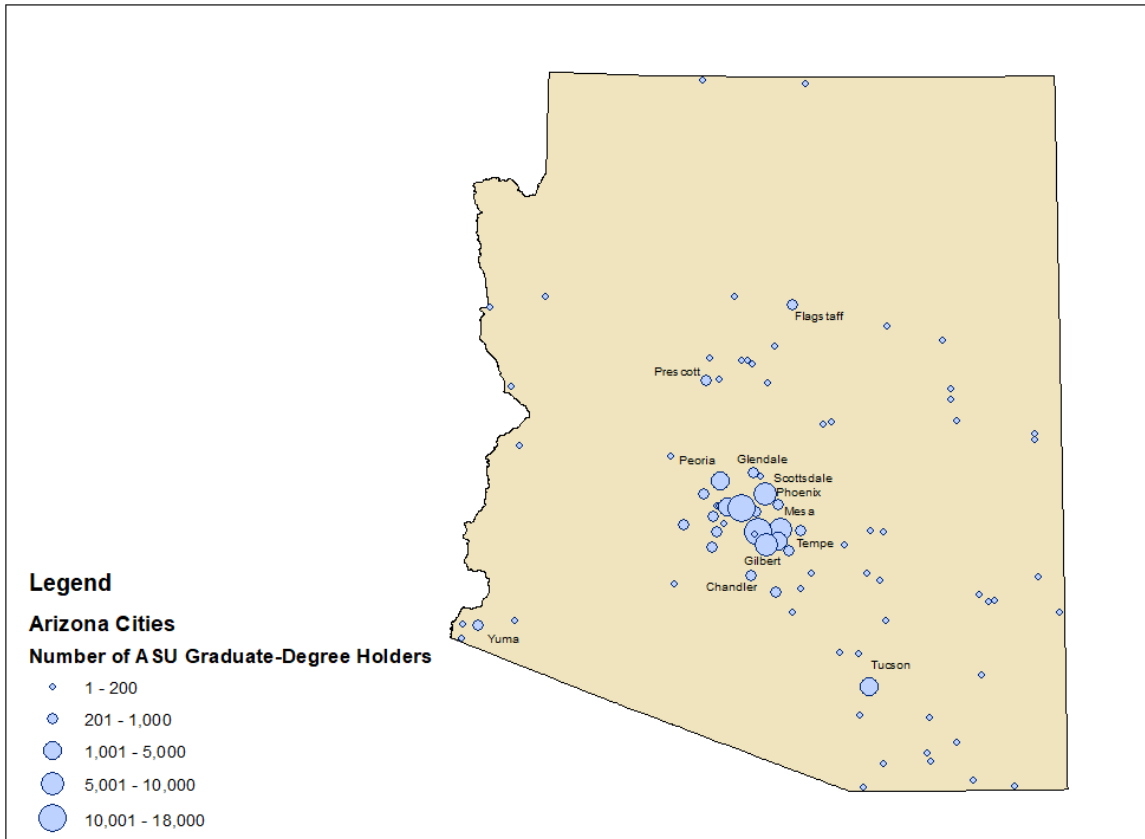


The location of ASU graduate-degree holders depends on several factors: residence before attending ASU (or residence while enrolled online), appropriate job opportunities, and a variety of quality-of-place factors (the latter are especially important among retirees). ASU graduate-degree holders have a strong geographic preference for the western United States. Expressed as a share of the population, the southern states not adjacent to the Atlantic Ocean are the least common places of residence of ASU graduate-degree holders, with fewer than 65 ASU graduate-degree holders per 1 million residents in Alabama, Kentucky, Louisiana, Mississippi, and West Virginia.

Using the zip code, residents of Arizona were placed into three subregions: Metropolitan Phoenix (Maricopa and Pinal counties), Metropolitan Tucson (Pima County), and the balance of the state (the other 12 counties). Of those ASU graduate-degree holders living in Arizona, 90.3 percent (64,553) live in Metro Phoenix. Metro Tucson is home to 4.6 percent (3,286). The remaining 5.1 percent (3,682) live in the balance of the state.

The city names in the alumni database correspond to the city assigned to each zip code, which may not correspond to city boundaries. The largest number of ASU graduate-degree holders living in Arizona live in zip codes assigned to Phoenix (17,788), followed by Tempe (10,830), Scottsdale (6,974), Chandler (6,393), Mesa (6,300), Gilbert (4,627), and Tucson (2,870). Map 3 displays the distribution across the state.

MAP 3
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY ARIZONA CITY



Expressed per 1,000 residents, the ranking of ASU graduate-degree holders by Arizona city is considerably different:

- Cave Creek 88
- Tempe 57
- Litchfield Park 52
- Paradise Valley 40
- Scottsdale 28
- Chandler 24
- Pinetop-Lakeside 23
- Carefree 23
- Gilbert 18

Degree Earned

Of the 142,328 ASU graduate-degree holders, 7,385 (5.2 percent) earned a juris doctor degree (also known as a “professional” degree), 15,346 (10.8 percent) hold a doctorate, and 119,597 (84.0 percent) have a master’s degree as their highest degree. The most common graduate degrees of ASU graduate-degree holders are shown in Chart 1.

The colleges from which the degrees were granted are shown in Chart 2. The variation in the number depends in part on when the earliest living degree holder graduated from a college. This is shown in parentheses after the college’s name.

Age, Year of Graduation, and Age at Graduation

The age of ASU graduate-degree holders as of March 4, 2020 by five-year age group is shown in Chart 3. The mean is 49, median is 46, and mode is 29. The individual’s age at the time of graduation is displayed in Chart 4. The mean is 32, median is 30, and mode is 26.

The year of graduation is presented in Chart 5. The mean is 2002, median is 2006, and mode is 2019.

Measures of Earnings

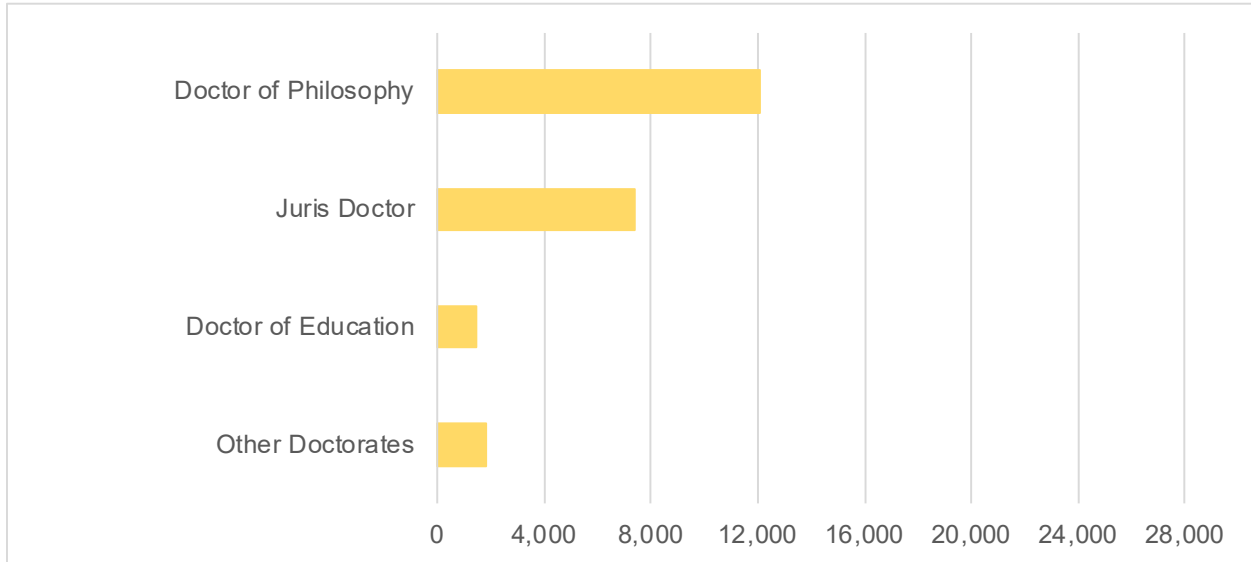
Since the alumni database does not include a measure of earnings, other sources of earnings data are used to impute an estimate of earnings for each ASU graduate-degree holder, based on their age, degree level, and field of degree. National workforce participation rates are applied by age and degree level.

Current Population Survey

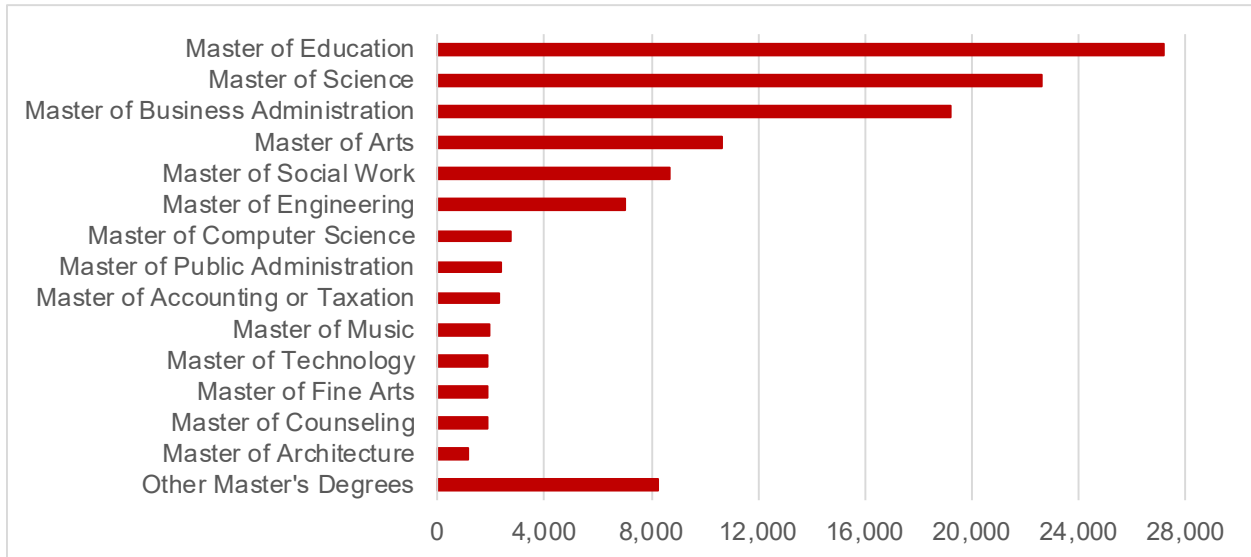
The Current Population Survey (CPS) provides national data on the mean and median earnings of those 25 and older with earnings by age group and educational attainment. In each cross-tabulation of 10-year age group and educational attainment category, mean earnings is greater than median earnings — generally by at least 15 percent and by as much as 40 percent. The mean is substantially higher than the median due to more variation in the half of the earnings distribution above the median than in the half below the median. In particular, a small proportion of workers report extremely high earnings. The differential between the mean and median is greatest among those with professional and doctoral degrees and least among those without a bachelor’s degree.

**CHART 1
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY TYPE OF DEGREE**

DOCTORATES

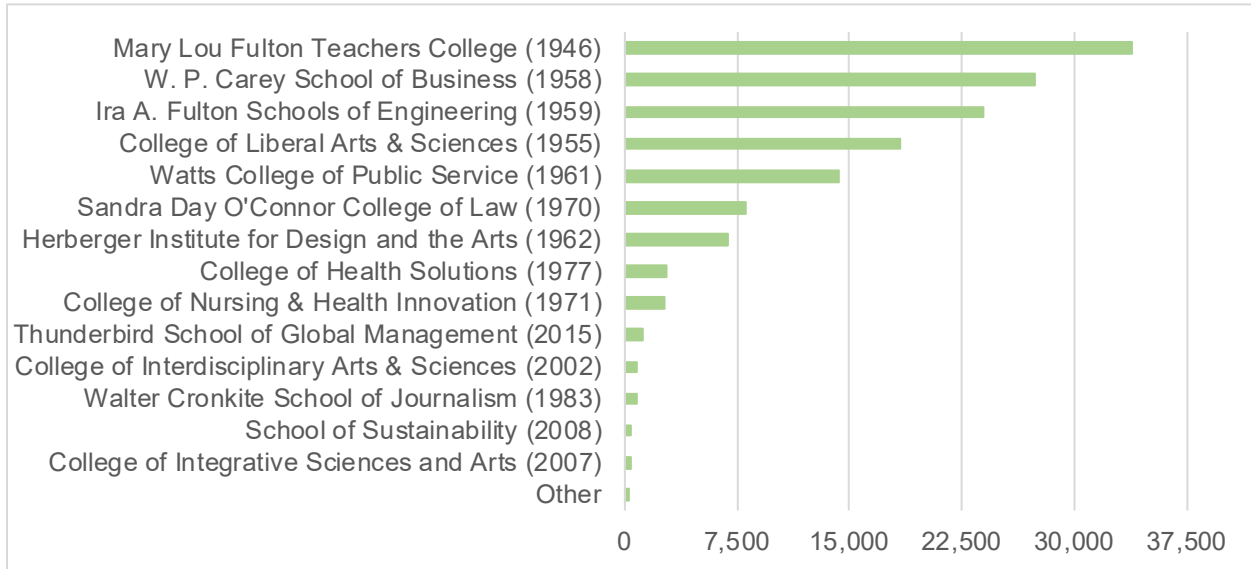


MASTER'S DEGREES



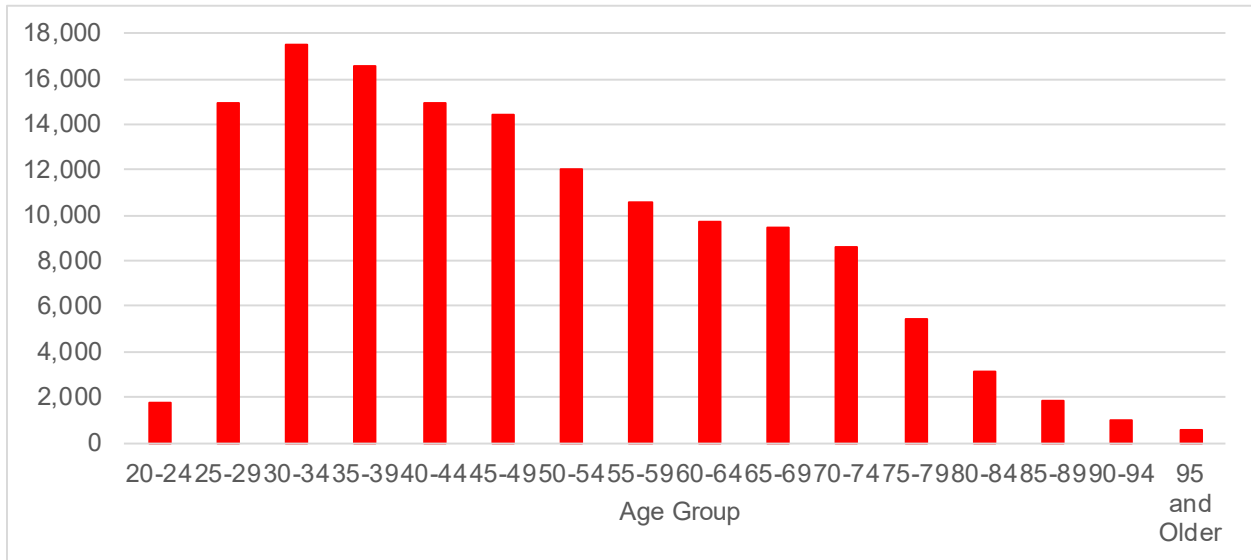
Source: Calculated from ASU alumni database as of March 4, 2020.

CHART 2
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY COLLEGE



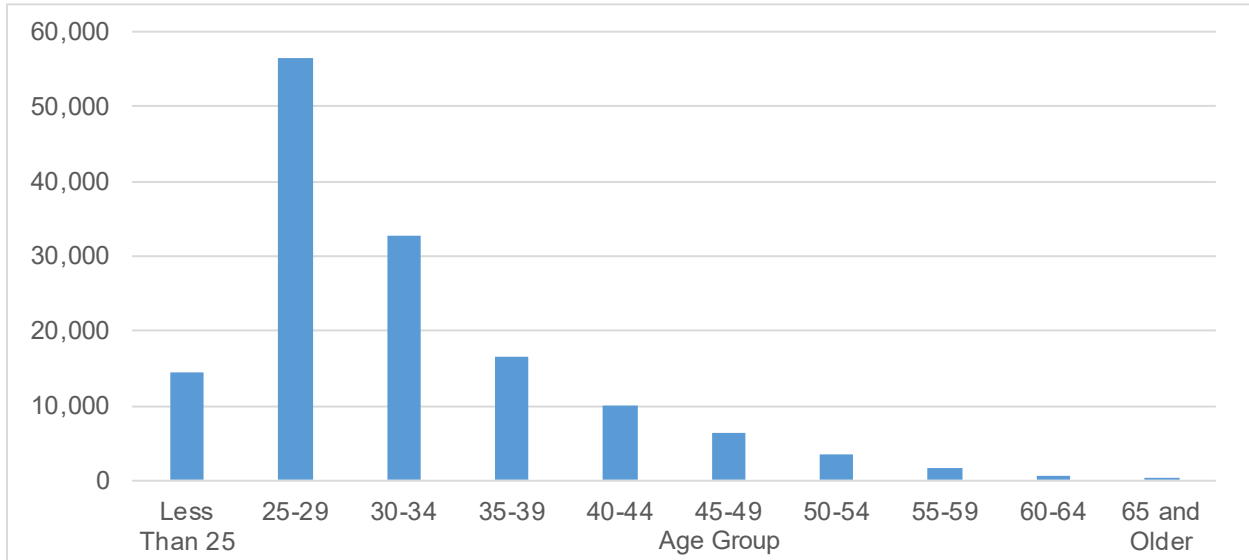
Source: Calculated from ASU alumni database as of March 4, 2020.

CHART 3
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY AGE



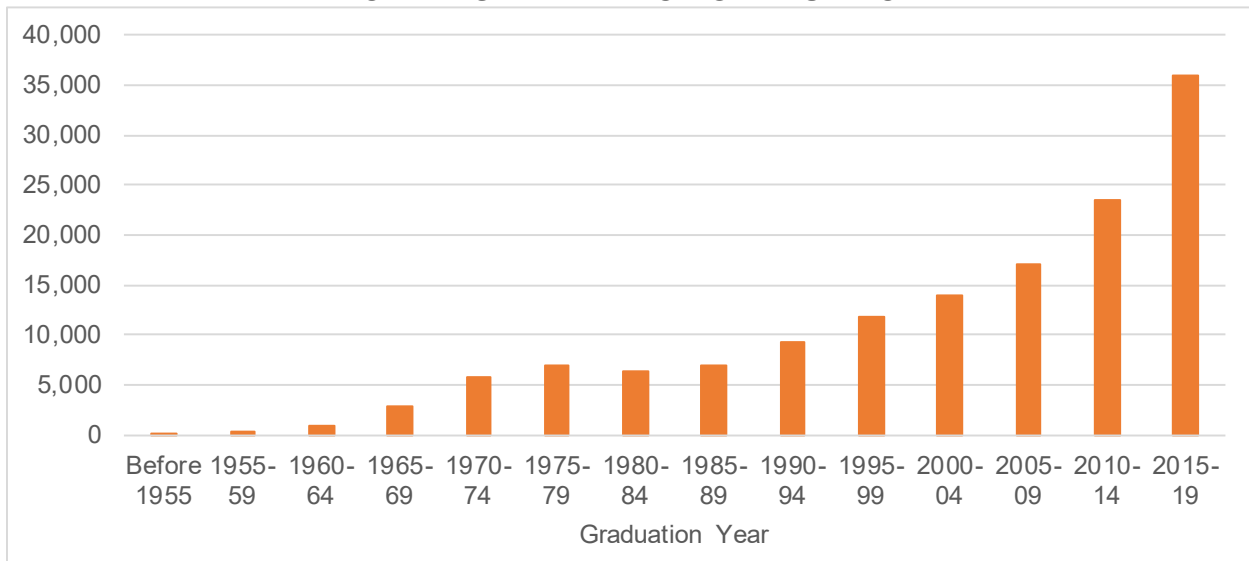
Source: Calculated from ASU alumni database as of March 4, 2020.

CHART 4
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY AGE AT GRADUATION



Source: Calculated from ASU alumni database as of March 4, 2020.

CHART 5
NUMBER OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY YEAR OF GRADUATION



Source: Calculated from ASU alumni database as of March 4, 2020.

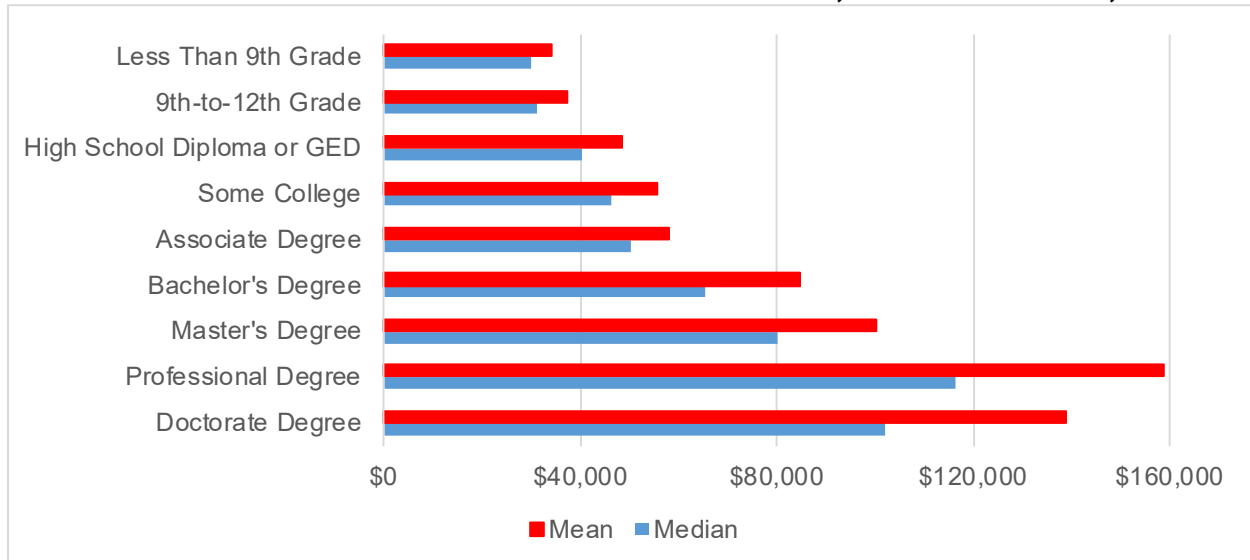
The CPS provides two sets of earnings data by age group and educational attainment — one based on all individuals who had earnings during a year regardless of the number of hours worked and one limited to those who worked full-time and year-round. Since the latter controls for the number of hours worked, it is more reliable in making comparisons across age groups and educational attainment categories. The former is used to impute the earnings of ASU graduate-degree holders, a portion of whom (particularly those of traditional retirement age) presumably work less than full-time and year-round.

Due to the small sample size of the CPS, sampling error is significant, especially for smaller population groups, such as when the data are cross-tabulated by age and educational attainment. The sampling error is apparent when comparing results year by year. No adjustment has been made to the latest data for 2018.

Earnings increase with the level of educational attainment, as seen in Chart 6. The percentage increase in mean and median earnings from one educational attainment category to the next category is displayed in Chart 7 for the 35-to-44 age group (this age group was selected since most individuals with a graduate degree had earned their final degree by the age of 35). Along with receiving a bachelor’s degree, receiving a professional or doctorate degree provides the greatest boosts in earnings.

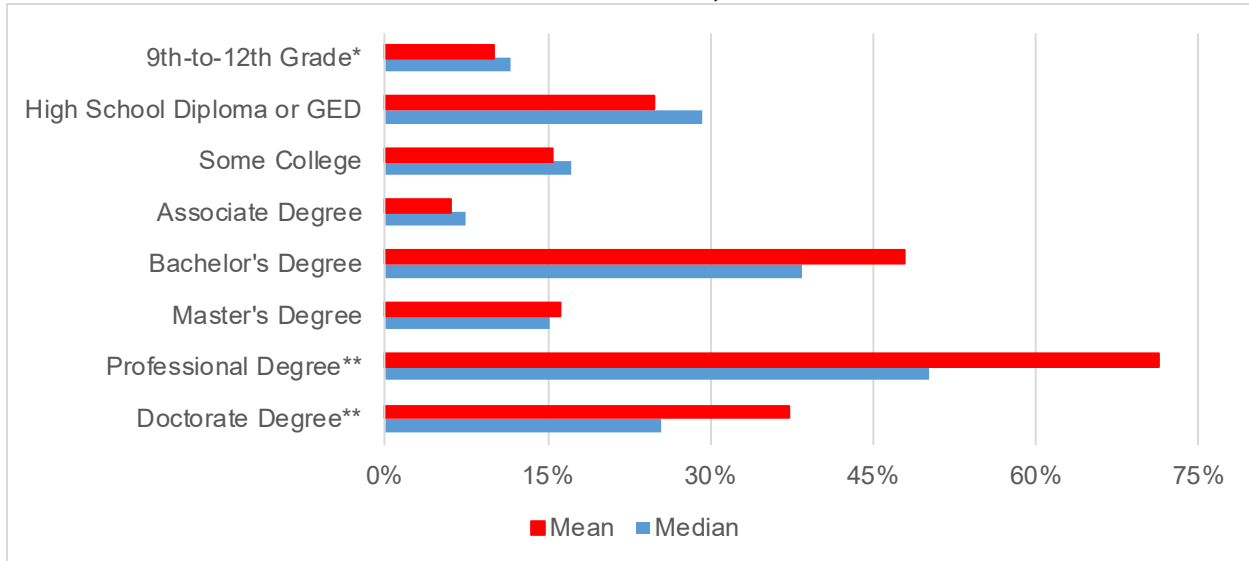
Earnings also increase with age, though primarily only through age 44, as seen in Chart 8. In Chart 9, median earnings by age group and educational attainment are shown.

CHART 6
EARNINGS BY EDUCATIONAL ATTAINMENT AMONG THOSE 25-TO-64 YEARS OF AGE WORKING FULL-TIME AND YEAR-ROUND, UNITED STATES, 2018



Source: Calculated from U.S. Department of Commerce, Census Bureau, Current Population Survey.

CHART 7
PERCENTAGE INCREASE IN EARNINGS FROM ONE EDUCATIONAL ATTAINMENT CATEGORY TO THE NEXT CATEGORY AMONG THOSE 35-TO-44 YEARS OF AGE WORKING FULL-TIME AND YEAR-ROUND, UNITED STATES, 2018



* Without a high school diploma or GED, compared to those whose maximum educational attainment is less than ninth grade.

** Compared to master's degree.

Source: Calculated from U.S. Department of Commerce, Census Bureau, Current Population Survey.

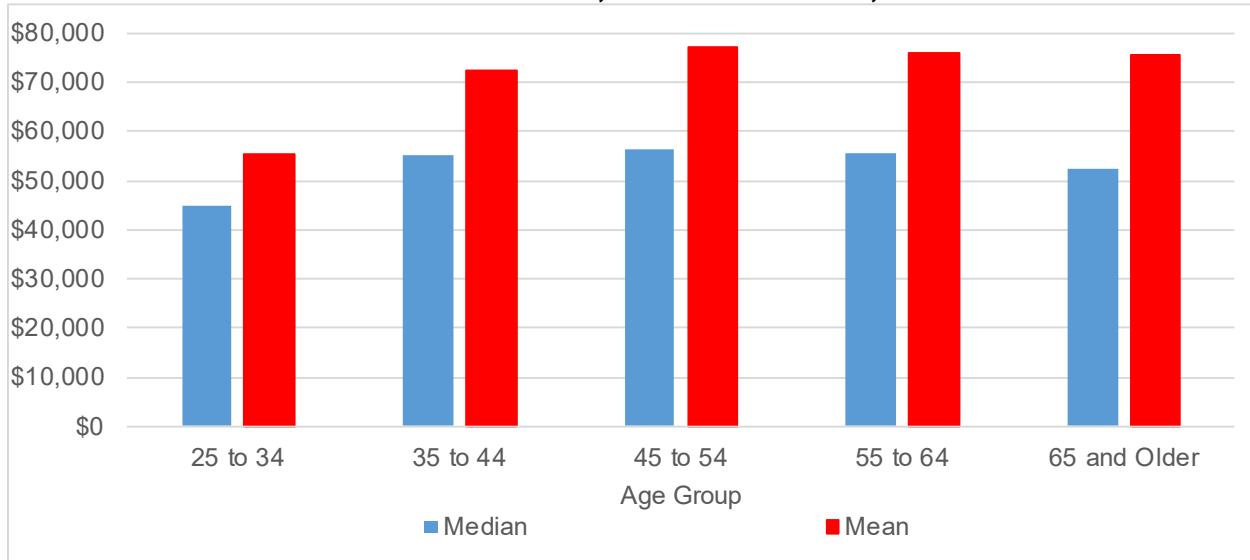
In addition to the earnings data, the CPS also provides the workforce participation rate by age group and level of degree (see Chart 10). The participation rate, which increases with educational attainment, does not vary much between the ages of 25 and 54, particularly among those with a graduate degree. The rate lowers between the ages of 55 and 64, particularly among those with limited educational attainment, and drops significantly at age 65 and beyond, though not as quickly among those with graduate degrees.

Arizona Board of Regents

Each year, the Arizona Board of Regents (ABOR) reports the earnings of ASU graduates who are working in Arizona. No information is available for ASU graduates working outside Arizona.

The latest ABOR report is for earnings in 2018 for graduates from 1990 through 2018, by year of graduation. Bachelor's degree graduates are tallied separately from those with a graduate degree, but information is not available by level of graduate degree (master's, professional, and doctorate). In addition to the basic data from the ABOR report, median earnings are reported by the Classification of Instructional Programs (CIP), with five graduation years aggregated (the first from 1994 through 1998 and the last from 2014 through 2018).

**CHART 8
EARNINGS BY AGE GROUP AMONG THOSE WORKING FULL-TIME
AND YEAR-ROUND, UNITED STATES, 2018**



Source: Calculated from U.S. Department of Commerce, Census Bureau, Current Population Survey.

Since earnings vary by age, as seen in Charts 8 and 9, and since age is correlated to the year of graduation, considerable variation is seen in the median earnings of ASU graduate-degree holders by year of graduation (see Chart 11).

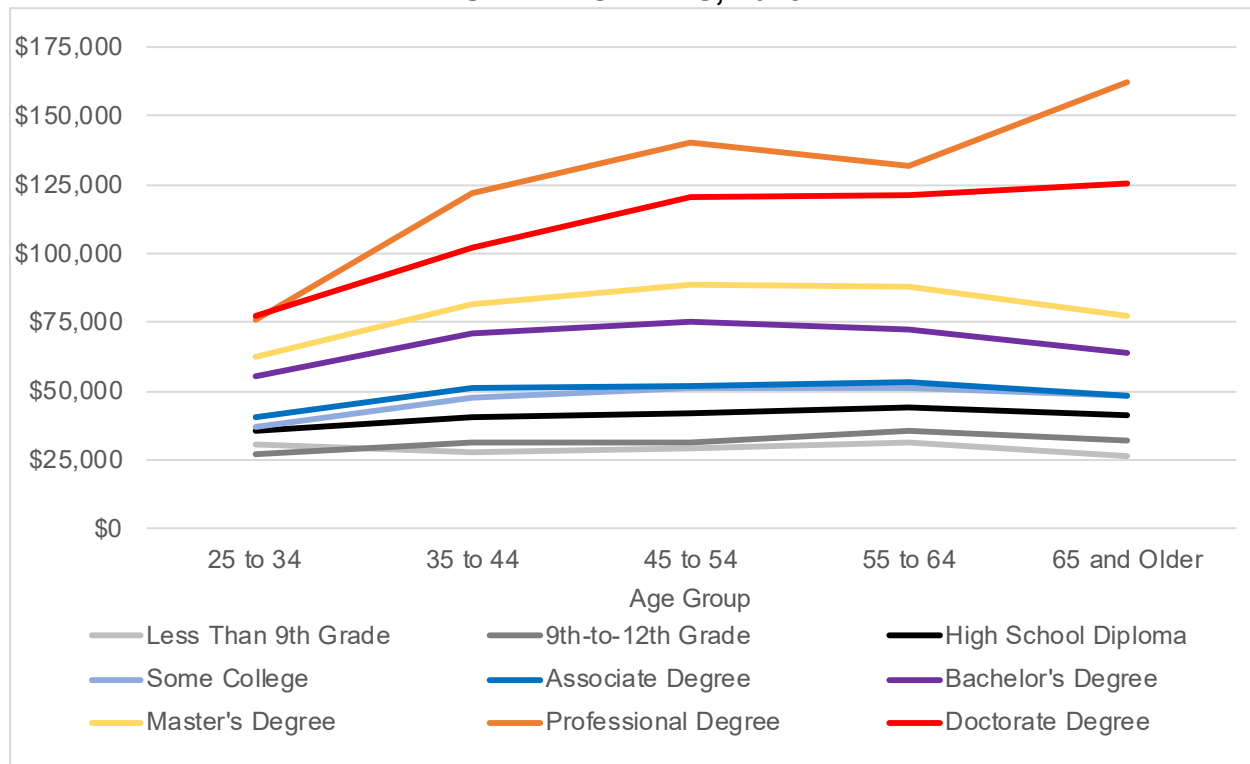
In most CIP categories and aggregations of graduation years, the number of individuals is small. The figures for graduates from 2014 through 2018, shown in Table 1, demonstrate the wide differential in earnings by CIP category.

American Community Survey

Descriptive data from the American Community Survey (ACS) specific to graduate-degree holders are provided in this subsection. The latest data are for 2018. The survey error from the ACS, though still substantial, is not as large as from the CPS, allowing state-level data to be analyzed.

Nationally, 12.6 percent of the 25-and-older population had earned a graduate degree in 2018. In Arizona, the proportion with a graduate degree was lower (11.2 percent). Arizona ranked 30th among the U.S. states and the District of Columbia. Arizona's proportion was less than the national figure for each type of graduate degree: 8.0-versus-9.0 percent for master's degrees, 1.8-versus-2.2 percent for professional degrees, and 1.3-versus-1.5 percent for doctorate degrees.

CHART 9
MEDIAN EARNINGS BY AGE GROUP AND EDUCATIONAL ATTAINMENT
AMONG THOSE WORKING FULL-TIME AND YEAR-ROUND,
UNITED STATES, 2018



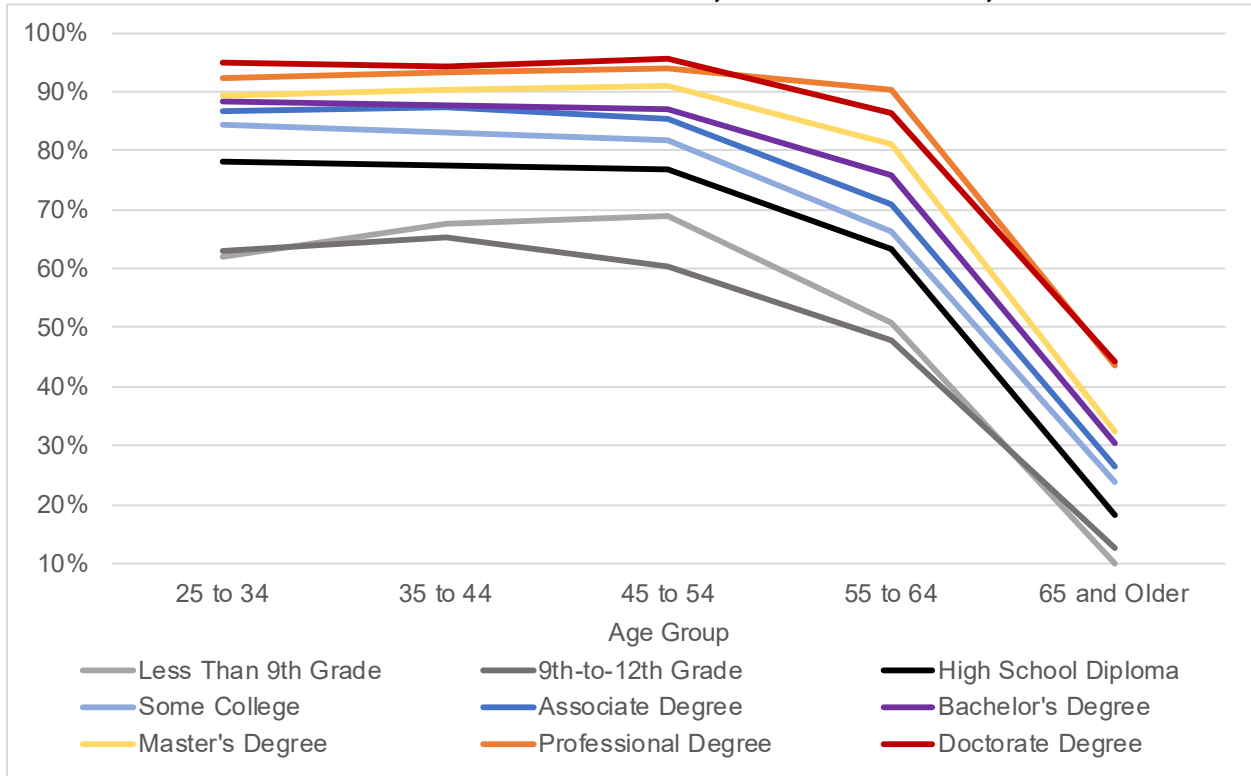
Source: Calculated from U.S. Department of Commerce, Census Bureau, Current Population Survey.

The ACS also provides median earnings of those 25 and older with earnings by educational attainment. All graduate degrees are combined. For the educational attainment categories that can be directly compared to the CPS categories, the median earnings for the nation from the ACS are less than from the CPS (by 10.9 percent overall, 12.5 percent for high school graduates, and 8.1 percent for those with a bachelor’s degree).

The median earnings figure of those with a graduate degree varies widely by state. In 2018, the highest figure was \$100,698 in the District of Columbia and the lowest figure was \$55,120 in West Virginia. Arizona’s median of \$65,573 was 8.9 percent less than the national average of \$72,492 and ranked 27th. The median earnings figure of those with a graduate degree are used to adjust the economic impacts of ASU graduate-degree holders for state of residence at the end of this paper.

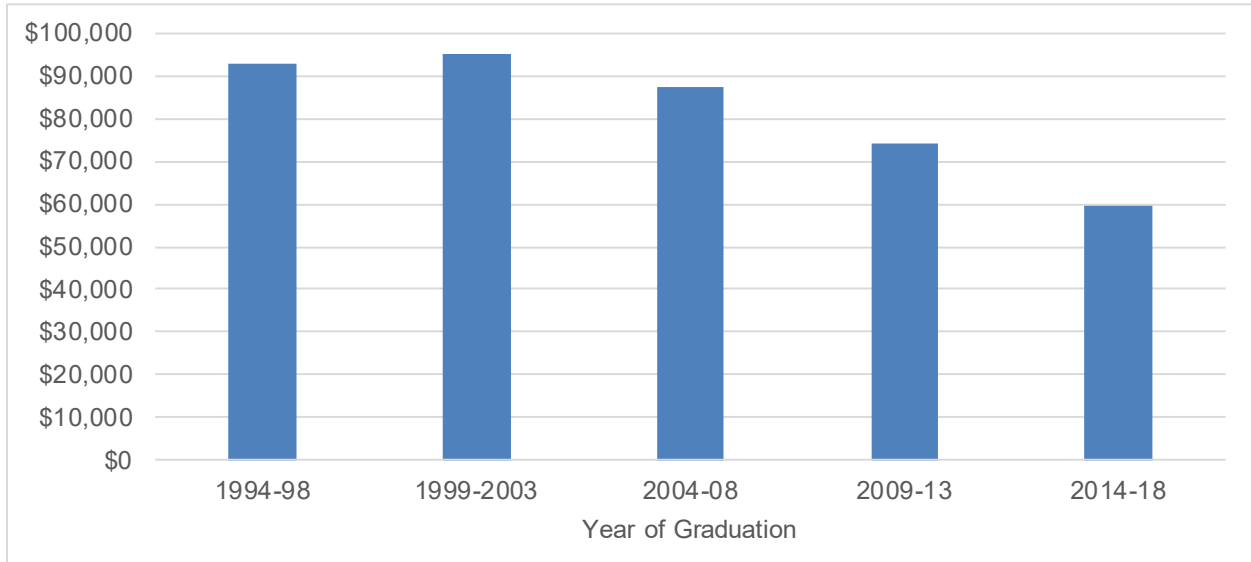
Adjusted for the cost of living using the latest (2017) Regional Price Parity estimates of the U.S. Department of Commerce, Bureau of Economic Analysis, the median earnings of Arizonans with a graduate degree was 5.5 percent less than the national average. Arizona ranked 30th.

**CHART 10
WORKFORCE PARTICIPATION RATE BY AGE GROUP
AND EDUCATIONAL ATTAINMENT, UNITED STATES, 2018**



Source: Calculated from U.S. Department of Commerce, Census Bureau, Current Population Survey.

CHART 11
MEDIAN EARNINGS OF ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS WHO WERE WORKING IN ARIZONA IN 2018



Source: Arizona Board of Regents.

TABLE 1
MEDIAN EARNINGS OF ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS WHO WERE WORKING IN ARIZONA IN 2018 BY CLASSIFICATION OF
INSTRUCTIONAL PROGRAMS, GRADUATES BETWEEN 2014 AND 2018 ONLY

	Number of Individuals	Median Earnings
Computer and Information Sciences & Support Services	329	\$91,343
Business, Management, Marketing, and Related Support	2,486	82,360
Engineering	1,753	81,688
Mathematics and Statistics	72	72,783
Health Professions and Related Clinical Sciences	1,129	71,047
Engineering Technologies/Technicians	168	66,683
Legal Professions and Studies	989	65,850
Psychology	208	59,560
University Total	13,567	59,545
Biological and Biomedical Sciences	199	57,926
Natural Resources and Conservation	125	57,858
Architecture and Related Services	264	56,252
Physical Sciences	79	55,442
Parks, Recreation, Leisure and Fitness Studies	59	52,597
Multi/Interdisciplinary Studies	175	51,403
Education	2,596	51,126
Security and Protective Services	336	50,813
Social Sciences	253	50,652
English Language and Literatures/Letters	117	49,956
Public Administration and Social Service Professions	1,514	49,252
Communication, Journalism, and Related Programs	204	49,064
History	64	47,549
Foreign Languages, Literatures, and Linguistics	60	47,276
Philosophy and Religious Studies	42	47,139
Liberal Arts and Sciences, General Studies & Humanities	141	43,375
Area, Ethnic, Cultural, and Gender Studies	21	43,322
Family and Consumer Sciences/Human Sciences	307	42,596
Visual and Performing Arts	361	33,779

Source: Arizona Board of Regents.

IMPACT OF ASU GRADUATE-DEGREE HOLDERS

The economic impact of ASU graduate-degree holders is expressed as aggregate earnings. An earnings figure was imputed for each individual, calculated as follows:

- The starting point was the overall mean earnings figure for the United States by level of degree from the CPS: \$87,570 for master’s degrees, \$150,215 for professional degrees, and \$125,331 for doctorates. These means are based on the earnings of all workers, not those working full-time and year-round.
- The starting earnings figure was adjusted for the age of the individual and the field of degree (CIP).
 - The age adjustment used CPS data for 10-year age groups, interpolating earnings by single year of age. Mean earnings by single year of age was expressed as a ratio to the overall mean by degree level.
 - The field-of-degree adjustment used the ABOR data by CIP. In many of the CIP categories, the number of individuals who earned a degree over a five-year period and were working in Arizona in 2018 was too small to produce a reasonable median earnings figure. For example, across the five five-year aggregations of graduation dates, the median for the physical sciences category ranged from 93-to-130 percent of the overall median. To produce more reliable figures by CIP, a weighted earnings figure was calculated for the entire 1994-through-2018 period for each CIP category. Median earnings by CIP was expressed as a ratio to the overall median.²
- The earnings figure for each individual was calculated as the mean by level of degree times the factor for age times the factor for the field of degree.
- In order to tally the total impact over all 142,328 individuals, the earnings figure by individual was further adjusted for workforce participation using the CPS data on workforce participation by age and degree level. Workforce participation by single year of age was estimated, using a combination of interpolated values from the 10-year age groups and workforce participation rates by single year of age for the nation calculated from the ACS PUMS (public use microdata sample).

Economic Impact

The total worldwide earnings of ASU graduate-degree holders as of March 2020 based on 2018 earnings data is estimated at \$11.5 billion. The aggregate total can be calculated for subgroups based on any of the fields available in the alumni database. Detail is provided below by region of residence and by year of graduation of ASU graduate-degree holders.

By Region of Residence

A breakout of the impact of ASU graduate-degree holders by geographic region of residence is provided in Table 2. The number and their aggregate earnings vary substantially by region. Just more than half (50.3 percent) live in Arizona. Arizona’s share of aggregate earnings assuming

² The assignment of the CIP category to an individual was based on a combination of the diploma, academic plan description, and school. In some cases, judgment had to be used in selecting the CIP category. For those who graduated prior to 1980, the academic plan description is nearly always missing from the alumni database. If the nature of the degree was not available, the field-of-degree factor was assumed to be 1 for Doctor of Philosophy and Master of Science degrees and 0.9 for Master of Arts degrees.

TABLE 2
EARNINGS OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY PLACE OF RESIDENCE

Place of Residence	Number Living	Aggregate Earnings in Millions		Share Working	Average Earnings	Average Age
		Assuming 100% Workforce Participation	Adjusted for Workforce Participation			
TOTAL	142,328	\$14,034.5	\$11,516.6	82.1%	\$98,607	49.0
Arizona	71,521	6,871.0	5,604.0	81.6	96,070	49.2
Metropolitan Phoenix	64,553	6,299.2	5,178.1	82.2	97,582	48.6
Metropolitan Tucson	3,286	270.3	213.0	78.8	82,249	51.5
Balance of State	3,682	301.5	212.9	70.6	81,885	57.9
U.S. Regions:						
Balance of Mountain	8,248	791.8	625.8	79.0	96,004	51.9
Pacific	20,412	2,106.8	1,747.3	82.9	103,213	48.2
West North Central	3,220	304.1	247.4	81.4	94,430	50.5
West South Central	5,644	585.7	480.3	82.0	103,778	49.8
East North Central	5,719	553.5	461.2	83.3	96,791	47.4
East South Central	1,351	127.7	101.6	79.6	94,541	50.6
New England	2,050	202.7	170.7	84.2	98,882	47.4
Mid-Atlantic	4,119	400.9	341.8	85.3	97,337	46.2
South Atlantic	8,051	794.5	649.7	81.8	98,684	49.4
Other	307	31.4	27.3	86.9	102,233	45.3
Foreign	5,892	716.6	627.5	87.6	121,628	42.8
Unknown	5,794	547.7	432.1	78.9	94,521	54.1

Notes:

The number living is as of March 4, 2020.

The aggregate earnings estimates are based on 2018 data and reflect part-time employment by a portion of the graduates. Average earnings is calculated as aggregate earnings — assuming 100 percent workforce participation — divided by the number living.

The earnings figures of those living in other countries and of those of unknown location are based on the U.S. national average.

The U.S. regions, as defined by the U.S. Census Bureau, consist of the following:

Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.

Pacific: Alaska, California, Hawaii, Oregon and Washington.

West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota.

West South Central: Arkansas, Louisiana, Oklahoma and Texas.

East North Central: Illinois, Indiana, Michigan, Ohio and Wisconsin.

East South Central: Alabama, Kentucky, Tennessee and Mississippi.

New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

Mid-Atlantic: New Jersey, New York and Pennsylvania.

South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia and West Virginia.

Other: U.S. territories and military personnel stationed overseas.

Source: Calculated by authors.

100 percent workforce participation is somewhat less (49.0 percent) since average earnings in Arizona is 2.6 percent less than the total. Since all of the figures are based on national earnings data, the variation in average earnings across the regions reflects differences by region in the age distribution, the degree level, and the field of degree of ASU graduate-degree holders. No adjustment is made in this table for geographic variations in earnings or the cost of living.

Arizona's share of the aggregate earnings of ASU graduate-degree holders adjusted for workforce participation is a bit lower (48.7 percent) since the workforce participation rate of those living in Arizona (81.6 percent) is a little less than the total of all ASU graduate-degree holders of 82.1 percent. The variation in the workforce participation rates across the regions reflects differences by region in the age distribution and the degree level of ASU graduate-degree holders. No adjustment is made for geographic variations in workforce participation rates by age.

In Table 3, the information presented in Table 2 is displayed by level of degree. Overall and by degree level, average earnings, the share working, and the average age generally are within 5 percent of the overall total by region. Table 4 provides two ways of evaluating the impact of ASU graduate-degree holders on regions in the United States: per capita earnings and the total number of graduates per 1 million residents. A summary of ASU graduate-degree holders by region follows.

Arizona and Its Subregions. Compared to all ASU graduate-degree holders, a disproportionately high share of individuals living in Arizona have a juris doctor degree. This is offset by a disproportionately low share with a doctorate. (A very low proportion of those earning a doctorate who enter academia likely remain in Arizona.) The average earnings of those living in Arizona is below the average of all ASU graduate-degree holders, primarily among those with doctorates and master's degrees.

Within Arizona, 90.3 percent of ASU graduate-degree holders live in Metro Phoenix, compared to just more than two-thirds of all Arizonans living in Metro Phoenix. The statistics for Metro Phoenix — average earnings, percentage working, and average age — are in line with the overall total and with most regions. In contrast, in Metro Tucson and especially in the balance of the state, ASU graduate-degree holders on average are older, with lesser earnings and a lower share working. Thus, a disproportionate share (92.3 percent) of the state's aggregate earnings of ASU graduate-degree holders come from those living in Metro Phoenix.

Per capita earnings and the total number of graduates per 1 million residents are far higher in Arizona, especially in Metro Phoenix, than in any other U.S. region.

Foreign. The earnings of those living in other countries is based on U.S. averages. For countries such as China and India, use of the U.S. figures likely result in an overstatement of earnings. For other countries, such as Canada and Japan, the U.S. figures likely introduce little error.

Overall, just more than 4 percent of the individuals in the alumni database live in another country. Few of these individuals hold a juris doctor degree. The average earnings of those living in other countries is relatively high, due to two factors. First, only 6.1 percent of the individuals are 65 and older, compared to 21.2 percent of all ASU graduate-degree holders. Second, a much

**TABLE 3
EARNINGS OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY PLACE OF RESIDENCE AND DEGREE LEVEL**

Place of Residence	Number Living	DOCTORATE DEGREES Aggregate Earnings in Millions		Share Working	Average Earnings	Average Age
		Assuming 100% Workforce Participation	Adjusted for Workforce Participation			
TOTAL	15,346	\$1,981.4	\$1,633.5	82.4%	\$129,120	52.6
Arizona	6,028	735.4	607.4	82.6	121,997	51.6
Metropolitan Phoenix	5,491	671.6	560.8	83.5	122,304	50.8
Metropolitan Tucson	238	30.6	24.1	78.7	128,639	56.0
Balance of State	299	33.2	22.6	67.9	111,064	62.3
U.S. Regions:						
Balance of Mountain Pacific	1,114	138.8	107.5	77.5	124,631	56.0
West North Central	2,471	341.8	283.0	82.8	138,320	53.0
West South Central	460	56.6	46.0	81.3	123,023	53.7
East North Central	789	105.0	83.7	79.7	133,048	55.1
East South Central	774	98.8	82.9	83.8	127,703	51.6
New England	246	30.7	24.5	79.9	124,789	53.8
Mid-Atlantic	321	41.4	35.2	85.1	129,103	50.3
South Atlantic	603	78.8	68.4	86.9	130,653	50.0
Other	1,164	154.0	125.2	81.3	132,301	53.8
Foreign	40	5.3	4.6	88.3	131,317	50.1
Unknown	638	102.6	90.9	88.6	160,808	50.7
	698	92.6	74.0	79.9	132,619	54.3

Place of Residence	Number Living	JURIS DOCTOR DEGREES Aggregate Earnings in Millions		Share Working	Average Earnings	Average Age
		Assuming 100% Workforce Participation	Adjusted for Workforce Participation			
TOTAL	7,385	\$1,335.9	\$1,113.7	83.4%	\$180,887	50.0
Arizona	5,065	911.0	757.2	83.1	179,866	50.0
Metropolitan Phoenix	4,629	832.7	697.5	83.8	179,889	49.5
Metropolitan Tucson	129	23.3	19.5	83.7	180,798	49.8
Balance of State	307	55.0	40.2	73.2	179,125	56.8
U.S. Regions:						
Balance of Mountain Pacific	428	79.4	64.1	80.7	185,573	52.6
West North Central	776	140.3	118.0	84.1	180,738	49.4
West South Central	95	17.8	15.0	84.5	187,058	50.8
East North Central	156	29.1	25.4	87.2	186,684	48.1
East South Central	184	33.3	28.2	84.7	180,823	48.9
New England	35	6.6	5.2	78.5	187,637	56.9
Mid-Atlantic	45	8.6	7.3	85.5	190,326	52.0
South Atlantic	113	20.4	18.1	88.3	180,931	46.0
Other	294	54.5	45.7	83.8	185,378	51.0
Foreign	16	3.2	2.8	86.8	201,308	51.8
Unknown	20	3.8	3.2	84.1	189,435	50.7
	158	27.9	23.6	84.7	176,578	46.6

(continued)

TABLE 3 (continued)
EARNINGS OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY PLACE OF RESIDENCE AND DEGREE LEVEL

Place of Residence	Number Living	MASTER'S DEGREES Aggregate Earnings in Millions		Share Working	Average Earnings	Average Age
		Assuming 100% Workforce Participation	Adjusted for Workforce Participation			
TOTAL	119,597	\$10,717.2	\$8,769.4	81.8%	\$89,611	48.5
Arizona	60,428	5,224.5	4,239.2	81.1	86,458	48.9
Metropolitan Phoenix	54,433	4,795.0	3,919.9	81.7	88,089	48.3
Metropolitan Tucson	2,919	216.3	169.3	78.3	74,111	51.2
Balance of State	3,076	213.3	150.1	70.4	69,344	57.6
U.S. Regions:						
Balance of Mountain	6,706	573.6	454.2	79.2	85,532	51.2
Pacific	17,165	1,624.7	1,346.3	82.9	94,654	47.5
West North Central	2,665	230.0	186.3	81.0	86,314	50.0
West South Central	4,699	451.6	371.2	82.2	96,111	48.9
East North Central	4,761	421.4	350.2	83.1	88,518	46.7
East South Central	1,070	90.5	71.9	79.5	84,542	49.7
New England	1,684	152.7	128.1	83.9	90,678	46.7
Mid-Atlantic	3,403	301.7	255.3	84.6	88,658	45.4
South Atlantic	6,593	586.0	478.8	81.7	88,883	48.6
Other	251	22.9	19.8	86.6	91,282	44.0
Foreign	5,234	610.3	533.3	87.4	116,594	41.8
Unknown	4,938	427.2	334.5	78.3	64,794	54.4

Notes:

The number living is as of March 4, 2020.

The aggregate earnings estimates are based on 2018 data and reflect part-time employment by a portion of the graduates. Average earnings is calculated as aggregate earnings — assuming 100 percent workforce participation — divided by the number living.

The earnings figures of those living in other countries and of those of unknown location are based on the U.S. national average.

The U.S. regions, as defined by the U.S. Census Bureau, consist of the following:

Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.

Pacific: Alaska, California, Hawaii, Oregon and Washington.

West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota.

West South Central: Arkansas, Louisiana, Oklahoma and Texas.

East North Central: Illinois, Indiana, Michigan, Ohio and Wisconsin.

East South Central: Alabama, Kentucky, Tennessee and Mississippi.

New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

Mid-Atlantic: New Jersey, New York and Pennsylvania.

South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia and West Virginia.

Other: U.S. territories and military personnel stationed overseas.

Source: Calculated by authors.

TABLE 4
EARNINGS OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY PLACE OF RESIDENCE RELATIVE TO POPULATION

Place of Residence	Per Capita Earnings	Number of Graduates Per 1 Million Residents			
		Total	Doctorate	Profes- sional	Master's
Arizona	\$769.9	9,826	828	696	8,302
Metropolitan Phoenix	1,045.4	13,033	1,109	935	10,990
Metropolitan Tucson	202.7	3,128	227	123	2,779
Balance of State	166.9	2,887	234	241	2,412
U.S. Regions:					
Balance of Mountain	35.6	469	63	24	382
Pacific	32.7	382	46	15	321
West North Central	11.5	150	22	4	124
West South Central	11.8	139	19	4	116
East North Central	9.8	122	17	4	102
East South Central	5.3	71	13	2	56
New England	11.5	138	22	3	113
Mid-Atlantic	8.3	100	15	3	83
South Atlantic	9.9	122	18	5	100

Notes:

The number living is as of March 4, 2020.

The aggregate earnings estimates used to calculate per capita earnings are based on 2018 data and reflect part-time employment by a portion of the graduates.

The U.S. regions, as defined by the U.S. Census Bureau, consist of the following:

Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.

Pacific: Alaska, California, Hawaii, Oregon and Washington.

West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota.

West South Central: Arkansas, Louisiana, Oklahoma and Texas.

East North Central: Illinois, Indiana, Michigan, Ohio and Wisconsin.

East South Central: Alabama, Kentucky, Tennessee and Mississippi.

New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

Mid-Atlantic: New Jersey, New York and Pennsylvania.

South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia and West Virginia.

Other: U.S. territories and military personnel stationed overseas.

Source: Calculated by authors, using July 1, 2019 population estimates of the U.S. Department of Commerce, Census Bureau.

higher share of those living in other countries than of all ASU graduate-degree holders earned a degree in a high-paying field, including business, computer science, engineering, physical and biological sciences, and technology.

Unknown. This category consists of those ASU graduate-degree holders whose address is blank in the alumni database. Overall, just more than 4 percent of the individuals in the alumni database have an unknown address.

The average age among those with master's degrees is rather high, causing average earnings to be low. An examination of the age distribution of individuals with an unknown address reveals a high proportion of age 75 and older (21.2 percent versus 8.5 percent overall). Thus, some individuals with an unknown address may be deceased. As with those living in other countries, use of the U.S. earnings figures may not be appropriate for those with an unknown address.

ASU graduate-degree holders with an unknown address combined with those living in another country account for only 9.2 percent of the estimated overall \$11.5 billion impact. Thus, even if the impact of ASU graduate-degree holders with an unknown address and those living in another country are somewhat overstated, the effect on the overall estimate of \$11.5 billion is at most a few hundred million dollars.

Balance of Mountain Region. Other than Arizona, per capita earnings and the total number of graduates per 1 million residents are highest in the Mountain region. A relatively high share of the residents of the Mountain region hold a doctorate. The average age is relatively high in each of the degree levels, suggesting that along with much of Arizona, the Mountain region is a favored destination for ASU graduate-degree holders of retirement age.

Pacific Region. Other than Arizona and the balance of the Mountain region, per capita earnings and the total number of graduates per 1 million residents are highest in the Pacific region. Average earnings is above average among those with doctorates and master's degrees.

Other Regions. Per capita earnings and the total number of graduates per 1 million residents are much lower in each of the other regions than in the western part of the country. The figures are especially low in the East South Central region.

By Graduation Date

Aggregate earnings figures by graduation date are shown in Table 5. In the earlier graduation years, many ASU graduates have died, the workforce participation rate is low, and most of those still active in the workforce do not work full-time and year-round, greatly reducing average earnings. Among more recent graduates, the number of deaths is insignificant — the number living reflects the sizable increase in the number of graduate degrees earned by ASU students in recent years. Workforce participation rates are high and few work less than full-time and year-round, boosting average earnings. The lower average earnings of the most recent graduates are due to their younger age and fewer years of work experience.

TABLE 5
EARNINGS OF LIVING ARIZONA STATE UNIVERSITY GRADUATE-DEGREE
HOLDERS BY YEAR OF GRADUATION

Year of Graduation	Number Living	Aggregate Earnings in Millions		Share Working	Average Earnings	Average Age
		Assuming 100% Workforce Participation	Adjusted for Workforce Participation			
TOTAL	142,328	\$14,034.5	\$11,516.6	82.1%	\$98,607	49
Before 1955	113	2.5	0.0	0.3	22,262	95
1955-59	298	7.7	0.1	0.9	25,815	92
1960-64	926	33.4	1.4	4.2	36,144	87
1965-69	2,983	137.2	17.1	12.5	45,999	82
1970-74	5,888	373.0	94.6	25.4	63,345	77
1975-79	7,035	497.5	202.1	40.6	70,711	72
1980-84	6,363	567.0	329.1	58.1	89,107	68
1985-89	6,932	708.8	516.8	72.9	102,255	64
1990-94	9,378	1,046.8	846.8	80.9	111,625	60
1995-99	11,919	1,392.8	1,203.4	86.4	116,855	55
2000-04	13,946	1,684.5	1,495.5	88.8	120,787	50
2005-09	17,017	1,970.3	1,767.0	89.7	115,783	45
2010-14	23,497	2,437.8	2,201.9	90.3	103,748	39
2015-19	36,033	3,175.2	2,840.7	89.5	88,120	33

Notes:

The number living is as of March 4, 2020.

The aggregate earnings estimates are based on 2018 data and reflect part-time employment by a portion of the graduates. Average earnings is calculated as aggregate earnings — assuming 100 percent workforce participation — divided by the number living.

Source: Calculated by authors.

Fiscal Impact

In addition to an economic impact, a fiscal impact of ASU graduate-degree holders living in Arizona has been estimated. The fiscal impact is measured as the estimated taxes paid on earnings, expressed as the total impact on all state and local governments. Since the tax rate to apply is not known definitively, a range of tax payments is provided.

The latest ABOR report assumes an average tax rate of 7.1 percent, but this is based on a 2007 study conducted by the Government of the District of Columbia. More recent studies by that organization place the tax rate at between 8.4-and-8.6 percent for Arizonans with incomes of between \$50,000 and \$150,000.³

The Institute on Taxation and Economic Policy (ITEP) places the tax rate at 8.5 percent for Arizonans with an income between \$55,000 and \$96,400.⁴ The estimated mean earnings of ASU

³ “Tax Rates and Tax Burdens: A Nationwide Comparison,” <https://cfo.dc.gov/node/215912>.

⁴ “Who Pays? A Distributional Analysis of the Tax Systems in All 50 States,” October 2018, <https://itep.org/wp-content/uploads/whopays-ITEP-2018.pdf>.

graduate-degree holders living in Arizona of \$96,070 is near the top of this range. According to ITEP, the tax rate in the next-higher income bracket of \$96,400-to-189,900 is only 7.5 percent.

Based on the earnings figure of \$5,604 million and a tax rate of 7.1 percent, ASU graduate-degree holders living in Arizona paid \$397.9 million to Arizona state and local governments based only on their earnings. Using a tax rate of 8.5 percent, the figure is \$476.3 million.

In fiscal year 2017, the latest data, state government collected 56.75 percent of the state and local government taxes paid in Arizona.⁵ Based on the 7.1 percent tax rate, this amounts to \$225.8 million; based on an 8.5 percent rate, the figure is \$270.3 million.

Adjustment of Economic Impact by State of Residence

Based on data from the ACS, the median earnings of workforce participants with a graduate degree aged 25 and older vary considerably by state. Various factors, including geographic differences in the cost of living, cause this variation in earnings by state.

To account for this geographic variation, the imputed earnings figure for each individual in the alumni database living in the United States was adjusted by the ratio of median earnings of those with a graduate degree by state to the national average. Table 6 summarizes the impact of this adjustment.

Overall for the nation (excluding those living in U.S. territories and those stationed overseas), this adjustment lowers the impact of ASU graduate-degree holders by 2.6 percent (\$255 million). The effect of the adjustment varies widely by region, from an increase of 18.8 percent in the Pacific region to a decrease of 17.4 percent in the East South Central region. The impact of those living in Arizona is lowered by 8.9 percent with the adjustment.

⁵ U.S. Census Bureau, Annual Survey of State and Local Government Finances, <https://www.census.gov/programs-surveys/gov-finances.html>.

**TABLE 6
EFFECT OF ADJUSTING EARNINGS BY STATE**

Region	Aggregate Earnings in Millions Adjusted for Workforce Participation		Average Earnings		Percentage of Adjusted to Unadjusted
	Unadjusted	Adjusted	Unadjusted	Adjusted	
United States	\$10,430	\$10,175	\$97,739	\$95,211	97.4%
Arizona	5,604	5,105	96,070	87,519	91.1
Balance of Mountain Pacific	626	579	96,009	88,693	92.4
Pacific	1,747	2,077	103,213	122,613	118.8
West North Central	247	225	94,430	85,890	91.0
West South Central	480	461	103,778	99,409	95.8
East North Central	461	448	96,791	94,043	97.2
East South Central	102	84	94,541	78,117	82.6
New England	171	185	98,882	106,703	107.9
Mid-Atlantic	342	371	97,337	105,604	108.5
South Atlantic	650	640	98,684	96,990	98.3
Share of Nation:					
Arizona	53.7%	50.2%	98.3%	91.9%	
Balance of Mountain Pacific	6.0	5.7	98.2	93.2	
Pacific	16.8	20.4	105.6	128.8	
West North Central	2.4	2.2	96.6	90.2	
West South Central	4.6	4.5	106.2	104.4	
East North Central	4.4	4.4	99.0	98.8	
East South Central	1.0	0.8	96.7	82.0	
New England	1.6	1.8	101.2	112.1	
Mid-Atlantic	3.3	3.6	99.6	110.9	
South Atlantic	6.2	6.3	101.0	101.9	

Note: The United States includes only the 50 states and the District of Columbia.

Source: Calculated by authors, using 2018 median earnings of graduate-degree holders age 25 and older by state from the U.S. Department of Commerce, Census Bureau, American Community Survey.