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The economic impact of those attaining a graduate degree from Arizona State University

THE EARNINGS OF THOSE ATTAINING A GRADUATE DEGREE FROM ARIZONA STATE UNIVERSITY

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This analysis of the impact of those earning a graduate degree from Arizona State University uses two datasets:

- A dataset from the ASU Foundation of graduates of ASU who earned a graduate degree from 2013 through 2017.
- A dataset from the Arizona Board of Regents of all ASU graduates from 1990 through 2015 who worked in Arizona in 2015.

Various federal government data sources also are used, with 2016 data generally the most recent. The economic impact of those earning a graduate degree from ASU is measured as aggregate earnings and the fiscal impact is measured as aggregate state and local government taxes paid. For consistency and to reflect those graduating subsequent to the latest data, the earning figures are brought forward to 2018.

ASU FOUNDATION DATASET

This dataset includes all ASU graduates earning a master's or doctoral degree between 2013 and 2017. The fields in this dataset include the description of the degree (for example, master of arts), the major, and the school or college. Also included is the zip code of the current residence of the ASU graduate. Of key importance is that the ASU Foundation dataset provides no indication of the work status or earnings of the graduates. Thus, the economic impact of these individuals has to be estimated based on indirect data. Two methods are used. One method uses national data on earnings and workforce participation from the Current Population Survey (CPS) as a starting point; the latest CPS data are for 2016. The other method uses the same workforce participation estimates, but substitutes earnings data from the ABOR dataset for 2015.

Other fields are included in the ASU Foundation dataset but are not used in this analysis. A self-supplied job title is available for less than 7 percent of the graduates. The sex and race/ethnicity of the graduates also are not used, due to the much greater sampling error in the CPS for such small subsets of the population, as discussed on the next page.

Method 1

This method uses national data from the CPS to estimate the proportion of the graduates in the workforce and the earnings of those graduates who are working. The CPS provides workforce participation and earnings by age group and by maximum educational attainment. Three CPS educational attainment categories are relevant to this analysis: master's degree, professional degree (such as juris doctor), and doctorate. Workforce participation and earnings per worker vary by age, but the age of the ASU graduates is not known. For this analysis, it is assumed that those graduating from ASU with a graduate degree from 2013 through 2017 were between the ages of 25 and 34 in 2018. This assumption produces a conservative estimate of the earnings of ASU graduates since some graduates are older and have higher earnings. In addition, the workforce participation rate of the ASU graduates is assumed to be equal to those nationally between the ages of 25 and 34 who have earned a graduate degree.

Earnings per worker are available from the CPS for two groups: all workers and those working full-time and year-round. Since the former group includes part-time and/or seasonal workers, earnings per worker for this group is less than for those working full-time and year-round, while the number of workers is greater for the first group than the second group. The workforce status of the ASU graduates is unknown — not only whether the individual is working, but whether

they are working full-time and year-round. Thus, the CPS results for all workers are used in this analysis.

The CPS reports mean and median earnings per worker. 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 percentage of the population report very high earnings. The mean figure is used in this report since the goal is to provide an estimate of the aggregate impact of ASU graduates.

Sampling error is an issue when using CPS data, even data for the nation. As the entire population is increasingly subdivided, sampling error becomes increasingly significant. For example, for those between the ages of 25 and 34, sampling error is insignificant for the entire population, moderately large for those with a master’s degree and substantial for those who have earned a professional degree or a doctorate degree. Sampling error would be unacceptably large if these categories were further subdivided by sex and race/ethnicity.

Due to the sampling error, the results from the 2016 CPS for earnings and the workforce participation rate of those in the 25-to-34 age group are not directly used. Instead, the results for the six years of consistently reported data were examined. The 2016 CPS results were adjusted as follows:

- For each educational attainment category in each year, mean earnings and the workforce participation rate were calculated as ratios to the overall figures. No trend in the ratios can be discerned in the six years of data examined.
- The median ratio for the six years was multiplied by the overall 2016 mean earnings and workforce participation rate.

Overall Estimates

By educational attainment category, the adjusted earnings and workforce participation figures estimated from the CPS are applied to the number of graduates in the ASU Foundation dataset. The results for 2016 are presented in Table 1. Due to the various assumptions and the sampling error in the CPS, the figures in Table 1 (other than the number of graduates) must be viewed as estimates.

**TABLE 1
OVERALL ESTIMATE OF EARNINGS IN 2016 OF THOSE ATTAINING
A GRADUATE DEGREE FROM ARIZONA STATE UNIVERSITY
FROM 2013 THROUGH 2017**

	Master’s	Professional	Doctorate	Total
Number of Graduates	27,030	1,021	3,225	31,276
Percentage With Earnings	91%	91%	93%	91.2%
Number With Earnings	24,597	929	2,999	28,525
Mean Earnings Per Worker	\$65,200	\$95,400	\$81,100	\$67,855
Aggregate Earnings in Millions	\$1,603.7	\$88.6	\$243.2	\$1,935.6

Sources: ASU Foundation (number of graduates) and U.S. Department of Commerce, Census Bureau, Current Population Survey (percentage with earnings and mean earnings per worker).

Estimates by Place of Residence

A shortcoming of the estimates presented in Table 1 is that a highly disproportionate share of ASU graduates live and work in Arizona and that workers in Arizona have lower earnings than their counterparts in the rest of the country. To produce a better estimate, the ratio of earnings per worker in Arizona relative to the national average was estimated using data from the American Community Survey (ACS). For subnational areas, sampling error in the ACS is substantially smaller than in the CPS, though the magnitude of the ACS error still is significant. Because of this, the amount of detail offered in the ACS is limited. For earnings by age and educational attainment, the ACS data are limited to a single category for graduate degrees and to the population age 25 and older. Only the median is provided. As with the CPS data, a time series of the ACS is examined; consistent data are available for 2005 through 2016.

Median earnings per worker for all workers age 25 and older in Arizona in 2016 was 95 percent of the national average. This ratio is equal to the median ratio of 2005 through 2016. The lower median earnings per worker in Arizona is in part related to the state's below-average cost of living. After adjusting for the cost of living, median earnings per worker still is lower in Arizona than the nation; the disproportionate share of the Arizona workforce with limited educational attainment is a primary cause of the cost-of-living-adjusted shortfall.

For those with a graduate degree, the shortfall in median earnings per worker in Arizona relative to the nation was substantially larger: more than 11 percent in 2016 and 9 percent for the median of the 12 years. This differential is believed to be unrepresentative of younger workers with a graduate degree. Arizona has a disproportionate share of well-educated individuals who moved to the state upon retirement but who remain active in Arizona's workforce on a part-time or sporadic basis, thereby lowering the median earnings of the 25 and older population reported in the ACS. Therefore, the overall shortfall of 5 percent in median earnings per worker in Arizona relative to the nation is assumed to be representative of younger workers who have earned a graduate degree.

In order to determine the impact of ASU graduates living and working in Arizona separate from those living elsewhere, the zip codes in the ASU Foundation dataset were used to determine residence and presumably, place of work. Of those graduates in the ASU Foundation dataset for which the current residence is known, 59.8 percent were in Arizona. The 9.4 percent of graduates for whom the current address is not known were assigned to Arizona in the same proportion. Workforce participation rates of those with a graduate degree are assumed to be the same in Arizona as elsewhere.

In Table 2, the results are shown separately for Arizona residents and others. While 59.8 percent of the graduates lived in Arizona in 2017, they accounted for 58.8 percent of aggregate earnings due to lower earnings per worker in Arizona. Total aggregate earnings in 2016 of \$1,877.5 million as calculated in Table 2 is a little less than the more simplistically estimated figure of \$1,935.6 million in Table 1.

TABLE 2
ESTIMATE OF EARNINGS IN 2016 OF THOSE GRADUATING FROM
ARIZONA STATE UNIVERSITY WITH A GRADUATE DEGREE
BETWEEN 2013 AND 2017, BY PLACE OF RESIDENCE IN 2017

	Master's	Professional	Doctorate	Total
Number of Graduates	27,030	1,021	3,225	31,276
Percentage With Earnings	91%	91%	93%	91.2%
Number With Earnings	24,597	929	2,999	28,525
Share of Workers in Arizona	59.3%	79.8%	57.5%	59.8%
Arizona Residents:				
Number With Earnings	14,589	741	1,724	17,054
Mean Earnings Per Worker	\$61,940	\$90,630	\$77,045	\$64,888
Aggregate Earnings in Millions	\$903.6	\$67.2	\$132.8	\$1,103.6
Non-Arizona Residents:				
Number With Earnings	10,008	188	1,275	11,471
Mean Earnings Per Worker	\$65,200	\$95,400	\$81,100	\$67,279
Aggregate Earnings in Millions	\$652.5	\$17.9	\$103.4	\$773.9
Total:				
Number With Earnings	24,597	929	2,999	28,525
Mean Earnings Per Worker	\$63,266	\$91,595	\$78,769	\$65,819
Aggregate Earnings in Millions	\$1,556.2	\$85.1	\$236.2	\$1,877.5

Sources: ASU Foundation (number of graduates and percentage living in Arizona), U.S. Department of Commerce, Census Bureau, Current Population Survey (percentage with earnings and mean earnings per worker); and American Community Survey (comparison of earnings per worker in Arizona and nation).

Method 2

As part of the ABOR dataset, the number of individuals earning graduate degrees between 2011 and 2015, the number working in 2015, and the median wage in 2015 of those working are presented by two-digit code of the Classification of Instructional Programs (CIP). Those graduating with a graduate degree were assigned to one of 28 CIP categories. The categories with the largest number of graduates were business, education, and engineering.

In Method 2, the median wage by CIP category is cross-tabulated with the degree description, major, and college/school in the ASU Foundation's dataset, allowing an estimate of earnings to be assigned to each graduate. Since the median wage from the ABOR dataset is based only on those working in Arizona, the median wage in Arizona is divided by 0.95 to estimate the median wage of those not in Arizona. The earnings per worker estimate is the only difference from Method 1.

The results are tallied by place of residence in Table 3. Aggregate earnings from Method 2 is slightly lower than from Method 1, but the one-year difference in earnings (2015 earnings in Table 3 versus 2016 earnings in Table 2) accounts for much of the lower figure.

TABLE 3
EARNINGS IN 2015 OF THOSE GRADUATING FROM ARIZONA STATE UNIVERSITY WITH A GRADUATE DEGREE BETWEEN 2013 AND 2017 AND WORKING IN ARIZONA IN 2017

Number of Graduates	31,276
Percentage With Earnings	91.2%
Number With Earnings	28,525
Share of Workers in Arizona	59.8%
Arizona Residents:	
Number With Earnings	17,054
Mean Earnings Per Worker	\$63,706
Aggregate Earnings in Millions	\$1,086.4
Non-Arizona Residents:	
Number With Earnings	11,471
Mean Earnings Per Worker	\$64,068
Aggregate Earnings in Millions	\$734.9
Total:	
Number With Earnings	28,525
Mean Earnings Per Worker	\$63,851
Aggregate Earnings in Millions	\$1,821.4

Sources: ASU Foundation (number of graduates and percentage living in Arizona); U.S. Department of Commerce, Census Bureau, Current Population Survey (percentage with earnings); and Arizona Board of Regents (earnings per worker).

ABOR DATASET

The third method uses the ABOR dataset that includes those earning degrees from ASU since 1990. The methodology and results of an analysis of the entire dataset — those graduating with bachelor’s degrees as well as those with graduate degrees — are presented in the October 2016 paper “The Impact of Arizona State University Graduates Employed in Arizona in 2015” (<https://wpcarey.asu.edu/sites/default/files/valueasudegree10-16.pdf>).

Only those graduates employed in Arizona and covered by the unemployment insurance program are included in the ABOR dataset. In addition, only those who graduated since 1990 are included. In the 2016 paper, the results were presented in three categories:

- Only for those in the ABOR dataset.
- Those in the ABOR dataset plus an estimate for those graduating before 1990.
- Those in the ABOR dataset plus the estimate for graduates before 1990 plus an estimate for those working in Arizona not covered by the unemployment insurance program.

Table 4 provides the results for the overall total (the third category), but only for those earning a graduate degree. These figures are quite different from those in the earlier tables since Table 4 includes all alumni of ASU who earned a graduate degree. In addition, the figures in Table 4 are limited to those working in Arizona.

TABLE 4
EARNINGS IN 2015 OF THOSE GRADUATING FROM ARIZONA STATE UNIVERSITY WITH A GRADUATE DEGREE AND WORKING IN ARIZONA IN 2015

Number Working	53,660
Average Earnings Per Worker	\$72,288
Aggregate Earnings in Millions	\$3,879

Source: Calculated from “The Impact of Arizona State University Graduates Employed in Arizona in 2015,” October 2016, <https://wpcarey.asu.edu/sites/default/files/valueasudegree10-16.pdf>.

SUMMARY OF ECONOMIC AND FISCAL IMPACTS

The results of the three methods, all adjusted to 2018 dollars, are compared in Table 5. The adjustment used the actual inflation rate calculated from the gross domestic product implicit price deflator for 2016 (1.3 percent) and 2017 (1.8 percent) and a projection for 2018 (2.0 percent). The calculation of tax payments is made using two tax rates; see the October 2016 paper for details.

Methods 1 and 2 provide similar estimates of the economic and fiscal impacts of those graduating from ASU with a graduate degree between 2013 and 2017. Since Method 3 includes everyone who earned a graduate degree from ASU through 2015, the impacts are much larger.

TABLE 5
EARNINGS IN 2018 DOLLARS OF THOSE GRADUATING FROM ARIZONA STATE UNIVERSITY WITH A GRADUATE DEGREE

	Method (Values In Millions of Dollars)		
	1	2	3
Aggregate Earnings			
Total	\$1,949	\$1,916	\$-
Arizona	1,146	1,143	4,081
Other	803	773	-
Arizona Government Tax Payments			
Tax Rate of 7.15 Percent:			
State and Local Governments	81.9	81.7	292
State Government	48.7	48.6	174
Tax Rate of 8.2 Percent:			
State and Local Governments	93.9	93.7	335
State Government	55.9	55.8	199

Note: Estimates from Methods 1 and 2 were calculated using graduates from 2013 through 2017; Method 3 estimates were generated from all graduates through 2015.

Sources: Aggregate earnings from Tables 2 through 4 are inflated to 2018 based on the gross domestic product implicit price deflator from U.S. Department of Commerce, Bureau of Economic Analysis.