

# Carnegie Mellon University

## 2019 Economic Impact Update

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## 1 Introduction

This memorandum represents an update of key economic impact estimates from Econsult Solutions, Inc. 2017 economic impact study for Carnegie Mellon University (CMU). For your convenience, updated results are shown alongside the equivalent results from the previous study.

Economic impacts were estimated for three distinct geographies: Pittsburgh, the Pittsburgh 10-county region, and Pennsylvania.<sup>1</sup> Tax revenue impacts were estimated for both the City of Pittsburgh and the Commonwealth of Pennsylvania governments.

CMU's aggregate economic impact is the sum of its impact from four non-overlapping categories:

1. Annual operations
2. Capital investments
3. Student and visitor spending
4. Alumni wage premium

## 2 Impact from Annual Operations

CMU's most direct and consistent contribution to the economy is through its large and growing annual operations. Its ongoing operations and payroll to its employees support jobs and businesses within the city, regional, and state economies. CMU's current budget is about \$1.3 billion, 23 percent higher than the 2016 budget.<sup>2</sup> It directly employs 5,750 employees, up from 5,575 employees in FY 2016.

CMU's annual operating expenditures generate significant indirect and induced impacts to the city, region, and state. This is because goods and services are produced locally, while salaries are spent locally, and in both cases local businesses are supported. At larger and larger geographies, the economic impact increases because of the larger area in which spillover effects can occur. Thus, the overall economic impact of CMU's annual operations is the sum of its direct economic footprint plus the indirect and induced effects that that footprint creates. Based on the input-output model constructed, the direct expenditures for FY2020 within CMU generated approximately:

- \$1.46 billion in total output within the City of Pittsburgh, supporting over 8,150 direct, indirect, and induced jobs with \$847 million in earnings.
- \$2.31 billion in total output within the Pittsburgh region, supporting nearly 13,300 direct, indirect, and induced jobs with \$1.11 billion in earnings; and
- \$2.34 billion in total output within Pennsylvania, supporting nearly 13,390 direct, indirect, and induced jobs with \$1.12 billion in earnings.

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<sup>1</sup> The Pittsburgh region utilized in this memo is comprised of ten counties in Pennsylvania as defined and served by the Allegheny Conference on Community Development. These counties are: Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland.

<sup>2</sup> While CMU's budget is around \$1.3 billion, our model excludes certain expenditures, such as depreciation, interest, amortization, and direct expenditures that leave the geographic area. These expenditures do not circulate in the local or statewide economies and therefore do not create economic impact in the locations of interest.

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Table 1 - Annual Economic Impact of CMU's Operations as of FY 2020

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$1,057	\$1,068	\$1,076
Indirect and Induced Output (\$M)	\$407	\$1,244	\$1,267
<b>Total Output (\$M)</b>	<b>\$1,465</b>	<b>\$2,313</b>	<b>\$2,342</b>
<b>Employment</b>	<b>8,151</b>	<b>13,293</b>	<b>13,389</b>
<b>Employee Compensation (\$M)</b>	<b>\$847</b>	<b>\$1,114</b>	<b>\$1,118</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*Table 2 - Annual Economic Impact of CMU's Operations as of FY 2016

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$859	\$868	\$874
Indirect and Induced Output (\$M)	\$331	\$1,011	\$1,029
<b>Total Output (\$M)</b>	<b>\$1,190</b>	<b>\$1,879</b>	<b>\$1,903</b>
<b>Employment</b>	<b>7,610</b>	<b>12,410</b>	<b>12,500</b>
<b>Employee Compensation (\$M)</b>	<b>\$726</b>	<b>\$955</b>	<b>\$959</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

Although CMU is a non-profit entity, the fiscal impacts generated by its operating activity are substantial. Operating activities increase the Commonwealth's tax bases directly by employing faculty and staff members, which generates taxable income, and indirectly via spending by CMU's vendors and employees. It is estimated that ongoing operating activity by CMU generates approximately \$10.8 million in City tax revenue and an additional \$39.3 million in Commonwealth of Pennsylvania tax revenues.

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**Table 3 - Annual Tax Revenue Generation from CMU's Operations as of FY 2020**

<b>Tax Type</b>	<b>City of Pittsburgh<sup>3</sup></b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$10.04	\$25.84
Sales and Use Taxes (\$M)	\$0.33	\$10.83
Business Taxes (\$M)	\$0.40	\$2.59
<b>Total (\$M)</b>	<b>\$10.76</b>	<b>\$39.26</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

**Table 4 - Annual Tax Revenue Generation from CMU's Operations as of FY 2016**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$8.61	\$22.16
Sales and Use Taxes (\$M)	\$0.28	\$9.29
Business Taxes (\$M)	\$0.34	\$2.22
<b>Total (\$M)</b>	<b>\$9.22</b>	<b>\$33.66</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

### 3 Impact from Capital Investments

Capital investments, such as new construction, renovation, or major maintenance projects, represent one-time costs that support the University's mission and goals. Due to the lumpy nature of the construction outlays, it is helpful to analyze multiple years' worth of capital spending in order to smooth for peaks and valleys in spending. CMU's average annualized capital investment over the past five years is over \$152 million, which is up considerably as compared to the previous five-year period.

This local direct effect of capital spending results in additional indirect and induced spending that increases the total economic impact on the local economy. There can be additional one-time impacts when local engineering, architectural, technology, network, and security services are used, and from local purchases of fixtures and equipment. Based on the input-output model constructed for this analysis, annually over the last four years, the direct construction expenditures within CMU generated approximately:

- \$191 million in total output within the City of Pittsburgh, supporting nearly 1,300 direct, indirect, and induced jobs with \$83 million in earnings.
- \$284 million in total output within the Pittsburgh region, supporting about 1,800 direct, indirect, and induced jobs with \$116 million in earnings; and
- \$293 million in total output within Pennsylvania, supporting nearly 1,850 direct, indirect, and induced jobs with \$117 million in earnings.

<sup>3</sup> Local Sales and Use Taxes generated within the City Pittsburgh included in this figure are collected by Allegheny County

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**Table 5 - Annualized Economic Impact of CMU's Capital Investments from FY 2016 to FY 2020**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$145	\$145	\$145
Indirect and Induced Output (\$M)	\$46	\$139	\$148
<b>Total Output (\$M)</b>	<b>\$191</b>	<b>\$284</b>	<b>\$293</b>
<b>Employment</b>	<b>1,258</b>	<b>1,800</b>	<b>1,840</b>
<b>Employee Compensation (\$M)</b>	<b>\$83</b>	<b>\$116</b>	<b>\$117</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 6 - Annualized Economic Impact of CMU's Capital Investments as of FY 2016**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$100	\$100	\$100
Indirect and Induced Output (\$M)	\$32	\$96	\$102
<b>Total Output (\$M)</b>	<b>\$132</b>	<b>\$196</b>	<b>\$202</b>
<b>Employment</b>	<b>930</b>	<b>1,330</b>	<b>1,360</b>
<b>Employee Compensation (\$M)</b>	<b>\$57</b>	<b>\$80</b>	<b>\$81</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

Additional fiscal impact is generated for the state government during the construction period. Each year, the direct, indirect, and induced spending caused by CMU's capital investments generated approximately \$1.0 million in City tax revenues and an additional \$6.8 million in Commonwealth of Pennsylvania tax revenues.

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**Table 7 - Annualized Tax Revenue Generation from CMU's Capital Investments from FY 2016 to FY 2020**

<b>Tax Type</b>	<b>City of Pittsburgh<sup>4</sup></b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$0.68	\$3.50
Sales and Use Taxes (\$M)	\$0.16	\$2.64
Business Taxes (\$M)	\$0.20	\$0.64
<b>Total (\$M)</b>	<b>\$1.04</b>	<b>\$6.78</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 8 - Annualized Tax Revenue Generation from CMU's Capital Investments as of FY 2016**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$0.47	\$2.42
Sales and Use Taxes (\$M)	\$0.11	\$1.82
Business Taxes (\$M)	\$0.14	\$0.44
<b>Total (\$M)</b>	<b>\$0.72</b>	<b>\$4.68</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

## 4 Impact from Student and Visitor Spending

Over and above its own spending on operating activities and capital investments, CMU draws out-of-town spending into the city and region from students and visitors that would likely not occur without the school's presence. The largest category of ancillary spending is CMU students, who spend money in a variety of categories during their academic careers. Notably, enrollment at CMU has gone up 10 percent compared to 2016 enrollment; this increase in enrollment will translate to greater spending throughout the local economy. While student spending on tuition, on-campus living, and dining hall food is already reflected in CMU's operating budget, student spending on off-campus food, entertainment, transportation, and personal supplies represent injections of purchasing power into the regional economy.

Using information from CMU as well as national data on projected total costs for students, ESI has developed updated ancillary spending profiles for on-campus and off-campus students to determine the amount of spending within the local, regional, and statewide economies. Student and visitor spending at CMU are estimated to generate (see Table 9):

- \$131 million in total output within the City of Pittsburgh, supporting over 1,100 direct, indirect, and induced jobs with \$25 million in earnings.

<sup>4</sup> Local Sales and Use Taxes generated within the City Pittsburgh included in this figure are collected by Allegheny County.

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- \$189 million in total output within the Pittsburgh region, supporting over 1,500 direct, indirect, and induced jobs with \$42 million in earnings; and
- \$192 million in total output within Pennsylvania, supporting over 1,560 direct, indirect, and induced jobs with \$43 million in earnings.

**Table 9 - Annual Economic Impact of Ancillary Student and Visitor Spending as of FY 2020**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$111	\$124	\$124
Indirect and Induced Output (\$M)	\$20	\$64	\$68
<b>Total Output (\$M)</b>	<b>\$131</b>	<b>\$189</b>	<b>\$192</b>
<b>Employment</b>	<b>1,109</b>	<b>1,507</b>	<b>1,561</b>
<b>Employee Compensation (\$M)</b>	<b>\$25</b>	<b>\$42</b>	<b>\$43</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 10 - Annual Economic Impact of Ancillary Student and Visitor Spending as of FY 2016**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Output (\$M)	\$95	\$106	\$106
Indirect and Induced Output (\$M)	\$17	\$55	\$58
<b>Total Output (\$M)</b>	<b>\$112</b>	<b>\$161</b>	<b>\$164</b>
<b>Employment</b>	<b>1,030</b>	<b>1,400</b>	<b>1,450</b>
<b>Employee Compensation (\$M)</b>	<b>\$21</b>	<b>\$36</b>	<b>\$37</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

The economic impact of student and visitor spending results in additional tax revenue for the local and state governments. Each year, the direct, indirect, and induced spending caused by CMU's ancillary spending generates approximately \$470,000 in City tax revenues and an additional \$3.5 million in Commonwealth of Pennsylvania tax revenues (see Table 11).

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**Table 11 - Annual Tax Revenue Generation from Ancillary Spending by CMU Students and Visitors as of FY 2020**

<b>Tax Type</b>	<b>City of Pittsburgh<sup>5</sup></b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$0.21	\$1.23
Sales and Use Taxes (\$M)	\$0.12	\$1.82
Business Taxes (\$M)	\$0.14	\$0.45
<b>Total (\$M)</b>	<b>\$0.47</b>	<b>\$3.49</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 12 - Annual Tax Revenue Generation from Ancillary Spending by CMU Students and Visitors as of FY 2016**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$0.18	\$1.05
Sales and Use Taxes (\$M)	\$0.10	\$1.55
Business Taxes (\$M)	\$0.12	\$0.38
<b>Total (\$M)</b>	<b>\$0.40</b>	<b>\$2.98</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

## 5 Impact from Alumni Wage Premium

The link between educational attainment and earnings power is well-established. A wage premium associated with additional education is often conceptualized and calculated from the perspective of the student, who can compare the costs associated with various educational (or non-educational) options with the expected return. The following analysis utilizes this same framework to estimate the gain not to the student, but rather to the city, the region, and the state economies. Additional earnings attributable to CMU alumni are estimated, and translated into additional spending power within the local economy, which supports local employment and earnings.

Each year, the estimated increase in earnings generates significant economic impacts (see Table 13):

- \$58 million in total output within the City of Pittsburgh, supporting over 380 direct, indirect, and induced jobs with \$12 million in earnings.

<sup>5</sup> Local Sales and Use Taxes generated within the City Pittsburgh included in this figure are collected by Allegheny County.



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- \$335 million in total output within the Pittsburgh region, supporting over 2,260 direct, indirect, and induced jobs with \$100 million in earnings; and
- \$430 million in total output within Pennsylvania, supporting about 2,830 direct, indirect, and induced jobs with \$125 million in earnings.

**Table 13 - Annual Economic Impacts from the Wage Premium Associated with CMU Alumni as of FY 2020**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Wage Premium (\$M)	\$202	\$364	\$474
<b>Total Output (\$M)</b>	<b>\$58</b>	<b>\$335</b>	<b>\$430</b>
<b>Total Employment</b>	<b>381</b>	<b>2,264</b>	<b>2,830</b>
<b>Total Earnings (\$M)</b>	<b>\$12</b>	<b>\$100</b>	<b>\$125</b>

Source: Carnegie Mellon (2019), Econsult Solutions (2019)

**Table 14 - Annual Economic Impacts from the Wage Premium Associated with CMU Alumni as of FY 2016**

	City of Pittsburgh	Pittsburgh Region	State of Pennsylvania
Direct Wage Premium (\$M)	\$166	\$312	\$412
<b>Total Output (\$M)</b>	<b>\$48</b>	<b>\$287</b>	<b>\$374</b>
<b>Total Employment</b>	<b>340</b>	<b>2,110</b>	<b>2,680</b>
<b>Total Earnings (\$M)</b>	<b>\$10</b>	<b>\$86</b>	<b>\$109</b>

Source: Carnegie Mellon (2019), Econsult Solutions (2019)

Wage premiums attributable to degrees conferred by CMU generate additional tax revenues for the City of Pittsburgh and the Commonwealth of Pennsylvania. In particular, this activity translates into increased income tax revenue (due to increased earnings) and increased sales and business tax revenue (due to increased household spending). In aggregate, the economic activity attributable to wage premium effects generates an estimated \$1.87 million for City of Pittsburgh and \$22.58 million for the Commonwealth of Pennsylvania governments respectively.

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**Table 15 - Annual Tax Revenue Generation from the Wage Premium Associated with CMU as of FY 2020**

<b>Tax Type</b>	<b>City of Pittsburgh<sup>6</sup></b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$1.76	\$17.83
Sales and Use Taxes (\$M)	\$0.05	\$3.82
Business Taxes (\$M)	\$0.06	\$0.93
<b>Total (\$M)</b>	<b>\$1.87</b>	<b>\$22.58</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 16 - Annual Tax Revenue Generation from the Wage Premium Associated with CMU as of FY 2016**

<b>Tax Type</b>	<b>City of Pittsburgh</b>	<b>Commonwealth of Pennsylvania</b>
Personal Income Taxes (\$M)	\$1.45	\$15.49
Sales and Use Taxes (\$M)	\$0.04	\$3.32
Business Taxes (\$M)	\$0.05	\$0.81
<b>Total (\$M)</b>	<b>\$1.54</b>	<b>\$19.62</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*

## 6 Aggregate Annual Economic Impact

CMU contributes significantly to its local, regional, and state economies through its operations, capital investments, ancillary spending by students and visitors, and the wage premium of CMU alumni living and working in the region. These four impact categories can be summed to arrive at an aggregate annual economic and tax revenue impact for the university. Combined, CMU produces \$3.26 billion in economic impact for the state economy and supports over 19,600 direct, indirect, and induced jobs statewide. Ninety-six percent of those jobs are in the region and over half are in the City of Pittsburgh. Notably, CMU's statewide economic impact grew by about \$600 million between 2016 and 2020. This is a function of both organic growth of the university's operations, students and alumni spending, as well as a significant increase in major capital investments in recent years.

<sup>6</sup> Local Sales and Use Taxes generated within the City Pittsburgh included in this figure are collected by Allegheny County.

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**Table 17 - Summary of Annual CMU Economic Impacts within the City of Pittsburgh, Pittsburgh Region, and State of Pennsylvania as of FY 2020**

City of Pittsburgh	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$1,465	\$191	\$131	\$58	<b>\$1,845</b>
Employment (jobs)	8,151	1,258	1,109	381	<b>10,899</b>
Earnings (\$M)	\$847	\$83	\$25	\$12	<b>\$966</b>
Pittsburgh Region	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$2,313	\$284	\$189	\$335	<b>\$3,120</b>
Employment (jobs)	13,293	1,800	1,507	2,264	<b>18,863</b>
Earnings (\$M)	\$1,114	\$116	\$42	\$100	<b>\$1,372</b>
State of Pennsylvania	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$2,342	\$293	\$192	\$430	<b>\$3,257</b>
Employment (jobs)	13,389	1,840	1,561	2,830	<b>19,620</b>
Earnings (\$M)	\$1,118	\$117	\$43	\$125	<b>\$1,404</b>

Source: Carnegie Mellon (2019), Econsult Solutions (2019)

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**Table 18 - Summary of Annual CMU Economic Impacts within the City of Pittsburgh, Pittsburgh Region, and State of Pennsylvania as of FY 2016**

City of Pittsburgh	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$1,190	\$132	\$112	\$48	<b>\$1,482</b>
Employment (jobs)	7,610	930	1,030	340	<b>9,910</b>
Earnings (\$M)	\$726	\$57	\$21	\$10	<b>\$814</b>
Pittsburgh Region	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$1,879	\$196	\$161	\$287	<b>\$2,523</b>
Employment (jobs)	12,410	1,330	1,400	2,110	<b>17,250</b>
Earnings (\$M)	\$955	\$80	\$36	\$86	<b>\$1,157</b>
State of Pennsylvania	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Alumni Wage Premium	Annual Total
Total Output (\$M)	\$1,903	\$202	\$164	\$374	<b>\$2,653</b>
Employment (jobs)	12,500	1,360	1,450	2,680	<b>17,990</b>
Earnings (\$M)	\$959	\$81	\$36	\$109	<b>\$1,185</b>

Source: Carnegie Mellon (2019), Econsult Solutions (2019)

CMU's robust economic output helps to grow local and state tax bases, yielding significant fiscal impacts for the city and state governments. CMU economic impact generates a total of \$14.2 million for City of Pittsburgh and \$72.1 million for the Commonwealth of Pennsylvania. Between 2016 and 2018, the aggregate tax revenue generated by CMU increased by \$2.3 million and \$11.2 million to the City of Pittsburgh and Commonwealth of Pennsylvania respectively.

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**Table 19 - Summary of Annual CMU Tax Revenue Impacts to the City of Pittsburgh and State of Pennsylvania Governments as of FY 2020**

Jurisdiction	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Wage Premium and Talent Attraction	Annual Total
City of Pittsburgh (\$M)	\$10.76	\$1.04	\$0.47	\$1.87	<b>\$14.15</b>
Commonwealth of Pennsylvania (\$M)	\$39.26	\$6.78	\$3.49	\$22.58	<b>\$72.11</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)***Table 20 - Summary of Annual CMU Tax Revenue Impacts to the City of Pittsburgh and State of Pennsylvania Governments as of FY 2016**

Jurisdiction	Ongoing Operations	Capital Investments	Ancillary Student and Visitor Spending	Wage Premium and Talent Attraction	Annual Total
City of Pittsburgh (\$M)	\$9.22	\$0.72	\$0.40	\$1.54	<b>\$11.88</b>
Commonwealth of Pennsylvania (\$M)	\$33.66	\$4.68	\$2.98	\$19.62	<b>\$60.88</b>

*Source: Carnegie Mellon (2019), Econsult Solutions (2019)*