AMERICAN COLLEGE of EDUCATION®

Main Report

OCTOBER 2023

# The Economic Value of American College of Education

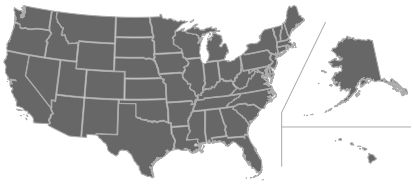
Lightcast

# Contents

# Executive summary

*This report assesses the impact of American College of Education (ACE) on the national economy and the benefits generated by the college for students, taxpayers, and society. The results of this study show that ACE creates a positive net impact on the national economy and generates a positive return on investment for students while generating significant benefits for taxpayers and society.*

# Impact on the national economy

The United States

As a result of studying at ACE, students gained new skills, making them more productive workers. Today, thousands of ACE's alumni are employed in the U.S. The productivity of ACE alumni generated **$587.7 million** in added income for the U.S. economy in calendar year (CY) 2022 (January 1, 2022 to December 31, 2022). This accumulated impact of former ACE students currently employed in the U.S. workforce is equivalent to supporting **9,786 jobs**.

American College of Education added **$587.7 million** to the U.S. economy in CY 2022.

### Important note

When reviewing the impacts estimated in this study, it is important to note that the study reports impacts in the form of added income rather than sales. Sales includes all of the intermediary costs associated with producing goods and services, as well as money that leaks out of the country as it is spent at out-of-country businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages and is synonymous with gross domestic product (GDP) and value added. For this reason, it is a more meaningful measure of new economic activity than sales.

# Investment analysis


Investment analysis is the practice of comparing the costs and benefits of an investment to determine whether or not it is profitable. This study evaluates ACE as an investment from the perspectives of students and society and measures the benefits received by taxpayers.

## Student perspective

Students invest their own money and time in their education to pay for tuition, digital library and resources. While attending ACE, nearly all students were fully employed. This analysis considers the foregone earnings some students would have generated had they not been pursuing a degree during the year. Summed across, these direct outlays and opportunity costs yields a total of **$82.9 million** in present value student costs.

In return, students will receive a present value of **$1.6 billion** in increased earnings over their working lives. This translates to a return of **$19.20** in higher future earnings for every dollar that students invest in their education at ACE. The corresponding annual rate of return is **120.7%**.

## Taxpayer perspective

ACE is a private college and receives little to no federal, state, or local government funding, yet American taxpayers still receive a significant amount of benefits from ACE. Since there is minimal taxpayer funding, we focus on the benefits

received by taxpayers. Taxpayers will receive an estimated present value of **$724.7 million** in added tax revenue stemming from the students' higher lifetime earnings and the increased output of organizations in the workforce. Savings to the public sector add another estimated **$218.7 million** in benefits due to a reduced demand for government-funded social services in the U.S. Throughout the students' working lives, taxpayers will receive a total of **$943.4 million**, the present value sum of the added tax revenues and public sector savings.

Taxpayers will receive a cumulative value of **$943.4 million** over the course of the students' working lives.

## Social perspective

Because of little to no taxpayer funding, ACE students themselves represent a key group of stakeholders investing in the college. Their direct expenses as well as opportunity costs amounted to **$82.9 million** in CY 2022. In return, the U.S. society as a whole will receive an estimated present value of **$2.5 billion** in added national revenue over the course of the students' working lives. The U.S. will also benefit from an estimated **$623.2 million** in present value social savings related to reduced crime, lower welfare and unemployment assistance, and increased health and well-being across the country. Throughout the students' working lives, the U.S. will receive a total of **$3.1 billion**, the present value sum of the added revenue and social savings. For every dollar society invests in ACE, an average of **$37.10** in benefits will accrue to society in the U.S. over the course of the students' careers.


## Acknowledgments

Lightcast gratefully acknowledges the excellent support of the staff at American College of Education in making this study possible. Special thanks go to Mr. Geordie Hyland, President and CEO, who approved the study, and to Jared Hughes, Director of Institutional Analytics; William Liu, Chief Marketing Officer; Bryce Petersen, Chief Financial Officer; and Paul Savory, VP of Continuous Improvement, who collected much of the data and information requested. Any errors in the report are the responsibility of Lightcast and not of any of the above-mentioned individuals.

# Introduction

American College of Education (ACE), established in 2005, has today grown to serve nearly 14,000 degree-seeking students. The college is led by Mr. Geordie Hyland, President and CEO. The college's service area, for the purpose of this report, is the United States (the U.S.) and consists of all 50 states and the District of Columbia.

While ACE affects the nation in a variety of ways, many of them difficult to quantify, this study considers the college's economic benefits. The college naturally helps students achieve their individual potential and develop the knowledge, skills, and abilities they need to have fulfilling and prosperous careers. However, ACE impacts the U.S. beyond influencing the lives of students. The college's program offerings supply employers with workers to make their organizations more productive. In addition, the benefits created by the college include such items as increased tax receipts and decreased public sector costs generated by students.

This report assesses the impact of ACE as a whole on the national economy and the benefits generated by the college for students, taxpayers, and society. The approach is twofold. We begin with an alumni impact analysis of the college on the U.S. economy. To derive results, we rely on a specialized Multi-Regional Social Accounting Matrix (MR-SAM) model to calculate the added income created in the U.S. economy as a result of increased consumer spending and the added knowledge, skills, and abilities of students. Results of the economic impact analysis demonstrate the impact of alumni who are still employed in the U.S. workforce.

> American College of Education impacts the U.S. beyond influencing the lives of students.

The second component of the study measures the benefits generated by ACE for the following stakeholder groups: students, taxpayers, and society. For students, we perform an investment analysis to determine how the money spent by students on their education performs as an investment over time. The students' investment, in this case, consists of their out-of-pocket expenses and the opportunity cost from attending the college. ACE students work full-time or part-time while pursuing educational career goals. In return for these investments, students receive a lifetime of higher earnings. For taxpayers, the study measures the benefits to taxpayers in the form of increased tax revenues and

public sector savings stemming from a reduced demand for social services. Finally, for society, the study assesses how the students' higher earnings and improved quality of life create benefits throughout the entire U.S.

The study uses a wide array of data that are based on several sources, including calendar year (CY) 2022 (January 1, 2022 to December 31, 2022) academic and financial reports from ACE; industry and employment data from the Bureau of Labor Statistics and Census Bureau; outputs of Lightcast's impact model and MR-SAM model; and a variety of published materials relating education to social behavior.

### Making education accessible

By keeping tuition amongst the lowest in the industry and purposely not participating in awarding federal Title IV funding (i.e., federal financial aid), ACE is an affordable option. With tuition rates remaining unchanged since 2016, more than 87% of ACE's students self-finance their education, avoiding the burden of debt.

Chapter 1:

# Profile of American College of Education and the economy

**AMERICAN COLLEGE OF EDUCATION** (ACE) is a fully online accredited private college and provides a wide range of relevant and well-regarded programs to undergraduate and graduate students. Since its founding in 2005, ACE has operated under the belief that it can provide both a quality and affordable education. Today, ACE has nearly 37,000 graduates with an ACE degree that are making a difference in their school districts, hospital groups, and communities. The college has a mission-driven focus of serving individuals with the training and skills for career advancement. In CY 2022, ACE served a student body of nearly 14,000 undergraduate and graduate students.

American College of Education is ranked number one in the nation for most master's degrees conferred in English as a Second Language and Bilingual Education, Educational Administration, and Health and Wellness Education, providing vital community educators.

ACE not only offers bachelor's completion degrees but also provides exceptional educational opportunities by offering affordable advanced degrees in Education, Healthcare, Nursing, and Business. ACE has expanded to offer full programs, certificates, and micro-credentials within each of its program focuses. Most recently, ACE launched the mission-driven Master of Public Health for working professionals. ACE partners with over 2,000 school districts, hospitals, businesses, and organizations to help students advance their career. Students benefit from these partnerships through Employer Grants, transfer-credit opportunities, and networking events.

ACE is also a vital asset to national employers as it is continuously ranked number one in the nation for most master's degrees conferred in English as a Second Language and Bilingual Education, Educational Administration, and Health and Wellness Education, providing vital community educators. The college adds highly-trained human capital to the national workforce.

# ACE employee and finance data


The study uses two general types of information: 1) data collected from the college, and 2) national economic data obtained from various public sources and Lightcast's proprietary data modeling tools.[1] This chapter presents the basic underlying information from ACE used in this analysis and provides an overview of the U.S. economy.

## Revenues

Figure 1.1 shows the college's annual revenues by funding source—a total of $49.8 million in CY 2022. As indicated, tuition and fees comprised 98% of total revenue. All other revenue (i.e., auxiliary revenue, sales and services, interest, and donations) comprised the remaining 2%. These data are critical in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

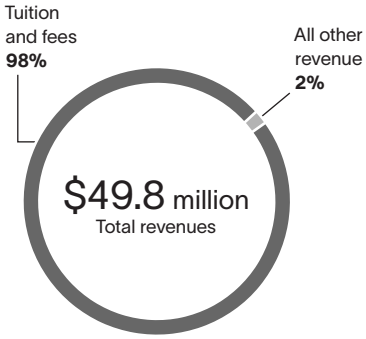
## Expenditures

Figure 1.2 displays ACE's expense data. The combined payroll at ACE amounted to $28.1 million. This was equal to 59% of the college's total expenses for CY 2022. Other expenditures, including depreciation and interest and purchases of supplies and services, made up $19.2 million.

## Students

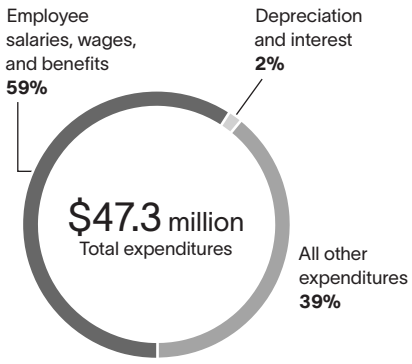
ACE served 13,764 degree-seeking students in CY 2022. These numbers represent unduplicated student headcounts. The breakdown of the student body by gender was

**Figure 1.1: American College of Education revenues by source, CY 2022**




Source: Data provided by ACE.

**Figure 1.2: American College of Education expenses by function, CY 2022**




Source: Data provided by ACE.

1 See Appendix 5 for a detailed description of the data sources used in the Lightcast modeling tools.

76% female and 24% male. The breakdown by ethnicity was 69% white, 26% students of color, and 5% unknown. The students' overall average age was 38 years old.[2] An estimated 96% of students remain in the U.S. after finishing their time at ACE and the remaining 4% settle outside the U.S.[3]

Table 1.1 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In CY 2022, ACE served 206 Ed.D. graduates, 3,632 master's degree graduates, 55 postbaccalaureate certificate graduates, 25 bachelor's degree graduates, and 233 certificate graduates. Another 9,613 students enrolled in courses for credit but did not complete a degree during the reporting year.

We use credits to track the educational workload of the students. The average number of credits per student was 12.4.

**Table 1.1: Breakdown of student headcount and credit production by education level, CY 2022**

| Category | Headcount | Total credits | Average credits |
|---|---|---|---|
| Ed.D. graduates | 206 | 1,464 | 7.1 |
| Master's degree graduates | 3,632 | 52,708 | 14.5 |
| Postbaccalaureate certificate graduates | 55 | 607 | 11.0 |
| Bachelor's degree graduates | 25 | 321 | 12.8 |
| Certificate graduates | 233 | 2,903 | 12.5 |
| Continuing students | 9,613 | 112,213 | 11.7 |
| **Total students** | **13,764** | **170,216** | **12.4** |

Source: Data provided by ACE.

2 Unduplicated headcount, gender, ethnicity, and age data provided by ACE.

3 Settlement data provided by ACE.

# The U.S. economy

Since ACE was first established, it has been enhancing the workforce, providing U.S. residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. Table 1.2 summarizes the breakdown of the national economy by major industrial sector ordered by total income, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the country's total income, which is the gross domestic product (GDP).

**Table 1.2: Income by major industry sector in the U.S., 2022***

| Industry sector | Labor income (millions) | Non-labor income (millions) | Total income (millions)** | % of total income | Sales (millions) |
|---|---|---|---|---|---|
| Manufacturing | $1,284,119 | $1,438,959 | $2,723,078 | 11% | $6,784,267 |
| Other Services (except Public Administration) | $553,620 | $2,090,349 | $2,643,969 | 11% | $3,489,733 |
| Finance & Insurance | $1,336,875 | $896,128 | $2,233,003 | 9% | $3,858,306 |
| Professional & Technical Services | $1,645,092 | $353,597 | $1,998,689 | 8% | $3,073,386 |
| Health Care & Social Assistance | $1,641,072 | $243,046 | $1,884,118 | 8% | $3,013,447 |
| Government, Non-Education | $1,358,981 | $479,609 | $1,838,590 | 7% | $10,640,172 |
| Wholesale Trade | $692,550 | $885,872 | $1,578,421 | 6% | $2,592,648 |
| Retail Trade | $853,755 | $583,101 | $1,436,855 | 6% | $2,447,792 |
| Information | $549,479 | $815,206 | $1,364,684 | 5% | $2,307,004 |
| Construction | $869,342 | $163,641 | $1,032,983 | 4% | $2,119,424 |
| Real Estate & Rental & Leasing | $583,136 | $344,202 | $927,338 | 4% | $2,144,811 |
| Administrative & Waste Services | $680,368 | $162,943 | $843,312 | 3% | $1,524,862 |
| Government, Education | $812,854 | $0 | $812,854 | 3% | $940,391 |
| Accommodation & Food Services | $461,656 | $323,651 | $785,307 | 3% | $1,498,224 |
| Transportation & Warehousing | $592,975 | $183,223 | $776,198 | 3% | $1,633,398 |
| Management of Companies & Enterprises | $459,369 | $35,839 | $495,208 | 2% | $807,543 |
| Utilities | $98,207 | $294,223 | $392,430 | 2% | $661,970 |
| Mining, Quarrying, & Oil and Gas Extraction | $94,621 | $262,227 | $356,848 | 1% | $668,202 |
| Educational Services | $253,125 | $32,945 | $286,070 | 1% | $410,831 |
| Arts, Entertainment, & Recreation | $173,738 | $79,460 | $253,198 | 1% | $394,746 |
| Agriculture, Forestry, Fishing & Hunting | $154,861 | $87,627 | $242,488 | 1% | $573,111 |
| **Total** | **$15,149,794** | **$9,755,847** | **$24,905,641** | **100%** | **$51,584,266** |

* Data reflect the most recent year for which data are available. Lightcast data are updated quarterly.

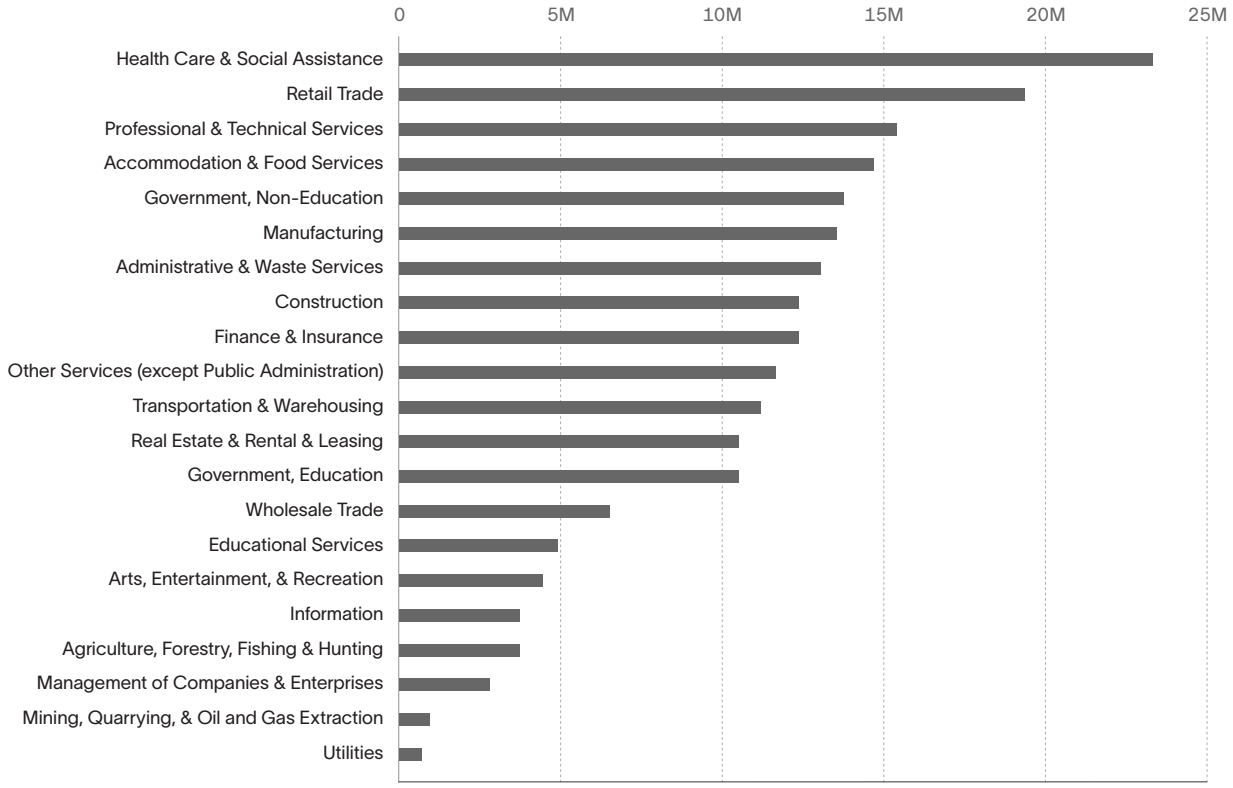
** Numbers may not sum to totals due to rounding.

Source: Lightcast industry data.

As shown in Table 1.2, the total income, or GDP, of the U.S. is approximately $24.9 trillion, equal to the sum of labor income ($15.1 trillion) and non-labor income ($9.8 trillion).

Figure 1.3 provides the breakdown of jobs by industry in the U.S. The Health Care & Social Assistance sector is the largest employer, supporting 23.3 million jobs or 11.1% of total employment in the nation. The second largest employer is the Retail Trade sector, supporting 19.4 million jobs or 9.3% of the nation's total employment. Altogether, the nation supports 209.3 million jobs.[4]

**Figure 1.3: Jobs by major industry sector in the U.S., 2022***




* Data reflect the most recent year for which data are available. Lightcast data are updated quarterly.

Source: Lightcast employment data.

4 Job numbers reflect Lightcast's complete employment data, which includes the following four job classes: 1) employees who are counted in the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW), 2) employees who are not covered by the federal unemployment insurance (UI) system and are thus excluded from QCEW, 3) self-employed workers, and 4) extended proprietors.

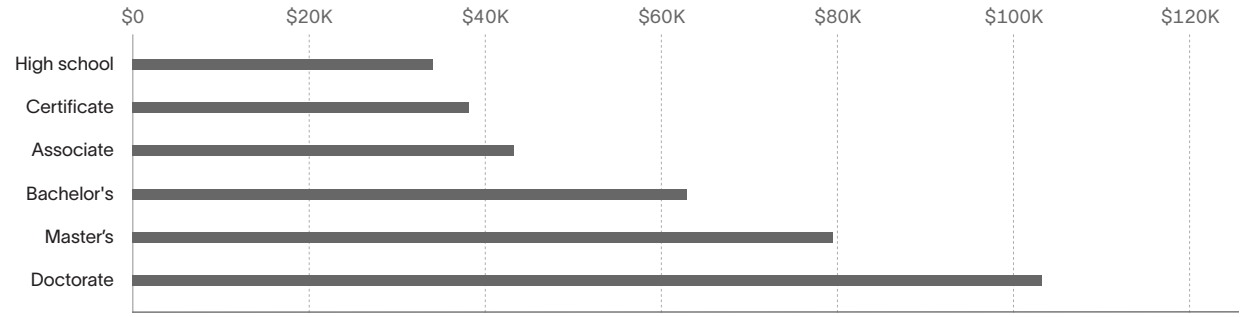
Table 1.3 and Figure 1.4 present the mean earnings by education level in the U.S. at the midpoint of the average-aged worker's career. These numbers are derived from Lightcast's complete employment data on average earnings per worker in the U.S.[5] The numbers are then weighted by the college's demographic profile. As shown, students have the potential to earn more as they achieve higher levels of education. Students who earn a master's degree from ACE can expect approximate wages of $79,100 per year within the U.S., approximately $16,200 more than someone with a bachelor's degree.

**Table 1.3: Average earnings by education level at the career midpoint for American College of Education students**

| Education level | U.S. earnings | Difference from next lowest degree |
|---|---|---|
| High school or equivalent | $34,000 | n/a |
| Certificate | $37,700 | $3,700 |
| Associate degree | $43,500 | $5,800 |
| Bachelor's degree | $62,900 | $19,400 |
| Master's degree | $79,100 | $16,200 |
| Doctoral degree | $102,700 | $23,600 |

Source: Lightcast employment data.

**Figure 1.4: Average earnings by education level at the career midpoint for American College of Education students**




Source: Lightcast employment data.

5 Wage rates in the Lightcast MR-SAM model combine state and federal sources to provide earnings that reflect complete employment, including proprietors, self-employed workers, and others not typically included in national data, as well as benefits and all forms of employer contributions. As such, Lightcast industry earnings-per-worker numbers are generally higher than those reported by other sources.

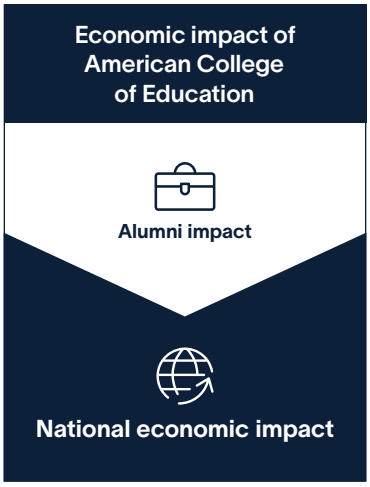
Chapter 2:

# Economic impact on the U.S. economy

*The greatest economic impact of ACE stems from the education and skills training that it provides to students. Since it was established, the college has educated students who have subsequently entered and re-entered the U.S. workforce. As the skills of these students accumulated, they expanded the stock of human capital, boosted the competitiveness of U.S. organizations, and enlarged the nation's overall output. The sum of these varied effects, measured in terms of added income, constitutes the total impact of ACE students on the national economy. As the number of ACE students employed in the nation increases, the impact that they collectively generate in the economy will continue to grow.*

**WHEN EXPLORING** economic impact—represented by alumni impact for the purposes of this study—we consider the following hypothetical question:

**How would economic activity change in the U.S. if American College of Education and all its alumni did not exist in CY 2022?**




The economic impact should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure net impacts, not gross impacts. Gross impacts represent an upper-bound estimate in terms of capturing all activity stemming from the college; however, net impacts reflect a truer measure of economic impact since they demonstrate what would not have existed in the national economy if not for the college.

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in income. This measure is similar to the commonly used gross domestic product (GDP). Income may be further broken out into the **labor income impact**, also known as earnings, which assesses the change in employee compensation; and the **non-labor income impact**, which assesses the change in business profits. Together, labor income and non-labor income sum to total income.

Another way to state the impact is in terms of **jobs**, a measure of the number of full- and part-time jobs that would be required to support the change in income. Finally, a frequently used measure is the **sales impact**, which comprises the change in business sales revenue in the economy as a result of increased economic activity. It is important to bear in mind, however, that much of this sales revenue leaves the national economy through intermediary transactions and costs.[6] All of these measures—added labor and non-labor income, total income, jobs, and sales—are used to estimate the economic impact results presented in this chapter. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

- The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses.
- The initial round of spending creates more spending in the economy, resulting in what is commonly known as the **multiplier effect**. The multiplier effect comprises the additional activity that occurs across all industries in the economy and may be further decomposed into the following three types of effects:

6 See Appendix 4 for an example of the intermediary costs included in the sales impact but not in the income impact.

- The **direct effect** refers to the additional economic activity that occurs as the industries affected by the initial effect spend money to purchase goods and services from their supply chain industries.
- The **indirect effect** occurs as the supply chain of the initial industries creates even more activity in the economy through their own inter-industry spending.
- The **induced effect** refers to the economic activity created by the household sector as the businesses affected by the initial, direct, and indirect effects raise salaries or hire more people.[7]

The terminology used to describe the economic effects listed above differs slightly from that of other commonly used input-output models, such as IMPLAN. For example, the initial effect in this study is called the "direct effect" by IMPLAN, as shown in the table below. Further, the term "indirect effect" as used by IMPLAN refers to the combined direct and indirect effects defined in this study. To avoid confusion, readers are encouraged to interpret the results presented in this chapter in the context of the terms and definitions listed above. Note that, regardless of the effects used to decompose the results, the total impact measures are analogous.

| **Lightcast** | Initial | Direct | Indirect |
|---|---|---|---|
| **IMPLAN** | Direct | Indirect | |

Multiplier effects in this analysis are derived using Lightcast's Multi-Regional Social Accounting Matrix (MR-SAM) input-output model that captures the interconnection of industries, government, and households in the U.S. The Lightcast MR-SAM contains approximately 1,000 industry sectors at the highest level of detail available in the North American Industry Classification System (NAICS) and supplies the industry-specific multipliers required to determine the impacts associated with increased activity within a given economy. For more information on the Lightcast MR-SAM model and its data sources, see Appendix 5.

**Net impacts** reflect a truer measure of economic impact since they demonstrate what would not have existed in the national economy if not for the college.

7 Many regional and state studies also include "induced effects" created by consumer spending. In national models, however, induced effects generally overstate impacts and are thus excluded from the analysis.

# Alumni impact

In this section, we estimate the economic impacts stemming from the added labor income of alumni in combination with their employers' added non-labor income. This impact is based on the number of students who have attended ACE *throughout its history.* We then use this total number to consider the impact of those students in CY 2022. Former students who earned a degree as well as those who may not have finished their degree are considered alumni.

> The greatest economic impact of American College of Education stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni.

ACE alumni create an economic impact from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—that they have developed. While attending ACE, students gain experience, education, and the knowledge, skills, and abilities that increase their productivity and allow them to command a higher wage once they enter the workforce. But the reward of increased productivity does not stop there. Talented professionals make capital more productive too (e.g., buildings, production facilities, equipment). The employers of ACE alumni enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits).

The initial effect of alumni is comprised of two main components. The first and largest of these is the added labor income of ACE's alumni. The second component of the initial effect is comprised of the added non-labor income of the organizations that employ ACE alumni.

We begin by estimating the portion of alumni who are employed in the workforce. To estimate the historical employment patterns of alumni in the nation, we use the following sets of data or assumptions: 1) settling-in factors to determine how long it takes the average student to settle into a career;[8] 2) death, retirement, and unemployment rates from the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics; and 3) migration data from the Internal Revenue Service.[9] The result is the estimated portion of alumni from each previous year who were still actively employed in the nation as of CY 2007.

The next step is to quantify the skills and human capital that alumni acquired from the college. We use the students' production of credits as a proxy for accumulated human capital. The average number of credits completed per student in CY 2022 was 12.4. To estimate the number of credits present in the workforce during the analysis year, we use the college's historical student headcount over the past 15 years, from CY 2007 to CY 2022. We apply a 15-year time horizon to include all alumni active in the national workforce who have not reached the average retirement age of 67.

We multiply the 12.4 average credits per student by the headcounts that we estimate are still actively employed from each of the previous years.[10] Students who enroll at the college more than one year are counted at least twice in the historical enrollment data. However, credits remain distinct regardless of when and by whom they were earned, so there is no duplication in the credit counts. We estimate there are approximately 1.2 million credits from alumni active in the workforce.

Next, we estimate the value of the credits, or the skills and human capital acquired by ACE alumni. This is done using the *incremental* added labor income stemming from the students' higher wages. The incremental added labor income is the difference between the wage earned by ACE alumni and the alternative wage they would have earned had they not attended ACE. Using the national incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average

### ACE graduate Jasmine Perry earns MSN while overcoming cancer

American College of Education graduate Jasmine Perry earned her Master of Science in Nursing in 2022. She was able to finish ACE's fully online RN to MSN program while working full time, being a busy mom to five kids and battling stage three cancer.

8 Settling-in factors are used to delay the onset of the benefits to students from the education gained during the year of analysis in order to allow time for them to find employment and settle into their advanced careers. In the absence of hard data, we assume two years for ACE graduate degree-seeking students.

9 According to a study performed by Pew Research Center, people who have already moved are more likely to move again than people who do not move. Therefore, migration rates are dampened to account for the idea that if they do not move in the first two years after leaving the college, then they are less likely to migrate out compared to the average person.

10 This assumes the average credit load and level of study from past years is equal to the credit load and level of study of students today.

gross value per credit to equal $348. This value represents the national average incremental increase in wages that alumni of ACE received during the analysis year for every credit they completed.

Because workforce experience leads to increased productivity and higher wages, the value per credit varies depending on the students' workforce experience, with the highest value applied to the credits of students who had been employed the longest by the CY 2022, and the lowest value per credit applied to students who were just entering the workforce. More information on the theory and calculations behind the value per credit appears in Appendix 6. In determining the amount of added labor income attributable to alumni, we multiply the credits of alumni in each year of the historical time horizon by the corresponding average value per credit for that year, and then sum the products together. This calculation yields approximately $435.2 million in gross labor income from increased wages received by alumni in CY 2022 (as shown in Table 2.1).

**Table 2.1: Number of credits in workforce and initial labor income created in the U.S., CY 2022**

| | |
|---|---|
| Number of credits in workforce | 1,248,981 |
| Average gross value per credit | $348 |
| **Initial labor income, gross** | **$435,163,933** |
| **Adjustment for counterfactual scenario** | |
| Percent reduction for alternative education opportunities | 5% |
| **Initial labor income, net** | **$413,405,736** |

Source: Lightcast impact model.

The next row in Table 2.1 shows an adjustment used to account for a counterfactual outcome. Counterfactual outcomes in economic analysis represent what would have happened if a given event had not occurred. The event in question is the education and training provided by ACE and subsequent influx of skilled labor into the U.S. economy. The counterfactual scenario that we address is the adjustment for alternative education opportunities. In the counterfactual scenario where ACE does not exist, we assume a portion of ACE alumni would have received a comparable education elsewhere in the U.S. or would have left the U.S. and received a comparable education and then returned to the U.S. The incremental added labor income that accrues to those students cannot be counted towards the added labor income from ACE alumni. The adjustment for alternative education opportunities amounts to a 5% reduction of the $435.2 million in added labor income. This means that 5% of the added labor income from ACE alumni would have been generated in the U.S. anyway, even if the college did not exist. For more information on the alternative education adjustment, see Appendix 7.

The $413.4 million in added labor income appears under the initial effect in the labor income column of Table 2.2. To this we add an estimate for initial non-labor income. Businesses that employ ACE alumni see higher profits as a result of the increased productivity of their capital assets. To estimate this additional income, we allocate the initial increase in labor income ($413.4 million) to the six-digit NAICS industry sectors where students are most likely to be employed. This allocation entails a process that

maps completers in the nation to the detailed occupations for which those completers have been trained, and then maps the detailed occupations to the six-digit industry sectors in the MR-SAM model.[11] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics, we map the breakdown of the college's completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from the MR-SAM model to map the occupational distribution of the $413.4 million in initial labor income effects to the detailed industry sectors in the MR-SAM model.[12]

Once these allocations are complete, we apply the ratio of non-labor to labor income provided by the MR-SAM model for each sector to our estimate of initial labor income. This computation yields an estimated $23.8 million in added non-labor income attributable to the college's alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the U.S. economy, equal to approximately $437.2 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix.


**Table 2.2: Alumni impact, CY 2022**

| | Labor income (thousands) | Non-labor income (thousands) | Total income (thousands) | Sales (thousands) | Jobs supported |
|---|---|---|---|---|---|
| **Initial effect** | **$413,406** | **$23,832** | **$437,238** | **$691,471** | **7,059** |
| **Multiplier effect** | | | | | |
| Direct effect | $77,024 | $7,267 | $84,292 | $137,846 | 1,520 |
| Indirect effect | $60,374 | $5,770 | $66,144 | $107,864 | 1,207 |
| **Total multiplier effect** | **$137,398** | **$13,037** | **$150,436** | **$245,710** | **2,727** |
| **Total impact (initial + multiplier)** | **$550,804** | **$36,869** | **$587,673** | **$937,181** | **9,786** |

Source: Lightcast impact model.

Table 2.2 shows the multiplier effects of alumni. Multiplier effects occur as alumni generate an increased demand for consumer goods and services through the expenditure of their higher wages. Further, as the industries where alumni are employed increase their output, there is a corresponding increase in the demand for input from the industries in the employers' supply chain. Together, the incomes generated by the expansions in business input purchases and household spending constitute the multiplier effect of the increased productivity of the college's alumni. The final results are $137.4 million in added labor income and $13 million in added non-labor income, for an overall total of $150.4 million in multiplier effects. The grand total of the alumni impact is $587.7 million in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 9,786 jobs.

11 Completer data comes from the Integrated Postsecondary Education Data System (IPEDS), which organizes program completions according to the Classification of Instructional Programs (CIP) developed by the National Center for Education Statistics (NCES).

12 For example, if the MR-SAM model indicates that 20% of jobs in SOC 51-4121 (Welders) occur in NAICS 332313 (Plate Work Manufacturing) in the given region, then we allocate 20% of the initial labor income effect under SOC 51-4121 to NAICS 332313.

Table 2.3 displays the alumni impact of ACE by each industry sector based on their two-digit NAICS code. The table shows the alumni impact broken down by each industry sector's individual impact on the national economy using processes outlined earlier in this chapter. By showing the impact from individual industry sectors, it is possible to see in finer detail the industries that drive the greatest impact on the national economy from the college's alumni productivity and from where ACE alumni are employed. For example, the ACE alumni in the Government, Education industry sector generated an impact of $154.6 million in CY 2022.

**Table 2.3: American College of Education impact by industry, CY 2022**

| Industry sector | Total income (thousands) | Jobs supported |
|---|---|---|
| Government, Education | $249,915 | 3,243 |
| Educational Services | $154,601 | 3,092 |
| Government, Non-Education | $97,773 | 1,112 |
| Health Care & Social Assistance | $43,567 | 1,329 |
| Other Services (except Public Administration) | $19,510 | 785 |
| Professional & Technical Services | $7,432 | 81 |
| Information | $3,981 | 14 |
| Arts, Entertainment, & Recreation | $3,743 | 63 |
| Administrative & Waste Services | $2,164 | 29 |
| Management of Companies & Enterprises | $1,678 | 10 |
| Finance & Insurance | $836 | 4 |
| Manufacturing | $475 | 3 |
| Wholesale Trade | $428 | 2 |
| Retail Trade | $407 | 7 |
| Construction | $292 | 4 |
| Transportation & Warehousing | $258 | 3 |
| Accommodation & Food Services | $181 | 3 |
| Utilities | $152 | <1 |
| Real Estate & Rental & Leasing | $150 | 1 |
| Agriculture, Forestry, Fishing, & Hunting | $100 | 2 |
| Mining, Quarrying, & Oil and Gas Extraction | $28 | <1 |
| **Total impact** | **$587,673** | **9,786** |

Source: Lightcast impact model.

## Breaking boundaries with education as a first-generation graduate

"Of all the institutions I researched, ACE provided a culture where I could thrive. I could rely on its flexibility, affordability and student-centered approach."

—Dr. Marissa Winmill, M.Ed. in Educational Leadership, Ed.D. in Leadership

Chapter 3:

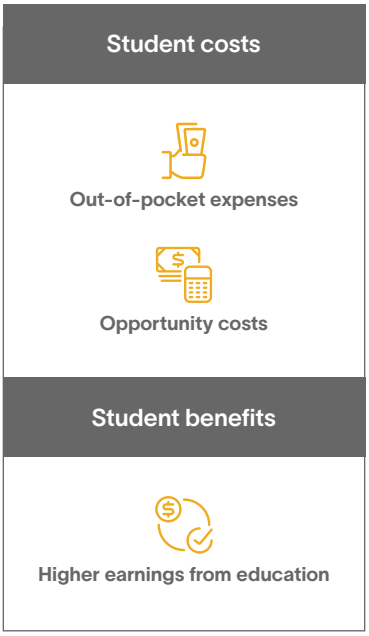
# Investment analysis

*The benefits generated by ACE affect the lives of many people. The most obvious beneficiaries are the college's students; they give up present day opportunities in terms of time and money to go to the college in return for a lifetime of higher wages and improved quality of life. But the benefits do not stop there. As students earn more, communities, and citizens throughout the U.S. benefit from an enlarged economy and a reduced demand for social services. In the form of increased tax revenues and public sector savings, the benefits of education extend as far as the local, state, or federal government.*

*Investment analysis is the process of evaluating total costs and measuring these against total benefits to determine whether or not a proposed venture will be profitable. If benefits outweigh costs, then the investment is worthwhile. If costs outweigh benefits, then the investment will lose money and is thus considered infeasible. In this chapter, we evaluate the return on investment for ACE students and the U.S. society and measure the benefits ACE provides to taxpayers.*

# Student perspective

To enroll in postsecondary education, students pay for tuition and forego monies that otherwise they would have earned had they chosen to work instead of attend college. From the perspective of students, education is the same as an investment; i.e., they incur a cost, or put up a certain amount of money, with the expectation of receiving benefits in return. The total costs consist of the tuition and fees that students pay and the opportunity cost of foregone time and money. The benefits are the higher earnings that students receive as a result of their education.




## Calculating student costs

Student costs consist of two main items: direct outlays and opportunity costs. Direct outlays include tuition and fees, equal to $49 million from Figure 1.1. Direct outlays also include the cost of access to digital library and resources. On average, full-time students spent $31 each on digital library and resources during the reporting year.[13] Multiplying this figure by the number of full-time equivalents (FTEs) produced by ACE in CY 2022[14] generates a total cost of $248 thousand for digital library and resources.

In addition to the cost of tuition, digital library and resources, students also experienced an opportunity cost of attending college during the analysis year. Opportunity cost is the most difficult component of student costs to estimate. It measures the value of time and earnings foregone by students who go to college rather than work. To calculate it, we need to know the difference between the students' full earning potential and what they actually earn while attending the college.

We derive the students' full earning potential by weighting the average annual earnings levels in Table 1.3 according to the education level breakdown of the student population at the start of the analysis year.[15] However, the earnings levels in Table 1.3 reflect what average workers earn at the midpoint of their careers, not while attending the college. Because of this, we adjust the earnings levels to the average age of the

13 Based on the data provided by ACE.

14 A single FTE is equal to 30 credits for undergraduate students and 24 credits for graduate students, so there were 6,130 FTEs produced by students in CY 2022, equal to 170,216 credits divided by the weighted average number of credits per student.

15 This is based on students who reported their prior level of education to ACE.

student population (38) to better reflect their wages at their current age.[16] This calculation yields an average full earning potential of $62,696 per student.

In determining how much students earn while enrolled in postsecondary education, an important factor to consider is the time that they actually spend on postsecondary education, since this is the only time that they are required to give up a portion of their earnings. We use the students' credit production as a proxy for time, under the assumption that the more credits students earn, the less time they have to work, and, consequently, the greater their foregone earnings. Overall, students attending ACE in CY 2022 earned an average of 12.4 credits per student, which is approximately equal to 51% of a full academic year.[17] We therefore do not include more than $31,947 (or 51%) of the students' full earning potential in the opportunity cost calculations.

Another factor to consider is the students' employment status while enrolled in postsecondary education. It is estimated that 98% of students are employed.[18] For the remainder of students, we assume that they are either seeking work or planning to seek work once they complete their educational goals. By choosing to enroll, therefore, non-working students give up everything that they can potentially earn during the academic year (i.e., the $31,947). The total value of their foregone earnings thus comes to $6.6 million.

Working students are able to maintain all or part of their earnings while enrolled. Many ACE students are fully-employed working professionals in relevant career paths to the degree advancement they are pursuing. ACE's online learner accessibility enables working professionals to hold occupations in fields relevant to the graduate degrees they pursue for career advancement. We assume ACE working students hold jobs that pay 95% of what they would have earned had they chosen to work full-time rather than go to college.[19] The remaining 5% comprises the percentage of their full earning potential that they forego. Obviously, this assumption varies by person; some students forego more and others less. Since we have accounted for jobs ACE working professionals hold while attending, the 5% in foregone earnings serves as a reasonable average to account for contractual earning potential working professionals forego.

Working students also give up a portion of their leisure time in order to attend higher education institutions. According to the Bureau of Labor Statistics American Time Use Survey, students forego up to 0.1 hours of leisure time per day.[20] Assuming that an hour of leisure is equal in value to an hour of work, we derive the total cost of leisure by multiplying the number of leisure hours foregone during the academic year by the average hourly pay of the students' full earning potential. For working students, therefore,


16 Further discussion on this adjustment appears in Appendix 6.

17 Equal to 12.4 credits divided by 30 for the proportion of undergraduate students and 24 for the proportion of graduate students, the assumed number of credits in a full-time academic year.

18 Based on data provided by ACE.

19 The 95% assumption is based on the average hourly wage of occupations commonly held by ACE working students divided by the national average hourly wage. Occupational wage estimates are published by the Bureau of Labor Statistics (see http://www.bls.gov/oes/current/oes_nat.htm).

20 American Time Use Survey. 2018-2021. Last modified July 2022. https://www.bls.gov/tus/data.htm.

their total opportunity cost is $29.5 million, equal to the sum of their foregone earnings ($21.5 million) and foregone leisure time ($8 million).

The steps leading up to the calculation of student costs appear in Table 3.1. Direct outlays amount to $49.3 million, the sum of tuition and fees ($49 million) and digital library and resources ($248 thousand). Opportunity costs for working and non-working students amount to $33.7 million, excluding $2.5 million in offsetting residual aid that is paid directly to students.[21] Summing direct outlays and opportunity costs together yields a total of $82.9 million in present value student costs.

**Table 3.1: Present value of student costs, CY 2022 (thousands)**

| | |
|---|---|
| **Direct outlays in CY 2022** | |
| Tuition and fees | $49,006 |
| Digital library and resources | $248 |
| **Total direct outlays** | **$49,254** |
| **Opportunity costs in CY 2022** | |
| Earnings foregone by non-working students | $6,596 |
| Earnings foregone by working students | $21,546 |
| Value of leisure time foregone by working students | $7,996 |
| Less residual aid | -$2,480 |
| **Total opportunity costs** | **$33,658** |
| **Total present value student costs** | **$82,912** |

Source: Based on data provided by ACE and outputs of the Lightcast impact model.

## Linking education to earnings

Having estimated the costs of education to students, we weigh these costs against the benefits that students receive in return. The relationship between education and earnings is well documented and forms the basis for determining student benefits. As shown in Table 1.3, national mean earnings levels at the midpoint of the average-aged worker's career increase as people achieve higher levels of education. The differences between national earnings levels define the incremental benefits of moving from one education level to the next.

A key component in determining the students' return on investment is the value of their future benefits stream; i.e., what they can expect to earn in return for the investment they make in education. We calculate the future benefits stream to the college's CY 2022 students first by determining their average annual increase in earnings, equal to $48.3 million. This value represents the higher wages that accrue to students at the midpoint of their careers and is calculated based on the marginal wage increases of the credits that students complete while attending the college. Using the U.S. earnings,

21 Residual aid is the remaining portion of scholarship or grant aid distributed directly to a student after the college applies tuition and fees.

the marginal wage increase per credit is $284. For a full description of the methodology used to derive the $48.3 million, see Appendix 6.

The second step is to project the $48.3 million annual increase in earnings into the future, for as long as students remain in the workforce. We do this using the Mincer function to predict the change in earnings at each point in an individual's working career.[22] The Mincer function originated from Mincer's seminal work on human capital (1958). The function estimates earnings using an individual's years of education and post-schooling experience. While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Card (1999 and 2001) addresses a number of these criticisms using U.S. based research over the last three decades and concludes that any upward bias in the Mincer parameters is on the order of 10% or less. We use nationwide education level-specific Mincer coefficients. To account for any upward bias, we incorporate a 10% reduction in our projected earnings, otherwise known as the ability bias. With the $48.3 million representing the students' higher earnings at the midpoint of their careers, we apply scalars from the Mincer function to yield a stream of projected future benefits that gradually increase from the time students enter the workforce, peak shortly after the career midpoint, and then dampen slightly as students approach retirement at age 67. This earnings stream appears in Column 2 of Table 3.2.

As shown in Table 3.2, the $48.3 million in gross higher earnings occurs around Year 1, which is the approximate midpoint of the students' future working careers given the average age of the student population and an assumed retirement age of 67. In accordance with the Mincer function, the gross higher earnings that accrue to students in the year leading up to the midpoint is less than $48.3 million and the gross higher earnings in the years after the midpoint are greater than $48.3 million.

The final step in calculating the students' future benefits stream is to net out the potential benefits generated by students who are either not yet active in the workforce or who leave the workforce over time. This adjustment appears in Column 3 of Table 3.2 and represents the percentage of the student population in CY 2022 that will be employed in the workforce in a given year. Note that the percentage in the first year of the time horizon is relatively lower than those in subsequent years. This is because many students still enrolled at the college or who are degree completers take time to look for career advancement placement after graduation. Accordingly, we apply a set of "settling-in" factors to account for the time needed by students to find their next employment or promotion based on the education gained leading into their next career step. As discussed in Chapter 2, settling-in factors are used to delay the onset of the benefits to students from the education gained during the year of analysis in order to allow time for them to find employment and settle into their advanced careers. In the absence of hard data, we assume two years for ACE graduate degree-seeking students.

22 Appendix 6 provides more information on the Mincer function and how it is used to predict future earnings growth.

Table 3.2: Projected benefits and costs, student perspective

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Year | Gross higher earnings to students (millions) | % active in workforce* | Net higher earnings to students (millions) | Student costs (millions) | Net cash flow (millions) |
| 0 | $45.5 | 93% | $42.1 | $82.9 | -$40.8 |
| 1 | $48.3 | 98% | $47.1 | $0.0 | $47.1 |
| 2 | $51.1 | 97% | $49.7 | $0.0 | $49.7 |
| 3 | $53.8 | 97% | $52.3 | $0.0 | $52.3 |
| 4 | $56.6 | 97% | $54.8 | $0.0 | $54.8 |
| 5 | $59.3 | 97% | $57.3 | $0.0 | $57.3 |
| 6 | $62.0 | 96% | $59.7 | $0.0 | $59.7 |
| 7 | $64.6 | 96% | $62.1 | $0.0 | $62.1 |
| 8 | $67.1 | 96% | $64.3 | $0.0 | $64.3 |
| 9 | $69.5 | 95% | $66.3 | $0.0 | $66.3 |
| 10 | $71.9 | 95% | $68.3 | $0.0 | $68.3 |
| 11 | $74.0 | 95% | $70.0 | $0.0 | $70.0 |
| 12 | $76.1 | 94% | $71.7 | $0.0 | $71.7 |
| 13 | $78.0 | 94% | $73.1 | $0.0 | $73.1 |
| 14 | $79.7 | 93% | $74.3 | $0.0 | $74.3 |
| 15 | $81.2 | 93% | $75.3 | $0.0 | $75.3 |
| 16 | $82.6 | 92% | $76.0 | $0.0 | $76.0 |
| 17 | $83.8 | 91% | $76.6 | $0.0 | $76.6 |
| 18 | $84.7 | 91% | $76.9 | $0.0 | $76.9 |
| 19 | $85.5 | 90% | $76.9 | $0.0 | $76.9 |
| 20 | $86.1 | 89% | $76.8 | $0.0 | $76.8 |
| 21 | $86.4 | 88% | $76.3 | $0.0 | $76.3 |
| 22 | $86.5 | 87% | $75.6 | $0.0 | $75.6 |
| 23 | $86.5 | 86% | $74.7 | $0.0 | $74.7 |
| 24 | $86.2 | 85% | $73.5 | $0.0 | $73.5 |
| 25 | $85.7 | 84% | $72.2 | $0.0 | $72.2 |
| 26 | $85.0 | 83% | $70.6 | $0.0 | $70.6 |
| 27 | $84.1 | 82% | $68.8 | $0.0 | $68.8 |
| 28 | $83.0 | 81% | $66.9 | $0.0 | $66.9 |
| **Present value** | | | **$1,591.9** | **$82.9** | **$1,509.0** |

* Includes the "settling-in" factors and attrition.

Source: Lightcast impact model.

| Benefit-cost ratio | Internal rate of return | Payback period (years) |
|---|---|---|
| 19.2 | 120.7% | 0.9 |

Beyond the initial years of the time horizon, students will leave the workforce for any number of reasons, whether death, retirement, or unemployment. We estimate the rate of attrition using the same data and assumptions applied in the calculation of the attrition rate in the alumni impact analysis of Chapter 2.[23] The likelihood of leaving the workforce increases as students age, so the attrition rate is more aggressive near the end of the time horizon than in the beginning. Column 4 of Table 3.2 shows the net higher earnings to students after accounting for both the settling-in patterns and attrition.

## Return on investment for students

Having estimated the students' costs and their future benefits stream, the next step is to discount the results to the present to reflect the time value of money. For the student perspective, we assume a discount rate of 1.4% (see below). Around 87% of ACE graduate degree-seeking students are fully employed working professionals paying for education out-of-pocket and the remaining 13% took out private loans. The discount rate is based upon a weighted average of the percent of students who took out private loans and the percent who paid out of pocket.[24] In Appendix 1, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to student costs to derive the investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1.0, a rate of return that exceeds the discount rate, and a reasonably short payback period.

### Discount rate

The discount rate is a rate of interest that converts future costs and benefits to present values. For example, $1,000 in higher earnings realized 30 years in the future is worth much less than $1,000 in the present. All future values must therefore be expressed in present value terms in order to compare them with investments (i.e., costs) made today. The selection of an appropriate discount rate, however, can become an arbitrary and controversial undertaking. As suggested in economic theory, the discount rate should reflect the investor's opportunity cost of capital, i.e., the rate of return one could reasonably expect to obtain from alternative investment schemes. In this study we assume a 1.4% discount rate from the student perspective and a 0.2% discount rate from the perspectives of taxpayers and society.

In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately $1.6 billion, the present value of all of the future earnings increments (see the bottom section of Column 4). This may also be interpreted as the gross capital asset value of the students' higher earnings stream. In effect, the aggregate student

23 See the discussion of the alumni impact in Chapter 2. The main sources for deriving the attrition rate are the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics. Note that we do not account for migration patterns in the student investment analysis because the higher earnings that students receive as a result of their education will accrue to them regardless of where they find employment.

24 Source: The U.S. Department of Education. Note, unlike federal student loan interest rates, rates on private student loans vary depending on the lender and the financial profile of the borrower. Private student loans range from 4% to nearly 15%. We have taken the average of 9.5% for this study.

body in CY 2022 is rewarded for its investment in ACE with a capital asset valued at $1.6 billion.

The students' cost of attending the college is shown in Column 5 of Table 3.2, equal to a present value of $82.9 million. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 19.2 (equal to $1.6 billion in benefits divided by $82.9 million in costs).

Another way to compare the same benefits stream and associated cost is to compute the rate of return. The rate of return indicates the interest rate that a bank would have to pay a depositor to yield an equally attractive stream of future payments.[25] Table 3.2 shows students of ACE earning average returns of 120.7% on their investment of time and money. This is a favorable return compared, for example, to approximately 1% on a standard bank savings account, or 9.6% on stocks and bonds (30-year average return).

American College of Education students see an average rate of return of **120.7%** for their investment of time and money.

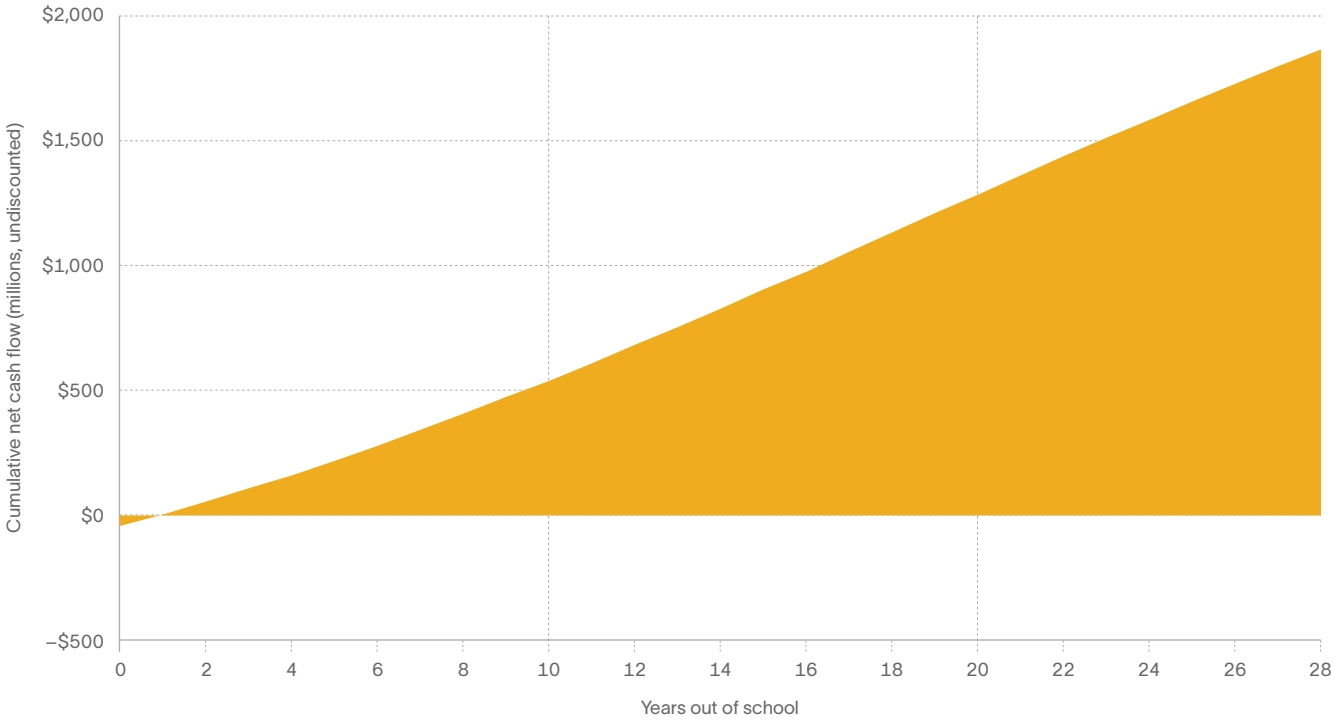
Note that returns reported in this study are real returns, not nominal. When a bank promises to pay a certain rate of interest on a savings account, it employs an implicitly nominal rate. Bonds operate in a similar manner. If it turns out that the inflation rate is higher than the stated rate of return, then money is lost in real terms. In contrast, a real rate of return is on top of inflation. For example, if inflation is running at 3% and a nominal percentage of 5% is paid, then the real rate of return on the investment is only 2%. In Table 3.2, the 120.7% student rate of return is a real rate. With an inflation rate of 2.5% (the average rate reported over the past 20 years as per the U.S. Department of Commerce, Consumer Price Index), the corresponding nominal rate of return is 123.2%, higher than what is reported in Table 3.2.

The payback period is defined as the length of time it takes to entirely recoup the initial investment.[26] Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at ACE see, on average, a payback period of 11 months (0.9 years). That is, around 11 months (0.9 years) after their initial investment of foregone earnings and out-of-pocket costs, an ACE student will have received enough higher future earnings to fully recover those costs (Figure 3.1).

25 Rates of return are computed using the familiar internal rate-of-return calculation. Note that, with a bank deposit or stock market investment, the depositor puts up a principal, receives in return a stream of periodic payments, and then recovers the principal at the end. Someone who invests in education, on the other hand, receives a stream of periodic payments that include the recovery of the principal as part of the periodic payments, but there is no principal recovery at the end. These differences notwithstanding comparable cash flows for both bank and education investors yield the same internal rate of return.

26 Payback analysis is generally used by the business community to rank alternative investments when safety of investments is an issue. Its greatest drawback is it does not account for the time value of money. The payback period is calculated by dividing the cost of the investment by the net return per period. In this study, the cost of the investment includes tuition and fees plus the opportunity cost of time; it does not account for student living expenses.

**Figure 3.1: Student payback period**




Source: Lightcast impact model.

# Taxpayer perspective

From the taxpayer perspective, the pivotal step is to determine the public benefits that specifically accrue to the government, even without taxpayer support. For example, benefits resulting from earnings growth are limited to increased tax payments. Similarly, savings related to improved health, reduced crime, and fewer welfare and unemployment claims, discussed below, reflect those received strictly by the government. Since ACE is a private college and receives little to no taxpayer funding, a benefit-cost ratio and internal rate of return for taxpayers are not measured in this analysis.


## Growth in tax revenues

As a result of their time at ACE, students earn more because of the skills they learned while attending the college, and organizations earn more because student skills make capital more productive (buildings, machinery, and everything else). This in turn raises profits and other earnings. Together, increases in labor and non-labor (i.e., capital) income are considered the effect of a skilled workforce. These in turn increase tax revenues since the government is able to apply tax rates to higher earnings.

Estimating the effect of ACE on increased tax revenues begins with the present value of the students' future earnings stream, which is displayed in Column 4 of Table 3.2. To these net higher earnings, we apply a multiplier derived from Lightcast's MR-SAM model to estimate the added labor income created in the nation as students and businesses spend their higher earnings.[27] As labor income increases, so does non-labor income, which consists of monies gained through investments. To calculate the growth in non-labor income, we multiply the increase in labor income by a ratio of the U.S. gross domestic product to total labor income. To each of these, we apply the prevailing tax rates so we capture only the tax revenues attributable to the government from this additional revenue.

Not all of these tax revenues may be counted as benefits to the nation, however. Some students leave the U.S. during the course of their careers, and the higher earnings they receive as a result of their education leaves the U.S. with them. To account for this dynamic, we combine student settlement data from the college with data on migration

27 For a full description of the Lightcast MR-SAM model, see Appendix 5.

patterns from the Internal Revenue Service to estimate the number of students who will leave the national workforce over time.

We apply another reduction factor to account for the students' alternative education opportunities. This is the same adjustment that we use in the calculation of the alumni impact in Chapter 2 and is designed to account for the counterfactual scenario where ACE does not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the college cannot be counted as new benefits to society. For this analysis, we assume an alternative education variable of 5%, meaning that 5% of the student population at the college would have generated benefits anyway even without the college. For more information on the alternative education variable, see Appendix 7.

After adjusting for attrition and alternative education opportunities, we calculate the present value of the future added tax revenues that occur in the nation, equal to $724.7 million. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of 0.2%. This is the real treasury interest rate reported by the Office of Management and Budget (OMB) for 30-year investments, and in Appendix 1, we conduct a sensitivity analysis of this discount rate.[28]

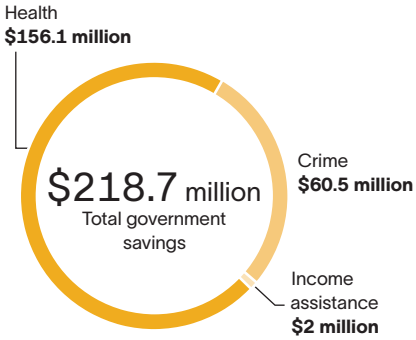
In addition to the creation of **higher tax revenues** to the government, education is statistically associated with a variety of lifestyle changes that generate **social savings**.

## Government savings

In addition to the creation of higher tax revenues to the government, education is statistically associated with a variety of lifestyle changes that generate social savings, also known as external or incidental benefits of education. These represent the avoided costs to the government that otherwise would have been drawn from public resources absent the education provided by ACE. Government savings appear in Figure 3.2 and Table 3.3 and break down into three main categories: 1) health savings, 2) crime savings, and 3) income assistance savings. Health savings include avoided medical costs that would have otherwise been covered by the government. Crime savings consist of avoided costs to the justice system (i.e., police protection, judicial and legal, and corrections). Income assistance benefits comprise avoided costs due to the reduced number of welfare and unemployment insurance claims.

The model quantifies government savings by calculating the probability at each education level that individuals will have poor health, commit crimes, or claim welfare and unemployment benefits. Deriving the probabilities involves assembling data from a variety of studies and surveys analyzing the correlation between education and health,

**Figure 3.2: Present value of government savings**




Source: Lightcast impact model.

28 Office of Management and Budget. "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses." *Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in Percent)*. https://www.whitehouse.gov/wp-content/uploads/2020/12/discount-history.pdf.

crime, and income assistance at the national level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved credits at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the college, will not have poor health, commit crimes, or demand income assistance. We dampen these results by the ability bias adjustment discussed earlier in the student perspective section and in Appendix 6 to account for factors (besides education) that influence individual behavior. We then multiply the marginal effects of education times the associated costs of health, crime, and income assistance.[29] Finally, we apply the same adjustments for attrition and alternative education to derive the net savings to the government. Total government savings appear in Figure 3.2 and sum to $218.7 million.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the nation, equal to $724.7 million, from students' higher earnings and increases in non-labor income. The sum of the government savings and the added tax revenue in the U.S. is $943.4 million, as shown in the bottom row of Table 3.3. These savings continue to accrue in the future as long as the CY 2022 student population of ACE remains in the workforce.

**Table 3.3: Present value of added tax revenue and government savings (thousands)**

| | |
|---|---|
| **Added tax revenue** | **$724,681** |
| **Government savings** | |
| Health-related savings | $156,135 |
| Crime-related savings | $60,512 |
| Income assistance savings | $2,034 |
| **Total government savings** | **$218,681** |
| **Total taxpayer benefits** | **$943,362** |

Source: Lightcast impact model.

## Total benefits to taxpayers

The $943.4 million in taxpayer benefits accrue as long as the CY 2022 student population is active in the national workforce. Table 3.4 outlines the stream of benefits taxpayers receive.

**Table 3.4: Projected benefits, taxpayer perspective**

| 1 | 2 |
|---|---|
| **Year** | **Benefits to taxpayers (millions)** |
| 0 | $24.9 |
| 1 | $26.3 |
| 2 | $27.2 |
| 3 | $28.2 |
| 4 | $29.2 |
| 5 | $30.1 |
| 6 | $31.0 |
| 7 | $31.8 |
| 8 | $32.7 |
| 9 | $33.4 |
| 10 | $34.1 |
| 11 | $34.8 |
| 12 | $35.4 |
| 13 | $35.9 |
| 14 | $36.3 |
| 15 | $36.6 |
| 16 | $36.9 |
| 17 | $37.0 |
| 18 | $37.1 |
| 19 | $37.0 |
| 20 | $36.9 |
| 21 | $36.6 |
| 22 | $36.3 |
| 23 | $35.9 |
| 24 | $35.3 |
| 25 | $34.7 |
| 26 | $34.0 |
| 27 | $33.2 |
| 28 | $32.4 |
| **Present value** | **$943.4** |

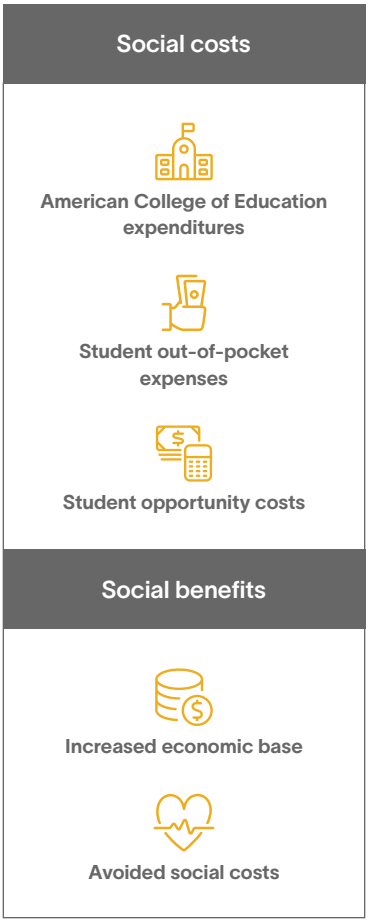
Source: Lightcast impact model.

29 For a full list of the data sources used to calculate the social externalities, see the Resources and References section. See also Appendix 10 for a more in-depth description of the methodology.

# Social perspective

The U.S. benefits from the education that ACE provides through the earnings that students create in the nation and through the savings that they generate through their improved lifestyles. Society's investment in ACE stems from student direct and opportunity costs, as ACE students represent the main investor group of ACE due to zero taxpayer funding. We weigh the benefits generated by ACE to its students against their total costs. The student costs include their direct expenditures and all foregone earnings, totaling a present value of $82.9 million.

On the benefits side, any benefits that accrue to the U.S. as a whole—including students, employers, taxpayers, and anyone else who stands to benefit from the activities of ACE—are counted as benefits under the social perspective. We group these benefits under the following broad headings: 1) increased earnings in the U.S., and 2) social externalities stemming from improved health, reduced crime, and reduced unemployment in the U.S. (see the Beekeeper Analogy box for a discussion of externalities). Both of these benefits components are described more fully in the following sections.




## Growth in the national economic base

In the process of absorbing the newly acquired skills of students who attend ACE, not only does the productivity of the U.S. workforce increase, but so does the productivity of its physical capital and assorted infrastructure. Students earn more because of the skills they learned while attending the college, and organizations earn more because student skills make capital more productive (buildings, machinery, and everything else). This in turn raises profits and other business property income. Together, increases in labor and non-labor (i.e., capital) income are considered the effect of a skilled workforce.

Estimating the effect of ACE on the nation's economic base follows a similar process used when calculating increased tax revenues in the taxpayer perspective. However, instead of looking at just the tax revenue portion, we include all of the added earnings and business output. First, we calculate the students' future higher earnings stream. We factor in student attrition and alternative education opportunities to arrive at net higher earnings. We again apply multipliers derived from Lightcast's MR-SAM model to estimate the added labor and non-labor income created in the U.S. as students

### Beekeeper analogy

Beekeepers provide a classic example of positive externalities (sometimes called "neighborhood effects"). The beekeeper's intention is to make money selling honey. Like any other business, receipts must at least cover operating costs. If they don't, the business shuts down.

But from society's standpoint, there is more. Flowers provide the nectar that bees need for honey production, and smart beekeepers locate near flowering sources such as orchards. Nearby orchard owners, in turn, benefit as the bees spread the pollen necessary for orchard growth and fruit production. This is an uncompensated external benefit of beekeeping, and economists have long recognized that society might actually do well to subsidize activities that produce positive externalities, such as beekeeping.

Educational institutions are like beekeepers. While their principal aim is to provide education and raise people's earnings, in the process they create an array of external benefits. Students' health and lifestyles are improved, and society indirectly benefits just as orchard owners indirectly benefit from beekeepers. In an effort to provide a more comprehensive report of the benefits generated by education, the model accounts for many of these external social benefits.

and businesses spend their higher earnings and as organizations generate additional profits from this increased output (added student and business income in Figure 3.3).

Using this process, we calculate the present value of the future added income that occurs in the nation, equal to $2.5 billion. Recall from the discussion of the student and taxpayer perspectives that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 0.2%.

## Social savings

Similar to the government savings discussed above, society as a whole sees savings due to external or incidental benefits of education. These represent the avoided costs that otherwise would have been drawn from private and public resources absent the education provided by ACE. Social benefits appear in Table 3.5 and break down into three main categories: 1) health savings, 2) crime savings, and 3) income assistance savings. These are similar to the categories from the taxpayer perspective above, although health savings now also include lost productivity and other effects associated with smoking, alcohol dependence, obesity, depression, and drug abuse. In addition to avoided costs to the justice system, crime savings also consist of avoided victim costs and benefits stemming from the added productivity of individuals who otherwise would have been incarcerated. Income assistance savings are comprised of the avoided government costs due to the reduced number of welfare and unemployment insurance claims.

Table 3.5 displays the results of the analysis. The first row shows the increased economic base in the U.S., equal to $2.5 billion, from students' higher earnings and their multiplier effects and increases in non-labor income. Social savings appear next, beginning with a breakdown of savings related to health. These include savings due to a reduced demand for medical treatment and social services, improved worker productivity and reduced absenteeism, and a reduced number of vehicle crashes and fires induced by alcohol or smoking-related incidents. These savings amount to $544.9 million. Crime

savings amount to $76.3 million, including savings associated with a reduced number of crime victims, added worker productivity, and reduced expenditures for police and law enforcement, courts and administration of justice, and corrective services. Finally, the present value of the savings related to income assistance amounts to $2 million, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to $623.2 million in benefits to communities and citizens in the U.S.

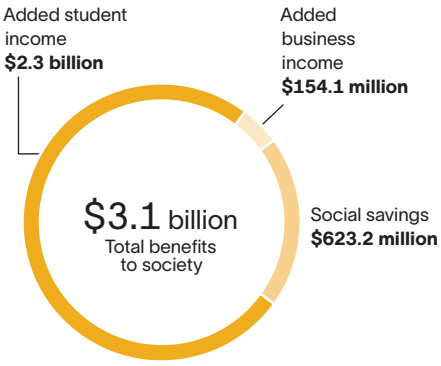
The sum of the social savings and the increased economic base is $3.1 billion, as shown in the bottom row of Table 3.5 and in Figure 3.3. These savings accrue in the future as long as the CY 2022 student population of ACE remains in the workforce.

**Table 3.5: Present value of the future increased economic base and social savings in the U.S. (thousands)**

| | |
|---|---|
| **Increased economic base** | **$2,456,546** |
| **Social savings** | |
| **Health** | |
| Smoking | $31,179 |
| Alcohol dependence | $107,189 |
| Obesity | $149,086 |
| Depression | $225,036 |
| Drug abuse | $32,409 |
| **Total health savings** | **$544,899** |
| **Crime** | |
| Criminal justice system savings | $58,608 |
| Crime victim savings | $1,218 |
| Added productivity | $16,461 |
| **Total crime savings** | **$76,287** |
| **Income assistance** | |
| Welfare savings | $1,585 |
| Unemployment savings | $449 |
| **Total income assistance savings** | **$2,034** |
| **Total social savings** | **$623,220** |
| **Total, increased economic base + social savings** | **$3,079,766** |

Source: Lightcast impact model.

**Figure 3.3: Present value of benefits to society**




Source: Lightcast impact model.

## ACE graduate Natalie Morehouse joins mom as an ACE alumni

American College of Education graduate Natalie Morehouse was inspired to continue her education at ACE after she witnessed her mom do it. At ACE's 2022 commencement ceremony, Morehouse was welcomed onstage by her mother, an ACE alumni and current faculty member.

## Return on investment for society

Table 3.6 presents the stream of benefits accruing to the U.S. society and the total social costs of generating those benefits. Comparing the present value of the benefits and the social costs, we have a benefit-cost ratio of 37.1. This means that for every dollar invested in an education from ACE, whether it is the money spent on operations of the college or money spent by students on tuition and fees, an average of $37.10 in benefits will accrue to society in the U.S.[30]

## With and without social savings

Earlier in this chapter, social benefits attributable to education (improved health, reduced crime, and reduced demand for income assistance) were defined as externalities that are incidental to the operations of ACE. Some would question the legitimacy of including these benefits in the calculation of rates of return to education, arguing that only the tangible benefits (higher earnings) should be counted. Table 3.4 and Table 3.6 are inclusive of social benefits reported as attributable to ACE. Recognizing the other point of view, Table 3.7 shows benefits for taxpayers and rates of return for society, exclusive of social benefits. As indicated, taxpayers still receive sizable benefits; and, from the social perspective, returns are still above threshold values (a net present value greater than zero and a benefit-cost ratio greater than 1.0), confirming that society as a whole receives value from investing in ACE.

**Table 3.7: Taxpayer and social perspectives with and without social savings**

| | Including social savings | Excluding social savings |
|---|---|---|
| **Taxpayer perspective** | | |
| Present value benefits (millions) | $943.4 | $724.7 |
| **Social perspective** | | |
| Net present value (millions) | $2,996.9 | $2,373.6 |
| Benefit-cost ratio | 37.1 | 29.6 |

Source: Lightcast impact model.

### Kelly's story: Getting an M.Ed. degree online from ACE

"What I appreciate most about American College of Education is that it's very clear and evident that the information being presented is research-based and jam-packed full of knowledge and educational research. This degree has changed my life to expand my interaction and my students in a K to 5 setting rather than just in one kindergarten classroom."

—Kelly Boersma, M.Ed

30 The rate of return is not reported for the social perspective because the beneficiaries of the investment are not necessarily the same as the original investors.

Table 3.6: **Projected benefits and costs, social perspective**

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Year | Benefits to society (millions) | Social costs (millions) | Net cash flow (millions) |
| 0 | $80.1 | $82.9 | -$2.8 |
| 1 | $84.6 | $0.0 | $84.6 |
| 2 | $87.9 | $0.0 | $87.9 |
| 3 | $91.2 | $0.0 | $91.2 |
| 4 | $94.4 | $0.0 | $94.4 |
| 5 | $97.6 | $0.0 | $97.6 |
| 6 | $100.6 | $0.0 | $100.6 |
| 7 | $103.6 | $0.0 | $103.6 |
| 8 | $106.4 | $0.0 | $106.4 |
| 9 | $109.0 | $0.0 | $109.0 |
| 10 | $111.4 | $0.0 | $111.4 |
| 11 | $113.6 | $0.0 | $113.6 |
| 12 | $115.6 | $0.0 | $115.6 |
| 13 | $117.3 | $0.0 | $117.3 |
| 14 | $118.7 | $0.0 | $118.7 |
| 15 | $119.9 | $0.0 | $119.9 |
| 16 | $120.8 | $0.0 | $120.8 |
| 17 | $121.3 | $0.0 | $121.3 |
| 18 | $121.5 | $0.0 | $121.5 |
| 19 | $121.4 | $0.0 | $121.4 |
| 20 | $121.0 | $0.0 | $121.0 |
| 21 | $120.2 | $0.0 | $120.2 |
| 22 | $119.1 | $0.0 | $119.1 |
| 23 | $117.6 | $0.0 | $117.6 |
| 24 | $115.9 | $0.0 | $115.9 |
| 25 | $113.8 | $0.0 | $113.8 |
| 26 | $111.5 | $0.0 | $111.5 |
| 27 | $108.9 | $0.0 | $108.9 |
| 28 | $106.1 | $0.0 | $106.1 |
| **Present value** | **$3,079.8** | **$82.9** | **$2,996.9** |

Source: Lightcast impact model.

Benefit-cost ratio
37.1

Payback period (years)
<1

Chapter 4:

# Conclusion


**WHILE ACE'S VALUE** to the U.S. is larger than simply its monetized impact, understanding the economic value is an important asset to understanding the college's value as a whole. In order to fully assess ACE's value to the national economy, this report has evaluated the college from the perspectives of alumni impact analysis and investment analysis.

From an alumni impact perspective, we calculated that ACE generates a total alumni impact of **$587.7 million** in total added income for the U.S. economy and is equivalent to supporting **9,786 jobs**.

Since ACE's activity represents an investment by various parties, including students and society as a whole, we also considered the college as an investment to see the value it provides to these investors. For each dollar invested by students and society, ACE offers a benefit of **$19.20** and **$37.10**, respectively. These results indicate that ACE is an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the college creates a wide range of positive social benefits that accrue to taxpayers and society in general within the U.S. Finally, though ACE is a private college and receives no federal funding and little to no state and local taxpayer support, taxpayers will receive **$943.4 million** in benefits throughout the students' working lives.

Modeling the impact of the college is subject to many factors, the variability of which we considered in our sensitivity analysis (Appendix 1). With this variability accounted for, we present the findings of this study as a robust picture of the economic value of ACE.

### ACE partnerships

ACE partners with over 2,000 school districts, hospitals, businesses, and organizations to help students advance their career. Students benefit from these partnerships through Employer Grants, transfer-credit opportunities, and networking events.

Lightcast

Lightcast provides colleges and universities with labor market data that help create better outcomes for students, businesses, and communities. Our data, which cover more than 99% of the U.S. workforce, are compiled from a wide variety of government sources, job postings, and online profiles and résumés. Hundreds of institutions use Lightcast to align programs with regional needs, drive enrollment, connect students with in-demand careers, track their alumni's employment outcomes, and demonstrate their institution's economic impact on their region. Visit lightcast.io/solutions/education to learn more or connect with us.

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# Appendix 1: Sensitivity analysis



Sensitivity analysis measures the extent to which a model's outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected. In this chapter we test the sensitivity of the model to the following input factors: 1) the alternative education variable, 2) the student employment variables, and 3) the discount rate.

## Alternative education variable

The alternative education variable (5%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the college in the country. Given the difficulty in accurately specifying the alternative education variable, we test the sensitivity of the taxpayer and social investment analysis results to its magnitude. Variations in the alternative education assumption are calculated around base case results listed in the middle column of Table A1.1. Next, the model brackets the base case assumption on either side with a plus or minus 10%, 25%, and 50% variation in assumptions. Analyses are then repeated introducing one change at a time, holding all other variables constant. For example, an increase of 10% in the alternative education assumption (from 5.0% to 5.5%) reduces the taxpayer perspective present value benefits from $943.4 million to $940.6 million. Likewise, a decrease of 10% (from 5.0% to 4.5%) in the assumption increases the present value from $943.4 million to $946.1 million.

**Table A1.1: Sensitivity analysis of alternative education variable, taxpayer and social perspectives**

| % variation in assumption | -50% | -25% | -10% | Base case | 10% | 25% | 50% |
|---|---|---|---|---|---|---|---|
| **Alternative education variable** | **2.5%** | **3.8%** | **4.5%** | **5.0%** | **5.5%** | **6.3%** | **7.5%** |
| **Taxpayer perspective** | | | | | | | |
| Present value benefits (millions) | $957.1 | $950.2 | $946.1 | $943.4 | $940.6 | $936.6 | $929.9 |
| **Social perspective** | | | | | | | |
| Net present value (millions) | $3,077.9 | $3,037.4 | $3,013.1 | $2,996.9 | $2,980.6 | $2,956.3 | $2,915.8 |
| Benefit-cost ratio | 38.1 | 37.6 | 37.3 | 37.1 | 36.9 | 36.7 | 36.2 |

Based on this sensitivity analysis, the conclusion can be drawn that ACE investment analysis results from the taxpayer and social perspectives are not very sensitive to relatively large variations in the alternative education variable. As indicated, taxpayers and society will still receive financial benefits. The conclusion is that although the

assumption is difficult to specify, its impact on overall investment analysis results for the taxpayer and social perspectives is not very sensitive.

## Student employment variables

Employment variables include the following: 1) the percentage of students who are employed while attending the college and 2) the percentage of earnings that working students receive relative to the earnings they would have received had they not chosen to attend the college. Both employment variables affect the investment analysis results from the student perspective.

Students incur substantial expense by attending ACE because of the time they spend not gainfully employed. Some of that cost is recaptured if students remain partially (or fully) employed while attending. It is estimated that 98% of students are employed.[31] This variable is tested in the sensitivity analysis by changing it first to 100% and then to 0%.

The second student employment variable is more difficult to estimate. In this study we estimate that students who are working while attending the college earn only 95%, on average, of the earnings that they statistically would have received if not attending ACE. This suggests that many students hold part-time jobs that accommodate their ACE attendance, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 95% variable is an estimation based on the average hourly wages of the most common jobs held by students while attending college relative to the average hourly wages of all occupations in the U.S. The model captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 95% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table A1.2, with *A* defined as the percent of students employed and *B* defined as the percent that students earn relative to their full earning potential. Base case results appear in the shaded row; here the assumptions remain unchanged, with *A* equal to 98% and *B* equal to 95%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases *A* to 100% while holding *B* constant, Scenario 2 increases *B* to 100% while holding *A* constant, Scenario 3 increases both *A* and *B* to 100%, and Scenario 4 decreases both *A* and *B* to 0%.

**Table A1.2: Sensitivity analysis of student employment variables**

| Variations in assumptions | Net present value (millions) | Internal rate of return | Benefit-cost ratio |
|---|---|---|---|
| Base case: A = 98%, B = 95% | $1,509.0 | 120.7% | 19.2 |
| Scenario 1: A = 100%, B = 95% | $1,515.0 | 140.6% | 20.7 |
| Scenario 2: A = 98%, B = 100% | $1,530.6 | 250.1% | 25.9 |
| Scenario 3: A = 100%, B = 100% | $1,537.0 | 373.1% | 29.0 |
| Scenario 4: A = 0%, B = 0% | $1,105.4 | 13.2% | 3.3 |

Note: A = percent of students employed; B = percent earned relative to statistical averages.

31 Based on data provided by ACE.

- **Scenario 1:** Increasing the percentage of students employed (A) from 98% to 100%, the net present value and benefit-cost ratio improve to $1.52 billion and 20.7, respectively, relative to base case results. Improved results are attributable to a lower opportunity cost of time; all students are employed in this case.
- **Scenario 2:** Increasing earnings relative to statistical averages (B) from 95% to 100%, the net present value and benefit-cost ratio results improve to $1.53 billion and 25.9, respectively, relative to base case results; this strong improvement, again, is attributable to a lower opportunity cost of time.
- **Scenario 3:** Increasing both assumptions *A* and *B* to 100% simultaneously, the net present value and benefit-cost ratio improve yet further to $1.54 billion and 29.0, respectively, relative to base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to statistical averages) while attending classes.
- **Scenario 4:** Finally, decreasing both *A* and *B* to 0% reduces the net present value, internal rate of return, and benefit-cost ratio to $1.1 billion, 13.2%, and 3.3, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[32]

It is strongly emphasized in this section that base case results are very attractive in that results are all above their threshold levels. As is clearly demonstrated here, results of the first three alternative scenarios appear much more attractive, although they overstate benefits. Results presented in Chapter 3 are realistic, indicating that investments in ACE generate excellent returns, well above the long-term average percent rates of return in stock and bond markets.

## Discount rate

The discount rate is a rate of interest that converts future monies to their present value. In investment analysis, the discount rate accounts for two fundamental principles: 1) the time value of money, and 2) the level of risk that an investor is willing to accept. Time value of money refers to the value of money after interest or inflation has accrued over a given length of time. An investor must be willing to forego the use of money in the present to receive compensation for it in the future. The discount rate also addresses the investors' risk preferences by serving as a proxy for the minimum rate of return that the proposed risky asset must be expected to yield before the investors will be persuaded to invest in it. Typically, this minimum rate of return is determined by the known returns of less risky assets where the investors might alternatively consider placing their money.

In this study, we assume a 1.4% discount rate for students and a 0.2% discount rate for society and taxpayers. Similar to the sensitivity analysis of the alternative education variable, we vary the base case discount rates for students, taxpayers, and society on

32 Note that reducing the percent of students employed to 0% automatically negates the percent they earn relative to full earning potential, since none of the students receive any earnings in this case.

either side by increasing the discount rate by 10%, 25%, and 50%, and then reducing it by 10%, 25%, and 50%. Note that, because the payback period is based on the undiscounted cash flow, it is unaffected by changes in the discount rate. As such, only variations in the net present value and the benefit-cost ratio are shown for the student and social perspectives and variations in the present value are shown for the taxpayer perspective in Table A1.3.

**Table A1.3: Sensitivity analysis of discount rate**

| % variation in assumption | -50% | -25% | -10% | Base case | 10% | 25% | 50% |
|---|---|---|---|---|---|---|---|
| **Student perspective** | | | | | | | |
| Discount rate | 0.7% | 1.1% | 1.3% | 1.4% | 1.5% | 1.8% | 2.1% |
| Net present value (millions) | $1,675.7 | $1,589.5 | $1,540.6 | $1,509.0 | $1,478.3 | $1,433.8 | $1,363.5 |
| Benefit-cost ratio | 21.2 | 20.2 | 19.6 | 19.2 | 18.8 | 18.3 | 17.4 |
| **Taxpayer perspective** | | | | | | | |
| Discount rate | 0.10% | 0.15% | 0.18% | 0.20% | 0.22% | 0.25% | 0.30% |
| Present value benefits (millions) | $957.1 | $950.2 | $946.1 | $943.4 | $940.6 | $936.6 | $929.9 |
| **Social perspective** | | | | | | | |
| Discount rate | 0.10% | 0.15% | 0.18% | 0.20% | 0.22% | 0.25% | 0.30% |
| Net present value (millions) | $3,042.0 | $3,019.3 | $3,005.8 | $2,996.9 | $2,987.9 | $2,974.6 | $2,952.6 |
| Benefit-cost ratio | 37.7 | 37.4 | 37.3 | 37.1 | 37.0 | 36.9 | 36.6 |

As demonstrated in Table A1.3, an increase in the discount rate leads to a corresponding decrease in the expected returns, and vice versa. For example, increasing the student discount rate by 50% (from 1.4% to 2.1%) reduces the students' benefit-cost ratio from 19.2 to 17.4. Conversely, reducing the discount rate for students by 50% (from 1.4% to 0.7%) increases the benefit-cost ratio from 19.2 to 21.2. The sensitivity analysis results for taxpayers and society show the same inverse relationship between the discount rate and the benefits.

# Appendix 2: Glossary of terms



**Alternative education:** A "with" and "without" measure of the percent of students who would still be able to avail themselves of education if the college under analysis did not exist. An estimate of 10%, for example, means that 10% of students do not depend directly on the existence of the college in order to obtain their education.

**Asset value:** Capitalized value of a stream of future returns. Asset value measures what someone would have to pay today for an instrument that provides the same stream of future revenues.

**Attrition rate:** The rate at which students leave the workforce due to out-migration, unemployment, retirement, or death.

**Benefit-cost ratio:** Present value of benefits divided by present value of costs. If the benefit-cost ratio is greater than 1, then benefits exceed costs, and the investment is feasible.

**Counterfactual scenario:** What would have happened if a given event had not occurred. In the case of this impact study, the counterfactual scenario is a scenario where the college did not exist.

**Demand:** Relationship between the market price of education and the volume of education demanded (expressed in terms of enrollment). The law of the downward-sloping demand curve is related to the fact that enrollment increases only if the price (tuition and fees) is lowered, or conversely, enrollment decreases if price increases.

**Discounting:** Expressing future revenues and costs in present value terms.

**Earnings (labor income):** Income that is received as a result of labor; i.e., wages.

**Economics:** Study of the allocation of scarce resources among alternative and competing ends. Economics is not normative (what ought to be done), but positive (describes what is, or how people are likely to behave in response to economic changes).

**Elasticity of demand:** Degree of responsiveness of the quantity of education demanded (enrollment) to changes in market prices (tuition and fees). If a decrease in fees increases or decreases total enrollment by a significant amount, demand is elastic. If enrollment remains the same or changes only slightly, demand is inelastic.

**Externalities:** Impacts (positive and negative) for which there is no compensation. Positive externalities of education include improved social behaviors such as improved health, lower crime, and reduced demand for income assistance. Educational institutions do not receive compensation for these benefits, but benefits still occur because education is statistically proven to lead to improved social behaviors.

**Gross domestic product:** Measure of the final value of all goods and services produced in the country after netting out the cost of goods used in production. Alternatively, gross domestic product (GDP) equals the combined incomes of all factors of production; i.e., labor, land and capital. These include wages, salaries, proprietors' incomes, profits, rents, and other. Gross domestic product is also sometimes called value added or added income.

**Initial effect:** Income generated by the initial injection of monies into the economy through the payroll of the college and the higher earnings of its students.

**Input-output analysis:** Relationship between a given set of demands for final goods and services and the implied amounts of manufactured inputs, raw materials, and labor that this requires. When educational institutions pay wages and salaries and spend money for supplies in the country, they also generate earnings in all sectors of the economy, thereby increasing the demand for goods and services and jobs. Moreover, as students enter or rejoin the workforce with higher skills, they earn higher salaries and wages. In turn, this generates more consumption and spending in other sectors of the economy.

**Internal rate of return:** Rate of interest that, when used to discount cash flows associated with investing in education, reduces its net present value to zero (i.e., where the present value of revenues accruing from the investment are just equal to the present value of costs incurred). This, in effect, is the breakeven rate of return on investment since it shows the highest rate of interest at which the investment makes neither a profit nor a loss.

**Multiplier effect:** Additional income created in the economy as the college and its students spend money in the country. It consists of the income created by the supply chain of the industries initially affected by the spending of the college and its students (i.e., the direct effect) and income created by the supply chain of the initial supply chain (i.e., the indirect effect).

**NAICS:** The North American Industry Classification System (NAICS) classifies North American business establishment in order to better collect, analyze, and publish statistical data related to the business economy.

**Net cash flow:** Benefits minus costs, i.e., the sum of revenues accruing from an investment minus costs incurred.

**Net present value:** Net cash flow discounted to the present. All future cash flows are collapsed into one number, which, if positive, indicates feasibility. The result is expressed as a monetary measure.

**Non-labor income:** Income received from investments, such as rent, interest, and dividends.

**Opportunity cost:** Benefits foregone from alternative B once a decision is made to allocate resources to alternative A. Or, if individuals choose to attend college, they forego earnings that they would have received had they chose instead to work full-time. Foregone earnings, therefore, are the "price tag" of choosing to attend college.

**Payback period:** Length of time required to recover an investment. The shorter the period, the more attractive the investment. The formula for computing payback period is:

*Payback period = cost of investment/net return per period*

# Appendix 3: Frequently asked questions (FAQs)

*This appendix provides answers to some frequently asked questions about the results.*

## What is economic impact analysis?

Economic impact analysis quantifies the impact from a given economic event—in this case, the presence of the college and its alumni—on the economy of a specified area.

## What is investment analysis?

Investment analysis is a standard method for determining whether or not an existing or proposed investment is economically viable. This methodology is appropriate in situations where a stakeholder puts up a certain amount of money with the expectation of receiving benefits in return, where the benefits that the stakeholder receives are distributed over time, and where a discount rate must be applied in order to account for the time value of money.

## Do the results differ by region, and if so, why?

Yes. Regional economic data are drawn from Lightcast's proprietary MR-SAM model, the Census Bureau, and other sources to reflect the specific earnings levels, jobs numbers, unemployment rates, population demographics, and other key characteristics of the region served by the college. Therefore, model results for the college are specific to the given region.

## Are the funds transferred to the college increasing in value, or simply being re-directed?

Lightcast's approach is not a simple "rearranging of the furniture" where the impact of operations spending is essentially a restatement of the level of funding received by the college. Rather, it is an impact assessment of the additional income created in the region as a result of the college spending on payroll and other non-pay expenditures, net of any impacts that would have occurred anyway if the college did not exist.

## How do my college's rates of return compare to that of other institutions?

In general, Lightcast discourages comparisons between institutions since many factors, such as regional economic conditions, institutional differences, and student

demographics are outside of the college's control. It is best to compare the rate of return to the discount rates of 4.4% (for students) and 0.2% (for society and taxpayers), which can also be seen as the opportunity cost of the investment (since these stakeholder groups could be spending their time and money in other investment schemes besides education). If the rate of return is higher than the discount rate, the stakeholder groups can expect to receive a positive return on their educational investment.

Lightcast recognizes that some institutions may want to make comparisons. As a word of caution, if comparing to an institution that had a study commissioned by a firm other than Lightcast, then differences in methodology will create an "apples to oranges" comparison and will therefore be difficult. The study results should be seen as unique to each institution.

## Net present value (NPV): How do I communicate this in laymen's terms?

Which would you rather have: a dollar right now or a dollar 30 years from now? That most people will choose a dollar now is the crux of net present value. The preference for a dollar today means today's dollar is therefore worth more than it would be in the future (in most people's opinion). Because the dollar today is worth more than a dollar in 30 years, the dollar 30 years from now needs to be adjusted to express its worth today. Adjusting the values for this "time value of money" is called discounting and the result of adding them all up after discounting each value is called net present value.

## Internal rate of return (IRR): How do I communicate this in laymen's terms?

Using the bank as an example, an individual needs to decide between spending all of their paycheck today and putting it into savings. If they spend it today, they know what it is worth: $1 = $1. If they put it into savings, they need to know that there will be some sort of return to them for spending those dollars in the future rather than now. This is why banks offer interest rates and deposit interest earnings. This makes it so an individual can expect, for example, a 3% return in the future for money that they put into savings now.

## Total alumni impact: How do I communicate this in laymen's terms?

Big numbers are great but putting them into perspective can be a challenge. To add perspective, find an industry with roughly the same "% of GDP" as your college (Table 1.2). This percentage represents its portion of the total gross domestic product. This allows the college to say that their single brick and mortar campus does just as much for the U.S. as the entire Utilities *industry*, for example. This powerful statement can help put the large total impact number into perspective.

# Appendix 4: Example of sales versus income



Lightcast's economic impact study differs from many other studies because we prefer to report the impacts in terms of income rather than sales (or output). Income is synonymous with value added or gross domestic product (GDP). Sales include all the intermediary costs associated with producing goods and services. Income is a net measure that excludes these intermediary costs:

*Income = Sales – Intermediary Costs*

For this reason, income is a more meaningful measure of new economic activity than reporting sales. This is evidenced by the use of gross domestic product (GDP)—a measure of income—by economists when considering the economic growth or size of a country.

To demonstrate the difference between income and sales, let us consider an example of a baker's production of a loaf of bread. The baker buys the ingredients such as eggs, flour, and yeast for $2.00. He uses capital such as a mixer to combine the ingredients and an oven to bake the bread and convert it into a final product. Overhead costs for these steps are $1.00. Total intermediary costs are $3.00. The baker then sells the loaf of bread for $5.00.

The sales amount of the loaf of bread is $5.00. The income from the loaf of bread is equal to the sales amount less the intermediary costs:

*Income = $5.00 – $3.00 = $2.00*

In our analysis, we provide context behind the income figures by also reporting the associated number of jobs. The impacts are also reported in sales and earnings terms for reference.

# Appendix 5: Lightcast MR-SAM



Lightcast's MR-SAM represents the flow of all economic transactions in a given region. It replaces Lightcast's previous input-output (IO) model, which operated with some 1,000 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (i.e., multipliers) in the regional economy as a result of industries entering or exiting the region. The MR-SAM model performs the same tasks as the old IO model, but it also does much more. Along with the same 1,000 industries, government, household, and investment sectors embedded in the old IO tool, the MR-SAM exhibits much more functionality, a greater amount of data, and a higher level of detail on the demographic and occupational components of jobs (16 demographic cohorts and about 750 occupations are characterized).

This appendix presents a high-level overview of the MR-SAM. Additional documentation on the technical aspects of the model is available upon request.

## Data sources for the model

The Lightcast MR-SAM model relies on a number of internal and external data sources, mostly compiled by the federal government. What follows is a listing and short explanation of our sources. The use of these data will be covered in more detail later in this appendix.

**Lightcast Data** are produced from many data sources to produce detailed industry, occupation, and demographic jobs and earnings data at the local level. This information (especially sales-to-jobs ratios derived from jobs and earnings-to-sales ratios) is used to help regionalize the national matrices as well as to disaggregate them into more detailed industries than are normally available.

**BEA Make and Use Tables (MUT)** are the basis for input-output models in the U.S. The *make* table is a matrix that describes the amount of each commodity made by each industry in a given year. Industries are placed in the rows and commodities in the columns. The *use* table is a matrix that describes the amount of each commodity used by each industry in a given year. In the use table, commodities are placed in the rows and industries in the columns. The BEA produces two different sets of MUTs, the benchmark and the summary. The benchmark set contains about 500 sectors and is released every five years, with a five-year lag time (e.g., 2002 benchmark MUTs were released in 2007). The summary set contains about 80 sectors and is released every year, with a two-year lag (e.g., 2010 summary MUTs were released in late 2011/early 2012). The MUTs are used in the Lightcast MR-SAM model to produce an industry-by-industry matrix describing all industry purchases from all industries.

**BEA Gross Domestic Product (GDP)** describes gross domestic product from the value added (also known as added income) perspective. Value added is equal to employee compensation, gross operating surplus, and taxes on production and imports, less subsidies. Each of these components is reported for each country and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The Lightcast MR-SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

**BEA National Income and Product Accounts (NIPA)** cover a wide variety of economic measures for the nation, including gross domestic product (GDP), sources of output, and distribution of income. This dataset is updated periodically throughout the year and can be between a month and several years old depending on the specific account. NIPA data are used in many of the Lightcast MR-SAM processes as both controls and seeds.

**BEA Local Area Income (LPI)** encapsulates multiple tables with geographies down to the county level. The following two tables are specifically used: CA05 (Personal income and earnings by industry) and CA91 (Gross flow of earnings). CA91 is used when creating the commuting submodel and CA05 is used in several processes to help with place-of-work and place-of-residence differences, as well as to calculate personal income, transfers, dividends, interest, and rent.

**Bureau of Labor Statistics Consumer Expenditure Survey (CEX)** reports on the buying habits of consumers along with some information as to their income, consumer unit, and demographics. Lightcast utilizes this data heavily in the creation of the national demographic by income type consumption on industries.

**Census of Government's (CoG)** the government finance dataset is used specifically to aid breaking out national data that is reported in the MUTs. This allows Lightcast to have unique production functions for each of its government sectors.

**Census' OnTheMap (OTM)** is a collection of three datasets for the census block level for multiple years. **Origin-Destination (OD)** offers job totals associated with both home census blocks and a work census block. **Residence Area Characteristics (RAC)** offers jobs totaled by home census block. **Workplace Area Characteristics (WAC)** offers jobs totaled by work census block. All three of these are used in the commuting submodel to gain better estimates of earnings by industry that may be counted as commuting. This dataset has holes for specific years and regions. These holes are filled with Census' Journey-to-Work described later.

**Census' Current Population Survey (CPS)** is used as the basis for the demographic breakout data of the MR-SAM model. This set is used to estimate the ratios of demographic cohorts and their income for the three different income categories (i.e., wages, property income, and transfers).

**Census' Journey-to-Work (JtW)** is part of the 2000 Census and describes the amount of commuting jobs between counties. This set is used to fill in the areas where OTM does not have data.

**Census' American Community Survey (ACS) Public Use Microdata Sample (PUMS)** is the replacement for Census' long form and is used by Lightcast to fill the holes in the CPS data.

**Oak Ridge National Lab (ORNL) County-to-County Distance Matrix (Skim Tree)** contains a matrix of distances and network impedances between each county via various modes of transportation such as highway, railroad, water, and combined highway-rail. Also included in this set are minimum impedances utilizing the best combination of paths. The ORNL distance matrix is used in Lightcast's gravitational flows model that estimates the amount of trade between counties in the country.

## Overview of the MR-SAM model

Lightcast's MR-SAM modeling system is a comparative static model in the same general class as RIMS II (Bureau of Economic Analysis) and IMPLAN (Minnesota Implan Group). The MR-SAM model is thus not an econometric model, the primary example of which is PolicyInsight by REMI. It relies on a matrix representation of industry-to-industry purchasing patterns originally based on national data which are regionalized with the use of local data and mathematical manipulation (i.e., non-survey methods). Models of this type estimate the ripple effects of changes in jobs, earnings, or sales in one or more industries upon other industries in a region.

The Lightcast MR-SAM model shows final equilibrium impacts—that is, the user enters a change that perturbs the economy and the model shows the changes required to establish a new equilibrium. As such, it is not a dynamic model that shows year-by-year changes over time (as REMI's does).

### National SAM

Following standard practice, the SAM model appears as a square matrix, with each row sum exactly equaling the corresponding column sum. Reflecting its kinship with the standard Leontief input-output framework, individual SAM elements show accounting flows between row and column sectors during a chosen base year. Read across rows, SAM entries show the flow of funds into column accounts (also known as receipts or the appropriation of funds by those column accounts). Read down columns, SAM entries show the flow of funds into row accounts (also known as expenditures or the dispersal of funds to those row accounts).

The SAM may be broken into three different aggregation layers: broad accounts, sub-accounts, and detailed accounts. The broad layer is the most aggregate and will be covered first. Broad accounts cover between one and four sub-accounts, which in turn cover many detailed accounts. This appendix will not discuss detailed accounts directly because of their number. For example, in the industry broad account, there are two sub-accounts and over 1,000 detailed accounts.

### Multi-regional aspect of the MR-SAM

Multi-regional (MR) describes a non-survey model that has the ability to analyze the transactions and ripple effects (i.e., multipliers) of not just a single region, but multiple regions interacting with each other. Regions in this case are made up of a collection of counties.

Lightcast's multi-regional model is built off of gravitational flows, assuming that the larger a county's economy, the more influence it will have on the surrounding counties' purchases and sales. The equation behind this model is essentially the same that Isaac Newton used to calculate the gravitational pull between planets and stars. In Newton's equation, the masses of both objects are multiplied, then divided by the distance separating them and multiplied by a constant. In Lightcast's model, the masses are replaced with the supply of a sector for one county and the demand for that same sector from another county. The distance is replaced with an impedance value that considers the distance, type of roads, rail lines, and other modes of transportation. Once this is calculated for every county-to-county pair, a set of mathematical operations is performed to make sure all counties absorb the correct amount of supply from every county and the correct amount of demand from every county. These operations produce more than 200 million data points.

## Components of the Lightcast MR-SAM model

The Lightcast MR-SAM is built from a number of different components that are gathered together to display information whenever a user selects a region. What follows is a description of each of these components and how each is created. Lightcast's internally created data are used to a great extent throughout the processes described below, but its creation is not described in this appendix.

### County earnings distribution matrix

The county earnings distribution matrices describe the earnings spent by every industry on every occupation for a year—i.e., earnings by occupation. The matrices are built utilizing Lightcast's industry earnings, occupational average earnings, and staffing patterns.

Each matrix starts with a region's staffing pattern matrix which is multiplied by the industry jobs vector. This produces the number of occupational jobs in each industry for the region. Next, the occupational average hourly earnings per job are multiplied by 2,080 hours, which converts the average hourly earnings into a yearly estimate. Then the matrix of occupational jobs is multiplied by the occupational annual earnings per job, converting it into earnings values. Last, all earnings are adjusted to match the known industry totals. This is a fairly simple process, but one that is very important. These matrices describe the place-of-work earnings used by the MR-SAM.

### Commuting model

The commuting sub-model is an integral part of Lightcast's MR-SAM model. It allows the regional and multi-regional models to know what amount of the earnings can be

attributed to place-of-residence vs. place-of-work. The commuting data describe the flow of earnings from any county to any other county (including within the counties themselves). For this situation, the commuted earnings are not just a single value describing total earnings flows over a complete year but are broken out by occupation and demographic. Breaking out the earnings allows for analysis of place-of-residence and place-of-work earnings. These data are created using Bureau of Labor Statistics' OnTheMap dataset, Census' Journey-to-Work, BEA's LPI CA91 and CA05 tables, and some of Lightcast's data. The process incorporates the cleanup and disaggregation of the OnTheMap data, the estimation of a closed system of county inflows and outflows of earnings, and the creation of finalized commuting data.

### National SAM

The national SAM as described above is made up of several different components. Many of the elements discussed are filled in with values from the national Z matrix—or industry-to-industry transaction matrix. This matrix is built from BEA data that describe which industries make and use what commodities at the national level. These data are manipulated with some industry standard equations to produce the national Z matrix. The data in the Z matrix act as the basis for the majority of the data in the national SAM. The rest of the values are filled in with data from the county earnings distribution matrices, the commuting data, and the BEA's National Income and Product Accounts.

One of the major issues that affect any SAM project is the combination of data from multiple sources that may not be consistent with one another. Matrix balancing is the broad name for the techniques used to correct this problem. Lightcast uses a modification of the "diagonal similarity scaling" algorithm to balance the national SAM.

### Gravitational flows model

The most important piece of the Lightcast MR-SAM model is the gravitational flows model that produces county-by-county regional purchasing coefficients (RPCs). RPCs estimate how much an industry purchases from other industries inside and outside of the defined region. This information is critical for calculating all IO models.

Gravity modeling starts with the creation of an impedance matrix that values the difficulty of moving a product from county to county. For each sector, an impedance matrix is created based on a set of distance impedance methods for that sector. A distance impedance method is one of the measurements reported in the Oak Ridge National Laboratory's County-to-County Distance Matrix. In this matrix, every county-to-county relationship is accounted for in six measures: great-circle distance, highway impedance, rail miles, rail impedance, water impedance, and highway-rail-highway impedance. Next, using the impedance information, the trade flows for each industry in every county are solved for. The result is an estimate of multi-regional flows from every county to every county. These flows are divided by each respective county's demand to produce multi-regional RPCs.

# Appendix 6: Value per credit and the Mincer function



Two key components in the analysis are 1) the value of the students' educational achievements, and 2) the change in that value over the students' working careers. Both of these components are described in detail in this appendix.

## Value per credit

Typically, the educational achievements of students are marked by the credentials they earn. However, not all students who attended ACE in CY 2022 obtained a degree or certificate. Some returned the following year to complete their education goals, while others took a few courses and entered the workforce without graduating. As such, the only way to measure the value of the students' achievement is through their credits. This approach allows us to see the benefits to all students who attended the college, not just those who earned a credential.

To calculate the value per credit, we first determine how many credits are required to complete each education level. For example, assuming that there are 30 credits in an academic year, a student generally completes 120 credits in order to move from a high school diploma to a bachelor's degree, another 60 credits to move from a bachelor's degree to a master's degree, and so on. This progression of credits generates an education ladder beginning at the less than high school level and ending with the completion of a doctoral degree, with each level of education representing a separate stage in the progression.

The second step is to assign a unique value to the credits in the education ladder based on the wage differentials presented in Table 1.3. For example, the difference in national earnings between a high school diploma and a bachelor's degree is $28,900. We spread this $28,900 wage differential across the 120 credits that occur between a high school diploma and a bachelor's degree, applying a ceremonial "boost" to the last credit in the stage to mark the achievement of the degree.[33] We repeat this process for each education level in the ladder.

Next, we map the credit production of the CY 2022 student population to the education ladder. Table 1.1 provides information on the credit production of students attending ACE, broken out by educational achievement. In total, students completed 170,216 credits during the analysis year. We map each of these credits to the education ladder depending on the students' education level and the average number of credits they

33 Economic theory holds that workers that acquire education credentials send a signal to employers about their ability level. This phenomenon is commonly known as the sheepskin effect or signaling effect. The ceremonial boosts applied to the achievement of degrees in the Lightcast impact model are derived from Jaeger and Page (1996).

completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate degree and the bachelor's degree, and the average number of credits they completed informs the shape of the distribution curve used to spread out their total credit production within that stage of the progression.

The sum product of the credits earned at each step within the education ladder and their corresponding value yields the students' aggregate annual increase in income (*ΔE)*, as shown in the following equation:

$$\Delta E = \sum_{i=1}^{n} e_i h_i \text{ where } i \in 1, 2, \ldots n$$

and $n$ is the number of steps in the education ladder, $e_i$ is the marginal earnings gain at step *i,* and $h_i$ is the number of credits completed at step *i*.

Table A6.1 displays the result for the students' aggregate annual increase in income (*ΔE)*, a total of $48.3 million. By dividing this value by the students' total production of 170,216 credits during the analysis year, we derive an overall value of $284 per credit.

**Table A6.1: Aggregate annual increase in income of students and value per credit**

| | |
|---|---|
| Aggregate annual increase in income | $48,258,282 |
| Total credits in CY 2022 | 170,216 |
| **Value per credit** | **$284** |

Source: Lightcast impact model.

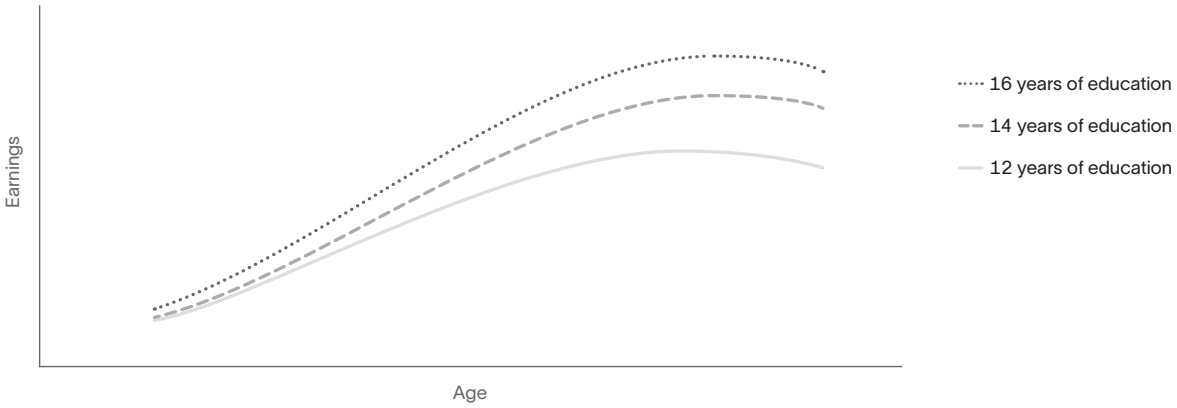
## Mincer function

The $284 value per credit in Table A6.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[34] While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use national education and Mincer coefficients.

34 See Mincer (1958 and 1974).

Figure A6.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum somewhere well after the midpoint of the working career, and then decline in later years. Second, individuals with higher levels of education reach their maximum earnings at an older age compared to individuals with lower levels of education (recall that age serves as a proxy for years of experience). And third, the benefits of education, as measured by the difference in earnings between education levels, increase with age.

**Figure A6.1: Lifecycle change in earnings**




In calculating the alumni impact in Chapter 2, we use the slope of the curve in Mincer's earnings function to condition the $284 value per credit to the students' age and work experience. To the students just starting their career during the analysis year, we apply a lower value per credit; to the students in the latter half or approaching the end of their careers we apply a higher value per credit. The original $284 value per credit applies only to the credit production of students precisely at the midpoint of their careers during the analysis year.

In Chapter 3 we again apply the Mincer function, this time to project the benefits stream of the CY 2022 student population into the future. Here too the value per credit is lower for students at the start of their career and higher near the end of it, in accordance with the scalars derived from the slope of the Mincer curve illustrated in Figure A6.1.

# Appendix 7: Alternative education variable



In a scenario where the college did not exist, some of its students would still be able to avail themselves of an alternative comparable education. These students create benefits in the country even in the absence of the college. The alternative education variable accounts for these students and is used to discount the benefits we attribute to the college.

Recall this analysis considers only relevant economic information regarding the college. Considering the existence of various other academic institutions surrounding the college, we have to assume that a portion of the students could find alternative education and either remain in or return to the country. For example, some students may participate in online programs while remaining in the country. Others may attend an institution outside the U.S. and returned upon completing their studies. For these students—who would have found an alternative education and produced benefits in the country regardless of the presence of the college—we discount the benefits attributed to the college. An important distinction must be made here: the benefits from students who would find alternative education outside the U.S. and not return are *not* discounted. Because these benefits would not occur in the country without the presence of the college, they must be included.

In the absence of the college, we assume 5% of the college's students would find alternative education opportunities and remain in or return to the U.S. We account for this by discounting the alumni impact, the benefits to taxpayers, and the benefits to society in the U.S. in Chapters 2 and 3 by 5%. In other words, we assume 5% of the benefits created by the college's students would have occurred anyway in the counterfactual scenario where the college did not exist. A sensitivity analysis of this adjustment is presented in Appendix 1.

# Appendix 8: Overview of investment analysis measures



The appendix provides context to the investment analysis results using the simple hypothetical example summarized in Table A8.1 below. The table shows the projected benefits and costs for a single student over time and associated investment analysis results.[35]

**Table A8.1: Example of the benefits and costs of education for a single student**

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Year** | **Tuition** | **Opportunity cost** | **Total cost** | **Higher earnings** | **Net cash flow** |
| 1 | $1,500 | $20,000 | $21,500 | $0 | -$21,500 |
| 2 | $0 | $0 | $0 | $5,000 | $5,000 |
| 3 | $0 | $0 | $0 | $5,000 | $5,000 |
| 4 | $0 | $0 | $0 | $5,000 | $5,000 |
| 5 | $0 | $0 | $0 | $5,000 | $5,000 |
| 6 | $0 | $0 | $0 | $5,000 | $5,000 |
| 7 | $0 | $0 | $0 | $5,000 | $5,000 |
| 8 | $0 | $0 | $0 | $5,000 | $5,000 |
| 9 | $0 | $0 | $0 | $5,000 | $5,000 |
| 10 | $0 | $0 | $0 | $5,000 | $5,000 |
| **Net present value** | | | **$21,500** | **$35,753** | **$14,253** |

Benefit-cost ratio
1.7

Internal rate of return
18.0%

Payback period (years)
4.2

Assumptions are as follows:

- Benefits and costs are projected out 10 years into the future (Column 1).
- The student attends the college for one year, and the cost of tuition is $1,500 (Column 2).
- Earnings foregone while attending the college for one year (opportunity cost) come to $20,000 (Column 3).

35 Note that this is a hypothetical example. The numbers used are not based on data collected from an existing college.

- Together, tuition and earnings foregone cost sum to $21,500. This represents the out-of-pocket investment made by the student (Column 4).
- In return, the student earns $5,000 more per year than he otherwise would have earned without the education (Column 5).
- The net cash flow (NCF) in Column 6 shows higher earnings (Column 5) less the total cost (Column 4).
- The assumed going rate of interest is 4%, the rate of return from alternative investment schemes for the use of the $21,500.

Results are expressed in standard investment analysis terms, which are as follows: the net present value, the internal rate of return, the benefit-cost ratio, and the payback period. Each of these is briefly explained below in the context of the cash flow numbers presented in Table A8.1.

## Net present value

The student in Table A8.1 can choose either to attend college or to forego post-secondary education and maintain his present employment. If he decides to enroll, certain economic implications unfold. Tuition and fees must be paid, and earnings will cease for one year. In exchange, the student calculates that with post-secondary education, his earnings will increase by at least the $5,000 per year, as indicated in the table.

The question is simple: Will the prospective student be economically better off by choosing to enroll? If he adds up higher earnings of $5,000 per year for the remaining nine years in Table A8.1, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different. Benefits are far lower than $45,000 because future money is worth less than present money. Costs (tuition plus earnings foregone) are felt immediately because they are incurred today, in the present. Benefits, on the other hand, occur in the future. They are not yet available. All future benefits must be discounted by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[36]

Let us take a brief example. At 4%, the present value of $5,000 to be received one year from today is $4,807. If the $5,000 were to be received in year 10, the present value would reduce to $3,377. Put another way, $4,807 deposited in the bank today earning 4% interest will grow to $5,000 in one year; and $3,377 deposited today would grow to $5,000 in 10 years. An "economically rational" person would, therefore, be equally satisfied receiving $3,377 today or $5,000 10 years from today given the going rate of interest of 4%. The process of discounting—finding the present value of future higher earnings—allows the model to express values on an equal basis in future or present value terms.

36 Technically, the interest rate is applied to compounding—the process of looking at deposits today and determining how much they will be worth in the future. The same interest rate is called a discount rate when the process is reversed—determining the present value of future earnings.

The goal is to express all future higher earnings in present value terms so that they can be compared to investments incurred today (in this example, tuition plus earnings foregone). As indicated in Table A8.1 the cumulative present value of $5,000 worth of higher earnings between years 2 and 10 is $35,753 given the 4% interest rate, far lower than the undiscounted $45,000 discussed above.

The net present value of the investment is $14,253. This is simply the present value of the benefits less the present value of the costs, or $35,753 - $21,500 = $14,253. In other words, the present value of benefits exceeds the present value of costs by as much as $14,253. The criterion for an economically worthwhile investment is that the net present value is equal to or greater than zero. Given this result, it can be concluded that, in this case, and given these assumptions, this particular investment in education is very strong.

## Internal rate of return

The internal rate of return is another way of measuring the worth of investing in education using the same cash flows shown in Table A8.1. In technical terms, the internal rate of return is a measure of the average earning power of money used over the life of the investment. It is simply the interest rate that makes the net present value equal to zero. In the discussion of the net present value above, the model applies the going rate of interest of 4% and computes a positive net present value of $14,253. The question now is what the interest rate would have to be in order to reduce the net present value to zero. Obviously, it would have to be higher—18.0% in fact, as indicated in Table A8.1. Or, if a discount rate of 18.0% were applied to the net present value calculations instead of the 4%, then the net present value would reduce to zero.

What does this mean? The internal rate of return of 18.0% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18.0%, higher earnings of $5,000 per year for the next nine years will earn back all investments of $21,500 made plus pay 18.0% for the use of that money ($21,500) in the meantime. Is this a good return? Indeed, it is. If it is compared to the 4% going rate of interest applied to the net present value calculations, 18.0% is far higher than 4%. It may be concluded, therefore, that the investment in this case is solid. Alternatively, comparing the 18.0% rate of return to the long-term 9.6% rate or so obtained from investments in stocks and bonds also indicates that the investment in education is strong relative to the stock market returns (on average).

## Benefit-cost ratio

The benefit-cost ratio is simply the present value of benefits divided by present value of costs, or $35,753 ÷ $21,500 = 1.7 (based on the 4% discount rate). Of course, any change in the discount rate would also change the benefit-cost ratio. Applying the 18.0% internal rate of return discussed above would reduce the benefit-cost ratio to 1.0, the breakeven solution where benefits just equal costs. Applying a discount rate higher than the 18.0% would reduce the ratio to lower than 1.0, and the investment

would not be feasible. The 1.7 ratio means that a dollar invested today will return a cumulative $1.70 over the ten-year time period.

## Payback period

This is the length of time from the beginning of the investment (consisting of tuition and earnings foregone) until higher future earnings give a return on the investment made. For the student in Table A8.1, it will take roughly 4.2 years of $5,000 worth of higher earnings to recapture his investment of $1,500 in tuition and the $20,000 in earnings foregone while attending the college. Higher earnings that occur beyond 4.2 years are the returns that make the investment in education in this example economically worthwhile. The payback period is a fairly rough, albeit common, means of choosing between investments. The shorter the payback period, the stronger the investment.

# Appendix 9: Social externalities

Education has a predictable and positive effect on a diverse array of social benefits. These, when quantified in dollar terms, represent significant social savings that directly benefit society communities and citizens throughout the U.S., including taxpayers. In this appendix we discuss the following three main benefit categories: 1) improved health, 2) reductions in crime, and 3) reduced demand for government-funded income assistance.

It is important to note that the data and estimates presented here should not be viewed as exact, but rather as indicative of the positive impacts of education on an individual's quality of life. The process of quantifying these impacts requires a number of assumptions to be made, creating a level of uncertainty that should be borne in mind when reviewing the results.

## Health

Statistics show a correlation between increased education and improved health. The manifestations of this are found in five health-related variables: smoking, alcohol dependence, obesity, depression, and drug abuse. There are other health-related areas that link to educational attainment, but these are omitted from the analysis until we can invoke adequate (and mutually exclusive) databases and are able to fully develop the functional relationships between them.

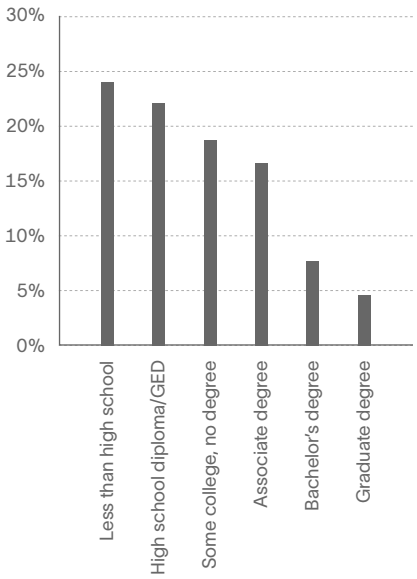
### Smoking

Despite a marked decline over the last several decades in the percentage of U.S. residents who smoke, a sizeable percentage of the U.S. population still smokes. The negative health effects of smoking are well documented in the literature, which identifies smoking as one of the most serious health issues in the U.S.

Figure A9.1 shows the prevalence of cigarette smoking among adults, 25 years and over, based on data provided by the National Health Interview Survey.[37] The data include adults who reported smoking more than 100 cigarettes during their lifetime and who, at the time of interview, reported smoking every day or some days. As indicated, the percent of who smoke begins to decline beyond the level of high school education.

The Centers for Disease Control and Prevention (CDC) reports the percentage of adults who are current smokers by state.[38] We use this information to inform the impact model.

**Figure A9.1: Prevalence of smoking among U.S. adults by education level**




Source: Centers for Disease Control and Prevention.

37 Centers for Disease Control and Prevention. "Table. Characteristics of current adult cigarette smokers," National Health Interview Survey, United States, 2016.

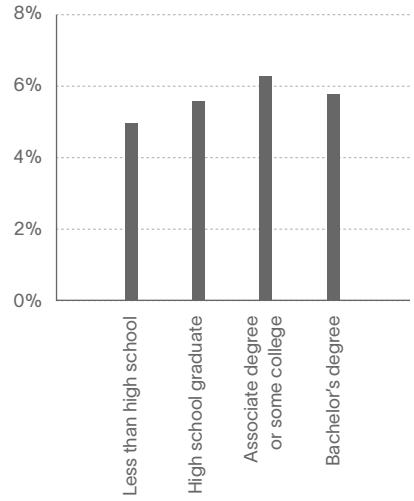
38 Centers for Disease Control and Prevention. "Current Cigarette Use Among Adults (Behavior Risk Factor Surveillance System) 2018." *Behavioral Risk Factor Surveillance System Prevalence and Trends Data,* 2018.

## Alcohol dependence

Although alcohol dependence has large public and private costs, it is difficult to measure and define. There are many patterns of drinking, ranging from abstinence to heavy drinking. Alcohol abuse is riddled with social costs, including health care expenditures for treatment, prevention, and support; workplace losses due to reduced worker productivity; and other effects.

Figure A9.2 compares the percentage of adults, 18 and older, that abuse or depend on alcohol by education level, based on data from the Substance Abuse and Mental Health Services Administration (SAMHSA).[39] These statistics give an indication of the correlation between education and the reduced probability of alcohol dependence. Adults with an associate degree or some college have higher rates of alcohol dependence than adults with a high school diploma or lower. Prevalence rates are lower for adults with a bachelor's degree or higher than those with an associate degree or some college. Although the data do not maintain a pattern of decreased alcohol dependence at every level of increased education, we include these rates in our model to ensure we provide a comprehensive view of the social benefits and costs correlated with education.

**Figure A9.2: Prevalence of alcohol dependence or abuse by education level**



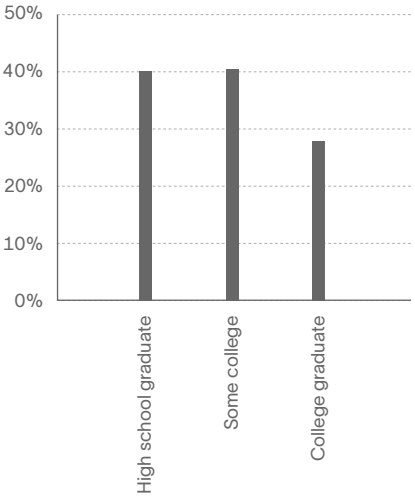

Source: Centers for Disease Control and Prevention.

## Obesity

The rise in obesity and diet-related chronic diseases has led to increased attention on how expenditures relating to obesity have increased in recent years. The average cost of obesity-related medical conditions is calculated using information from the *Journal of Occupational and Environmental Medicine*, which reports incremental medical expenditures and productivity losses due to excess weight.[40]

Data for Figure A9.3 is derived from the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over by education, gender, and ethnicity.[41] As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, the prevalence of obesity among adults with some college is actually greater than those with just a high school diploma. In general, though, obesity tends to decline with increasing levels of education.

**Figure A9.3: Prevalence of obesity by education level**




Source: Derived from data provided by the National Center for Health Statistics.

39 Substance Abuse and Mental Health Services Administration. "Table 5.4B—Alcohol Use Disorder in Past Year among Persons Aged 12 or Older, by Age Group and Demographic Characteristics: Percentages, 2017 and 2018." SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2017 and 2018.

40 Eric A. Finkelstein, Marco da Costa DiBonaventura, Somali M. Burgess, and Brent C. Hale, "The Costs of Obesity in the Workplace," *Journal of Occupational and Environmental Medicine* 52, no. 10 (October 2010): 971-976.

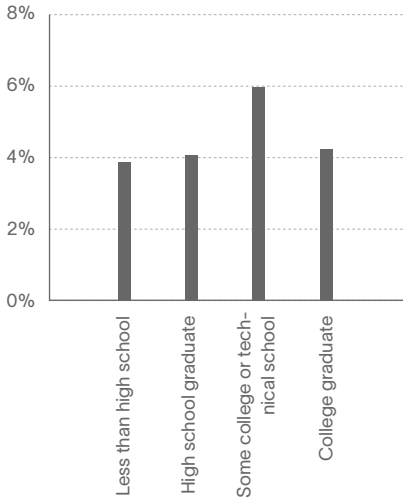
41 Ogden Cynthia L., Tala H. Fakhouri, Margaret D. Carroll, Craig M. Hales, Cheryl D. Fryar, Xianfen Li, David S. Freedman. "Prevalence of Obesity Among Adults, by Household Income and Education—United States, 2011–2014" National Center for Health Statistics, *Morbidity and Mortality Weekly Report*, 66:1369–1373 (2017).

### Depression

Capturing the full economic cost of mental illness is difficult because not all mental disorders have a correlation with education. For this reason, we only examine the economic costs associated with major depressive disorder (MDD), which are comprised of medical and pharmaceutical costs, workplace costs such as absenteeism, and suicide-related costs.[42]

Figure A9.4 summarizes the prevalence of MDD among adults by education level, based on data provided by the CDC.[43] As shown, people with some college are most likely to have MDD compared to those with other levels of educational attainment. People with a high school diploma or less, along with college graduates, are all fairly similar in the prevalence rates.

**Figure A9.4: Prevalence of major depressive episode by education level**

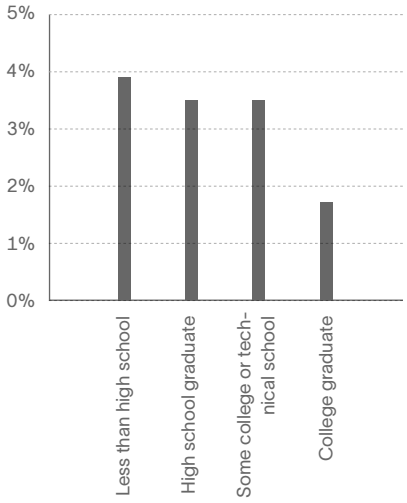



Source: National Survey on Drug Use and Health.

### Drug abuse

The burden and cost of illicit drug abuse is enormous in the U.S., but little is known about the magnitude of costs and effects at a national level. What is known is that the rate of people abusing drugs is inversely proportional to their education level. The higher the education level, the less likely a person is to abuse or depend on illicit drugs. The probability that a person with less than a high school diploma will abuse drugs is 3.9%, twice as large as the probability of drug abuse for college graduates (1.7%). This relationship is presented in Figure A9.5 based on data supplied by SAMHSA.[44] Similar to alcohol abuse, prevalence does not strictly decline at every education level. Health costs associated with illegal drug use are also available from SAMSHA, with costs to the government representing 40% of the total cost related to illegal drug use.[45]

**Figure A9.5: Prevalence of illicit drug dependence or abuse by education level**




Source: Substance Abuse and Mental Health Services Administration.

## Crime

As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial and legal, and corrections, 2) victim costs, and 3) productivity lost as a result of time spent in jail or prison rather than working.

42 Greenberg, Paul, Andree-Anne Fournier, Tammy Sisitsky, Crystal Pike, and Ronald Kesslaer. "The Economic Burden of Adults with Major Depressive Disorder in the United States (2005 and 2010)" *Journal of Clinical Psychiatry* 76:2, 2015.

43 National Survey on Drug Use and Health. "Table 8.40B: Major Depressive Episode (MDE) or MDE with Severe Impairment in Past Year among Persons Aged 18 or Older, and Receipt of Treatment for Depression in Past Year among Persons Aged 18 or Older with MDE or MDE with Severe Impairment in Past Year, by Geographic, Socioeconomic, and Health Characteristics: Numbers in Thousands, 2017 and 2018."

44 Substance Abuse and Mental Health Services Administration. "Table 5.3B—Illicit Drug Use Disorder in Past Year among Persons Aged 12 or Older, by Age Group and Demographic Characteristics: Percentages, 2017 and 2018." SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2017 and 2018.

45 Substance Abuse and Mental Health Services Administration. "Table A.2. Spending by Payer: Levels and Percent Distribution for Mental Health and Substance Abuse (MHSA), Mental Health (MH), Substance Abuse (SA), Alcohol Abuse (AA), Drug Abuse (DA), and All-Health, 2014." *Behavioral Health Spending & Use Accounts, 1986–2014. HHS Publication No. SMA-16-4975*, 2016.

Figure A9.6 displays the educational attainment of the incarcerated population in the U.S. Data are derived from the breakdown of the inmate population by education level in federal, state, and local prisons as provided by the U.S. Census Bureau.[46]

Victim costs comprise material, medical, physical, and emotional losses suffered by crime victims. Some of these costs are hidden, while others are available in various databases. Estimates of victim costs vary widely, attributable to differences in how the costs are measured. The lower end of the scale includes only tangible out-of-pocket costs, while the higher end includes intangible costs related to pain and suffering.[47]

Yet another measurable cost is the economic productivity of people who are incarcerated and are thus not employed. The measurable productivity cost is simply the number of additional incarcerated people, who could have been in the labor force, multiplied by the average income of their corresponding education levels.

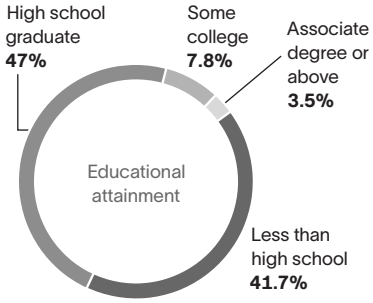
## Income assistance

Statistics show that as education levels increase, the number of applicants for government-funded income assistance such as welfare and unemployment benefits declines. Welfare and unemployment claimants can receive assistance from a variety of different sources, including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Medicaid, Supplemental Security Income (SSI), and unemployment insurance.[48]

Figure A9.7 relates the breakdown of TANF recipients by education level, derived from data provided by the U.S. Department of Health and Human Services.[49] As shown, the demographic characteristics of TANF recipients are weighted heavily towards the less than high school and high school categories, with a much smaller representation of individuals with greater than a high school education.

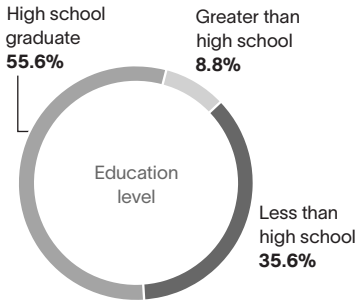
Unemployment rates also decline with increasing levels of education, as illustrated in Figure A9.8. These data are provided by the Bureau of Labor Statistics.[50] As shown, unemployment rates range from 5.4% for those with less than a high school diploma to 1.9% for those at the graduate degree level or higher.

**Figure A9.6:**
**Educational attainment of the incarcerated population**



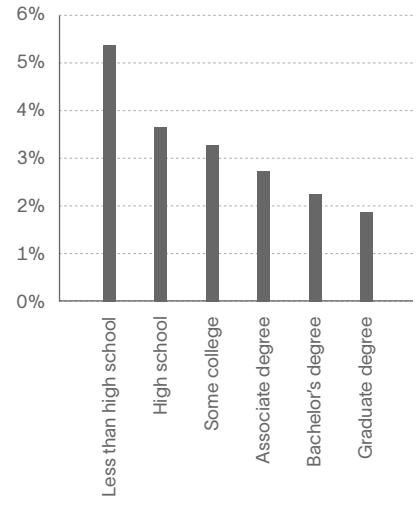

Source: Derived from data provided by the U.S. Census Bureau.

**Figure A9.7:**
**Breakdown of TANF recipients by education level**




Source: US. Department of Health and Human Services, Office of Family Assistance.

**Figure A9.8: Unemployment by education level**




Source: Bureau of Labor Statistics.

46 U.S. Census Bureau. "Educational Characteristics of Prisoners: Data from the ACS." 2011.

47 McCollister, Kathryn E., Michael T. French, and Hai Fang. "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation." *Drug and Alcohol Dependence* 108, no. 1-2 (April 2010): 98-109.

48 Medicaid is not considered in this analysis because it overlaps with the medical expenses in the analyses for smoking, alcohol dependence, obesity, depression, and drug abuse. We also exclude any welfare benefits associated with disability and age.

49 U.S. Department of Health and Human Services, Office of Family Assistance. "Characteristics and Financial Circumstances of TANF Recipients, Fiscal Year 2018."

50 Bureau of Labor Statistics. "Table 7. Employment status of the civilian noninstitutional population 25 years and over by educational attainment, sex, race, and Hispanic or Latino ethnicity." Current Population Survey, Labor Force Statistics, Household Data Annual Averages, 2019.