California Community Colleges

MAIN REPORT

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The Economic Value of the California Community College System

Emsi | burningglass

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Executive summary

This report assesses the impact of the California Community College System[1] on the state economy and the benefits generated by the colleges for students, taxpayers, and society. The results of this study show that California's Community Colleges create a positive net impact on the state economy and generate a positive return on investment for students, taxpayers, and society.

1 The California Community College System consists of the 116 public community colleges in California. See Appendix 1 for a list of the institutions included within the California Community College System.

ECONOMIC IMPACT ANALYSIS

During the analysis year, California's Community Colleges spent $8.5 billion on payroll and benefits for 91,328 full-time and part-time employees, and spent another $4.2 billion on goods and services to carry out the colleges' day-to-day operations. This initial round of spending creates more spending across other businesses throughout the state economy, resulting in the commonly referred to multiplier effects. This analysis estimates the net economic impact of California's Community Colleges that directly takes into account the fact that state and local dollars spent on California's Community Colleges could have been spent elsewhere in the state if not directed towards the colleges. This spending would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of California's Community Colleges.

> The additional income of **$128.2 billion** created by California's Community Colleges is equal to approximately **4.2%** of the total gross state product of California.

This analysis shows that in fiscal year (FY) 2018-19, operations, construction, and student spending of the colleges, together with the enhanced productivity of their alumni, generated **$128.2 billion** in added income for the California economy. The additional income of $128.2 billion created by California's Community Colleges is equal to approximately **4.2%** of the total gross state product (GSP) of California. For perspective, this impact from the colleges is larger than the entire Construction industry in the state. The impact of $128.2 billion is equivalent to supporting **1.5 million jobs**.

For further perspective, this means that **one out of every 16 jobs** in California is supported by the activities of the colleges and their students. These economic impacts break down as follows:

Operations spending impact

Payroll and benefits to support the colleges' day-to-day operations amounted to $8.5 billion. The colleges' non-pay expenditures amounted to $4.2 billion. The net impact of operations spending by the colleges in California during the analysis year was approximately **$11 billion** in added income, which is equivalent to supporting **99,470 jobs**.

Construction spending impact

California's Community Colleges invest in construction each year to maintain facilities, create additional capacities, and meet growing educational demands. While the amount varies from year to year, these quick infusions of income and jobs have a substantial impact on the state economy. In FY 2018-19, California's Community Colleges' construction spending generated **$13.6 million** in added income, which is equivalent to supporting **165 jobs**.

Student spending impact

Around 6% of students attending California's Community Colleges originated from outside the state. Some of these students relocated to California to attend the colleges. In addition, some students, referred to as retained students, are residents of California who would have left the state if not for the existence of California's Community Colleges. The money that these students spent toward living expenses in California is attributable to the colleges.

The expenditures of relocated and retained students in the state during the analysis year added approximately **$8.2 billion** in income for the California economy, which is equivalent to supporting **135,021 jobs**.

Alumni impact

Over the years, students gained new skills, making them more productive workers, by studying at the colleges. Today, hundreds of thousands of these former students are employed in California.

The accumulated impact of former students currently employed in the California workforce amounted to **$109 billion** in added income for the California economy, which is equivalent to supporting **1.3 million jobs**.

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 state as it is spent at out-of-state businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages, and is synonymous with gross state product (GSP) 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 considers California's Community Colleges as an investment from the perspectives of students, taxpayers, and society.

Student perspective

Students invest their own money and time in their education to pay for tuition, books, and supplies. Many take out student loans to attend the colleges, which they will pay back over time. While some students were employed while attending the colleges, students overall forewent earnings that they would have generated had they been in full employment instead of learning. Summing these direct outlays, opportunity costs, and future student loan costs yields a total of **$10.9 billion** in present value student costs.

In return, students will receive a present value of **$54.4 billion** in increased earnings over their working lives. This translates to a return of **$5.00** in higher future earnings for every dollar that students invest in their education at the colleges. The corresponding annual rate of return is **19.6%**.

Taxpayer perspective

Taxpayers provided **$10.1 billion** of state and local funding to California's Community Colleges in FY 2018-19. In return, taxpayers will receive an estimated present value of **$19.4 billion** in added tax revenue stemming from the students' higher lifetime earnings and the increased output of businesses. Savings to the public sector add another estimated **$2.1 billion** in benefits due to a reduced demand for government-funded social services in California. For every tax dollar spent educating students attending the colleges, taxpayers will receive an average of **$2.10** in return over the course of the students' working lives. In other words, taxpayers enjoy an annual rate of return of **5.4%**.

> For every tax dollar spent educating students attending California's Community Colleges, taxpayers will receive an average of **$2.10** in return over the course of the students' working lives.

Social perspective

People in California invested **$22.8 billion** in California's Community Colleges in FY 2018-19. This includes the colleges' expenditures, student expenses, and student opportunity costs. In return, the state of California will receive an estimated present value of **$262.5 billion** in added state revenue over the course of the students' working lives. California will also benefit from an estimated **$3.3 billion** in present value social savings related to reduced crime, lower welfare and unemployment, and increased health and well-being across the state. For every dollar society invests in California's Community Colleges, an average of **$11.70** in benefits will accrue to California over the course of the students' careers.

ACKNOWLEDGMENTS

Emsi Burning Glass gratefully acknowledges the excellent support of the staff at the California Community College System in making this study possible. Special thanks go to Eloy Ortiz Oakley, Chancellor, who approved the study, and to Stacy Fisher, Senior Director of Strategic Projects & Initiatives, Success Center, who collected much of the data and information requested. Any errors in the report are the responsibility of Emsi Burning Glass and not of any of the above-mentioned individuals.

INTRODUCTION

The California Community College System, established in 1967, has today grown to serve 2.1 million credit and 250,587 non-credit students. The system is led by Eloy Ortiz Oakley, Chancellor.

While California's Community Colleges affect the state in a variety of ways, many of them difficult to quantify, this study considers the colleges' economic benefits. The colleges naturally help students achieve their individual potential and develop the knowledge, skills, and abilities they need to have fulfilling and prosperous careers. However, California's Community Colleges impact California beyond influencing the lives of students. The colleges' program offerings supply employers with workers to make their businesses more productive. The colleges, their day-to-day operations, their construction activities, and the expenditures of their students support the state economy through the output and employment generated by state vendors. The benefits created by the colleges extend as far as the state treasury in terms of the increased tax receipts and decreased public sector costs generated by students across the state.

California's Community Colleges impact California beyond influencing the lives of students.

This report assesses the impact of California's Community Colleges as a whole on the state economy and the benefits generated by the colleges for students, taxpayers, and society. The approach is twofold. We begin with an economic impact analysis of the colleges on the California 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 California economy as a result of increased consumer spending and the added knowledge, skills, and abilities of students. Results of the economic impact analysis are broken out according to the following impacts: 1) impact of the colleges' day-to-day operations, 2) impact of the colleges' construction spending, 3) impact of student spending, and 4) impact of alumni who are still employed in the California workforce.

The second component of the study measures the benefits generated by California's Community Colleges 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, the cost of interest incurred on student loans, and the opportunity cost of attending the colleges as opposed to working. In return for these investments, students receive a lifetime of higher earnings. For taxpayers, the study measures the benefits to state 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 California as a whole.

The study uses a wide array of data that are based on several sources, including the FY 2018-19 academic and financial reports from the Foundation for California Community Colleges; industry and employment data from the Bureau of Labor Statistics and Census Bureau; outputs of Emsi Burning Glass's impact model and MR-SAM model; and a variety of published materials relating education to social behavior.

CHAPTER 1:

Profile of the California Community College System and the economy

TODAY, CALIFORNIA'S COMMUNITY COLLEGES enroll nearly 2.4 million students (over 2.1 million credit students and over 250,000 non-credit students). The mission of the colleges as a system is to provide students with the knowledge and background necessary to compete in today's economy.

California's Community Colleges offer programs at the bachelor's degree, associate degree, certificate, and non-credit training levels. There are 73 districts within the California Community College System emcompassing 116 individual community colleges. Each of these colleges allow students to meet their individual aspirations, whether that is transferring to a four-year college or seeking job-training skills. Through this, California's Community Colleges are at the forefront in combating income inequality and are trailblazers in supporting social and economic mobility. Beyond that, California's Community Colleges partner with industry and labor to deliver relevant and innovative programs.

California's Community Colleges are at the forefront in combating income inequality and are trailblazers in supporting social and economic mobility.

CALIFORNIA'S COMMUNITY COLLEGES' EMPLOYEE AND FINANCE DATA

The study uses two general types of information: 1) data collected from the Foundation for California Community Colleges and 2) state economic data obtained from various public sources and Emsi Burning Glass's proprietary data modeling tools.[2] This chapter presents the basic underlying information from California's Community Colleges used in this analysis and provides an overview of the California economy.

Employee data

Data provided by the Foundation for California Community Colleges include information on faculty and staff by place of work and by place of residence. These data appear in Table 1.1. As shown, California's Community Colleges employed 45,033 full-time and 46,295 part-time faculty and staff in FY 2018-19 (including student workers). Of these, nearly 100% worked in the state and nearly 100% lived in the state.[3] These data are used to isolate the portion of the employees' payroll and household expenses that remains in the state economy.

Table 1.1:
EMPLOYEE DATA, FY 2018-19

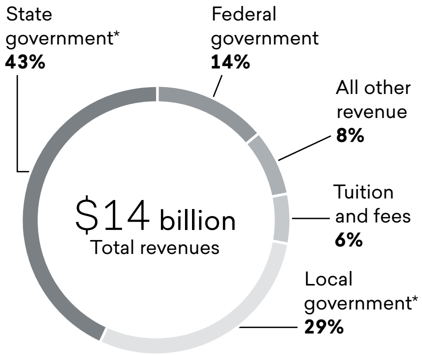
Full-time faculty and staff	45,033
Part-time faculty and staff	46,295
Total faculty and staff	**91,328**
% of employees who work in the state	100%
% of employees who live in the state	100%

Source: Data provided by the Foundation for California Community Colleges and estimates provided by Emsi Burning Glass.

Revenues

Figure 1.1 shows California's Community Colleges' annual revenues by funding source—a total of $14 billion in FY 2018-19. As indicated, tuition and fees comprised 6% of total revenue, and revenues from local, state, and federal government sources comprised another 86%. All other revenue (i.e., auxiliary revenue, sales and services, interest, and donations) comprised the remaining 8%. These data are critical in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

Figure 1.1: CALIFORNIA'S COMMUNITY COLLEGES' REVENUES BY SOURCE, FY 2018-19

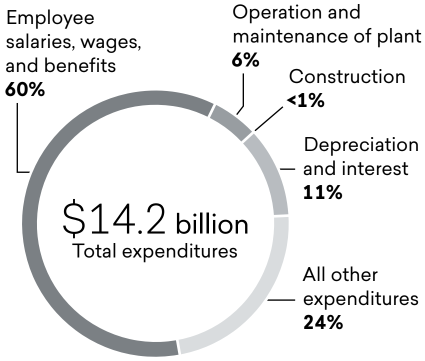


*Revenue from state and local government includes capital appropriations.
Source: Data provided by the Foundation for California Community Colleges.

Expenditures

Figure 1.2 displays California's Community Colleges' expense data. The combined payroll at California's Community Colleges, including student salaries and wages, amounted to $8.5 billion. This was equal to 60% of the colleges' total expenses for FY 2018-19. Other expenditures, including operation and maintenance of plant, construction, depreciation and interest, and purchases of supplies and services, made up $5.7 billion. When we calculate the impact of these expenditures in Chapter 2, we exclude expenses for depreciation and interest, as they represent a devaluing of the colleges' assets rather than an outflow of expenditures.

Figure 1.2: CALIFORNIA'S COMMUNITY COLLEGES' EXPENSES BY FUNCTION, FY 2018-19



Source: Data provided by the Foundation for California Community Colleges.
Percentages may not add due to rounding.

2 See Appendix 6 for a detailed description of the data sources used in the Emsi Burning Glass modeling tools.
3 Data points estimated from a sample of over 50 studies conducted in the past three years by Emsi Burning Glass for California's Community Colleges.

Students

The colleges served 2.1 million students taking courses for credit and 250,587 non-credit students in FY 2018-19. These numbers represent unduplicated student headcounts. The breakdown of the student body by gender was 46% male and 54% female. The breakdown by ethnicity was 72% students of color, 25% white, and 3% unknown. The students' overall average age was 28 years old.[4] An estimated 94% of students remain in California after finishing their time at California's Community Colleges and the remaining 6% settle outside the state.[5]

Table 1.2 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In FY 2018-19, the colleges served 500 bachelor's degree graduates, 272,103 associate degree graduates, and 66,930 certificate graduates. Another 1.6 million students enrolled in courses for credit but did not complete a degree during the reporting year. The colleges offered dual credit courses to high schools, serving a total of 172,009 students over the course of the year. Non-degree seeking students, referred to as non-credit students, who were enrolled in workforce or professional development programs accounted for 248,478 students.

We use credit hour equivalents (CHEs) to track the educational workload of the students. One CHE is equal to 15 contact hours of classroom instruction per semester. The average number of CHEs per student was 9.2.

Table 1.2: BREAKDOWN OF STUDENT HEADCOUNT AND CHE PRODUCTION BY EDUCATION LEVEL, FY 2018-19

Category	Headcount	Total CHEs	Average CHEs
Bachelor's degree graduates	500	10,126	20.3
Associate degree graduates	272,103	4,741,193	17.4
Certificate graduates	66,930	881,851	13.2
Continuing students	1,621,785	13,783,564	8.5
Dual credit students	172,009	822,537	4.8
Non-credit students	248,478	1,789,312	7.2
Total, all students	**2,381,805**	**22,028,583**	**9.2**

Source: Data provided by the Foundation for California Community Colleges.

4 Unduplicated headcount, gender, ethnicity, and age data provided by the Foundation for California Community Colleges.
5 Because the Foundation for California Community Colleges were unable to provide settlement data, Emsi Burning Glass used estimates based on student origin.

Since the colleges were first established, they have been serving California by enhancing the workforce, providing local residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. Table 1.3 summarizes the breakdown of the state economy by major industrial sector, 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 state's total income, which can also be considered as the state's gross state product (GSP).

Table 1.3: LABOR AND NON-LABOR INCOME BY MAJOR INDUSTRY SECTOR IN CALIFORNIA, 2020*

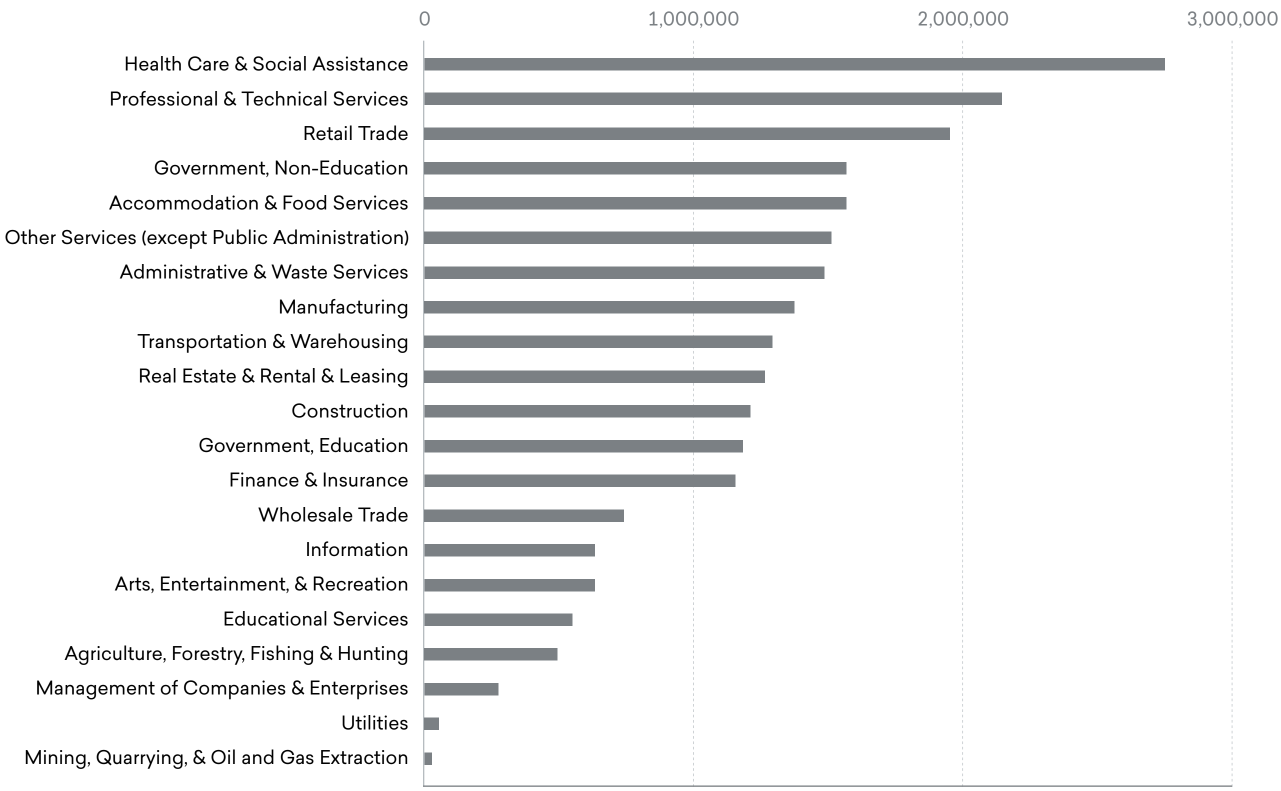
Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)**	% of total income	Sales (millions)
Other Services (except Public Administration)	$52,056	$287,339	$339,395	11%	$496,340
Manufacturing	$164,453	$172,657	$337,110	11%	$713,901
Information	$127,085	$200,193	$327,279	11%	$536,286
Professional & Technical Services	$242,548	$56,516	$299,064	10%	$443,251
Government, Non-Education	$183,222	$55,330	$238,552	8%	$1,240,085
Health Care & Social Assistance	$176,138	$35,954	$212,092	7%	$343,447
Finance & Insurance	$125,060	$86,873	$211,933	7%	$387,001
Wholesale Trade	$69,655	$88,050	$157,706	5%	$260,356
Retail Trade	$87,102	$58,193	$145,295	5%	$243,931
Construction	$93,638	$22,475	$116,113	4%	$218,040
Government, Education	$106,628	$0	$106,628	4%	$123,099
Administrative & Waste Services	$75,750	$17,755	$93,506	3%	$159,784
Transportation & Warehousing	$66,566	$22,513	$89,079	3%	$179,530
Real Estate & Rental & Leasing	$74,564	$10,008	$84,572	3%	$272,261
Accommodation & Food Services	$48,964	$30,167	$79,131	3%	$145,774
Management of Companies & Enterprises	$43,401	$3,788	$47,189	2%	$77,285
Arts, Entertainment, & Recreation	$31,255	$14,065	$45,319	1%	$66,904
Utilities	$11,384	$31,342	$42,726	1%	$60,860
Educational Services	$27,819	$6,116	$33,935	1%	$47,636
Agriculture, Forestry, Fishing & Hunting	$23,729	-$8,076	$15,653	1%	$71,215
Mining, Quarrying, & Oil and Gas Extraction	$3,102	$6,811	$9,913	<1%	$18,553
Total	**$1,834,121**	**$1,198,067**	**$3,032,188**	**100%**	**$6,105,537**

* Data reflect the most recent year for which data are available. Emsi Burning Glass data are updated quarterly.
** Numbers may not add due to rounding.
Source: Emsi Burning Glass industry data.

As shown in Table 1.3, the total income, or GSP, of California is approximately $3 trillion, equal to the sum of labor income ($1.8 trillion) and non-labor income ($1.2 trillion). In Chapter 2, we use the total added income as the measure of the relative impacts of the colleges on the state economy.

Figure 1.3 provides the breakdown of jobs by industry in California. The Health Care & Social Assistance sector is the largest employer, supporting 2.8 million jobs or 11.5% of total employment in the state. The second largest employer is the Professional & Technical Services sector, supporting 2.2 million jobs or 9.0% of the state's total employment. Altogether, the state supports 24 million jobs.[6]

Figure 1.3: JOBS BY MAJOR INDUSTRY SECTOR IN CALIFORNIA, 2020*



* Data reflect the most recent year for which data are available. Emsi Burning Glass data are updated quarterly.
Source: Emsi Burning Glass employment data.

6 Job numbers reflect Emsi Burning Glass'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 or state unemployment insurance (UI) system and are thus excluded from QCEW, 3) self-employed workers, and 4) extended proprietors.

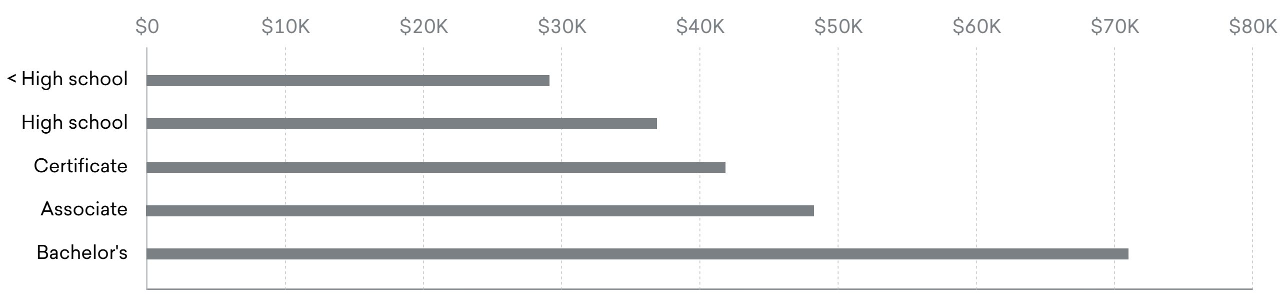
Table 1.4 and Figure 1.4 present the mean earnings by education level in California at the midpoint of the average-aged worker's career. These numbers are derived from Emsi Burning Glass's complete employment data on average earnings per worker in the state.[7] The numbers are then weighted by the colleges' demographic profiles, and state earnings are weighted by students' settlement patterns. As shown, students have the potential to earn more as they achieve higher levels of education compared to maintaining a high school diploma. Students who earn an associate degree from the colleges can expect approximate wages of $48,200 per year within California, approximately $11,100 more than someone with a high school diploma.

Table 1.4: AVERAGE EARNINGS BY EDUCATION LEVEL AT THE MIDPOINT OF A CALIFORNIA'S COMMUNITY COLLEGES' STUDENT

Education level	**State earnings**	**Difference from next lowest degree**
Less than high school	$28,900	n/a
High school or equivalent	$37,100	$8,200
Certificate	$42,100	$5,000
Associate degree	$48,200	$6,100
Bachelor's degree	$71,300	$23,100

Source: Emsi Burning Glass employment data.

Figure 1.4: AVERAGE EARNINGS BY EDUCATION LEVEL AT THE MIDPOINT OF A CALIFORNIA'S COMMUNITY COLLEGES' STUDENT



Source: Emsi Burning Glass employment data.

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

CHAPTER 2:

Economic impacts on the California economy

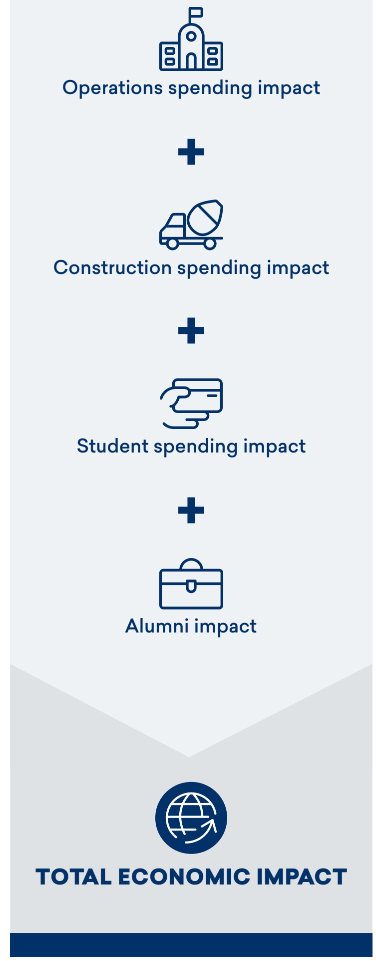
California's Community Colleges impact the California economy in a variety of ways. The colleges are employers and buyers of goods and services. They attract monies that otherwise would not have entered the state economy through their day-to-day operations, their construction activities, and the expenditures of their students. Further, they provide students with the knowledge, skills, and abilities they need to become productive citizens and add to the overall output of the state.

IN THIS CHAPTER, we estimate the following economic impacts of California's Community Colleges: 1) the operations spending impact, 2) the construction spending impact, 3) the student spending impact, and 4) the alumni impact, measuring the income added in the state as former students expand the state economy's stock of human capital.

When exploring each of these economic impacts, we consider the following hypothetical question:

How would economic activity change in California if California's Community Colleges and all the colleges' alumni did not exist in FY 2018-19?

Each of the economic impacts 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 colleges; however, net impacts reflect a truer measure of economic impact since they demonstrate what would not have existed in the state economy if not for the colleges.



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 state product (GSP). 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 state economy through intermediary transactions and costs.[8] 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

8 See Appendix 5 for an example of the intermediary costs included in the sales impact but not in the income impact.

economy and may be further decomposed into the following three types of effects:

- 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.

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.

Emsi Burning Glass	Initial	Direct	Indirect	Induced
IMPLAN	Direct	Indirect		Induced

Multiplier effects in this analysis are derived using Emsi Burning Glass's Multi-Regional Social Accounting Matrix (MR-SAM) input-output model that captures the interconnection of industries, government, and households in the state. The Emsi Burning Glass 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 Emsi Burning Glass MR-SAM model and its data sources, see Appendix 6.

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

OPERATIONS SPENDING IMPACT

Faculty and staff payroll is part of the state's total earnings, and the spending of employees for groceries, apparel, and other household expenditures helps support state businesses. The colleges themselves purchase supplies and services, and many of their vendors are located in California. These expenditures create a ripple effect that generates still more jobs and higher wages throughout the economy.

Table 2.1 presents the colleges' expenditures (not including construction) for the following three categories: 1) salaries, wages, and benefits, 2) operation and maintenance of plant, and 3) all other expenditures, including purchases for supplies and services. Also included in all other expenditures are expenses associated with grants and scholarships. Many students receive grants and scholarships that exceed the cost of tuition and fees. The colleges then dispense this

Table 2.1: CALIFORNIA'S COMMUNITY COLLEGES' EXPENSES BY FUNCTION (EXCLUDING DEPRECIATION & INTEREST), FY 2018-19

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Employee salaries, wages, and benefits	$8,511,955	$13,772	$8,525,726
Operation and maintenance of plant	$743,981	$91,210	$835,191
All other expenditures	$2,507,094	$845,362	$3,352,455
Total	**$11,763,029**	**$950,344**	**$12,713,373**

This table does not include expenditures for construction, as they are presented separately in the following section.
Source: Data provided by the Foundation for California Community Colleges and the Emsi Burning Glass impact model.

residual financial aid to students, who spend it on living expenses. Some of this spending takes place in the state, and is therefore an injection of new money into the state economy that would not have happened if the colleges did not exist. In this analysis, we exclude expenses for depreciation and interest due to the way those measures are calculated in the national input-output accounts, and because depreciation represents the devaluing of the colleges' assets rather than an outflow of expenditures.[9]

The first step in estimating the multiplier effects of the colleges' operational expenditures is to map these categories of expenditures to the approximately 1,000 industries of the Emsi Burning Glass MR-SAM model. Assuming that the spending patterns of the colleges' personnel approximately match those of the average U.S. consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure coefficients provided by Emsi Burning Glass's national SAM. Nearly 100% of California's Community Colleges employees work in California (see Table 1.1), and therefore we consider almost 100% of the salaries, wages, and benefits. For the other two expenditure categories (i.e., operation and maintenance of plant and all other expenditures), we assume the colleges' spending patterns approximately match national averages and apply the national spending coefficients for NAICS 903612 (Colleges, Universities, and Professional Schools (Local Government)).[10] Operation and maintenance of plant expenditures are mapped to the industries that relate to capital construction, maintenance, and support, while the colleges' remaining expenditures are mapped to the remaining industries.

We now have three vectors of expenditures for California's Community Colleges: one for salaries, wages, and benefits; another for operation and maintenance of plant; and a third for the colleges' purchases of supplies and services. The next step is to estimate the portion of these expenditures that occur inside the state. The expenditures occurring outside the state are known as leakages. We estimate in-state expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by state suppliers, for each of the approximately 1,000 industries in the MR-SAM model.[11] For example, if 40% of the demand for NAICS 541211 (Offices of Certified Public Accountants) is satisfied by state suppliers, the RPC for that industry is 40%. The remaining 60% of the demand for NAICS 541211 is provided by suppliers located outside the state. The three vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-state expenditures associated with the colleges. See Table 2.1 for a breakout of the expenditures that occur in-state. Finally, in-state spending is entered, industry by industry, into the MR-SAM model's multiplier matrix, which in turn

9 This aligns with the economic impact guidelines set by the Association of Public and Land-Grant Universities. Ultimately, excluding these measures results in more conservative and defensible estimates.

10 See Appendix 3 for a definition of NAICS.

11 See Appendix 6 for a description of Emsi Burning Glass's MR-SAM model.

provides an estimate of the associated multiplier effects on state labor income, non-labor income, total income, sales, and jobs.

Table 2.2 presents the economic impact of the colleges' operations spending. The people employed by California's Community Colleges and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled *multiplier effect*. Summing the initial and multiplier effects, the gross impacts are $14.5 billion in labor income and $5 billion in non-labor income. This sums to a total impact of $19.5 billion in total added income associated with the spending of the colleges and their employees in the state. This is equivalent to supporting 174,696 jobs.

Table 2.2: OPERATIONS SPENDING IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$8,511,955**	**$0**	**$8,511,955**	**$12,713,373**	**91,180**
Multiplier effect					
Direct effect	$1,077,399	$672,773	$1,750,172	$3,251,075	9,939
Indirect effect	$479,925	$251,453	$731,378	$1,419,826	4,408
Induced effect	$4,444,236	$4,043,188	$8,487,424	$14,449,445	69,168
Total multiplier effect	**$6,001,560**	**$4,967,414**	**$10,968,974**	**$19,120,346**	**83,515**
Gross impact (initial + multiplier)	**$14,513,515**	**$4,967,414**	**$19,480,929**	**$31,833,719**	**174,696**
Less alternative uses of funds	-$4,212,439	-$4,305,134	-$8,517,573	-$9,027,766	-75,225
Net impact	**$10,301,076**	**$662,280**	**$10,963,356**	**$22,805,953**	**99,470**

Source: Emsi Burning Glass impact model.

The $19.5 billion in gross impact is often reported by researchers as the total impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event—in this case, the expenditure of in-state funds on California's Community Colleges—had not occurred. California's Community Colleges received an estimated 83% of their funding from sources within California. This portion of the colleges' funding came from the tuition and fees paid by resident students, from the auxiliary revenue and donations from private sources located within the state, from state and local taxes, and from the financial aid issued to students by state and local government. We must account for the opportunity cost of this in-state funding. Had other industries received these monies rather than California's Community Colleges, income impacts would have still been created in the economy. In economic analysis, impacts that occur under counterfactual conditions are used to offset the impacts that actually occur in order to derive the true impact of the event under analysis.

We estimate this counterfactual by simulating a scenario where in-state monies spent on the colleges are instead spent on consumer goods and savings. This simulates the in-state monies being returned to the taxpayers and being spent by the household sector. Our approach is to establish the total amount spent by in-state students and taxpayers on California's Community Colleges, map this to the detailed industries of the MR-SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-state spending, and run the in-state spending through the MR-SAM model's multiplier matrix to derive multiplier effects. The results of this exercise are shown as negative values in the row labeled *less alternative uses of funds* in Table 2.2.

> The total net impact of the colleges' operations is **$11 billion** in total added income, which is equivalent to supporting **99,470 jobs**.

The total net impact of the colleges' operations is equal to the gross impact less the impact of the alternative use of funds—the opportunity cost of the state money. As shown in the last row of Table 2.2, the total net impact is approximately $10.3 billion in labor income and $662.3 million in non-labor income. This sums together to $11 billion in total added income and is equivalent to supporting 99,470 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of California's Community Colleges.

CONSTRUCTION SPENDING IMPACT

In this section, we estimate the economic impact of the colleges' construction spending. Because construction funding is separate from operations funding in the budgeting process, it is not captured in the operations spending impact estimated earlier. However, like operations spending, the construction spending creates subsequent rounds of spending and multiplier effects that generate still more jobs and income throughout the state. During FY 2018-19, California's Community Colleges spent a total of $25 million on various construction projects.

> During FY 2018-19, California's Community Colleges spent a total of **$25 million** on various construction projects.

Assuming the colleges' construction spending approximately matches national construction spending patterns of NAICS 903612 (Colleges, Universities, and Professional Schools (Local Government)), we map construction spending to the construction industries of the MR-SAM model. Next, we use the RPCs to estimate the portion of this spending that occurs in-state. Finally, the in-state spending is run through the multiplier matrix to estimate the direct, indirect, and induced effects. Because construction is so labor intensive, the non-labor income impact is relatively small.

To account for the opportunity cost of any in-state construction money, we estimate the impact of a similar alternative uses of funds as found in the operations spending impact. This is done by simulating a scenario where in-state monies spent on construction are instead spent on consumer goods. These impacts are then subtracted from the gross construction spending impacts. Again, since construction is so labor intensive, most of the added income stems from labor income as opposed to non-labor income. As a result, the non-labor impacts associated with spending in the non-construction sectors are larger than in the construction sectors, so the net non-labor impact of construction spending is negative. This means that had the construction money instead been spent on consumer goods, more non-labor income would have been created at the expense of less labor income. The total net impact is still positive and substantial.

Table 2.3 presents the impacts of the colleges' construction spending during FY 2018-19. Note the initial effect is purely a sales effect, so there is no initial change in labor or non-labor income. The FY 2018-19 construction spending creates a net total short-run impact of $13.6 million in added income—the equivalent of supporting 165 jobs in California.

Table 2.3: CONSTRUCTION SPENDING IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$24,972**	**0**
Multiplier effect					
Direct effect	$9,525	$2,288	$11,813	$22,183	123
Indirect effect	$4,068	$977	$5,045	$9,474	53
Induced effect	$9,577	$2,300	$11,878	$22,304	124
Total multiplier effect	**$23,171**	**$5,565**	**$28,736**	**$53,960**	**299**
Gross impact (initial + multiplier)	**$23,171**	**$5,565**	**$28,736**	**$78,933**	**299**
Less alternative uses of funds	-$7,499	-$7,664	-$15,163	-$16,071	-134
Net impact	**$15,672**	**-$2,099**	**$13,573**	**$62,861**	**165**

Source: Emsi Burning Glass impact model.

STUDENT SPENDING IMPACT

Both in-state and out-of-state students contribute to the student spending impact of California's Community Colleges; however, not all of these students can be counted towards the impact. Of the in-state students, only those students who were retained, or who would have left the state to seek education elsewhere had they not attended the colleges, are measured. Students who would have stayed in the state anyway are not counted towards the impact since their monies would have been added to the California economy regardless of the colleges. In addition, only the out-of-state students who relocated to California to attend the colleges are measured. Students who commute from outside the state or take courses online are not counted towards the student spending impact because they are not adding money from living expenses to the state.

While there were 2.1 million students attending the colleges who originated from California (not including dual credit high school students), not all of them would have remained in the state if not for the existence of California's Community Colleges. We apply a conservative assumption that 10% of these students would have left California for other education opportunities if the colleges did not exist.[12] Therefore, we recognize that the in-state spending of 205,622 students retained in the state is attributable to the colleges. These students, called retained students, spent money at businesses in the state for everyday needs such as groceries, accommodation, and transportation.

12 See Appendix 2 for a sensitivity analysis of the retained student variable.

Relocated students are also accounted for in California's Community Colleges' student spending impact. An estimated 139,752 students came from outside the state and lived off campus while attending the colleges in FY 2018-19. The off-campus expenditures of out-of-state students supported jobs and created new income in the state economy.[13]

The average costs for students appear in the first section of Table 2.4, equal to $19,825 per student. Note that this table excludes expenses for books and supplies, since many of these costs are already reflected in the operations impact discussed in the previous section. We multiply the $19,825 in annual costs by the 345,375 students who either were retained or relocated to the state because of California's Community Colleges and lived in-state but off campus. This provides us with an estimate of their total spending. Altogether, off-campus spending of relocated and retained students, once net of monies paid to student workers, generated sales of $6.8 billion, as shown in the bottom row of Table 2.4.

Table 2.4: AVERAGE STUDENT COSTS AND TOTAL SALES GENERATED BY RELOCATED AND RETAINED STUDENTS IN CALIFORNIA, FY 2018-19

Room and board	$14,977
Personal expenses	$2,744
Transportation	$2,104
Total expenses per student	**$19,825**
Number of students retained	*205,622*
Number of students relocated	*139,752*
Gross retained student sales	$4,076,460,115
Gross relocated student sales	$2,770,590,141
Total gross off-campus sales	**$6,847,050,256**
Wages and salaries paid to student workers*	$19,289,497
Net off-campus sales	**$6,827,760,758**

* This figure reflects only the portion of payroll that was used to cover the living expenses of relocated and retained student workers who lived in the state.
Source: Student costs provided by the Foundation for California Community Colleges. Emsi Burning Glass provided an estimate of the monies paid to student workers because the colleges was unable to provide the data. The number of relocated and retained students who lived in the state off campus while attending is derived by Emsi Burning Glass from the student origin data and in-term residence data provided by the Foundation for California Community Colleges. The data are based on all students.

Estimating the impacts generated by the $6.8 billion in student spending follows a procedure similar to that of the operations impact described above. We distribute the $6.8 billion in sales to the industry sectors of the MR-SAM model, apply RPCs to reflect in-state spending, and run the net sales figures through the MR-SAM model to derive multiplier effects.

13 Online students and students who commuted to California from outside the state are not considered in this calculation because it is assumed their living expenses predominantly occurred in the state where they resided during the analysis year. We recognize that not all online students live outside the state, but keep the assumption given data limitations.

Table 2.5 presents the results. The initial effect is purely sales-oriented and there is no change in labor or non-labor income. The impact of relocated and retained student spending thus falls entirely under the multiplier effect. The total impact of student spending is $5.1 billion in labor income and $3.1 billion in non-labor income. This sums together to $8.2 billion in total added income and is equivalent to supporting 135,021 jobs. These values represent the direct effects created at the businesses patronized by the students, the indirect effects created by the supply chain of those businesses, and the effects of the increased spending of the household sector throughout the state economy as a result of the direct and indirect effects.

> The total impact of student spending is **$8.2 billion** in total added income and is equivalent to supporting **135,021 jobs**.

Table 2.5: STUDENT SPENDING IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$6,827,761**	**0**
Multiplier effect					
Direct effect	$1,951,633	$1,215,605	$3,167,238	$5,632,809	51,601
Indirect effect	$955,052	$587,825	$1,542,877	$2,857,718	26,808
Induced effect	$2,156,487	$1,311,856	$3,468,343	$6,127,434	56,612
Total multiplier effect	**$5,063,172**	**$3,115,286**	**$8,178,458**	**$14,617,961**	**135,021**
Total impact (initial + multiplier)	**$5,063,172**	**$3,115,286**	**$8,178,458**	**$21,445,722**	**135,021**

Source: Emsi Burning Glass impact model.

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 the colleges *throughout their history*. We then use this total number to consider the impact of those students in the single FY 2018-19. Former students who earned a degree as well as those who may not have finished their degree or did not take courses for credit are considered alumni.

> The greatest economic impact of California's Community Colleges stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni.

While California's Community Colleges create an economic impact through their operations, construction, and student spending, the greatest economic impact of California's Community Colleges stem from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in the colleges' alumni. While attending the colleges, 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 the colleges' alumni enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits).

The methodology here differs from the previous impacts in one fundamental way. Whereas the previous spending impacts depend on an annually renewed injection of new sales into the state economy, the alumni impact is the result of years of past instruction and the associated accumulation of human capital. The initial effect of alumni is comprised of two main components. The first and largest of these is the added labor income of the colleges' former students. The second component of the initial effect is comprised of the added non-labor income of the businesses that employ former students of California's Community Colleges.

We begin by estimating the portion of alumni who are employed in the workforce. To estimate the historical employment patterns of alumni in the state, 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;[14] 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) state migration data from the Internal Revenue Service. The result is the estimated portion of alumni from each previous year who were still actively employed in the state as of FY 2018-19.

The next step is to quantify the skills and human capital that alumni acquired from the colleges. We use the students' production of CHEs as a proxy for accumulated human capital. The average number of CHEs completed per student in FY 2018-19 was 9.2. To estimate the number of CHEs present in the workforce during the analysis year, we use the colleges' historical student headcount over the past 30 years, from FY 1989-90 to FY 2018-19.[15] We multiply the 9.2 average CHEs per student by the headcounts that we estimate are still actively employed from each of the previous years.[16] Students who enroll at the colleges more than one year are counted at least twice in the historical enrollment data. However, CHEs remain distinct regardless of when and by whom they were earned, so there is no duplication in the CHE counts. We estimate there are approximately 434.2 million CHEs from alumni active in the workforce.

Next, we estimate the value of the CHEs, or the skills and human capital acquired by the colleges' 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 the colleges' alumni and the alternative wage they would have earned had they not attended the colleges. Using the state incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average value per CHE to equal $171.

14 Settling-in factors are used to delay the onset of the benefits to students in order to allow time for them to find employment and settle into their careers. In the absence of hard data, we assume a range between one and three years for students who graduate with a certificate or a degree, and between one and five years for returning students.

15 We apply a 30-year time horizon because the data on students who attended California's Community Colleges prior to FY 1989-90 is less reliable, and because most of the students served more than 30 years ago had left the state workforce by FY 2018-19.

16 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.

This value represents the state average incremental increase in wages that the colleges' alumni received during the analysis year for every CHE they completed.

Because workforce experience leads to increased productivity and higher wages, the value per CHE varies depending on the students' workforce experience, with the highest value applied to the CHEs of students who had been employed the longest by FY 2018-19, and the lowest value per CHE applied to students who were just entering the workforce. More information on the theory and calculations behind the value per CHE appears in Appendix 7. In determining the amount of added labor income attributable to alumni, we multiply the CHEs of former students in each year of the historical time horizon by the corresponding average value per CHE for that year, and then sum the products together. This calculation yields approximately $74.2 billion in gross labor income from increased wages received by former students in FY 2018-19 (as shown in Table 2.6).

Table 2.6: NUMBER OF CHES IN WORKFORCE AND INITIAL LABOR INCOME CREATED IN CALIFORNIA, FY 2018-19

Number of CHEs in workforce	434,248,872
Average value per CHE	$171
Initial labor income, gross	**$74,243,205,961**
Adjustments for counterfactual scenarios	
Percent reduction for alternative education opportunities	15%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$31,553,362,534**

Source: Emsi Burning Glass impact model.

The next two rows in Table 2.6 show two adjustments used to account for counterfactual outcomes. As discussed above, 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 California's Community Colleges and subsequent influx of skilled labor into the state economy. The first counterfactual scenario that we address is the adjustment for alternative education opportunities. In the counterfactual scenario where California's Community Colleges do not exist, we assume a portion of the colleges' alumni would have received a comparable education elsewhere in the state or would have left the state and received a comparable education and then returned to the state. The incremental added labor income that accrues to those students cannot be counted towards the added labor income from the colleges' alumni. The adjustment for alternative education opportunities amounts to a 15% reduction of the $74.2 billion in added labor income. This means that 15% of the added labor income from the colleges' alumni would have been generated in the state anyway, even if the colleges did not exist. For more information on the alternative education adjustment, see Appendix 8.

The other adjustment in Table 2.6 accounts for the importation of labor. Suppose California's Community Colleges did not exist and in consequence there were fewer skilled workers in the state. Businesses could still satisfy some of their need for skilled labor by recruiting from outside California. We refer to this as the labor import effect. Lacking information on its possible magnitude, we assume 50% of the jobs that students fill at state businesses could have been filled by workers recruited from outside the state if the colleges did not exist.[17] Consequently, the gross labor income must be adjusted to account for the importation of this labor, since it would have happened regardless of the presence of the colleges. We conduct a sensitivity analysis for this assumption in Appendix 2. With the 50% adjustment, the net added labor income added to the economy comes to $31.6 billion, as shown in Table 2.6.

The $31.6 billion in added labor income appears under the initial effect in the labor income column of Table 2.7. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of California's Community Colleges 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 ($31.6 billion) 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 state 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.[18] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics, we map the breakdown of the colleges' 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 $31.6 billion in initial labor income effects to the detailed industry sectors in the MR-SAM model.[19]

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 $11.5 billion in added non-labor income attributable to the colleges' alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the California economy, equal to approximately $43.1 billion. 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 2.7 shows the multiplier effects of alumni. Multiplier effects occur as alumni generate an increased demand for consumer goods and services through

17 A similar assumption is used by Walden (2014) in his analysis of the Cooperating Raleigh Colleges.

18 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).

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

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 colleges' alumni. The final results are $48.6 billion in added labor income and $17.3 billion in added non-labor income, for an overall total of $66 billion in multiplier effects. The grand total of the alumni impact is $109 billion in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 1.3 million jobs.

Table 2.7: ALUMNI IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$31,553,363**	**$11,524,837**	**$43,078,199**	**$93,194,358**	**487,290**
Multiplier effect					
Direct effect	$8,200,793	$3,317,818	$11,518,611	$24,078,280	128,956
Indirect effect	$4,115,777	$1,682,997	$5,798,774	$12,111,273	66,243
Induced effect	$36,327,366	$12,307,719	$48,635,085	$94,789,313	569,980
Total multiplier effect	**$48,643,935**	**$17,308,535**	**$65,952,470**	**$130,978,866**	**765,179**
Total impact (initial + multiplier)	**$80,197,298**	**$28,833,372**	**$109,030,670**	**$224,173,224**	**1,252,468**

Source: Emsi Burning Glass impact model.

TOTAL IMPACT OF CALIFORNIA'S COMMUNITY COLLEGES

The total economic impact of California's Community Colleges on California can be generalized into two broad types of impacts. First, on an annual basis, California's Community Colleges generate a flow of spending that has a significant impact on the state economy. The impacts of this spending are captured by the operations, construction, and student spending impacts. While not insignificant, these impacts do not capture the true purpose of California's Community Colleges. The basic mission of California's Community Colleges is to foster human capital. Every year, a new cohort of the colleges' former students adds to the stock of human capital in the state, and a portion of alumni continues to add to the state economy. Table 2.8 displays the grand total impacts of California's Community Colleges on the California economy in FY 2018-19. For context, the percentages of California's Community Colleges compared to the total labor income, total non-labor income, combined total income, sales, and jobs in California, as presented in Table 1.3 and Figure 1.3, are included. The total added value of California's Community Colleges is **$128.2 billion**, equivalent to **4.2%** of the GSP of California. By comparison, this contribution that the colleges provide on their own is larger than the entire Construction industry in the state. California's Community Colleges' total impact supported **1.5 million jobs** in FY 2018-19. For perspective, this means that **one out of every 16 jobs** in California is supported by the activities of the colleges and their students.

Table 2.8: TOTAL IMPACT OF CALIFORNIA'S COMMUNITY COLLEGES, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	$10,301,076	$662,280	$10,963,356	$22,805,953	99,470
Construction spending	$15,672	-$2,099	$13,573	$62,861	165
Student spending	$5,063,172	$3,115,286	$8,178,458	$21,445,722	135,021
Alumni	$80,197,298	$28,833,372	$109,030,670	$224,173,224	1,252,468
Total impact	**$95,577,217**	**$32,608,839**	**$128,186,056**	**$268,487,761**	**1,487,125**
% of the California economy	5.2%	2.7%	4.2%	4.4%	6.2%

Source: Emsi Burning Glass impact model.

These impacts from the colleges and their students stem from different industry sectors and spread throughout the state economy. Table 2.9 displays the total impact of California's Community Colleges by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations, construction, students, and alumni, as shown in Table 2.8, broken down by each industry sector's individual impact on the state 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 state economy from the colleges' spending and from where California's Community Colleges' alumni are employed. For example, California's Community Colleges' spending and alumni in the Health Care & Social Assistance industry sector generated an impact of $13.3 billion in FY 2018-19.

Table 2.9: TOTAL CALIFORNIA'S COMMUNITY COLLEGES IMPACT BY INDUSTRY, FY 2018-19

Industry sector	Total income (thousands)	Jobs supported
Government, Education	$17,430,466	193,276
Health Care & Social Assistance	$13,326,155	206,900
Professional & Technical Services	$12,625,625	119,302
Government, Non-Education	$12,486,067	82,331
Retail Trade	$11,259,073	162,630
Information	$9,603,851	24,768
Manufacturing	$7,833,458	42,781
Wholesale Trade	$6,030,889	30,976
Accommodation & Food Services	$4,976,915	107,064
Construction	$4,581,448	50,366
Other Services (except Public Administration)	$4,353,113	141,880
Real Estate & Rental & Leasing	$4,151,431	85,178
Finance & Insurance	$4,117,221	20,291
Educational Services	$3,708,657	68,794
Administrative & Waste Services	$3,549,655	53,142
Arts, Entertainment, & Recreation	$3,088,668	53,674
Transportation & Warehousing	$1,724,333	19,580
Management of Companies & Enterprises	$1,692,964	10,187
Utilities	$1,195,860	2,062
Agriculture, Forestry, Fishing, & Hunting	$278,007	11,165
Mining, Quarrying, & Oil and Gas Extraction	$172,198	778
Total impact	**$128,186,056**	**1,487,125**

Source: Emsi Burning Glass impact model.

CHAPTER 3:

Investment analysis

The benefits generated by California's Community Colleges affect the lives of many people. The most obvious beneficiaries are the colleges' students; they give up time and money to go to the colleges 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 California 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 state and local 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 consider California's Community Colleges as a worthwhile investment from the perspectives of students, taxpayers, and society.

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.

STUDENT COSTS

Out-of-pocket expenses

Opportunity costs

STUDENT BENEFITS

Higher earnings from education

Calculating student costs

Student costs consist of three main items: direct outlays, opportunity costs, and future principal and interest costs incurred from student loans. Direct outlays include tuition and fees, equal to $873.1 million from Figure 1.1. Direct outlays also include the cost of books and supplies. On average, full-time students spent $1,961 each on books and supplies during the reporting year.[20] Multiplying this figure by the number of full-time equivalents (FTEs) produced by California's Community Colleges in FY 2018-19[21] generates a total cost of $1.7 billion for books and supplies.

In order to pay the cost of tuition, many students had to take out loans. These students not only incur the cost of tuition from the colleges but also incur the interest cost of taking out loans. In FY 2018-19, students received a total of $132 million in federal loans to attend the colleges.[22] Students pay back these loans along with interest over the span of several years in the future. Since students pay off these loans over time, they accrue no initial cost during the analysis year. Hence, to avoid double counting, the $132 million in federal loans is subtracted from the costs incurred by students in FY 2018-19.

20 Based on the data provided by the Foundation for California Community Colleges.

21 A single FTE is equal to 30 CHEs, so there were 734,286 FTEs produced by students in FY 2018-19, equal to 22 million CHEs divided by 30.

22 Due to data limitations, only federal loans are considered in this analysis.

In addition to the cost of tuition, books, and supplies, 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 the colleges 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 colleges.

We derive the students' full earning potential by weighting the average annual earnings levels in Table 1.4 according to the education level breakdown of the student population when they first enrolled.[23] However, the earnings levels in Table 1.4 reflect what average workers earn at the midpoint of their careers, not while attending the colleges. Because of this, we adjust the earnings levels to the average age of the student population (28) to better reflect their wages at their current age.[24] This calculation yields an average full earning potential of $27,736 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' CHE production as a proxy for time, under the assumption that the more CHEs students earn, the less time they have to work, and, consequently, the greater their foregone earnings. Overall, students attending California's Community Colleges in FY 2018-19 earned an average of 9.6 CHEs per student (excluding dual credit high school students), which is approximately equal to 32% of a full academic year.[25] We thus include no more than $8,872 (or 32%) 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 69% of students are employed.[26] 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 $8,872). The total value of their foregone earnings thus comes to $6.1 billion.

Working students are able to maintain all or part of their earnings while enrolled. However, many of them hold jobs that pay less than statistical averages, usually because those are the only jobs they can find that accommodate their course schedule. These jobs tend to be at entry level, such as restaurant servers or

23 This is based on students who reported their prior level of education to the Foundation for California Community Colleges. The prior level of education data was then adjusted to exclude dual credit high school students. Emsi Burning Glass estimated the prior level of education at the graduate level of education based on a sample of over 50 studies conducted for California's Community Colleges over the past three years.

24 Further discussion on this adjustment appears in Appendix 7.

25 Equal to 9.6 CHEs divided by 30, the assumed number of CHEs in a full-time academic year.

26 Data point estimated from a sample of over 50 studies conducted in the past three years by Emsi Burning Glass for California's Community Colleges. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

cashiers. To account for this, we assume that working students hold jobs that pay 78% of what they would have earned had they chosen to work full-time rather than go to college.[27] The remaining 22% 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 do not know the actual jobs that students hold while attending, the 22% in foregone earnings serves as a reasonable average.

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 0.5 hours of leisure time per day.[28] 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, their total opportunity cost is $3.9 billion, equal to the sum of their foregone earnings ($3 billion) and foregone leisure time ($891 million).

Thus far we have discussed student costs during the analysis year. However, recall that students take out student loans to attend college during the year, which they will have to pay back over time. The amount they will be paying in the future must be a part of their decision to attend the colleges today. Students who take out loans are not only required to pay back the principal of the loan but to also pay back a certain amount in interest. The first step in calculating students' loan interest cost is to determine the payback time for the loans. The $132 million in loans was awarded to 21,260 students, averaging $6,208 per student in the analysis year. However, this figure represents only one year of loans. Because loan payback time is determined by total indebtedness, we assume that since the colleges are two-year colleges, students will be indebted twice that amount, or $12,415 on average. According to the U.S. Department of Education, this level of indebtedness will take 15 years to pay back under the standard repayment plan.[29]

This indebtedness calculation is used solely to estimate the loan payback period. Students will be paying back the principal amount of $132 million over time. After taking into consideration the time value of money, this means that students will pay off a discounted present value of $90.8 million in principal over the 15 years. In order to calculate interest, we only consider interest on the federal loans awarded to students in FY 2018-19. Using the student discount rate of 4.5%[30] as our interest rate, we calculate that students will pay a total discounted present

27 The 78% assumption is based on the average hourly wage of jobs commonly held by 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).

28 "Charts by Topic: Leisure and Sports Activities," American Time Use Survey, Last modified December 2016. http://www.bls.gov/tus/charts/leisure.htm.

29 Repayment period based on total education loan indebtedness, U.S. Department of Education, 2021. https://studentaid.ed.gov/sa/repay-loans/understand/plans/standard.

30 The student discount rate is derived from the baseline forecasts for the 10-year discount rate published by the Congressional Budget Office. See the Congressional Budget Office, Student Loan and Pell Grant Programs—March 2020 Baseline. https://www.cbo.gov/system/files/2020-03/51310-2020-03-studentloan.pdf.

value of $39.3 million in interest on student loans throughout the first 15 years of their working lifetime. The stream of these future interest costs together with the stream of loan payments is included in the costs of Column 5 of Table 3.2.

The steps leading up to the calculation of student costs appear in Table 3.1. Direct outlays amount to $2.4 billion, the sum of tuition and fees ($873.1 million) and books and supplies ($1.7 billion), less federal loans received ($132 million). Opportunity costs for working and non-working students amount to $8.3 billion, excluding $1.7 billion in offsetting residual aid that is paid directly to students.[31] Finally, we have the present value of future student loan costs, amounting to $130.1 million between principal and interest. Summing direct outlays, opportunity costs, and future student loan costs together yields a total of $10.9 billion in present value student costs.

Table 3.1: PRESENT VALUE OF STUDENT COSTS, FY 2018-19 (THOUSANDS)

Direct outlays in FY 2018-19	
Tuition and fees	$873,102
Less federal loans received	-$131,976
Books and supplies	$1,688,998
Total direct outlays	**$2,430,124**
Opportunity costs in FY 2018-19	
Earnings foregone by non-working students	$6,054,466
Earnings foregone by working students	$3,043,876
Value of leisure time foregone by working students	$890,980
Less residual aid	-$1,663,255
Total opportunity costs	**$8,326,068**
Future student loan costs (present value)	
Student loan principal	$90,848
Student loan interest	$39,257
Total present value student loan costs	**$130,105**
Total present value student costs	**$10,886,297**

Source: Based on data provided by the Foundation for California Community Colleges and outputs of the Emsi Burning Glass 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 1.4, state mean earnings levels at the midpoint of the average-aged worker's career increase as people achieve higher levels of

31 Residual aid is the remaining portion of scholarship or grant aid distributed directly to a student after the colleges apply tuition and fees.

education. The differences between state 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 colleges' FY 2018-19 students first by determining their average annual increase in earnings, equal to $3.8 billion. 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 CHEs that students complete while attending the colleges. Using the state of California earnings, the marginal wage increase per CHE is $173. For a full description of the methodology used to derive the $3.8 billion, see Appendix 7.

The second step is to project the $3.8 billion 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.[32] 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 state-specific and 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 $3.8 billion 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 $3.8 billion in gross higher earnings occurs at Year 13, 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 years leading up to the midpoint are less than $3.8 billion and the gross higher earnings in the years after the midpoint are greater than $3.8 billion.

32 Appendix 7 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	$2,300.8	9%	$214.4	$10,756.2	-$10,541.7
1	$2,424.1	22%	$537.3	$12.1	$525.1
2	$2,548.4	30%	$765.6	$12.1	$753.4
3	$2,673.0	44%	$1,180.9	$12.1	$1,168.7
4	$2,797.4	65%	$1,807.2	$12.1	$1,795.0
5	$2,921.1	95%	$2,784.8	$12.1	$2,772.6
6	$3,043.5	95%	$2,898.3	$12.1	$2,886.1
7	$3,163.9	95%	$3,009.4	$12.1	$2,997.2
8	$3,281.7	95%	$3,117.5	$12.1	$3,105.3
9	$3,396.3	95%	$3,222.0	$12.1	$3,209.9
10	$3,507.2	95%	$3,322.4	$12.1	$3,310.3
11	$3,613.5	95%	$3,418.1	$12.1	$3,405.9
12	$3,714.8	94%	$3,508.4	$12.1	$3,496.2
13	$3,810.5	94%	$3,592.7	$12.1	$3,580.6
14	$3,900.0	94%	$3,670.4	$12.1	$3,658.3
15	$3,982.7	94%	$3,740.9	$12.1	$3,728.8
16	$4,058.1	94%	$3,803.6	$0.0	$3,803.6
17	$4,125.8	94%	$3,857.9	$0.0	$3,857.9
18	$4,185.4	93%	$3,903.6	$0.0	$3,903.6
19	$4,236.4	93%	$3,940.1	$0.0	$3,940.1
20	$4,278.5	93%	$3,967.0	$0.0	$3,967.0
21	$4,311.5	92%	$3,984.2	$0.0	$3,984.2
22	$4,335.1	92%	$3,991.2	$0.0	$3,991.2
23	$4,349.3	92%	$3,988.1	$0.0	$3,988.1
24	$4,353.8	91%	$3,974.4	$0.0	$3,974.4
25	$4,348.8	91%	$3,950.2	$0.0	$3,950.2
26	$4,334.1	90%	$3,915.4	$0.0	$3,915.4
27	$4,310.0	90%	$3,870.2	$0.0	$3,870.2
28	$4,276.6	89%	$3,815.2	$0.0	$3,815.2
29	$4,234.1	89%	$3,750.6	$0.0	$3,750.6
30	$4,182.7	88%	$3,676.8	$0.0	$3,676.8
31	$4,122.9	87%	$3,594.4	$0.0	$3,594.4
32	$4,055.1	86%	$3,503.7	$0.0	$3,503.7
33	$3,979.5	86%	$3,405.4	$0.0	$3,405.4
34	$3,896.8	85%	$3,300.3	$0.0	$3,300.3
35	$3,807.4	84%	$3,189.1	$0.0	$3,189.1
36	$3,711.9	83%	$3,072.6	$0.0	$3,072.6
37	$3,610.8	82%	$2,951.6	$0.0	$2,951.6
38	$3,504.8	81%	$2,826.4	$0.0	$2,826.4
Present value			**$54,374.1**	**$10,886.3**	**$43,487.8**

* Includes the “settling-in” factors and attrition.
Source: Emsi Burning Glass impact model.

Benefit-cost ratio	Internal rate of return	Payback period (years)
5.0	19.6%	6.2

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 FY 2018-19 student population that will be employed in the workforce in a given year. Note that the percentages in the first five years of the time horizon are relatively lower than those in subsequent years. This is because many students delay their entry into the workforce, either because they are still enrolled at the colleges or because they are unable to find a job immediately upon graduation. Accordingly, we apply a set of "settling-in" factors to account for the time needed by students to find employment and settle into their careers. As discussed in Chapter 2, settling-in factors delay the onset of the benefits by one to three years for students who graduate with a certificate or a degree and by one to five years for degree-seeking students who do not complete during the analysis year.

Beyond the first five 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 economic impact analysis of Chapter 2.[33] 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 4.5% (see below). Because students tend to rely upon debt to pay for their educations—i.e. they are negative savers—their discount rate is based upon student loan interest

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 4.5% discount rate from the student perspective and a 0.4% discount rate from the perspectives of taxpayers and society.

33 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.

rates.[34] In Appendix 2, 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.

In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately $54.4 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 FY 2018-19 student body is rewarded for its investment in California's Community Colleges with a capital asset valued at $54.4 billion.

The students' cost of attending the colleges is shown in Column 5 of Table 3.2, equal to a present value of $10.9 billion. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 5.0 (equal to $54.4 billion in benefits divided by $10.9 billion 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.[35] Table 3.2 shows students of California's Community Colleges earning average returns of 19.6% 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 10% on stocks and bonds (30-year average return).

California's Community Colleges' students see an average rate of return of **19.6%** for their investment of time and money.

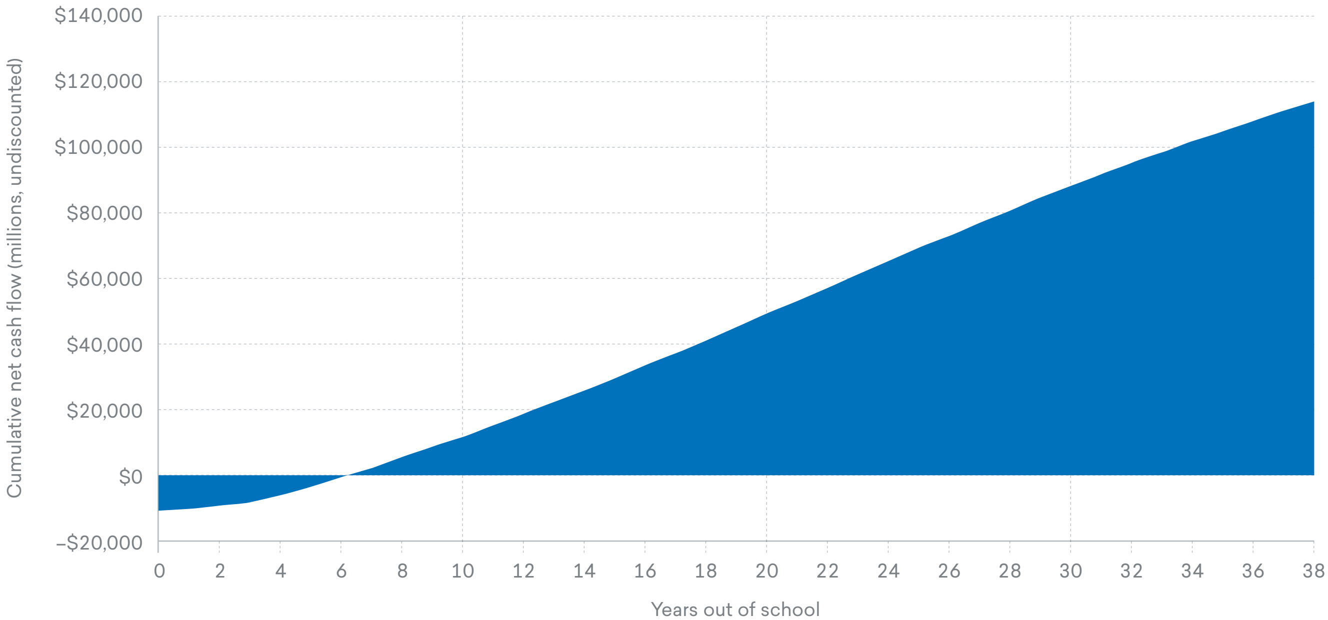
Note that returns reported in this study are real returns, not nominal. When a bank promises to pay a certain rate of interest on a savings account, it employs an implicitly nominal rate. Bonds operate in a similar manner. If it turns out that the inflation rate is higher than the stated rate of return, 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 19.6% student rate of return is a real rate. With an inflation rate of 2.1% (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 21.7%, higher than what is reported in Table 3.2.

34 The student discount rate is derived from the baseline forecasts for the 10-year Treasury rate published by the Congressional Budget Office. See the Congressional Budget Office, Student Loan and Pell Grant Programs—March 2020 Baseline. https://www.cbo.gov/system/files/2020-03/51310-2020-03-studentloan.pdf.

35 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.

The payback period is defined as the length of time it takes to entirely recoup the initial investment.[36] Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at California's Community Colleges see, on average, a payback period of 6.2 years, meaning 6.2 years after their initial investment of foregone earnings and out-of-pocket costs, they will have received enough higher future earnings to fully recover those costs (Figure 3.1).

Figure 3.1: STUDENT PAYBACK PERIOD



Source: Emsi Burning Glass impact model.

36 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 take into account 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 take into account student living expenses.

TAXPAYER PERSPECTIVE

From the taxpayer perspective, the pivotal step is to determine the public benefits that specifically accrue to state and local government. For example, benefits resulting from earnings growth are limited to increased state and local tax payments. Similarly, savings related to improved health, reduced crime, and fewer welfare and unemployment claims, discussed below, are limited to those received strictly by state and local government. In all instances, benefits to private residents, local businesses, or the federal government are excluded.

TAXPAYER COSTS

State/local funding

TAXPAYER BENEFITS

Increased tax revenue

Avoided costs to state/local government

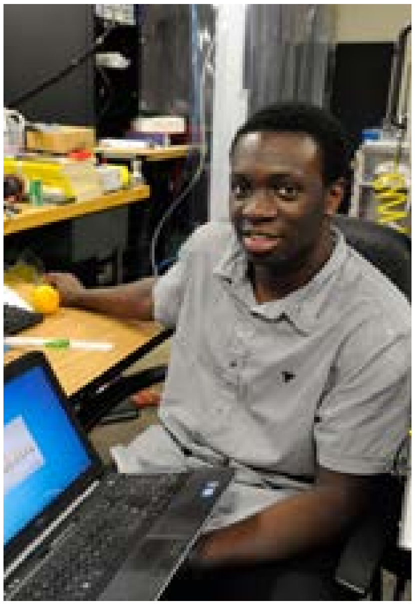
Growth in state tax revenues

As a result of their time at California's Community Colleges, students earn more because of the skills they learned while attending the colleges, and businesses 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. These in turn increase tax revenues since state and local government is able to apply tax rates to higher earnings.

Estimating the effect of California's Community Colleges 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 Emsi Burning Glass's MR-SAM model to estimate the added labor income created in the state as students and businesses spend their higher earnings.[37] 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 California gross state product to total labor income in the state. We also include the spending impacts discussed in Chapter 2 that were created in FY 2018-19 from operations, construction, and student spending. To each of these, we apply the prevailing tax rates so we capture only the tax revenues attributable to state and local government from this additional revenue.

37 For a full description of the Emsi Burning Glass MR-SAM model, see Appendix 6.

Not all of these tax revenues may be counted as benefits to the state, however. Some students leave the state during the course of their careers, and the higher earnings they receive as a result of their education leaves the state with them. To account for this dynamic, we combine student settlement data from the colleges with data on migration patterns from the Internal Revenue Service to estimate the number of students who will leave the state 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 the colleges do not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the colleges cannot be counted as new benefits to society. For this analysis, we assume an alternative education variable of 15%, meaning that 15% of the student population at the colleges would have generated benefits anyway even without the colleges. For more information on the alternative education variable, see Appendix 8.

We apply a final adjustment factor to account for the "shutdown point" that nets out benefits that are not directly linked to the state and local government costs of supporting the colleges. As with the alternative education variable discussed under the alumni impact, the purpose of this adjustment is to account for counterfactual scenarios. In this case, the counterfactual scenario is where state and local government funding for California's Community Colleges did not exist and the colleges had to derive the revenue elsewhere. To estimate this shutdown point, we apply a sub-model that simulates the students' demand curve for education by reducing state and local support to zero and progressively increasing student tuition and fees. As student tuition and fees increase, enrollment declines. For California's Community Colleges, the shutdown point adjustment is 0%, meaning that the colleges could not operate without taxpayer support. As such, no reduction applies. For more information on the theory and methodology behind the estimation of the shutdown point, see Appendix 10.

After adjusting for attrition, alternative education opportunities, and the shutdown point, we calculate the present value of the future added tax revenues that occur in the state, equal to $19.4 billion. 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 0.4%. This is the real treasury interest rate recommended by the Office of Management and Budget (OMB) for 30-year investments, and in Appendix 2, we conduct a sensitivity analysis of this discount rate.[38]

38 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).* Last modified November 2020. https://www.whitehouse.gov/wp-content/uploads/2020/12/discount-history.pdf.

Government savings

In addition to the creation of higher tax revenues to the state and local 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 California's Community Colleges. 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 state and local 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.

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

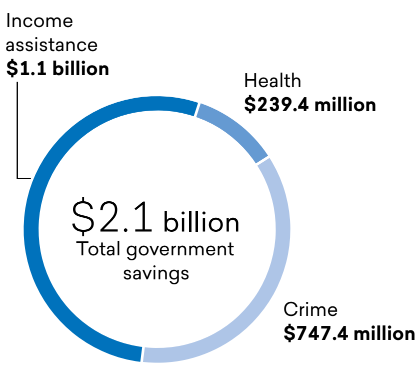
The model quantifies government savings by calculating the probability at each education level that individuals will have poor health, commit crimes, or claim welfare and unemployment benefits. Deriving the probabilities involves assembling data from a variety of studies and surveys analyzing the correlation between education and health, crime, and income assistance at the national and state level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved CHEs 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 colleges, 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 7 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

Table 3.3: PRESENT VALUE OF ADDED TAX REVENUE AND GOVERNMENT SAVINGS (THOUSANDS)

Added tax revenue	**$19,377,940**
Government savings	
Health-related savings	$239,433
Crime-related savings	$747,415
Income assistance savings	$1,121,120
Total government savings	**$2,107,968**
Total taxpayer benefits	**$21,485,908**

Source: Emsi Burning Glass impact model.

Figure 3.2: PRESENT VALUE OF GOVERNMENT SAVINGS



Source: Emsi Burning Glass impact model.

assistance.[39] Finally, we apply the same adjustments for attrition, alternative education, and the shutdown point to derive the net savings to the government. Total government savings appear in Figure 3.2 and sum to $2.1 billion.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to $19.4 billion, from students' higher earnings, increases in non-labor income, and spending impacts. The sum of the government savings and the added income in the state is $21.5 billion, as shown in the bottom row of Table 3.3. These savings continue to accrue in the future as long as the FY 2018-19 student population of the colleges remains in the workforce.

Return on investment for taxpayers

Taxpayer costs are reported in Table 3.4 and come to $10.1 billion, equal to the contribution of state and local government to California's Community Colleges. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 2.1 (= $21.5 billion ÷ $10.1 billion), indicating a profitable investment.

At 5.4%, the rate of return to state and local taxpayers is favorable. Given that the stakeholder in this case is the public sector, we use the discount rate of 0.4%, the real treasury interest rate recommended by the Office of Management and Budget for 30-year investments.[40] This is the return governments are assumed to be able to earn on generally safe investments of unused funds, or alternatively, the interest rate for which governments, as relatively safe borrowers, can obtain funds. A rate of return of 0.4% would mean that the colleges just pay their own way. In principle, governments could borrow monies used to support California's Community Colleges and repay the loans out of the resulting added taxes and reduced government expenditures. A rate of return of 5.4%, on the other hand, means that California's Community Colleges not only pay their own way, but also generate a surplus that the state and local government can use to fund other programs. It is unlikely that other government programs could make such a claim.

> A rate of return of **5.4%** means that California's Community Colleges not only pay their own way, but also generate a surplus that the state and local government can use to fund other programs.

39 For a full list of the data sources used to calculate the social externalities, see the Resources and References section. See also Appendix 11 for a more in-depth description of the methodology.

40 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).* Last modified November 2020. https://www.whitehouse.gov/wp-content/uploads/2020/12/discount-history.pdf.

Table 3.4: PROJECTED BENEFITS AND COSTS, TAXPAYER PERSPECTIVE

1 Year	2 Benefits to taxpayers (millions)	3 State and local government costs (millions)	4 Net cash flow (millions)
0	$1,297.8	$10,076.6	-$8,778.8
1	$117.2	$0.0	$117.2
2	$163.1	$0.0	$163.1
3	$250.4	$0.0	$250.4
4	$380.5	$0.0	$380.5
5	$580.0	$0.0	$580.0
6	$593.7	$0.0	$593.7
7	$609.2	$0.0	$609.2
8	$623.7	$0.0	$623.7
9	$637.5	$0.0	$637.5
10	$650.4	$0.0	$650.4
11	$662.1	$0.0	$662.1
12	$672.6	$0.0	$672.6
13	$681.9	$0.0	$681.9
14	$689.9	$0.0	$689.9
15	$696.2	$0.0	$696.2
16	$700.8	$0.0	$700.8
17	$703.7	$0.0	$703.7
18	$704.7	$0.0	$704.7
19	$704.0	$0.0	$704.0
20	$701.4	$0.0	$701.4
21	$697.0	$0.0	$697.0
22	$690.7	$0.0	$690.7
23	$682.5	$0.0	$682.5
24	$672.5	$0.0	$672.5
25	$660.7	$0.0	$660.7
26	$647.2	$0.0	$647.2
27	$632.0	$0.0	$632.0
28	$615.4	$0.0	$615.4
29	$597.4	$0.0	$597.4
30	$578.3	$0.0	$578.3
31	$558.1	$0.0	$558.1
32	$537.0	$0.0	$537.0
33	$515.1	$0.0	$515.1
34	$492.5	$0.0	$492.5
35	$469.5	$0.0	$469.5
36	$446.3	$0.0	$446.3
37	$423.0	$0.0	$423.0
38	$399.8	$0.0	$399.8
Present value	**$21,485.9**	**$10,076.6**	**$11,409.3**

Source: Emsi Burning Glass impact model.

Benefit-cost ratio	Internal rate of return	Payback period (years)
2.1	5.4%	16.1

SOCIAL PERSPECTIVE

California benefits from the education that California's Community Colleges provide through the earnings that students create in the state and through the savings that they generate through their improved lifestyles. To receive these benefits, however, members of society must pay money and forego services that they otherwise would have enjoyed if California's Community Colleges did not exist. Society's investment in California's Community Colleges stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by California's Community Colleges to these investor groups against the total social costs of generating those benefits. The total social costs include all California's Community Colleges' expenditures, all student expenditures (including interest on student loans) less tuition and fees, and all student opportunity costs, totaling a present value of $22.8 billion.

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

SOCIAL COSTS

California's Community Colleges' expenditures

Student out-of-pocket expenses

Student opportunity costs

SOCIAL BENEFITS

Increased state earnings

Avoided costs to society

Growth in state economic base

In the process of absorbing the newly acquired skills of students who attend the colleges, not only does the productivity of the California 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 colleges, and businesses 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 California's Community Colleges on the state's economic base follows a similar process used when calculating increased tax revenues in

Beekeeper analogy

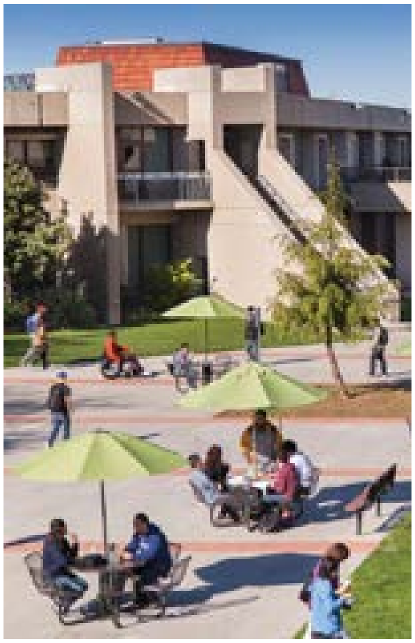
Beekeepers provide a classic example of positive externalities (sometimes called "neighborhood effects"). The beekeeper's intention is to make money selling honey. Like any other business, receipts must at least cover operating costs. If they don't, the business shuts down.

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. Aiming at a more complete accounting of the benefits generated by education, the model tracks and accounts for many of these external social benefits.

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 Emsi Burning Glass's MR-SAM model to estimate the added labor and non-labor income created in the state as students and businesses spend their higher earnings and as businesses generate additional profits from this increased output (added student and business income in Figure 3.3.). We also include the operations, construction, and student spending impacts discussed in Chapter 2 that were created in FY 2018-19 (added income from colleges activities in Figure 3.3.). The shutdown point does not apply to the growth of the economic base because the social perspective captures not only the state and local taxpayer support to the colleges, but also the support from the students and other non-government sources.

Using this process, we calculate the present value of the future added income that occurs in the state, equal to $262.5 billion. Recall from the discussion of the student and taxpayer 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. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 0.4%.



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 the colleges. 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 state, equal to $262.5 billion, from students' higher earnings and their multiplier effects, increases in non-labor income, and spending impacts. 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. Although the prevalence of these health conditions generally declines as individuals attain higher levels of education, prevalence rates are sometimes higher for individuals with certain levels of education. For example, adults with college degrees may be more likely to spend more on alcohol and become dependent on alcohol. Thus, in some cases the social savings associated with a health factor can be negative. Nevertheless, the overall health savings for society are positive, amounting to $1.4 billion. Crime savings amount to $810.8 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.

Table 3.5: PRESENT VALUE OF THE FUTURE INCREASED ECONOMIC BASE AND SOCIAL SAVINGS IN THE STATE (THOUSANDS)

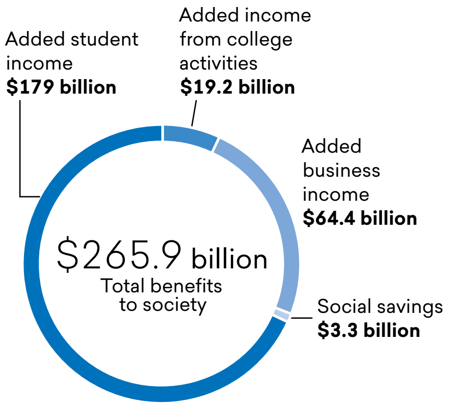
Increased economic base	**$262,544,843**
Social savings	
Health	
Smoking	$1,874,111
Alcohol dependence	-$524,150
Obesity	$643,665
Depression	-$599,839
Drug abuse	-$1,606
Total health savings*	**$1,392,180**
Crime	
Criminal justice system savings	$738,961
Crime victim savings	$9,014
Added productivity	$62,787
Total crime savings	**$810,762**
Income assistance	
Welfare savings	$933,046
Unemployment savings	$188,074
Total income assistance savings	**$1,121,120**
Total social savings	**$3,324,062**
Total, increased economic base + social savings	**$265,868,905**

* In some cases, health savings may be negative. This is due to increased prevalence rates at certain education levels.
Source: Emsi Burning Glass impact model.

Finally, the present value of the savings related to income assistance amount to $1.1 billion, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to $3.3 billion in benefits to communities and citizens in California.

The sum of the social savings and the increased state economic base is $265.9 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 FY 2018-19 student population of California's Community Colleges remain in the workforce.

Figure 3.3: PRESENT VALUE OF BENEFITS TO SOCIETY



Source: Emsi Burning Glass impact model.

Return on investment for society

Table 3.6 presents the stream of benefits accruing to the California 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 11.7. This means that for every dollar invested in an education from California's Community Colleges, whether it is the money spent on operations of the colleges or money spent by students on tuition and fees, an average of $11.70 in benefits will accrue to society in California.[41]

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 California's Community Colleges. 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 California's Community Colleges. Recognizing the other point of view, Table 3.7 shows rates of return for both the taxpayer and social perspectives exclusive of social benefits. As indicated, returns are still above threshold values (a benefit-cost ratio greater than 1.0 and a rate of return greater

Table 3.7: TAXPAYER AND SOCIAL PERSPECTIVES WITH AND WITHOUT SOCIAL SAVINGS

	Including social savings	Excluding social savings
Taxpayer perspective		
Net present value (millions)	$11,409.3	$9,301.3
Benefit-cost ratio	2.1	1.9
Internal rate of return	5.4%	4.6%
Payback period (no. of years)	16.1	18.7
Social perspective		
Net present value (millions)	$243,071.1	$239,747.0
Benefit-cost ratio	11.7	11.5

Source: Emsi Burning Glass impact model.

41 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	$19,799.4	$22,621.4	-$2,822.1
1	$1,507.8	$12.1	$1,495.6
2	$2,095.2	$12.1	$2,083.0
3	$3,208.5	$12.1	$3,196.4
4	$4,859.5	$12.1	$4,847.3
5	$7,378.6	$12.1	$7,366.5
6	$7,519.8	$12.1	$7,507.6
7	$7,677.7	$12.1	$7,665.6
8	$7,822.6	$12.1	$7,810.5
9	$7,955.0	$12.1	$7,942.8
10	$8,073.9	$12.1	$8,061.8
11	$8,178.8	$12.1	$8,166.7
12	$8,268.9	$12.1	$8,256.7
13	$8,343.3	$12.1	$8,331.2
14	$8,401.4	$12.1	$8,389.2
15	$8,442.4	$12.1	$8,430.3
16	$8,465.9	$0.0	$8,465.9
17	$8,471.6	$0.0	$8,471.6
18	$8,459.0	$0.0	$8,459.0
19	$8,428.3	$0.0	$8,428.3
20	$8,379.2	$0.0	$8,379.2
21	$8,311.8	$0.0	$8,311.8
22	$8,226.4	$0.0	$8,226.4
23	$8,123.0	$0.0	$8,123.0
24	$8,002.0	$0.0	$8,002.0
25	$7,863.6	$0.0	$7,863.6
26	$7,708.5	$0.0	$7,708.5
27	$7,537.6	$0.0	$7,537.6
28	$7,352.2	$0.0	$7,352.2
29	$7,153.4	$0.0	$7,153.4
30	$6,942.2	$0.0	$6,942.2
31	$6,720.0	$0.0	$6,720.0
32	$6,487.7	$0.0	$6,487.7
33	$6,246.8	$0.0	$6,246.8
34	$5,998.7	$0.0	$5,998.7
35	$5,745.1	$0.0	$5,745.1
36	$5,487.3	$0.0	$5,487.3
37	$5,226.6	$0.0	$5,226.6
38	$4,963.9	$0.0	$4,963.9
Present value	**$265,868.9**	**$22,797.8**	**$243,071.1**

Source: Emsi Burning Glass impact model.

Benefit-cost ratio	Payback period (years)
11.7	1.6

than 0.4%), confirming that taxpayers

receive value from investing in California's Community Colleges.

One out of every 16 jobs in California is supported by the activities of California's Community Colleges and their students.

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Emsi Burning Glass 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 Emsi Burning Glass 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 economicmodeling.com/higher-education to learn more or connect with us.

WHILE CALIFORNIA'S COMMUNITY COLLEGES' VALUE to California is larger than simply their economic impact, understanding the dollars and cents value is an important asset to understanding the colleges' value as a whole. In order to fully assess California's Community Colleges' value to the state economy, this report has evaluated the colleges from the perspectives of economic impact analysis and investment analysis.

From an economic impact perspective, we calculated that California's Community Colleges generate a total economic impact of **$128.2 billion** in total added income for the state economy. This represents the sum of several different impacts, including the colleges':

- Operations spending impact (**$11 billion**);
- Construction spending impact (**$13.6 million**);
- Student spending impact (**$8.2 billion**); and
- Alumni impact (**$109 billion**).

The total impact of $128.2 billion is equivalent to approximately **4.2%** of the total GSP of California and is equivalent to supporting **1.5 million jobs**. For perspective, this means that **one out of every 16 jobs** in California is supported by the activities of the colleges and their students.

Since California's Community Colleges' activity represents an investment by various parties, including students, taxpayers, and society as a whole, we also considered the colleges as an investment to see the value they provide to these investors. For each dollar invested by students, taxpayers, and society, California's Community Colleges offer a benefit of **$5.00**, **$2.10**, and **$11.70**, respectively. These results indicate that California's Community Colleges are an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the colleges expands the state economy and creates a wide range of positive social benefits that accrue to taxpayers and society in general within California.

Modeling the impact of the colleges is subject to many factors, the variability of which we considered in our sensitivity analysis (Appendix 2). With this variability accounted for, we present the findings of this study as a robust picture of the economic value of California's Community Colleges.

RESOURCES AND REFERENCES

Administration for Children and Families. "Fiscal Year 2016 TANF Financial Data." *Office of Family Assistance, TANF Financial Data*. 2018. https://www.acf.hhs.gov/ofa/resource/tanf-financial-data-fy-2016.

Baryla, Edward and Douglas Dotterweich. "Student Migration: Do Significant Factors Vary by Region?" *Education Economics* 9, no. 3 (2001).

Becker, Gary S. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York: Columbia College Press for NBER, 1964.

Bilkic, Natasa, Thomas Gries, and Margarethe Pilichowski. "Stay in School or Start Working? The Human Capital Investment Decision under Uncertainty and Irreversibility." *Labour Economics* 19, no. 5 (October 2012): 706-717.

Bureau of Labor Statistics. "Charts by Topic: Leisure and Sports Activities." *American Time Use Survey*. December 2016. http://www.bls.gov/tus/charts/leisure.htm.

Bureau of Labor Statistics. "Charts by Topic: Students." *American Time Use Survey.* December 2016. https://www.bls.gov/tus/charts/students.htm.

Bureau of Economic Analysis. "Table 1.1.6. Real Gross Domestic Product, Chained Dollars." *GDP and Personal Income*. Last modified January 27, 2017. http://www.bea.gov/iTable/iTableHtml.cfm?reqid=9&step=3&isuri=1&903=6.

Bureau of Justice Statistics. "Table 2: Prisoners under the Jurisdiction of State or Federal Correctional Authorities, by Jurisdiction, December 31, 2015 and 2016. *Prisoners in 2016, NCJ 251149, 2018*. https://www.bjs.gov/content/pub/pdf/p16.pdf.

Bureau of Labor Statistics. "Medical care commodities in U.S. city average, all urban consumers, not seasonally adjusted." CPI for All Urban Consumers (CPI-U). Accessed June 2021. https://beta.bls.gov/dataViewer/view/timeseries/CUUR0000SAM1.

Bureau of Labor Statistics. "Table 3. Employment status of the civilian noninstitutional population by age, sex, and race" Current Population Survey, Labor Force Statistics, Household Data, Annual Averages. Last modified January 2021. https://www.bls.gov/cps/cpsaat03.htm.

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. http://www.bls.gov/cps/cpsaat07.pdf.

Bureau of Labor Statistics. "Table 24: Historical Consumer Price Index for all Urban Consumers (CPI-U): U.S. City Average, All Items." May 2021. Accessed June 2021. https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-202105.pdf.

Bureau of Labor Statistics. "Table A-10: Unemployment rates by age, sex, and marital status, seasonally adjusted." Labor Force Statistics from the Current Population Survey. June 2021. Accessed June 2021. https://www.bls.gov/web/empsit/cpseea10.htm.

Bureau of Labor Statistics. "Unemployment rates and earnings by educational attainment, 2020." BLS Employment Projections. April 21, 2021. Accessed June 2021. https://www.bls.gov/emp/tables/unemployment-earnings-education.htm.

Buss, Christian, Jeffrey Parker, and Jon Rivenburg. "Cost, Quality and Enrollment Demand at Liberal Arts Colleges." *Economics of Education Review* 23, no. 1 (February 2004): 57-65.

Cammenga, Janelle. "State and Local Sales Tax Rates, 2021." *Tax Foundation*. January 6th, 2021. Accessed June 2021. https://taxfoundation.org/2021-sales-taxes/.

Card, David. "The Causal E ect of Education on Earnings." *Handbook of Labor Economics* 3 (1999): 1801-1863.

Card, David. "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems." *Econometrica* 69, no. 5 (September 2001): 1127-1160.

Carson, Ann E. "Prisoners in 2018." *Bureau of Justice Statistics NCJ* 253516, April 2020. https://www.bjs.gov/content/pub/pdf/p18.pdf.

Center on Budget and Policy Priorities. "Policy Basics—How Many Weeks of Unemployment are Available?" April 2018. https://www.cbpp.org/sites/default/files/atoms/files/policybasics-uiweeks.pdf.

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* [Data set]. https://www.cdc.gov/statesystem/cigaretteuseadult.html.

Centers for Disease Control and Prevention. "Heavy drinkers (adult men having more than 14 drinks per week and adult women having more than seven drink per week)." *Alcohol Consumption—2018, Behavioral Risk Factor Surveillance System Prevalence and Trends Data.* https://nccd.cdc.gov/BRFSSPrevalence/rdPage.aspx?rdReport=DPH_BRFSS.ExploreByTopic&irbLocationType=StatesAndMMSA&islClass=CLASS01&islTopic=Topic30&islYear=2018.

Centers for Disease Control and Prevention. "Table. Characteristics of Current Adult Cigarette Smokers." *National Health Interview Survey, United States, 2016.* https://www.cdc.gov/mmwr/volumes/67/wr/mm6702a1.htm#T1_down.

Centers for Medicare and Medicaid Services. "Table 16: National Health Expenditures (NHE), Amounts and Average Annual Growth from Previous Year Shown, by Type of Sponsor, Selected Calendar Years 2012-2028." *NHE Projections 2019-2028—Tables*. April 15th, 2020. Accessed June 2021. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected.html.

College Board. "Figure CP-1. Average Estimated Full-Time Undergraduate Budgets (Enrollment Weighted) by Sector, 2020-21". *The College Board, Annual Survey of Colleges, Trends in College Pricing and Student Aid 2020*. Accessed July 2021. https://research.collegeboard.org/trends/college-pricing.

Congressional Budget Office. “Table 4. Projection of Borrower Interest Rates—CBO’s March 2020 Baseline.” *Congressional Budget Office Publications CBO’s March 2020 Baseline Projections for the Student Loan Program*. March 6th, 2020. Accessed June 2021. https://www.cbo.gov/system/files/2020-03/51310-2020-03-studentloan.pdf.

Criminal Justice Expenditure and Employment Extracts Program. “Table 4. Justice System Expenditure by Character, State and Type of Government, Fiscal Year 2015” *Justice Expenditure and Employment Extracts 2015 (preliminary) NCJ 251780*. https://www.bjs.gov/index.cfm?ty=dcdetail&iid=286.

Damodaran, Aswath. “Historical Returns on Stocks, Bonds and Bills: 1928-2020” Stern School of Business at New York University. January 2021. Accessed June 2021. http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histretSP.html.

Dickerson, Andy, and Steven McIntosh. “The Impact of Distance to Nearest Education Institution on the Post Compulsory Education Participation Decision.” *Urban Studies* 50, no. 4 (2013): 742-758.

Dynarski, Susan M. “Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion.” *American Economic Review* 93, no. 1 (2003): 279-288.

Emsi Burning Glass Labor Market Data and Software. www.economicmodeling.com.

Federal Bureau of Investigation, Criminal Justice Information Services Division. “Table 1: Crime in the United States.” Crime in the United States 2016, Offenses Known to Law Enforcement. https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/tables/table-1.

Federal Bureau of Investigation, Criminal Justice Information Services Division. “Table 18: Estimated Number of Arrests, United States, 2016” in “Uniform Crime Reports.” Crime in the United States, 2016, Persons Arrested. https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/tables/table-18.

Federal Deposit Insurance Corporation. “Monthly Rate Cap Information as of June 21, 2021.” National Rates and Rate Caps—Monthly Update. Accessed July 2021. https://www.fdic.gov/regulations/resources/rates/.

Federal Reserve Economic Data. “Gross Domestic Product: Implicit Price Deflator, Index 2012=100, Quarterly, Seasonally Adjusted”. January 2021. Accessed June 2021. https://fred.stlouisfed.org/series/GDPDEF.

Finkelstein, Eric A., 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.

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.

Hamadeh, Mohamad and Roy Khoueiri. “Demand Elasticities for Higher Education in the United States.” *International Journal of Business and Economic Perspectives* 5, no. 2 (2010): 60-67.

Henderson, James M. and Richard E. Quandt. *Microeconomic Theory: A Mathematical Approach*. New York: McGraw-Hill Book Company, 1971.

Hernández-Murillo, Rubén, Lesli S. Ott, Michael T. Owyang, and Denise Whalen. "Patterns of Interstate Migration in the United States from the Survey of Income and Program Participation." *Federal Reserve Bank of St. Louis Review* 93, no. 3 (May/June 2011): 169-186. https://files.stlouisfed.org/files/htdocs/publications/review/11/05/169-186Hernandez.pdf.

Hilliard, Tom. "Out of Reach: Too Few New Yorkers are Earning a High School Equivalency Diploma". Table 3. High School Equivalency Attainment in the United States, 2012-2016. *Center for an Urban Future. October 2018.* Accessed July 2021. https://nycfuture.org/research/out-of-reach.

Jaeger, David A. and Marianne E. Page. "New Evidence on Sheepskin Effects in the Returns to Education." *The Review of Economics and Statistics* 78, no. 4 (November 1996): 733-740.

Jamal Ahmed, Elyse Phillips, Andrea S. Gentzke, David M. Homa, Stephen D. Babb, Brian A. King, and Linda J. Neff. "Current Cigarette Smoking Among Adults—United States, 2016." *Morbidity and Mortality Weekly Report 2018* 67:53-59. DOI: http://dx.doi.org/10.15585/mmwr.mm6702a1.

Kelchtermans, Stijn and Frank Verboven. "Participation and Study Decisions in a Public System of Higher Education." *Journal of Applied Econometrics* 25, no. 3 (2010): 355-391.

Leigh, Andrew and Chris Ryan. "Estimating Returns to Education Using Different Natural Experiments Techniques." *Economics of Education Review* 27 (2008): 149-160.

Leonesio, Michael V. "The Economics of Retirement: A Nontechnical Guide." *Social Security Bulletin* 59, no. 4 (Winter 1996): 29-50.

Loughead, Katherine. *Tax Foundation*. "State Individual Income Tax Rates and Brackets for 2020." February 4th, 2020. Accessed June 2021. https://taxfoundation.org/state-individual-income-tax-rates-and-brackets-for-2020/.

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. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2835847.

Mincer, Jacob. "Investment in Human Capital and Personal Income Distribution." *Journal of Political Economy* 66, no. 4 (August 1958): 281–302.

Mincer, Jacob. *Schooling, Experience and Earnings*. New York: National Bureau of Economic Research, 1974.

National Center for Education Statistics. Integrated Post-secondary Education Data System (IPEDS). http://nces.ed.gov/ipeds.

National Center for Health Statistics. "Table 58. Normal Weight, Overweight, and Obesity Among Persons 20 Years of Age and Over, by Selected Characteristics: United States, Selected Years 1988-1994 through 2011-2014." *Centers for Disease Control and Prevention, Health, United States, 2015.* https://www.cdc.gov/nchs/data/hus/2015/058.pdf.

National Employment Law Project. “Unemployment Insurance: An Overview of the Challenges and Strengths of Today’s System.” 2016. https://waysandmeans.house.gov/wp-content/uploads/2016/09/20160907HR-Testimony-Conti.pdf.

National Survey on Drug Use and Health. “Table 20: Illicit Drug Use Disorder in the Past Year, by Age Group and State: Percentages, Annual Averages, and P Values from Tests of Differences between Percentages, 2015-2016 and 2016-2017.” *Comparison of 2015-2016 and 2016-2017 Population Percentages (50 States and the District of Columbia).* https://www.samhsa.gov/data/report/comparison-2015-2016-and-2016-2017-nsduh-population-percentages-50-states-and-district.

National Survey on Drug Use and Health. “Table 31: Major Depressive Episode in the Past Year, by age group and state: Percentages, annual averages, and P values from tests of differences between percentages, 2015-2016 and 2016-2017.” *Comparison of 2015-2016 and 2016-2017 Population Percentages (50 States and the District of Columbia).* https://www.samhsa.gov/data/report/comparison-2015-2016-and-2016-2017-nsduh-population-percentages-50-states-and-district.

National Survey on Drug Use and Health. “Table 8.39B: 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 Demographic Characteristics: Percentages, 2017 and 2018.” https://www.samhsa.gov/data/report/2018-nsduh-detailed-tables.

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.” https://www.samhsa.gov/data/report/2018-nsduh-detailed-tables.

Nowotny, Kathryn, Ryan Masters, and Jason Boardman, 2016. “The relationship between education and health among incarcerated man and women in the United States” BMC Public Health. September 2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5009667/.

OECD (2020). “Household savings.” Accessed June 2021. https://data.oecd.org/hha/household-savings.htm#indicator-chart.

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)*. November 19th, 2020. Accessed June 2021. https://www.whitehouse.gov/wp-content/uploads/2020/12/discount-history.pdf.

Office of Management and Budget. “Table 14.1—Total Government Receipts in Absolute Amounts and as Percentages of GDP: 1948-2020.” OMB Historical Tables. Accessed June 2021. https://www.whitehouse.gov/omb/historical-tables/.

Ogden, Cynthia L., Molly M. Lamb, Margaret D. Carroll, and Katherine M. Flegal. “Figure 3. Prevalence of Obesity among Adults Aged 20 Years and Over, by Education, Sex, and Race and Ethnicity: United States 2005-2008.” *Obesity and Socioeconomic Status in Adults: United States 2005-2008, National Center for Health Statistics* no. 50. (2010).

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). https://www.cdc.gov/mmwr/volumes/66/wr/mm6650a1.htm?s_cid=mm6650a1_w#suggestedcitation.

Polachek, Solomon W. "Earnings Over the Lifecycle: The Mincer Earnings Function and its Applications." *Foundations and Trends in Microeconomics* 4, no. 3 (2008): 165-272.

Polachek, Solomon W. "Mincer's Overtaking Point and the Lifecycle Earnings Distribution." *Review of the Economics of the Household* 1, no. 4 (December 2003): 273-304.

Ramey, Valerie and Neville Francis. "A Century of Work and Leisure." *American Economic Journal: Macroeconomics* 1, no. 2 (2009): 189-224.

Sacks, Gonzales, Bouchery, Tomedi, & Brewer (2015). 2010 National and State Costs of Excessive Alcohol Consumption. *American Journal of Preventive Medicine*, 49(5), E73-E79. https://www.ajpmonline.org/article/S0749-3797(15)00354-2/pdf/.

Sevilla, Almudena, Jose Ignacio Gimenez-Nadal, and Jonathan I. Gershuny. "Leisure Inequality in the United States: 1965-2003." IZA Discussion Paper no. 6708 (July 2012).

Social Security Administration. "Retirement Benefits." *Full Retirement Age*. January 2021. https://www.ssa.gov/pubs/EN-05-10035.pdf.

State of Obesity. "Adult Obesity in the United States." Adult Obesity Rate by State, 2018. https://stateofobesity.org/adult-obesity/.

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.* https://store.samhsa.gov/shin/content/SMA16-4975/SMA16-4975.pdf.

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. https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.htm#tab5-4B.

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. https://www.samhsa.gov/data/sites/default/files/cbhsq-reports/NSDUHDetailedTabs2018R2/NSDUHDetailedTabs2018.pdf.

Supplemental Nutrition Assistance Program. "State Activity Report Fiscal Year 2016." *Food and Nutrition Service, Supplemental Nutrition Assistance Program, Program Accountability and Administration Division* (September 2017). https://fns-prod.azureedge.net/sites/default/files/snap/FY16-State-Activity-Report.pdf.

U.S. Census Bureau. “Annual Estimates of the Resident Population for Selected Age Groups by Sex: April 1, 2010 to July 1, 2019” in “2019 Population Estimates.”

Allan Hancock College	Evergreen Valley College	Ohlone College
American River College	Feather River Community College District	Orange Coast College
Antelope Valley College	Folsom Lake College	Oxnard College
Bakersfield College	Foothill College	Palo Verde College
Barstow Community College	Fresno City College	Palomar College
Berkeley City College	Fullerton College	Pasadena City College
Butte College	Gavilan College	Porterville College
Cabrillo College	Glendale Community College	Reedley College
Calbright College	Golden West College	Rio Hondo College
Canada College	Grossmont College	Riverside City College
Cerritos College	Hartnell College	Sacramento City College
Cerro Coso Community College	Imperial Valley College	Saddleback College
Chabot College	Irvine Valley College	San Bernardino Valley College
Chaffey College	Lake Tahoe Community College	San Diego City College
Citrus College	Laney College	San Diego Mesa College
City College of San Francisco	Las Positas College	San Diego Miramar College
Clovis Community College	Lassen Community College	San Joaquin Delta College
Coastline Community College	Long Beach City College	San Joaquin Valley College-Madera
College of Alameda	Los Angeles City College	San Jose City College
College of Marin	Los Angeles Harbor College	Santa Ana College
College of San Mateo	Los Angeles Mission College	Santa Barbara City College
College of the Canyons	Los Angeles Pierce College	Santa Monica College
College of the Desert	Los Angeles Southwest College	Santa Rosa Junior College
College of the Redwoods	Los Angeles Trade Technical College	Santiago Canyon College
College of the Sequoias	Los Angeles Valley College	Shasta College
College of the Siskiyous	Los Medanos College	Sierra College
Columbia College	Mendocino College	Skyline College
Compton College	Merced College	Solano Community College
Contra Costa College	Merritt College	Southwestern College
Copper Mountain Community College	MiraCosta College	Taft College
Cosumnes River College	Mission College	Ventura College
Crafton Hills College	Modesto Junior College	Victor Valley College
Cuesta College	Monterey Peninsula College	West Hills College-Coalinga
Cuyamaca College	Moorpark College	West Hills College-Lemoore
Cypress College	Moreno Valley College	West Los Angeles College
De Anza College	Mt San Antonio College	West Valley College
Diablo Valley College	Mt San Jacinto Community College District	Woodland Community College
East Los Angeles College	Napa Valley College	Yuba College
El Camino Community College District	Norco College	

https://www.census.gov/newsroom/press-kits/2020/population-estimates-detailed.html.

U.S. Census Bureau, Current Population Survey, 2018 Annual Social and Economic Supplement. "Table 1. Educational Attainment of the Population 18 Years and Over, by Age, Sex, Race, and Hispanic Origin: 2018." https://www.census.gov/data/tables/2018/demo/education-attainment/cps-detailed-tables.html.

U.S. Census Bureau, Current Population Survey, 2020 Annual Social and Economic Supplement. "Table 1. General Mobility, by Race and Hispanic Origin, Region, Sex, Age, Relationship to Householder, Educational Attainment, Marital Status, Nativity, Tenure, and Poverty Status: 2019 to 2020." December 2020. Accessed June 2021. https://www.census.gov/data/tables/2020/demo/geographic-mobility/cps-2020.html.

U.S. Census Bureau. "Educational Characteristics of Prisoners: Data from the ACS." 2011. https://www.census.gov/library/working-papers/2011/demo/SEHSD-WP2011-08.html.

U.S. Census Bureau. "Social Insurance and Human Services." *The 2012 Statistical Abstract.* http://www.census.gov/compendia/statab/cats/social_insurance_human_services.html.

U.S. Department of Agriculture, Office of Policy Support. Supplemental Nutrition Assistance Program Nutrition Assistance Program Report Series. "Characteristics of Supplemental Nutrition Assistance Program Households: Fiscal Year 2018." https://fns-prod.azureedge.net/sites/default/files/resource-files/Characteristics2018.pdf.

Table A2.1: SENSITIVITY ANALYSIS OF ALTERNATIVE EDUCATION VARIABLE, TAXPAYER AND SOCIAL PERSPECTIVES

% variation in assumption	**-50%**	**-25%**	**-10%**	**Base case**	**10%**	**25%**	**50%**
Alternative education variable	**8%**	**11%**	**14%**	**15%**	**17%**	**19%**	**23%**
Taxpayer perspective							
Net present value (millions)	$13,305	$12,357	$11,788	$11,409	$11,030	$10,461	$9,513
Rate of return	6.0%	5.7%	5.5%	5.4%	5.2%	5.0%	4.6%
Benefit-cost ratio	2.3	2.2	2.2	2.1	2.1	2.0	1.9
Social perspective							
Net present value (millions)	$266,530	$254,801	$247,763	$243,071	$238,379	$231,342	$219,612
Benefit-cost ratio	12.7	12.2	11.9	11.7	11.5	11.1	10.6

U.S. Department of Education, Federal Student Aid Office. "The Standard Repayment Plan." https://studentaid.ed.gov/sa/repay-loans/understand/plans/standard.

US Department of Education. National Reporting System for Adult Education. 2011 & 2015 Aggregate Reports for All Regions. Table 3: Participants by Program Type and Age. June 30th, 2012 and June 30th, 2016. Accessed 7/21/21. https://nrs.ed.gov/index.php/rt/reports/aggregate.

U.S. Department of Health and Human Services. "Welfare Indicators and Risk Factors: Fourteenth Report to Congress" Annual Report to Congress, 2015. https://aspe.hhs.gov/system/files/pdf/116161/Final%20Fourteenth%20Report%20-%20Final%209%2022%2015.pdf.

U.S. Department of Health and Human Services. "Welfare Indicators and Risk Factors: Seventeenth Report to Congress" Annual Report to Congress, 2018. https://aspe.hhs.gov/system/files/pdf/259196/WelfareIndicators17Threport.pdf.

U.S. Department of Health & Human Services, National Vital Statistics System, United States Life Tables, 2018. November 17th, 2020. Accessed June 2021. https://www.cdc.gov/nchs/data/nvsr/nvsr69/nvsr69-12-508.pdf.

U.S. Department of Health and Human Services, Office of Family Assistance. "Characteristics and Financial Circumstances of TANF Recipients, Fiscal Year 2018." https://www.acf.hhs.gov/sites/default/files/ofa/fy18_characteristics_web_508_2.pdf.

U.S. Department of Health & Human Services. "The Health Consequences of Smoking—50 Years of Progress." A Report of the Surgeon General, 2014. https://www.ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf.

Table A2.2: SENSITIVITY ANALYSIS OF LABOR IMPORT EFFECT VARIABLE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Labor import effect variable	25%	38%	45%	50%	55%	63%	75%
Alumni impact (millions)	$163,546	$136,288	$119,934	$109,031	$98,128	$81,773	$54,515

U.S. Department of Labor. "Unemployment Insurance Data Summary, 3rd Quarter 2019." https://oui.doleta.gov/unemploy/data_summary/DataSum.asp.

Walden, Michael, "The Local Economic Impact of the Cooperating Raleigh Colleges: Update 2013." March 2014. http://crcraleighcolleges.org/files/crcimpact2013-final.pdf.

Table A2.3: SENSITIVITY ANALYSIS OF STUDENT EMPLOYMENT VARIABLES

Variations in assumptions	Net present value (millions)	Internal rate of return	Benefit-cost ratio
Base case: A = 69%, B = 78%	$43,487.8	19.6%	5.0
Scenario 1: A = 100%, B = 78%	$47,652.3	27.6%	8.1
Scenario 2: A = 69%, B = 100%	$46,399.7	24.5%	6.8
Scenario 3: A = 100%, B = 100%	$52,056.1	59.2%	23.5
Scenario 4: A = 0%, B = 0%	$33,739.1	12.1%	2.6

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

APPENDIX 2: 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 labor import effect variable, 3) the student employment variables, 4) the discount rate, and 5) the retained student variable.

Alternative education variable

The alternative education variable (15%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the publicly-funded colleges in the state. 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 A2.1. 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 15% to 17%) reduces the taxpayer perspective rate of return from 5.4% to 5.2%. Likewise, a decrease of 10% (from 15% to 14%) in the assumption increases the rate of return from 5.4% to 5.5%.

Based on this sensitivity analysis, the conclusion can be drawn that California's Community Colleges investment analysis results from the taxpayer and social perspectives are not very sensitive to relatively large variations in the alternative education variable. As indicated, results are still above their threshold levels (net present value greater than zero, benefit-cost ratio greater than 1.0, and rate of return greater than the discount rate of 0.4%), even when the alternative education assumption is increased by as much as 50% (from 15% to 23%). 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.

Labor import effect variable

The labor import effect variable only affects the alumni impact calculation in Table 2.7. In the model we assume a labor import effect variable of 50%, which means that 50% of the state's labor demands would have been satisfied without the presence of California's Community Colleges. In other words, businesses that hired the colleges' students could have substituted some of these workers with equally-qualified people from outside the state had there been no California's Community Colleges' students to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the colleges.

Table A2.2 presents the results of the sensitivity analysis for the labor import effect

Table A2.4: SENSITIVITY ANALYSIS OF DISCOUNT RATE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Student perspective							
Discount rate	2.3%	3.4%	4.1%	4.5%	5.0%	5.7%	6.8%
Net present value (millions)	$69,279	$54,699	$47,631	$43,488	$39,739	$34,761	$33,331
Benefit-cost ratio	7.4	6.0	5.4	5.0	4.7	4.2	4.1
Taxpayer perspective							
Discount rate	0.2%	0.3%	0.4%	0.4%	0.4%	0.5%	0.6%
Net present value (millions)	$12,213	$11,806	$11,567	$11,409	$11,253	$11,022	$10,645
Benefit-cost ratio	2.2	2.2	2.1	2.1	2.1	2.1	2.1
Social perspective							
Discount rate	0.2%	0.3%	0.4%	0.4%	0.4%	0.5%	0.6%
Net present value (millions)	$252,797	$247,872	$244,977	$243,071	$241,184	$238,389	$233,824
Benefit-cost ratio	12.1	11.9	11.7	11.7	11.6	11.5	11.3

variable. As explained earlier, the assumption increases and decreases relative to the base case of 50% by the increments indicated in the table. Alumni productivity impacts attributable to California's Community Colleges, for example, range from a high of $163.5 billion at a -50% variation to a low of $54.5 billion at a +50% variation from the base case assumption. This means that if the labor import effect variable increases, the impact that we claim as attributable to alumni decreases. Even under the most conservative assumptions, the alumni impact on the California economy still remains sizeable.

Student employment variables

Student employment variables are difficult to estimate because many students do not report their employment status or because colleges generally do not collect this kind of information. Employment variables include the following: 1) the percentage of students who are employed while attending the colleges 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 colleges. Both employment variables affect the investment analysis results from the student perspective.

Students incur substantial expense by attending the colleges 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 69% of students are employed.[42] 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 colleges earn only 78%, on average, of the earnings that they statistically would have received if not attending the colleges. This suggests that many students hold part-time jobs that accommodate their attendance at the colleges, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 78% 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

Table A2.5: SENSITIVITY ANALYSIS OF RETAINED STUDENT VARIABLE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Retained student variable	5%	8%	9%	10%	11%	13%	15%
Student spending impact (thousands)	$5,743,894	$6,961,176	$7,691,545	$8,178,458	$8,665,371	$9,395,740	$10,613,021

captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 78% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table A2.3, 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 69% and *B* equal to 78%. 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%.

- **Scenario 1:** Increasing the percentage of students employed (A) from 69% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to $47.7 billion, 27.6%, and 8.1, 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 78% to 100%, the net present value, internal rate of return, and benefit-cost ratio

42 Emsi Burning Glass provided an estimate of the percentage of students employed because the Foundation for California Community Colleges was unable to provide data. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

results improve to $46.4 billion, 24.5%, and 6.8, respectively, relative to base case results; a strong improvement, again attributable to a lower opportunity cost of time.

- **Scenario 3:** Increasing both assumptions *A* and *B* to 100% simultaneously, the net present value, internal rate of return, and benefit-cost ratio improve yet further to $52.1 billion, 59.2%, and 23.5, 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 $33.7 billion, 12.1%, and 2.6, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[43]

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 California's Community Colleges 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 4.5% discount rate for students and a 0.4% discount rate for society and taxpayers.[44] Similar to the sensitivity analysis of the alternative

43 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.

44 These values are based on the baseline forecasts for the 10-year Treasury rate published by the Congressional Budget Office and the real treasury interest rates recommended by the Office of Management and Budget for 30-year investments. See the Congressional Budget Office "Table 4. Projection of Borrower Interest Rates: CBO's

education variable, we vary the base case discount rates for students, taxpayers, and society on 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 rate of return and the payback period are both based on the undiscounted cash flows, they are unaffected by changes in the discount rate. As such, only variations in the net present value and the benefit-cost ratio are shown for students, taxpayers, and society in Table A2.4.

As demonstrated in the table, 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 4.5% to 6.8%) reduces the students' benefit-cost ratio from 5.0 to 4.1. Conversely, reducing the discount rate for students by 50% (from 4.5% to 2.3%) increases the benefit-cost ratio from 5.0 to 7.4. The sensitivity analysis results for society and taxpayers show the same inverse relationship between the discount rate and the benefit-cost ratio, with the variance in results being the greatest under the social perspective (from a 12.1 benefit-cost ratio at a -50% variation from the base case to an 11.3 benefit-cost ratio at a 50% variation from the base case).

Retained student variable

The retained student variable only affects the student spending impact calculation in Table 2.5. For this analysis, we assume a retained student variable of 10%, which means that 10% of the colleges' students who originated from California would have left the state for other opportunities, whether that be education or employment, if California's Community Colleges did not exist. The money these retained students spent in the state for accommodation and other personal and household expenses is attributable to California's Community Colleges.

Table A2.5 presents the results of the sensitivity analysis for the retained student variable. The assumption increases and decreases relative to the base case of 10% by the increments indicated in the table. The student spending impact is recalculated at each value of the assumption, holding all else constant. Student spending impacts attributable to California's Community Colleges range from a high of $10.6 billion when the retained student variable is 15% to a low of $5.7 billion when the retained student variable is 5%. This means as the retained student variable decreases, the student spending attributable to California's Community Colleges decreases. Even under the most conservative assumptions, the student spending impact on the California economy remains substantial.

March 2020 Baseline" and the Office of Management and Budget "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses."

APPENDIX 3: 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 colleges 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 colleges in order to obtain their education.

Alternative use of funds: A measure of how monies that are currently used to fund the colleges might otherwise have been used if the colleges did not exist.

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: 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 economic impact study, the counterfactual scenario is a scenario where the colleges did not exist.

Credit hour equivalent: Credit hour equivalent, or CHE, is defined as 15 contact hours of education if on a semester system, and 10 contact hours if on a quarter system. In general, it requires 450 contact hours to complete one full-time equivalent, or FTE.

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 state product: Measure of the final value of all goods and services produced in a state after netting out the cost of goods used in production. Alternatively, gross state product (GSP) 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 state 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 colleges and the higher earnings of their 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 state, 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 colleges and their students spend money in the state. It consists of the income created by the supply chain of the industries initially affected by the spending of the colleges and their students (i.e., the direct effect), income created by the supply chain of the initial supply chain (i.e., the indirect effect), and the income created by the increased spending of the household sector (i.e., the induced 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 4: 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 colleges—on the economy of a specified region.

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 Emsi Burning Glass'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 colleges. Therefore, model results for the colleges are specific to the given region.

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

Emsi Burning Glass'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 colleges. Rather, it is an impact assessment of the additional income created in the region as a result of the colleges' spending on payroll and other non-pay expenditures, net of any impacts that would have occurred anyway if the colleges did not exist.

How does my system's rates of return compare to that of other systems?

In general, Emsi Burning Glass discourages comparisons between systems or institutions since many factors, such as regional economic conditions, institutional differences, and student demographics are outside of the colleges' control. It is best to compare the rate of return to the discount rates of 4.5% (for students) and 0.4% (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.

Emsi Burning Glass 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 Emsi Burning Glass, 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 economic 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 GSP" as your system (Table 1.3). This percentage represents its portion of the total gross state product in the state (similar to the nationally recognized gross domestic product but at a state level). This allows the system to say that the colleges' brick and mortar campuses do just as much for California as the entire Utilities *industry*, for example. This powerful statement can help put the large total impact number into perspective.

APPENDIX 5: EXAMPLE OF SALES VERSUS INCOME

Emsi Burning Glass'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 state product (GSP). 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. The difference is GSP reflects a state and GDP 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 6: EMSI BURNING GLASS MR-SAM

Emsi Burning Glass's MR-SAM represents the flow of all economic transactions in a given region. It replaces Emsi Burning Glass'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 state 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 Emsi Burning Glass 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.

Emsi Burning Glass 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 Emsi Burning Glass MR-SAM model to produce an industry-by-industry matrix describing all industry purchases from all industries.

BEA Gross Domestic Product by State (GSP) 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 state and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The Emsi Burning Glass 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 Emsi Burning Glass 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. Emsi Burning Glass utilizes this data heavily in the creation of the national demographic by income type consumption on industries.

Census of Government's (CoG) state and local government finance dataset is used specifically to aid breaking out state and local data that is reported in the MUTs. This allows Emsi Burning Glass to have unique production functions for each of its state and local 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 Emsi Burning Glass 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 Emsi Burning Glass's gravitational flows model that estimates the amount of trade between counties in the country.

Overview of the MR-SAM model

Emsi Burning Glass'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 Emsi Burning Glass 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.

Emsi Burning Glass'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 Emsi Burning Glass'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 takes into account 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 Emsi Burning Glass MR-SAM model

The Emsi Burning Glass 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. Emsi Burning Glass'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 Emsi Burning Glass'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 Emsi Burning Glass'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 Emsi Burning Glass'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. Emsi Burning Glass uses a modification of the "diagonal similarity scaling" algorithm to balance the national SAM.

GRAVITATIONAL FLOWS MODEL

The most important piece of the Emsi Burning Glass 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

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

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.

Table A7.1:
AGGREGATE ANNUAL INCREASE IN INCOME OF STUDENTS AND VALUE PER CHE

Aggregate annual increase in income	$3,810,522,315
Total credit hour equivalents (CHEs) in FY 2018-19	22,028,583
Value per CHE	**$173**

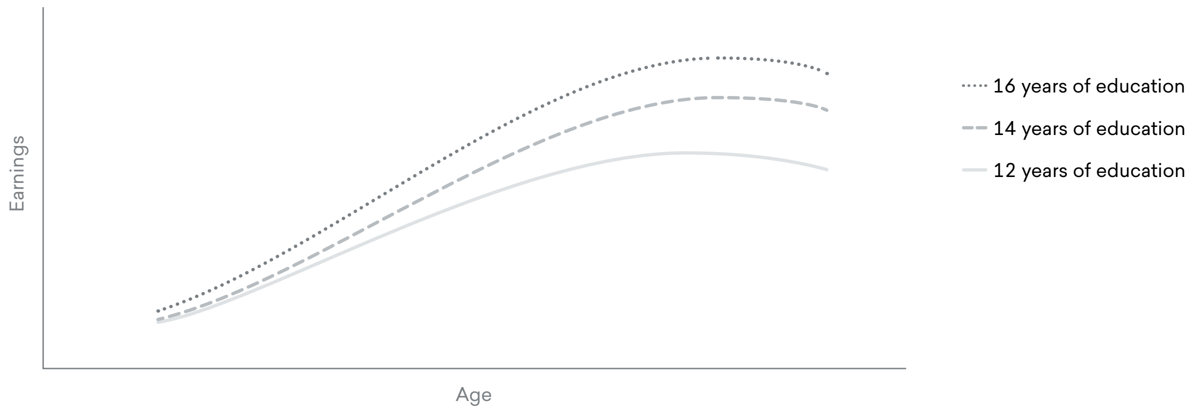
Source: Emsi Burning Glass impact model.

APPENDIX 7: VALUE PER CREDIT HOUR EQUIVALENT 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 CHE

Figure A7.1: LIFECYCLE CHANGE IN EARNINGS



Typically, the educational achievements of students are marked by the credentials they earn. However, not all students who attended the colleges in the 2018-19 analysis year 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 credit hour equivalents, or CHEs. This approach allows us to see the benefits to all students who attended the colleges, not just those who earned a credential.

To calculate the value per CHE, we first determine how many CHEs are required to complete each education level. For example, assuming that there are 30 CHEs in an academic year, a student generally completes 120 CHEs in order to move from a high school diploma to a bachelor's degree, another 60 CHEs to move from a bachelor's degree to a master's degree, and so on. This progression of CHEs 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 CHEs in the education ladder based on the wage differentials presented in Table 1.4. For example, the difference in state earnings between a high school diploma and an associate degree is $11,100. We spread this $11,100 wage differential across the 60 CHEs that occur between a high school diploma and an associate degree, applying a ceremonial "boost" to the last CHE in the stage to mark the achievement of the degree.[45] We repeat this process for each education level in the ladder.

Next, we map the CHE production of the FY 2018-19 student population to the education ladder. Table 1.2 provides information on the CHE production of students attending California's Community Colleges, broken out by educational achievement. In total, students completed 22,028,583 CHEs during the analysis year. We map each of these CHEs to the education ladder depending on the students' education level and the average number of CHEs they 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 CHEs they completed informs the shape of the distribution curve used to spread out their total CHE production within that stage of the progression.

The sum product of the CHEs 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:

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 CHEs completed at step i.

Table A7.1 displays the result for the students' aggregate annual increase in income (ΔE), a total of $3.8 billion. By dividing this value by the students' total production of 22,028,583 CHEs during the analysis year, we derive an overall value of $173 per CHE.

Mincer function

The $173 value per CHE in Table A7.1 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

45 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 Emsi Burning Glass impact model are derived from Jaeger and Page (1996).

distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[46] 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, socio-

Table A9.1: 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	Internal rate of return	Payback period (years)
1.7	18.0%	4.2

economic 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 state-specific and education level-specific Mincer coefficients.

Figure A7.1 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

46 See Mincer (1958 and 1974).

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.

In calculating the alumni impact in Chapter 2, we use the slope of the curve in Mincer's earnings function to condition the $173 value per CHE to the students' age and work experience. To the students just starting their career during the analysis year, we apply a lower value per CHE; to the students in the latter half or approaching the end of their careers we apply a higher value per CHE. The original $173 value per CHE applies only to the CHE 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 FY 2018-19 student population into the future. Here too the value per CHE 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 A7.1.

APPENDIX 8: ALTERNATIVE EDUCATION VARIABLE

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

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

In the absence of the colleges, we assume 15% of the colleges' students would find alternative education opportunities and remain in or return to the state. We account for this by discounting the alumni impact, the benefits to taxpayers, and the benefits to society in the state in Chapters 2 and 3 by 15%. In other words, we assume 15% of the benefits created by the colleges' students would have occurred anyway in the counterfactual scenario where the colleges did not exist. A sensitivity analysis of this adjustment is presented in Appendix 2.

APPENDIX 9: OVERVIEW OF INVESTMENT ANALYSIS MEASURES

The appendix provides context to the investment analysis results using the simple hypothetical example summarized in Table A9.1 below. The table shows the projected benefits and costs for a single student over time and associated investment analysis results.[47]

Assumptions are as follows:

- Benefits and costs are projected out 10 years into the future (Column 1).
- The student attends the colleges for one year, and the cost of tuition is $1,500 (Column 2).
- Earnings foregone while attending the colleges for one year (opportunity cost) come to $20,000 (Column 3).
- 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 A9.1.

Net present value

The student in Table A9.1 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.

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

If he adds up higher earnings of $5,000 per year for the remaining nine years in Table A9.1, 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.[48]

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.

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 A9.1 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 A9.1. In technical terms,

48 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 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

Figure A10.1: STUDENT DEMAND AND GOVERNMENT FUNDING BY TUITION AND FEES

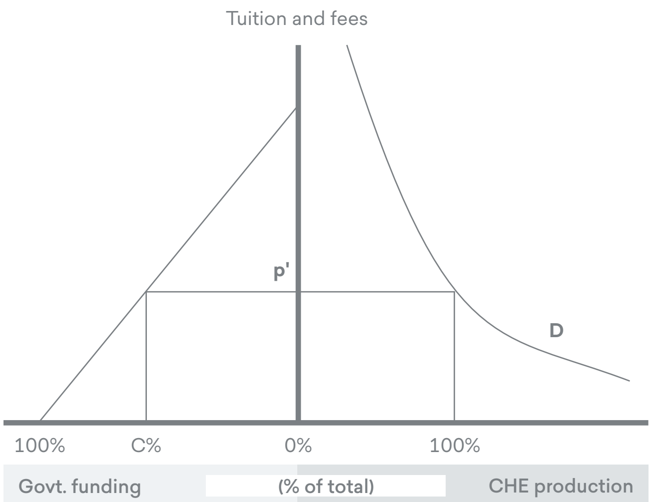
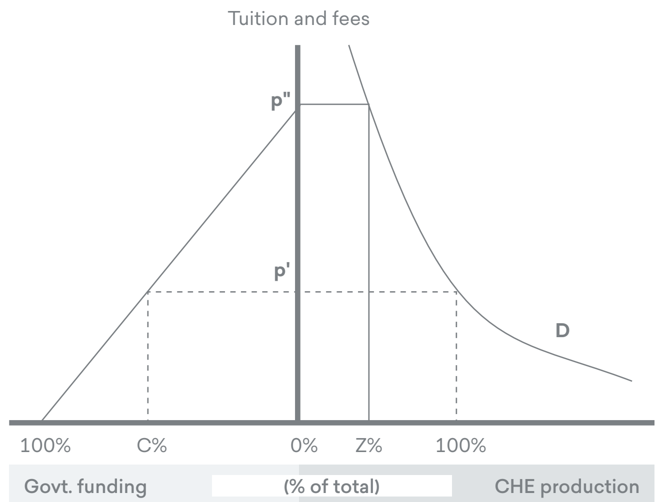


Figure A10.2: CHE PRODUCTION AND GOVERNMENT FUNDING BY TUITION AND FEES



to be higher—18.0% in fact, as indicated in Table A9.1. 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 10% 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 A9.1, 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 colleges. 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.

Figure A10.3:
SHUTDOWN POINT AFTER ZERO GOVERNMENT FUNDING

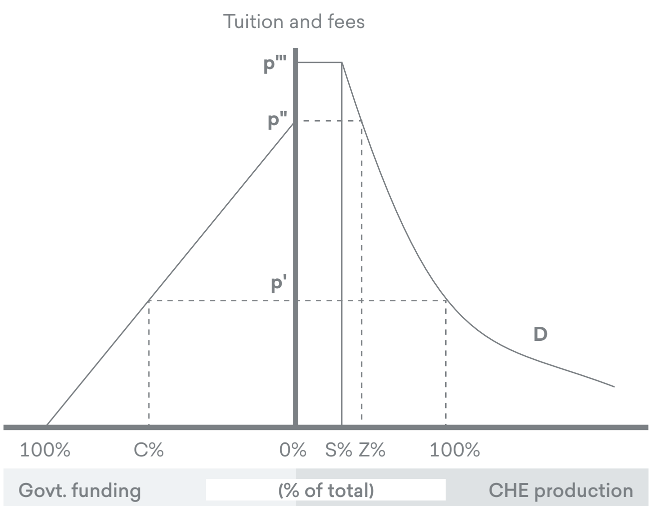
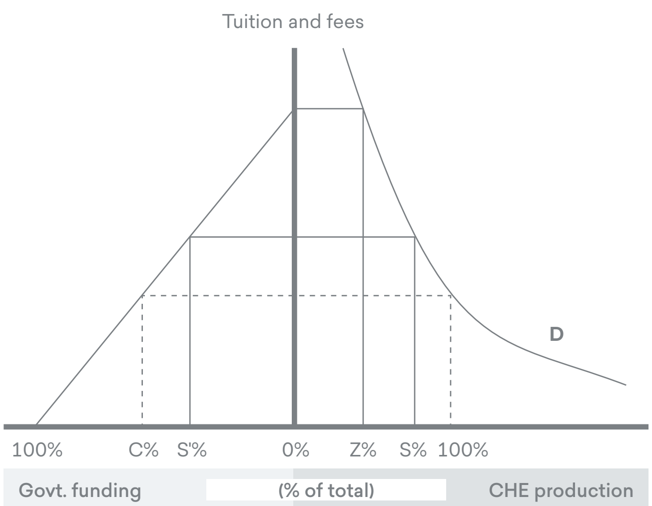


Figure A10.4:
SHUTDOWN POINT BEFORE ZERO GOVERNMENT FUNDING

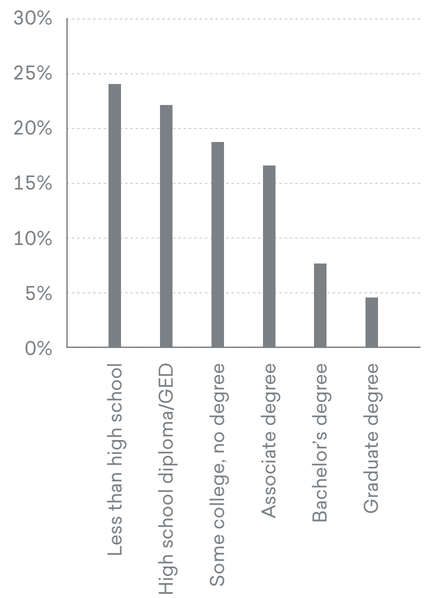


APPENDIX 10: SHUTDOWN POINT

The investment analysis in Chapter 3 weighs the benefits generated by the colleges against the state and local taxpayer funding that the colleges receive to support their operations. An important part of this analysis is factoring out the benefits that the colleges would have been able to generate anyway, even without state and local taxpayer support. This adjustment is used to establish a direct link between what taxpayers pay and what they receive in return. If the colleges are able to generate benefits without taxpayer support, then it would not be a true investment.[49]

The overall approach includes a sub-model that simulates the effect on student enrollment if the colleges lose their state and local funding and have to raise student tuition and fees in order to stay open. If the colleges can still operate without state and local support, then any benefits they generate at that level are discounted from total benefit estimates. If the simulation indicates that the colleges cannot stay open, however, then benefits are directly linked to costs, and no discounting applies. This appendix documents the underlying theory behind these adjustments.

Figure A11.1: PREVALENCE OF SMOKING AMONG U.S. ADULTS BY EDUCATION LEVEL



Source: Centers for Disease Control and Prevention.

State and local government support versus student demand for education

Figure A10.1 presents a simple model of student demand and state and local government support. The right side of the graph is a standard demand curve (*D*) showing student enrollment as a function of student tuition and fees. Enrollment is measured in terms of total credit hour equivalents (CHEs) and expressed as a percentage of the colleges' current CHE production. Current student tuition and fees are represented by p', and state and local government support covers *C%* of all costs. At this point in the analysis, it is assumed that the colleges have only two sources of revenues: 1) student tuition and fees and 2) state and local government support.

Figure A10.2 shows another important reference point in the model—where state and local government support is 0%, student tuition and fees are increased to p'', and CHE production is at *Z%* (less than 100%). The reduction in CHEs reflects the price elasticity of the students' demand for education, i.e., the extent to which the students' decision to attend the colleges is affected by the change in tuition and

49 Of course, as public training providers, the colleges would not be permitted to continue without public funding, so the situation in which they would lose all state support is entirely hypothetical. The purpose of the adjustment factor is to examine the colleges in standard investment analysis terms by netting out any benefits they may be able to generate that are not directly linked to the costs of supporting them.

fees. Ignoring for the moment those issues concerning the colleges' minimum operating scale (considered below in the section called "Calculating benefits at the shutdown point"), the implication for the investment analysis is that benefits to state and local government must be adjusted to net out the benefits that the colleges can provide absent state and local government support, represented as *Z%* of the colleges' current CHE production in Figure A10.2.

To clarify the argument, it is useful to consider the role of enrollment in the larger benefit-cost model. Let *B* equal the benefits attributable to state and local government support. The analysis derives all benefits as a function of student enrollment, measured in terms of CHEs produced. For consistency with the graphs in this appendix, *B* is expressed as a function of the percent of the colleges' current CHE production. Equation 1 is thus as follows:

1) B = B (100%)

This reflects the total benefits generated by enrollments at their current levels.

Consider benefits now with reference to *Z*. The point at which state and local government support is zero nonetheless provides for *Z%* (less than 100%) of the current enrollment, and benefits are symbolically indicated by the following equation:

2) B = B (Z%)

Inasmuch as the benefits in equation 2 occur with or without state and local government support, the benefits appropriately attributed to state and local government support are given by equation 3 as follows:

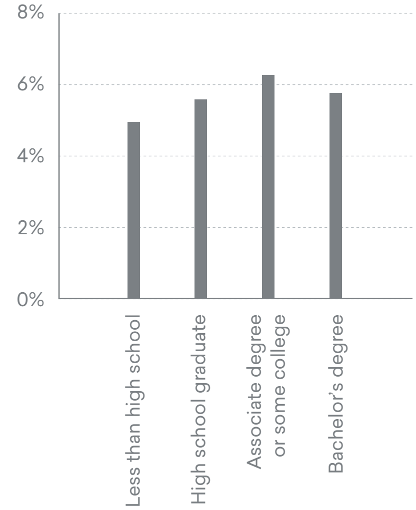
3) B = B (100%) − B (Z%)

Calculating benefits at the shutdown point

Colleges and universities cease to operate when the revenue they receive from the quantity of education demanded is insufficient to justify their continued operations. This is commonly known in economics as the shutdown point.[50] The shutdown point is introduced graphically in Figure A10.3 as *S%*. The location of point *S%* indicates that the colleges can operate at an even lower enrollment level than *Z%* (the point at which the colleges receive zero state and local government funding). State and local government support at point *S%* is still zero, and student tuition and fees have been raised to *p'''*. State and local government support is thus credited with the benefits given by equation 3, or *B = B (100%) − B (Z%)*. With student tuition and fees still higher than *p'''*, the colleges would no longer be able to attract enough students to keep their doors open, and they would shut down.

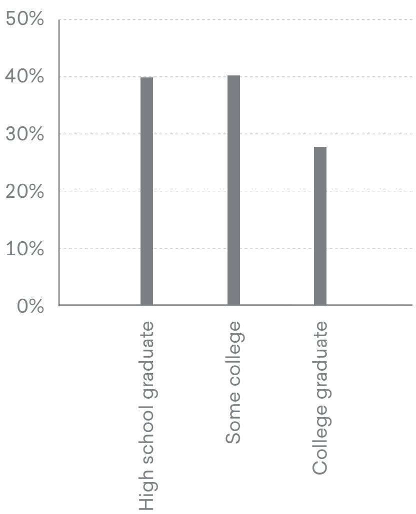
50 In the traditional sense, the shutdown point applies to firms seeking to maximize profits and minimize losses. Although profit maximization is not the primary aim of colleges and universities, the principle remains the same, i.e., that there is a minimum scale of operation required in order for colleges and universities to stay open.

Figure A11.2: PREVALENCE OF ALCOHOL DEPENDENCE OR ABUSE BY EDUCATION LEVEL



Source: Centers for Disease Control and Prevention.

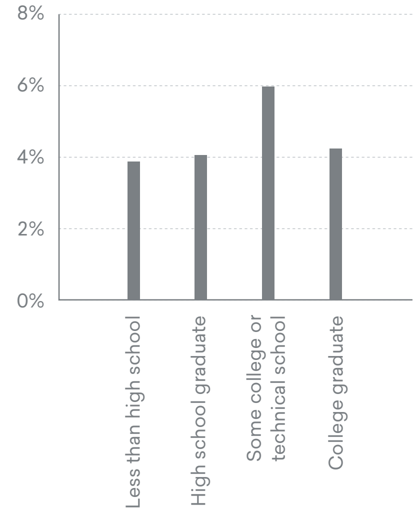
Figure A11.3: PREVALENCE OF OBESITY BY EDUCATION LEVEL



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

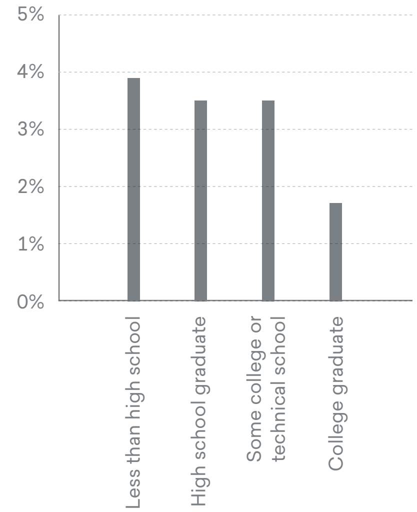
Figure A10.4 illustrates yet another scenario. Here, the shutdown point occurs at a level of CHE production greater than *Z%* (the level of zero state and local government support), meaning some minimum level of state and local government support is needed for the colleges to operate at all. This minimum portion of overall funding is indicated by *S'%* on the left side of the chart, and as before, the shutdown point is indicated by *S%* on the right side of chart. In this case, state and local government support is appropriately credited with all the benefits generated by the colleges' CHE production, or *B = B (100%).*

Figure A11.4: PREVALENCE OF MAJOR DEPRESSIVE EPISODE BY EDUCATION LEVEL



Source: National Survey on Drug Use and Health.

Figure A11.5: PREVALENCE OF ILLICIT DRUG DEPENDENCE OR ABUSE BY EDUCATION LEVEL



Source: Substance Abuse and Mental Health Services Administration.

APPENDIX 11: 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 state, 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.

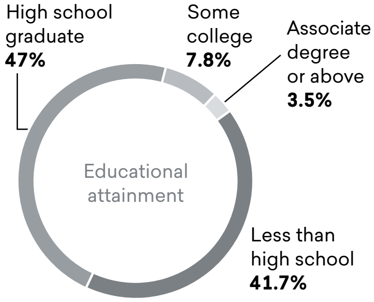
SMOKING

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 A11.1 shows the prevalence of cigarette smoking among adults, 25 years and over, based on data provided by the National Health Interview Survey.[51] 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.

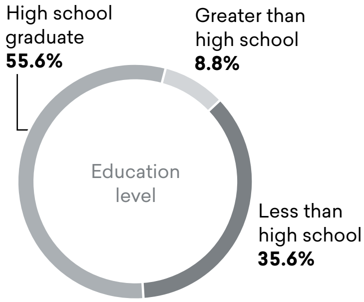
51 Centers for Disease Control and Prevention. "Table. Characteristics of current adult cigarette smokers," National Health Interview Survey, United States, 2016.

Figure A11.6:
EDUCATIONAL ATTAINMENT OF THE INCARCERATED POPULATION



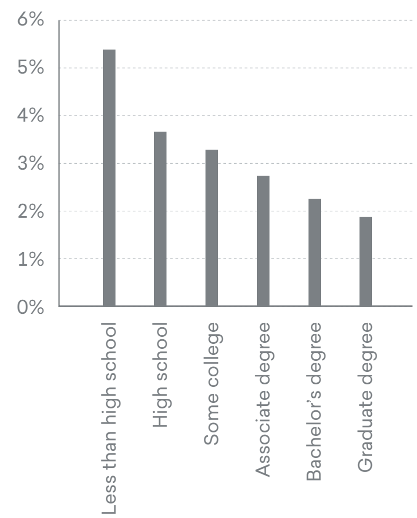
Source: Derived from data provided by the U.S. Census Bureau.

Figure A11.7:
BREAKDOWN OF TANF RECIPIENTS BY EDUCATION LEVEL



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

Figure A11.8: UNEMPLOYMENT BY EDUCATION LEVEL



Source: Bureau of Labor Statistics.