Emsi

The College of Health Care Professions: Economic Value Analysis



MAIN REPORT

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Executive summary





THE COLLEGE OF HEALTH CARE PROFESSIONS (CHCP), founded by physicians 30 years ago at the MacGregor Medical Association in the Texas Medical Center, has grown to become the largest allied healthcare training provider in Texas. CHCP works with over 1,500 employers to provide working adults flexible pathways to economic mobility. CHCP has been creating opportunities for students to enter meaningful professional careers, while improving quality health care in their communities.

CHCP provided Emsi with student and employer reported earnings data. Job titles are third party verified and salary data is verified whenever possible for their alumni. Around 99% of the more than 24,000 alumni surveyed live in Texas after graduating from CHCP. Approximately 86% of alumni completed a certificate and 14% completed an associate degree. Before enrolling at CHCP, alumni made an average of $11,530 per year. More specifically, certificate students earned $10,322 and associate degree students $18,830. After graduating from CHCP in as little as nine months, alumni made an average of $27,410 per year upon entry into the workforce, increasing their earnings by $15,880 per year. Certificate completers saw an annual increase in earnings of $15,430 and associate degree graduates $18,600.

This report assesses the impact of The College of Health Care Professions (CHCP) on the state economy and the benefits generated by the college for students, taxpayers, and society. The results of this study show that CHCP creates a positive net impact on the state economy and generates a positive return on investment for students and society, along with substantial benefits for taxpayers.[1]

> CHCP has grown to become the largest allied healthcare training provider in Texas.



1 For the purposes of this analysis, bachelor's degree students were excluded.

ECONOMIC IMPACT ANALYSIS

During the analysis year, CHCP spent $31.6 million on payroll and benefits for 495 full-time and part-time employees, and spent another $28.9 million on goods and services to carry out its 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 CHCP that directly takes into account the fact that tuition dollars spent by in-state students on CHCP could have been spent elsewhere in the state if not directed towards CHCP and 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 CHCP.

This analysis shows that in fiscal year (FY) 2018-19, operations spending of CHCP, together with the enhanced productivity of its alumni, generated **$469.1 million** in added income for the Texas economy. The impact of **$469.1 million** is equivalent to supporting **5,732 jobs**. These economic impacts break down as follows:

> The additional income of **$469.1 million** created by CHCP is equal to supporting **5,732 jobs** in Texas.

Operations spending impact

Payroll and benefits to support CHCP's day-to-day operations amounted to $31.6 million. The college's non-pay expenditures amounted to $28.9 million. The net impact of operations spending by the college in Texas during the analysis year was approximately **$35.5 million** in added income, which is equivalent to supporting **552 jobs**.

Alumni impact

Over the years, students gained new skills, making them more productive workers, by studying at CHCP. Today, thousands of these former students are employed in Texas. CHCP provided Emsi with student and employer reported earnings data. Job titles are third party verified and salary data is verified whenever possible for their alumni.

The accumulated impact of former students currently employed in the Texas workforce amounted to **$433.6 million** in added income for the Texas economy, which is equivalent to supporting **5,180 jobs**.

Important note

When reviewing the impacts estimated in this study, it's important to note that it 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.

RETURN ON INVESTMENT ANALYSIS



Return on 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 the benefits received by taxpayers from CHCP as well as the return on investment to its primary stakeholders, students and society.

Student perspective

CHCP's FY 2018-19 students paid a present value of **$68.2 million** to cover the cost of tuition, fees, supplies, and interest on student federal loans during the analysis year. They also forwent **$40 million** in money that they would have earned had they been working instead of attending college.

In return for their investment, CHCP's students will receive a stream of higher future earnings that will continue to grow throughout their working lives. From the thousands of alumni CHCP surveyed, upon re-entry into the workforce, CHCP graduates were making an average of $15,880 more in annual earnings than before they enrolled in CHCP. **Once students have completed their certificate or degree at CHCP, they are expected to receive $705,994 in higher future earnings over their working lifetime.** In FY 2018-19 alone, for the 22.3 average credit hours taken (a little less than half the credits needed for a certificate, the average increase in earnings per student will amount to $336,639 in higher earnings over a working lifetime. The present value of the cumulative higher future earnings that CHCP's FY 2018-19 students will receive over their working careers is **$1.02 billion. This translates to a return of $9.40 in higher future earnings for every dollar student invest in their education. Students' average annual rate of return is 68.0%.**

FOR EVERY $1 IN COSTS, CHCP STUDENTS RECEIVE MORE BENEFITS*

CHCP
9.4

Public college average
5.6

Public & private university average
3.4

* The reader should note that there are other factors, beyond the institution's performance, that affect the student return on investment results. While this can provide some context around the value provided by CHCP to its students, the university and college averages include institutions located in other states and public institutions. In addition, CHCP was able to provide alumni earnings data; the comparison institutions did not provide this data for their analyses.

Taxpayer perspective



CHCP received little to no Texas State taxpayer funding, yet Texas taxpayers still receive a significant amount of benefits from CHCP. Because there are no taxpayer costs, we simply look at the benefits received by taxpayers. Taxpayers will receive an estimated present value of **$218.6 million** 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 **$6.8 million** in benefits due to a reduced demand for government-funded social services in Texas. Throughout the students' working lives, Texas taxpayers will receive a total of **$225.4 million** in benefits.

> Texas taxpayers will receive a sum of **$225.4 million** in benefits over the course of the students' working lives.

Social perspective



In FY 2018-19, CHCP and its students incurred **$115.5 million** in costs to operate and educate its students. This includes the college's expenditures, student expenses, and student opportunity costs. In return, the state of Texas will receive an estimated present value of **$3.5 billion** in added state revenue over the course of the students' working lives. Texas will also benefit from an estimated **$16 million** 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 CHCP, an average of **$30.10** in benefits will accrue to Texas over the course of the students' careers.

ACKNOWLEDGMENTS

Emsi gratefully acknowledges the excellent support of the staff at The College of Health Care Professions in making this study possible. Special thanks go to Eric Bing, CEO, who approved the study, and to Bill Kohlhoff, Senior Vice President, Accreditation & Compliance, who collected much of the data and information requested. Any errors in the report are the responsibility of Emsi and not of any of the above-mentioned individuals.

INTRODUCTION



The College of Health Care Professions (CHCP), established in 1988, has today grown to serve 7,443 students, 7,242 are certificate and associate degree students. The college's service region, for the purpose of this report, is the State of Texas.

While CHCP affects the state in a variety of ways, many of them difficult to quantify, this study is concerned with considering its economic benefits. The college naturally helps students achieve their individual potential and develop the knowledge, skills, and abilities they need to have fulfilling and prosperous careers. However, CHCP impacts Texas beyond influencing the lives of students. The college's program offerings supply employers with workers to make their businesses more productive. The college's day-to-day operations support the state economy through the output and employment generated by state vendors. The benefits created by the college 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.

> CHCP impacts Texas beyond influencing the lives of students.

This report assesses the impact of CHCP as a whole on the state economy and the benefits generated by the college for students, taxpayers, and society. The approach is twofold. We begin with an economic impact analysis of the college on the Texas 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 Texas 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 college's day-to-day operations and 2) impact of alumni who are still employed in the Texas workforce.

The second component of the study measures the benefits generated by CHCP for the following stakeholder groups: students, taxpayers, and society. For students, we perform a return on 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 college 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 Texas 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 CHCP; industry and employment data from the Bureau of Labor Statistics and Census Bureau; outputs of Emsi's impact model and MR-SAM model; and a variety of published materials relating education to social behavior.

CHAPTER 1:

Profile of The College of Health Care Professions and the economy





THE COLLEGE OF HEALTH CARE PROFESSIONS (CHCP), founded by physicians 30 years ago at the MacGregor Medical Association in the Texas Medical Center, has grown to become the largest allied healthcare training provider in Texas. CHCP works with over 1,500 employers to provide working adults flexible pathways to economic mobility. CHCP has been creating opportunities for students to enter meaningful professional careers, while improving quality health care in their communities.

CHCP are a private, for-profit group of colleges that provides an important source of health care training for the Texas medical economy. With a network of locations across the state, the high-quality education and training the college provides helps staff Texas hospitals and clinics while giving students from all walks of life an entry point to successful careers in health care professions. In FY 2018-19, CHCP had an enrollment of 7,443 students. Of these, 7,242 were associate and certificate students and the remaining 201 are bachelor's degree students.

CHCP was originally established in 1988 as an in-house training academy for staff of the Texas Medical Center, operated by the physicians of the Macgregor Medical Practice. As the scope of its programs grew, it was approved to offer health care training to the general public by the Texas Workforce Committee in 1990. Since then, it has rapidly grown to encompass eight physical campuses and a significant online presence.

Today, CHCP has campuses in Austin, Houston Southwest, Houston Northwest, Houston Medical Center, North San Antonio, South San Antonio, Dallas, Fort Worth, and McAllen. This wide network reflects CHCP's commitment to providing everyone in Texas with access to health care training. CHCP takes particular steps build flexible programs that work for adult learners with complicated lives. With Texas demographics, this includes strong engagement with the Texas Hispanic communities to provide them a point of entry into the personal and financial success that health care careers can give. In addition, the college broadly offers

CHCP's eight physical campuses and online network reflects the college's commitment to providing everyone in Texas with access to health care training.

a variety of flexible schedules and financial aid and scholarships to make a health care education as attainable as possible.

Students who choose CHCP can choose from dozens of different certificate, associate degree, and bachelor's degree programs, in fields such as medical assisting, sonography, surgical technology, radiologic technology, and much more. Of these, approximately 15 are available on-campus and 10 are available online. Students in every program receive a fully accredited education that includes a significant hands-on element.

CHCP specializes in giving students real-world experience through its various employer and community partnerships, as part of its broader mission of serving both its students and its communities. The college's outreach programs range from offering free sonography for expectant mothers to working with regional blood and tissue centers to organizing blood drives to sponsoring food drives to supporting the needy in the campuses› communities. This work reflects CHCP›s belief that medical professionals are a key part of healthy communities, not just through the direct benefits of the work they do each day, but also through the broader impact they have on society.

CHCP EMPLOYEE AND FINANCE DATA

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

Employee data

Data provided by CHCP include information on faculty and staff by place of work and by place of residence. These data appear in Table 1.1. As shown, CHCP employed 379 full-time and 116 part-time faculty and staff in FY 2018-19. Of these, 93% worked and lived in the state. 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	379
Part-time faculty and staff	116
Total faculty and staff	**495**
% of employees who work in the state	93%
% of employees who live in the state	93%

Source: Data provided by CHCP.

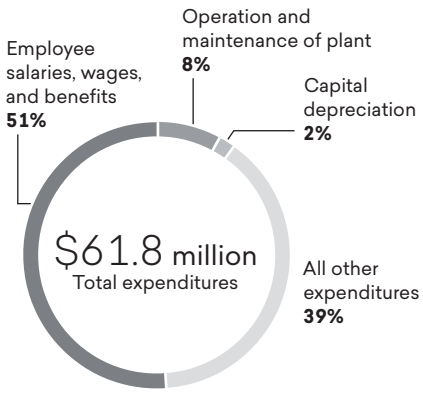
Revenues

In FY 2018-19, CHCP received a total of $67.1 million. Tuition and fees comprised 99.9% of total revenue. CHCP also received a small portion of revenue, $38.3 thousand, from its massage clinic, medical sonography clinic, and transcript requests.

Expenditures

Figure 1.1 displays CHCP's expense data. The combined payroll at CHCP amounted to $31.6 million. This was equal to 51% of the college's total expenses for FY 2018-19. Other expenditures, including operation and maintenance of plant, depreciation, and purchases of supplies and services, made up $30.2 million. 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 college's assets rather than an outflow of expenditures.

Figure 1.1: CHCP EXPENSES BY FUNCTION, FY 2018-19



Source: Data provided by CHCP.

FY 2018-19 students

CHCP served 7,443 students in FY 2018-19. These numbers represent unduplicated student headcounts. For the purposes of this analysis, only the 7,242 certificate and associate degree students are included, the 201 bachelor's degree students served in FY 2018-19 were excluded. The breakdown of the student body by gender was 89% female and 11% male. The breakdown by ethnicity was 56% Hispanic, 27% students of color (excluding Hispanic), 14% white, and 3% unknown. The students' overall average age was 27 years old.[3] More than 99% of students remain in Texas after finishing their time at CHCP.[4]

2 See Appendix 5 for a detailed description of the data sources used in the Emsi modeling tools.
3 Unduplicated headcount, gender, ethnicity, and age data provided by CHCP.
4 Settlement data provided by CHCP.

Table 1.2 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In FY 2018-19, CHCP served 326 associate degree graduates and 2,198 certificate graduates. Another 4,718 students enrolled in courses for credit but did not complete a degree during the reporting year. Recall that 201 bachelor's degree students are excluded from this analysis.

We use credits to track the educational workload of the students. One credit is equal to 15 contact hours of classroom instruction per semester. The average number of credits per student was 22.3.

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

Category	Headcount	Total credits	Average credits
Associate degree graduates	326	8,232	25.3
Certificate graduates	2,198	58,860	26.8
Continuing students	4,718	94,518	20.0
Total students	**7,242**	**161,610**	**22.3**

Source: Data provided by CHCP.

Alumni survey

CHCP provided Emsi with student and employer reported earnings data. Job titles are third party verified and salary data is verified whenever possible for their alumni. CHCP received data on the earnings of CHCP graduates prior to enrolling at CHCP and immediately after graduating from CHCP. CHCP provided Emsi with data for 24,669 certificate and associate degree graduates. Of these, 24,669 provided their state of residence, with 24,311 or 99% located in Texas after completing their certificate or degree at CHCP. Of this 24,311, 10,491 alumni included both their pre- and post-CHCP earnings. Of these 10,491 alumni, 86% completed a certificate and 14% completed an associate degree. In addition, 88% are female, 12% are male, and <1% are unspecified. Approximately 47% are Hispanic, 32% are white, and the remaining 21% are students of color (excluding Hispanic).

Table 1.3: ALUMNI CHARACTERISTICS

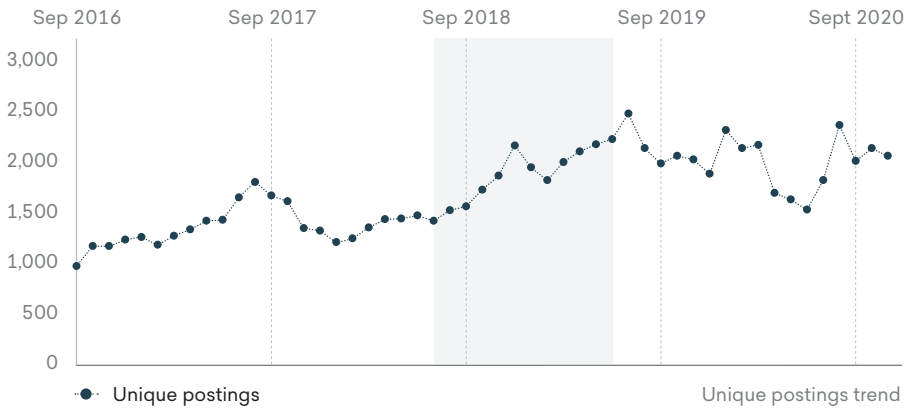
Category	Sample size	Percentage
Education level		
Certificate	9,002	86%
Associate	1,489	14%
Gender		
Female	9,239	88%
Male	1,246	12%
Unspecified	6	<1%
Ethnicity		
Hispanic	4,931	47%
White	3,340	32%
Students of color (excluding Hispanic)	2,220	21%
Total students	**10,491**	**100%**

Source: Data provided by CHCP.

In addition to demographics, 10,218 alumni in Texas provided their job titles (Figure 1.2). Almost half of the alumni listed Medical Assistant as their job title. We then categorized these job titles into occupations (Figure 1.3). CHCP alumni work in a variety of occupations, from dental assistants to diagnostic medical sonographers. Once again, almost half (45%) of alumni are medical assistants. Sixteen percent are radiological technicians & technologists and 11% are dental assistants. These three occupations hold 72% of CHCP's alumni. Mapping these occupations to industries, the top industries include Offices of Physicians (except Mental Health Specialists), General Medical & Surgical Hospitals, and Offices of Dentists. Almost 60% of alumni are in these top three industries.

Since almost half of CHCP's alumni are medical assistants in Texas, we looked further into the job market for medical assistants. In July 2018 to June 2019, there were 8,890 unique job postings for medical assistants in Texas. They saw a posting intensity of 8:1, or the ratio of total job postings to unique job postings. Given that the state's average posting intensity across all occupations is 5:1, this indicates that companies may be trying harder to hire medical assistants than other positions. Since September 2016, medical assistant job postings have generally been on an incline in Texas (Figure 1.5). Top companies hiring medical assistants in Texas include HCA Holdings, Inc., UnitedHealth Group Inc., Texas Health Resources, and Baylor Scott & White Health.

Figure 1.5: UNIQUE JOB POSTINGS FOR MEDICAL ASSISTANTS

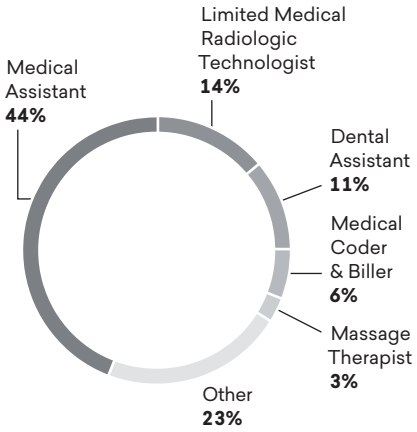


Source: Emsi job posting analytics data.

Before enrolling at CHCP, alumni made an average of $11,530 per year. More specifically, certificate students earned $10,322 per year and associate degree students earned $18,830 per year. After graduating from CHCP in as little as nine months, for clinical programs including an employer based externship, alumni made an average of $27,410 per year upon entry into the workforce, increasing their earnings by $15,880 per year.[5] Certificate students saw an annual increase in earnings of $15,430 and associate degree students an annual increase of $18,600.

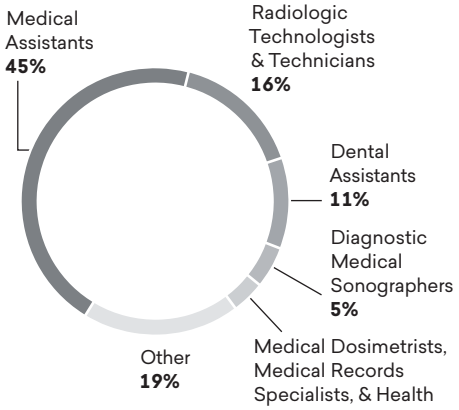
5 The reader should note that the increase in earnings is for CHCP graduates. Emsi recognizes that not all FY 2018-19 students will graduate; however, given data limitations, the increase in earnings calculated from CHCP graduate data is assumed for all students.

Figure 1.2:
ALUMNI TOP JOB TITLES



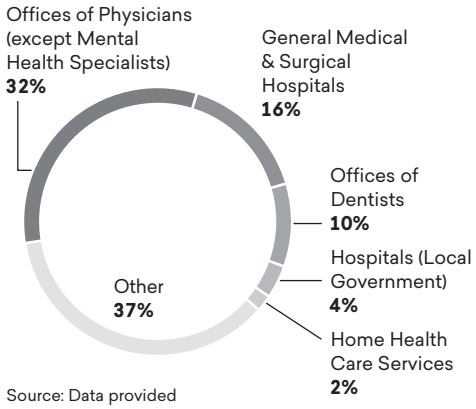
Source: Data provided by CHCP.

Figure 1.3:
ALUMNI TOP OCCUPATIONS



Source: Data provided by CHCP and Emsi.

Figure 1.4:
ALUMNI TOP INDUSTRIES



Source: Data provided by CHCP and Emsi.

Since these are earnings of CHCP graduates, we use the average total credits completed by CHCP's graduates to calculate the value, or increase in earnings, per credit. The average credits completed by certificate completers was 42.8, while the average total credits, including certificate program transfer-in credits completed by associate graduates was 70.8. The weighted average credits completed was 46.8. Dividing the average increase in earnings of $15,880 by the average credits completed by alumni (46.8) results in $340 average earnings per credit, or value per credit (Table 1.4).

Table 1.4: CHCP ALUMNI VALUE PER CREDIT

Education level	Total	Certificate	Associate
Number of alumni in sample	10,491	9,002	1,489
Alumni earnings			
Average pre-CHCP earnings	$11,530	$10,322	$18,830
Average post-CHCP earnings	$27,410	$25,752	$37,430
Average difference in earnings	**$15,880**	**$15,430**	**$18,600**
Credits			
Credit to complete*	46.8	42.8	70.8
Value per credit	**$340**	**$361**	**$263**

* Associate credit includes certificate program transfer-in credits.
Source: Based on data provided by CHCP and calculations performed by Emsi.

> CHCP alumni will see an average increase in annual earnings of **$15,880**.

THE TEXAS ECONOMY

Since the college was first established, it has been serving Texas by enhancing the workforce, providing local residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. Table 1.5 summarizes the breakdown of the state economy by major industrial sector ordered by total income, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the state's total income, which can also be considered as the state's gross state product (GSP).

Table 1.5: INCOME BY MAJOR INDUSTRY SECTOR IN TEXAS, 2019*

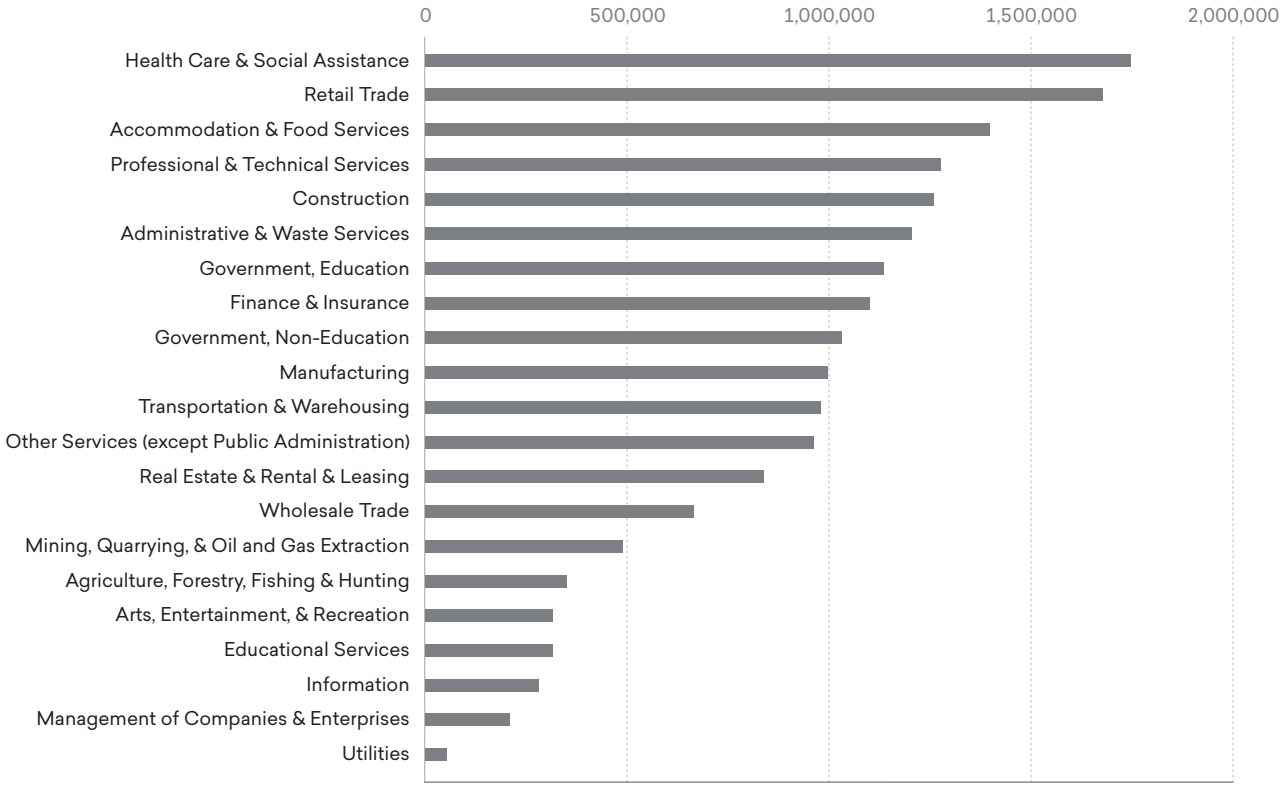
Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)**	% of total income	Sales (millions)
Manufacturing	$92,389	$129,831	$222,220	12%	$591,483
Mining, Quarrying, & Oil and Gas Extraction	$55,161	$107,399	$162,561	9%	$292,243
Other Services (except Public Administration)	$29,992	$126,020	$156,011	8%	$229,040
Wholesale Trade	$63,394	$89,172	$152,566	8%	$238,284
Finance & Insurance	$94,818	$49,963	$144,781	8%	$283,337
Professional & Technical Services	$111,114	$19,790	$130,904	7%	$197,432
Government, Non-Education	$84,180	$27,119	$111,299	6%	$553,610
Health Care & Social Assistance	$99,232	$11,667	$110,900	6%	$178,952
Construction	$78,847	$15,199	$94,046	5%	$178,861
Retail Trade	$60,011	$28,287	$88,298	5%	$146,653
Transportation & Warehousing	$51,993	$33,176	$85,169	5%	$152,650
Real Estate & Rental & Leasing	$44,178	$27,105	$71,283	4%	$156,628
Government, Education	$68,960	$0	$68,960	4%	$79,098
Information	$24,310	$38,886	$63,196	3%	$113,850
Administrative & Waste Services	$50,997	$8,630	$59,627	3%	$100,720
Accommodation & Food Services	$33,060	$14,076	$47,135	3%	$90,209
Management of Companies & Enterprises	$27,011	$2,038	$29,049	2%	$47,146
Utilities	$8,450	$19,508	$27,958	1%	$43,023
Educational Services	$12,574	$1,586	$14,160	1%	$20,293
Agriculture, Forestry, Fishing & Hunting	$10,659	$3,421	$14,081	1%	$39,552
Arts, Entertainment, & Recreation	$9,308	$2,576	$11,884	1%	$19,317
Total	**$1,110,638**	**$755,450**	**$1,866,088**	**100%**	**$3,752,380**

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

As shown in Table 1.5, the total income, or GSP, of Texas is approximately $1.9 trillion, equal to the sum of labor income ($1.1 trillion) and non-labor income ($755.5 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the college on the state economy.

Figure 1.6 provides the breakdown of jobs by industry in Texas. The Health Care & Social Assistance sector is the largest employer, supporting 1.7 million jobs or 9.6% of total employment in the state. The second largest employer is the Retail Trade sector, supporting 1.6 million jobs or 9.1% of the state's total employment. Altogether, the state supports 18.1 million jobs.[6]

Figure 1.6: JOBS BY MAJOR INDUSTRY SECTOR IN TEXAS, 2019*



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

6 Job numbers reflect Emsi'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.

CHAPTER 2:

Economic impacts on the Texas economy

CHCP impacts the Texas economy in a variety of ways. The college is an employer and buyer of goods and services. It attracts monies that otherwise would not have entered the state economy through its day-to-day operations. Further, it provides 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 CHCP: 1) the operations spending impact, and 2) 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 Texas if CHCP and all its 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 college; 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 college.

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in income. This measure is similar to the commonly used gross 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.[7] All of these measures—added labor and non-labor income, total income, jobs, and sales—are used to estimate the economic impact results presented in this chapter. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

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



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

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

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	Initial	Direct	Indirect	Induced
IMPLAN	Direct	Indirect		Induced

Multiplier effects in this analysis are derived using Emsi'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 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 MR-SAM model and its data sources, see Appendix 5.

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

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 college itself purchases supplies and services, and many of its vendors are located in Texas. These expenditures create a ripple effect that generates still more jobs and higher wages throughout the economy.



Table 2.1 presents college expenditures 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). 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 college's assets rather than an outflow of expenditures.[8] The first step in estimating the multiplier effects of the college's operational expenditures is to map these categories of expenditures to the approximately 1,000 industries of the Emsi MR-SAM model. Assuming that the spending patterns of college personnel approximately match those of the average consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure coefficients provided by Emsi's national SAM. Approximately 93% of CHCP employees work in Texas (see Table 1.1), and therefore we consider 93% of the salaries, wages, and benefits. For

Table 2.1: CHCP 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	$29,285	$2,306	$31,592
Operation and maintenance of plant	$3,829	$966	$4,795
All other expenditures	$18,719	$5,435	$24,154
Total	**$51,833**	**$8,708**	**$60,541**

Source: Data provided by CHCP and the Emsi impact model.

8 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.

the other two expenditure categories (i.e., operation and maintenance of plant and all other expenditures), we assume the college's spending patterns approximately match national averages and apply the national spending coefficients for NAICS 611210 (Junior Colleges).[9] Operation and maintenance of plant expenditures are mapped to the industries that relate to capital construction, maintenance, and support, while the college's remaining expenditures are mapped to the remaining industries.

We now have three vectors of expenditures for CHCP: one for salaries, wages, and benefits; another for operation and maintenance of plant; and a third for the college's 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.[10] 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 college. See Table 2.1 for a break-out 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 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 college operations spending. The people employed by CHCP and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income,

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	**$29,285**	**$0**	**$29,285**	**$60,541**	**459**
Multiplier effect					
Direct effect	$7,731	$3,180	$10,911	$22,548	140
Indirect effect	$4,339	$1,444	$5,783	$13,015	81
Induced effect	$18,352	$11,072	$29,424	$54,067	376
Total multiplier effect	**$30,422**	**$15,696**	**$46,118**	**$89,630**	**596**
Gross impact (initial + multiplier)	**$59,707**	**$15,696**	**$75,404**	**$150,171**	**1,055**
Less alternative uses of funds	-$22,863	-$17,027	-$39,890	-$49,786	-503
Net impact	**$36,844**	**-$1,330**	**$35,513**	**$100,385**	**552**

Source: Emsi impact model.

9 See Appendix 2 for a definition of NAICS.

10 See Appendix 5 for a description of Emsi's MR-SAM model.

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 $59.7 million in labor income and $15.7 million in non-labor income. This sums to a total impact of $75.4 million in total added income associated with the spending of the college and its employees in the state. This is equivalent to supporting 1,055 jobs.

The $75.4 million 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 CHCP—had not occurred. CHCP received an estimated 89% of its funding from sources within Texas. These monies came from the tuition and fees paid by resident students and from the auxiliary revenue. We must account for the opportunity cost of this in-state funding. Had other industries received these monies rather than CHCP, 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 college 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 CHCP, 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 college's operations is **$35.5 million** in total added income, which is equivalent to supporting **552 jobs**.

The total net impact of the college's 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 college's operations are labor-intensive, whereas the adjustment for alternative uses of funds is non-labor-intensive; therefore, the net non-labor impact is negative. Nevertheless, the overall net impact is positive and significant. It sums together to $35.5 million in total added income and is equivalent to supporting 552 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of CHCP.

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 CHCP *throughout its 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.

> CHCP also creates an economic impact that stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni.

While CHCP creates an economic impact through its operations spending, the greatest economic impact of CHCP stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni. While attending CHCP, 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 CHCP 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 impact in one fundamental way. Whereas the operations spending impact depends 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 CHCP's 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 CHCP.

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;[11] 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 Census Bureau. 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 college. We use the students' production of credits as a proxy for accumulated human capital. The average number of credits completed per student in FY 2018-19 was 22.3 (Table 1.2), roughly half of the number needed for many of the short-term certificates. It's important to note that students can begin enrolling throughout the year, with programs starting at a variety of dates, which many students in this calculation starting near the end of the year or finishing up their few remaining credits during the analysis year. Many of the certificate programs can be completed by most students in less than a year. To estimate the number of credits present in the workforce during the analysis year, we use the college's historical student headcount over the past 30 years, from FY 1989-90 to FY 2018-19.[12] We multiply the 22.3 average credits per student by the headcounts that we estimate are still actively employed from each of the previous years.[13] Students who enroll at the college more than one year are counted at least twice in the historical enrollment data. However, credits remain distinct regardless of when and by whom they were earned, so there is no duplication in the credit counts. We estimate there are approximately 925,830 credits from alumni active in the workforce.

Next, we adjust the value per credit of $340 (Table 1.4) to reflect the earnings of alumni at their career midpoint. Recall that the $340 value per credit was calculated using earnings provided by alumni at the start of their career. Because workforce experience leads to increased productivity and higher wages, the value per credit varies depending on the students' workforce experience, with the highest value applied to the credits of students who had been employed the longest by FY 2018-19, and the lowest value per credit applied to students

11 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.

12 We apply a 30-year time horizon because the data on students who attended CHCP 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.

13 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.

who were just entering the workforce. We do this using the Mincer function to predict the change in earnings at each point in an individual's working career.[14] 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 estimated earnings of alumni in FY 2018-19, otherwise known as the ability bias. After applying the Mincer earnings function and adjusting for ability bias, the average earnings of CHCP alumni active in the state workforce comes to $373. More information on the theory and calculations behind the value per credit appears in Appendix 6.

In determining the amount of added labor income attributable to alumni, we multiply the credits of former students in each year of the historical time horizon by the corresponding average value per credit for that year, and then sum the products together. This calculation yields approximately $345.2 million in gross labor income from increased wages received by former students in FY 2018-19 (Table 2.3).

Table 2.3: NUMBER OF CREDITS IN WORKFORCE AND INITIAL LABOR INCOME CREATED IN TEXAS, FY 2018-19

Number of credits in workforce	925,830
Average value per credit	$373
Initial labor income, gross	**$345,212,545**
Adjustments for counterfactual scenarios	
Percent reduction for alternative education opportunities	10%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$155,345,645**

Source: Emsi impact model.

The next two rows in Table 2.3 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 CHCP 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 CHCP does not exist, we assume a portion of CHCP alumni would have received a comparable education elsewhere in the state or would have left the state and received a comparable education and

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

then returned to the state. The incremental added labor income that accrues to those students cannot be counted towards the added labor income from CHCP alumni. The adjustment for alternative education opportunities amounts to a 10% reduction of the $345.2 million in added labor income. This means that 10% of the added labor income from CHCP alumni would have been generated in the state anyway, even if the college did not exist. For more information on the alternative education adjustment, see Appendix 7.

The other adjustment in Table 2.3 accounts for the importation of labor. Suppose CHCP 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 Texas. 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 college did not exist.[15] 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 college. We conduct a sensitivity analysis for this assumption in Appendix 1. With the 50% adjustment, the net added labor income added to the economy comes to $155.3 million, as shown in Table 2.3.

The $155.3 million in added labor income appears under the initial effect in the labor income column of Table 2.4. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of CHCP 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 ($155.3 million) to the six-digit NAICS industry sectors where students are employed. CHCP's surveyed alumni not only provided earnings data but also their job title. Emsi mapped these job titles to occupations using Emsi's Job Posting Analytics data. The detailed occupations were then mapped to the six-digit industry sectors in the MR-SAM model. Finally, we apply a matrix of wages by industry and by occupation from the MR-SAM model to map the occupational distribution of the $155.3 million in initial labor income effects to the detailed industry sectors in the MR-SAM model.[16]

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 $27.8 million in added non-labor income attributable to the college's alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the Texas economy, equal to approximately $183.2 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the

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

16 For example, if the MR-SAM model indicates that 58% of wages paid to workers in SOC 31-9092 (Medical Assistants) occur in NAICS 621111 (Offices of Physicians (except Mental Health Specialists), then we allocate 58% of the initial labor income effect under SOC 31-9092 to NAICS 621111.

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 2.4: ALUMNI IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$155,346**	**$27,836**	**$183,182**	**$316,654**	**2,180**
Multiplier effect					
Direct effect	$39,086	$7,790	$46,876	$80,101	555
Indirect effect	$19,519	$4,000	$23,519	$40,454	281
Induced effect	$154,142	$25,834	$179,976	$297,299	2,164
Total multiplier effect	**$212,747**	**$37,624**	**$250,371**	**$417,853**	**2,999**
Total impact (initial + multiplier)	**$368,092**	**$65,461**	**$433,553**	**$734,507**	**5,180**

Source: Emsi impact model.

Table 2.4 shows the multiplier effects of alumni. Multiplier effects occur as alumni generate an increased demand for consumer goods and services through the expenditure of their higher wages. Further, as the industries where alumni are employed increase their output, there is a corresponding increase in the demand for input from the industries in the employers' supply chain. Together, the incomes generated by the expansions in business input purchases and household spending constitute the multiplier effect of the increased productivity of the college's alumni. The final results are $212.7 million in added labor income and $37.6 million in added non-labor income, for an overall total of $250.4 million in multiplier effects. The grand total of the alumni impact is $433.6 million in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 5,180 jobs.

TOTAL CHCP IMPACT

The total economic impact of CHCP on Texas can be generalized into two broad types of impacts. First, on an annual basis, CHCP generates a flow of spending that has a significant impact on the state economy. The impacts of this spending are captured by the operations spending impact. While not insignificant, these impacts do not capture the true purpose of CHCP. The basic mission of CHCP is to foster human capital. Every year, a new cohort of former CHCP students adds to the stock of human capital in the state, and a portion of alumni continues to add to the state economy. Table 2.5 displays the grand total impacts of CHCP on the Texas economy in FY 2018-19. For context, the percentages of CHCP compared to the total labor income, total non-labor income, combined total income, sales, and jobs in Texas, as presented in Table 1.5 and Figure 1.6, are included. The total added value of CHCP is **$469.1 million**. CHCP's total impact supported **5,732 jobs** in FY 2018-19.



Table 2.5: TOTAL CHCP IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	$36,844	-$1,330	$35,513	$100,385	552
Alumni	$368,092	$65,461	$433,553	$734,507	5,180
Total impact	**$404,936**	**$64,130**	**$469,066**	**$834,892**	**5,732**

Source: Emsi impact model.

These impacts from the college and its students stem from different industry sectors and spread throughout the state economy. Table 2.6 displays the total impact of CHCP by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations and alumni, as shown in Table 2.5, 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 college's spending and from where CHCP alumni are employed. For example, CHCP's spending and alumni in the Health Care & Social Assistance industry sector generated an impact of $309 million in FY 2018-19.

Table 2.6: TOTAL CHCP IMPACT BY INDUSTRY, FY 2018-19

Industry sector	Total income (thousands)	Jobs supported
Health Care & Social Assistance	$308,951	3,570
Government, Education	$36,199	570
Government, Non-Education	$33,652	315
Administrative & Waste Services	$19,434	340
Real Estate & Rental & Leasing	$13,211	200
Finance & Insurance	$12,445	81
Retail Trade	$7,772	140
Professional & Technical Services	$7,053	82
Wholesale Trade	$6,916	36
Information	$4,164	16
Utilities	$4,083	10
Management of Companies & Enterprises	$3,863	28
Arts, Entertainment, & Recreation	$3,493	113
Educational Services	$3,176	67
Manufacturing	$2,400	20
Transportation & Warehousing	$1,788	29
Construction	$930	13
Mining, Quarrying, & Oil and Gas Extraction	$220	1
Agriculture, Forestry, Fishing, & Hunting	-$11	0
Accommodation & Food Services	-$142	-5
Other Services (except Public Administration)	-$531	108
Total impact	**$469,066**	**5,732**

Source: Emsi impact model.

CHAPTER 3:

Return on investment analysis

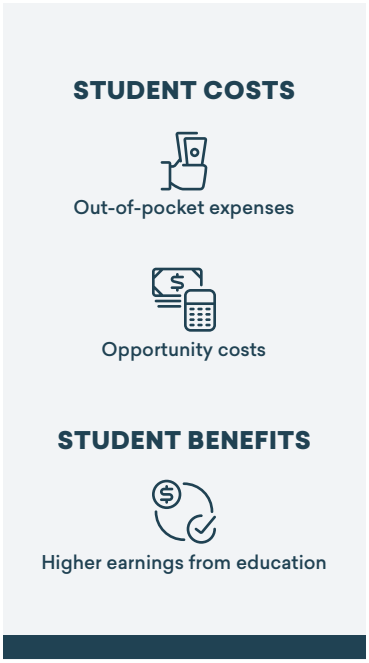
The benefits generated by CHCP affect the lives of many people. The most obvious beneficiaries are the college's students; they give up time and money to go to the college in return for a lifetime of higher wages and improved quality of life. But the benefits do not stop there. As students earn more, communities and citizens throughout Texas 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 government.

Return on 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 CHCP as a worthwhile investment from the perspectives of students and society, as well as the benefits that will be received by taxpayers.



STUDENT PERSPECTIVE

To enroll in postsecondary education, students pay money 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 monies that students pay in the form of tuition and fees and the opportunity costs of foregone time and money. The benefits are the higher earnings that students receive as a result of their education.



Calculating student costs

Student costs consist of 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 $67 million however, since we bachelor's degree students are not included in this analysis, the tuition paid by bachelor's degree students must be removed. Certificate and associate students paid $65.3 million in tuition and fees. Direct outlays also include the cost of books and supplies. On average, full-time students spent $1,060 each on books and supplies during the reporting year.[17] Multiplying this figure by the number of full-time equivalents (FTEs) produced by CHCP in FY 2018-19[18] generates a total cost of $6.8 million 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 college but also incur the interest cost of taking out federal loans.[19] In FY 2018-19, certificate and associate degree students received a total of $34.6 million in federal loans and $10.81 million in institutional student loans to attend CHCP. Students pay back these loans, along with interest for the federal loans, over the span of several years in the future. Since students pay off these loans over time, they accrue no initial

17 Based on the data provided by CHCP.

18 A single FTE is equal to 30 credits, so there were 5,387 FTEs produced by students in FY 2018-19, equal to 161,610 credits divided by 30.

19 Students receiving institutional loans do not have to pay interest on these loans.

cost during the analysis year. Hence, to avoid double counting, the $45.3 million in federal and institutional loans is subtracted from the costs incurred by students in FY 2018-19.



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 college rather than work. To calculate it, we need to know the difference between the students' full earning potential and what they actually earn while attending the college. Students' full earning potential is calculated by using the pre-CHCP attendance alumni earnings. Students who entered $0 were removed. The remaining earnings averaged to $15,853 in full-earning potential per student.[20]

In determining how much students earn while enrolled in postsecondary education, an important factor to consider is the time that they actually spend on postsecondary education, since this is the only time that they are required to give up a portion of their earnings. We use the students' credit production as a proxy for time, under the assumption that the more credits students earn, the less time they have to work, and, consequently, the greater their foregone earnings. Overall, students attending CHCP earned an average of 22.3 credits per student, which is approximately equal to 74% of a full academic year.[21] We thus include no more than $11,792 (or 74%) 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 85% of students are employed.[22] 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 $11,792). The total value of their foregone earnings thus comes to $12.8 million.

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 cashiers. To account for this, we assume that working students hold jobs that pay 69% of what they would have earned had they chosen to work full-time rather than go to college.[23] The remaining 31% comprises the percentage of their full

20 Note that this value is higher than the $11,530 pre-CHCP earnings listed in Table 1.4 because the $15,853 was calculated excluding $0 data while $11,530 included $0 data. To calculate the students' full earning potential, we only include those students already working.

21 Equal to 22.3 credits divided by 30, the assumed number of credits in a full-time academic year.

22 Based on data provided by CHCP.

23 The 69% 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).

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 31% 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.[24] 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 $27.1 million, equal to the sum of their foregone earnings ($22.4 million) and foregone leisure time ($4.8 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 college today. Students who take out federal 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 $34.6 million in federal loans was awarded to 5,964 students, averaging $7,602 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 CHCP is a two-year college, students will be indebted twice that amount, or $15,203 on average. According to the U.S. Department of Education, this level of indebtedness will take 15 years to pay back federal loans under the standard repayment plan.[25]

This indebtedness calculation is used solely to estimate the loan payback period. Students will be paying back the principal amount of $45.3 million over time. After taking into consideration the time value of money, this means that students will pay off a discounted present value of $30.2 million in principal over the 15 years. Students must not just pay back principal, but they must also pay back interest. Of the $45.3 million in loans, $10.8 million were institutional loans provided by CHCP. These loans are not charged interest. The remaining $34.6 million in loans are federal loans, and thus incur interest. Using the student discount rate of 5.1%[26] as our interest rate, we calculate that students will pay a total discounted present value of $11.3 million in interest on federal student loans throughout the first 15

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

25 Repayment period based on total education loan indebtedness, U.S. Department of Education, 2017. https://studentaid.ed.gov/sa/repay-loans/understand/plans/standard.

26 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 – May 2019 Baseline. https://www.cbo.gov/system/files?file=2019-05/51310-2019-05-studentloan.pdf.

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 $26.7 million, the sum of tuition and fees ($65.3 million) and books and supplies ($6.8 million), less federal ($34.6 million) and institutional ($10.8 million) loans received. Opportunity costs for working and non-working students amount to $40 million. Finally, we have the present value of future student loan costs, amounting to $41.5 million between principal and interest. Summing direct outlays, opportunity costs, and future student loan costs together yields a total of $108.2 million 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	$65,278
Less federal loans received	-$34,573
Less institutional loans received	-$10,764
Books and supplies	$6,800
Total direct outlays	**$26,741**
Opportunity costs in FY 2018-19	
Earnings foregone by non-working students	$12,810
Earnings foregone by working students	$22,369
Value of leisure time foregone by working students	$4,773
Total opportunity costs	**$39,951**
Future student loan costs (present value)	
Student total loan principal	$30,192
Student total loan interest*	$11,283
Total present value student loan costs	**$41,475**
Total present value student costs	**$108,167**

* Interest is only incurred on the $34.6 million in federal loans.
Source: Based on data provided by CHCP and outputs of the Emsi 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. As shown in Table 1.4, students who graduated from CHCP will on average make $15,880 more than what they made prior to attending the college. A key component in determining the students' return on investment is the value of their future benefits stream; i.e., what they can expect to earn in return for the investment they make in education. We calculate the future benefits stream to the college's FY 2018-19 students first by determining their average annual increase in earnings, equal to $54.9 million. This value represents the higher wages that accrue to students as they start their careers and is calculated based on the marginal wage increases of the credits

that students complete while attending the college. Using the pre- and post-CHCP attendance earnings data, the marginal wage increase per credit is $340 as students start their careers.

The second step is to project the $54.9 million annual increase in earnings into the future, for as long as students remain in the workforce. Once again, we use the Mincer function to predict the change in earnings at each point in an individual's working career and apply a 10% reduction to account for ability bias. After applying ability bias, $49.4 million represents the students' higher earnings upon entering their careers. Then, 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 $49.4 million in gross higher earnings occurs at Year 0, which is the start of the students' future working careers. In accordance with the Mincer function, as students gain more experience in the workforce, the gross higher earnings increase.

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 college 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.[27] 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.

27 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 return on 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.

Table 3.2: PROJECTED BENEFITS AND COSTS FOR 22.3 AVERAGE CREDITS TAKEN IN FY 2018-19, 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	$49.4	20%	$9.8	$66.7	-$56.9
1	$50.9	64%	$32.7	$4.0	$28.7
2	$52.4	84%	$43.9	$4.0	$39.9
3	$54.0	95%	$51.2	$4.0	$47.2
4	$55.5	95%	$52.6	$4.0	$48.6
5	$57.0	95%	$54.0	$4.0	$50.0
6	$58.6	95%	$55.4	$4.0	$51.4
7	$60.1	94%	$56.8	$4.0	$52.8
8	$61.6	94%	$58.1	$4.0	$54.1
9	$63.0	94%	$59.4	$4.0	$55.4
10	$64.5	94%	$60.7	$4.0	$56.7
11	$65.8	94%	$61.9	$4.0	$57.9
12	$67.2	94%	$63.1	$4.0	$59.1
13	$68.4	94%	$64.2	$4.0	$60.2
14	$69.6	94%	$65.2	$4.0	$61.2
15	$70.8	93%	$66.2	$4.0	$62.1
16	$71.8	93%	$67.0	$0.0	$67.0
17	$72.8	93%	$67.8	$0.0	$67.8
18	$73.7	93%	$68.5	$0.0	$68.5
19	$74.5	93%	$69.0	$0.0	$69.0
20	$75.2	92%	$69.5	$0.0	$69.5
21	$75.8	92%	$69.8	$0.0	$69.8
22	$76.3	92%	$70.0	$0.0	$70.0
23	$76.7	91%	$70.1	$0.0	$70.1
24	$77.0	91%	$70.1	$0.0	$70.1
25	$77.1	91%	$69.9	$0.0	$69.9
26	$77.2	90%	$69.6	$0.0	$69.6
27	$77.1	90%	$69.2	$0.0	$69.2
28	$77.0	89%	$68.6	$0.0	$68.6
29	$76.7	89%	$67.9	$0.0	$67.9
30	$76.3	88%	$67.1	$0.0	$67.1
31	$75.8	87%	$66.2	$0.0	$66.2
32	$75.2	87%	$65.1	$0.0	$65.1
33	$74.5	86%	$63.9	$0.0	$63.9
34	$73.7	85%	$62.6	$0.0	$62.6
35	$72.8	84%	$61.2	$0.0	$61.2
36	$71.8	83%	$59.8	$0.0	$59.8
37	$70.7	82%	$58.2	$0.0	$58.2
38	$69.6	81%	$56.5	$0.0	$56.5
39	$68.4	80%	$54.8	$0.0	$54.8
Present value			**$1,015.1**	**$108.2**	**$906.9**

* Includes the "settling-in" factors and attrition.
Source: Emsi impact model.

Benefit-cost ratio	Internal rate of return	Payback period (years)
9.4	68.0%	1.7

The present value of the cumulative higher future earnings that CHCP's FY 2018-19 students will receive over their working careers is $1.02 billion. In FY 2018-19 alone, for the 22.3 average credit hours taken (a little less than half of the credits needed for a certificate), the average increase in earnings per student will amount to $336,639 in higher earnings over a working lifetime. Once students have completed their certificate (in as little as nine months) or degree at CHCP, they are expected to receive $705,994 in higher future earnings over their working lifetime.

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 5.1% (see below). Because students tend to rely upon debt to pay for education—i.e. they are negative savers—their discount rate is based upon student loan interest rates.[28] In Appendix 1, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to student costs to derive the return on investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1.0, a rate of return that exceeds the discount rate, and a reasonably short payback period.



Discount rate

The discount rate is a rate of interest that converts future costs and benefits to present values. For example, $1,000 in higher earnings realized 30 years in the future is worth much less than $1,000 in the present. All future values must therefore be expressed in present value terms in order to compare them with investments (i.e., costs) made today. The selection of an appropriate discount rate, however, can become an arbitrary and controversial undertaking. As suggested in economic theory, the discount rate should reflect the investor's opportunity cost of capital, i.e., the rate of return one could reasonably expect to obtain from alternative investment schemes. In this study we assume a 5.1% discount rate from the student perspective and a 1.5% discount rate from the perspectives of taxpayers and society.

In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately $1.02 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 CHCP with a capital asset valued at $1.02 billion.

The students' cost of attending the college is shown in Column 5 of Table 3.2, equal to a present value of $108.2 million. Comparing the cost with the present

28 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 – May 2019 Baseline. https://www.cbo.gov/system/files?file=2019-06551310-2019-05-studentloan.pdf.

value of benefits yields a student benefit-cost ratio of 9.4 (equal to $1.02 billion in benefits divided by $108.2 million in costs).

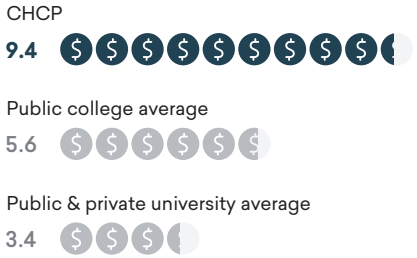
To provide some context to CHCP's average student benefit-cost ratio of 9.4, Emsi measured the average student return on investment of similarly sized institutions who received a study from Emsi in the past three years (Figure 3.1). The average student benefit-cost ratio across 10 similarly sized public and private universities was 3.4. The average student benefit-cost ratio across 10 similarly sized public colleges in Texas was 5.6. The reader should note that there are other factors, beyond the institution's performance, that affect the student return on investment results. While this can provide some context around the value provided by CHCP to its students, the university and college averages include institutions located in other states and public institutions. Other factors, such as differences in earnings across different states, influence the results. In addition, CHCP was able to provide earnings data of their students, the comparison institutions did not provide this data for their analyses, instead state averages were used. Regardless, the results indicate that CHCP is a strong investment option for its students.

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.[29] Table 3.2 shows students of CHCP earning average returns of 68.0% 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).

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 68.0% student rate of return is a real rate. With an inflation rate of 2.2% (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 70.2%, higher than what is reported in Table 3.2.

> For every dollar CHCP students invest in their education, they will receive **$9.40** in return in the form of higher future earnings.

Figure 3.1: HOW CHCP STUDENT BENEFIT-COST RATIO COMPARES*

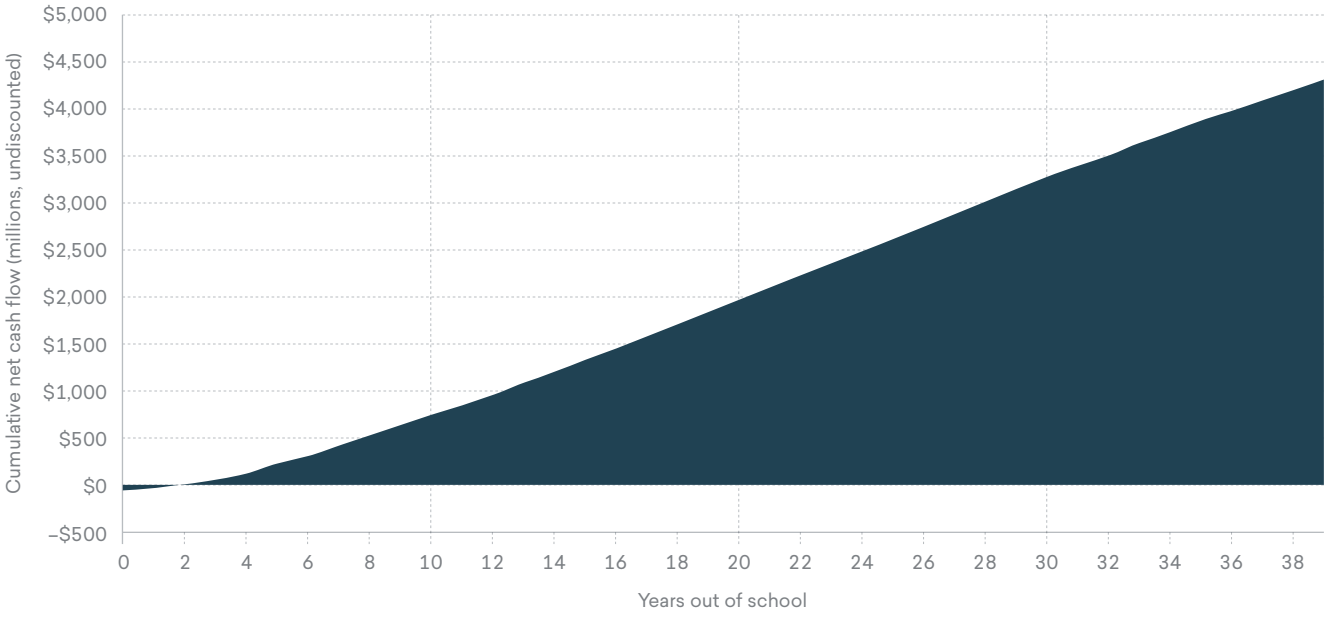


* The reader should note that there are other factors, beyond the institution's performance, that affect the student return on investment results. While this can provide some context around the value provided by CHCP to its students, the university and college averages include institutions located in other states and public institutions. In addition, CHCP was able to provide alumni earnings data; the comparison institutions did not provide this data for their analyses.

29 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.[30] Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at CHCP see, on average, a payback period of 1.7 years, meaning 1.7 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 3.2).

Figure 3.2: STUDENT PAYBACK PERIOD



Source: Emsi impact model.

30 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 government. For example, benefits resulting from earnings growth are limited to increased state 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 government. In all instances, benefits to private residents, local businesses, or the federal government are excluded.

TAXPAYER BENEFITS

Increased tax revenue

Avoided costs to state government

Growth in state tax revenues

As a result of their time at CHCP, students earn more because of the skills they learned while attending the college, 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 government is able to apply tax rates to higher earnings.

Estimating the effect of CHCP 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's MR-SAM model to estimate the added labor income created in the state as students and businesses spend their higher earnings.[31] 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 Texas gross state product to total labor income in the state. We also include the operations spending impact discussed in Chapter 2 that was created in FY 2018-19. We apply the prevailing tax rates so we capture only the tax revenues attributable to state government from this additional revenue.

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

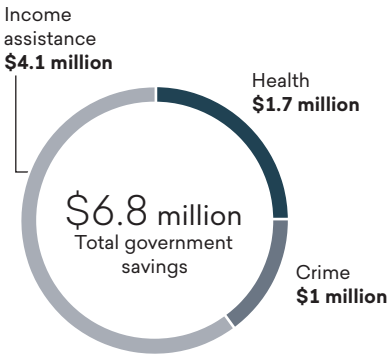
31 For a full description of the Emsi MR-SAM model, see Appendix 5.

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 college with data on migration patterns from the Census Bureau 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 CHCP does not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the college cannot be counted as new benefits to society. For this analysis, we assume an alternative education variable of 10%, meaning that 10% of the student population at the college would have generated benefits anyway even without the college. For more information on the alternative education variable, see Appendix 7.

After adjusting for attrition and alternative education opportunities, we calculate the present value of the future added tax revenues that occur in the state, equal to $218.6 million. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of 1.5%. This is the real treasury interest rate recommended by the Office of Management and Budget (OMB) for 30-year investments, and in Appendix 1, we conduct a sensitivity analysis of this discount rate.[32]

Figure 3.3: PRESENT VALUE OF GOVERNMENT SAVINGS



Source: Emsi impact model.

Government savings

In addition to the creation of higher tax revenues to the state 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 CHCP. Government savings appear in Figure 3.3 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 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 government, education is statistically associated with a variety of lifestyle changes that generate **social savings**.

32 Office of Management and Budget. "Discount Rates for Cost-Effectiveness Analysis of Federal Programs." *Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in Percent).* Last modified May 2019. https://www.whitehouse.gov/wp-content/uploads/2018/12/Discount-History.pdf.

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 credits at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the college, will not have poor health, commit crimes, or demand income assistance. We dampen these results by the ability bias adjustment discussed earlier in the student perspective section and in Appendix 6 to account for factors (besides education) that influence individual behavior. We then multiply the marginal effects of education times the associated costs of health, crime, and income assistance.[33] Finally, we apply the same adjustments for attrition and alternative education to derive the net savings to the government. Total government savings appear in Figure 3.3 and sum to $6.8 million.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to $218.6 million, from students' higher earnings, increases in non-labor income, and the operations spending impact. The sum of the government savings and the added income in the state is $225.4 million, 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 CHCP remains in the workforce.

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

Added tax revenue	**$218,611**
Government savings	
Health-related savings	$1,705
Crime-related savings	$1,017
Income assistance savings	$4,073
Total government savings	**$6,794**
Total taxpayer benefits	**$225,405**

Source: Emsi impact model.

Return on investment for taxpayers

The $225.4 million in taxpayer benefits accrue as long as the FY 2018-19 student population is active in the state workforce. Table 3.4 outlines the stream of benefits that taxpayers receive.

Table 3.4: PROJECTED BENEFITS FOR 22.3 AVERAGE CREDITS TAKEN IN FY 2018-19, TAXPAYER PERSPECTIVE

1	2
Year	**Benefits to taxpayers (millions)**
0	$3.9
1	$5.4
2	$7.0
3	$8.0
4	$8.0
5	$8.0
6	$8.0
7	$8.1
8	$8.1
9	$8.2
10	$8.2
11	$8.2
12	$8.2
13	$8.3
14	$8.3
15	$8.3
16	$8.3
17	$8.2
18	$8.2
19	$8.2
20	$8.1
21	$8.1
22	$8.0
23	$7.9
24	$7.8
25	$7.7
26	$7.6
27	$7.5
28	$7.4
29	$7.2
30	$7.1
31	$6.9
32	$6.7
33	$6.6
34	$6.4
35	$6.2
36	$6.0
37	$5.8
38	$5.6
39	$5.4
Present value	**$225.4**

Source: Emsi impact model.

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

SOCIAL PERSPECTIVE

Texas benefits from the education that CHCP provides 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 CHCP did not exist. Society's investment in CHCP stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by CHCP to these investor groups against the total social costs of generating those benefits. The total social costs include all CHCP expenditures, all student expenditures (including interest on student loans) less tuition and fees, and all student opportunity costs, totaling a present value of $115.5 million.

On the benefits side, any benefits that accrue to Texas as a whole—including students, employers, taxpayers, and anyone else who stands to benefit from the activities of CHCP—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.

Growth in state economic base

In the process of absorbing the newly acquired skills of students who attend CHCP, not only does the productivity of the Texas workforce increase, but so does the productivity of its physical capital and assorted infrastructure. Students earn more because of the skills they learned while attending the college, and 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 CHCP on the state's economic base follows a similar process used when calculating increased tax revenues in the taxpayer perspective.

SOCIAL COSTS

CHCP expenditures

Student out-of-pocket expenses

Student opportunity costs

SOCIAL BENEFITS

Increased state earnings

Avoided costs to society

Beekeeper analogy

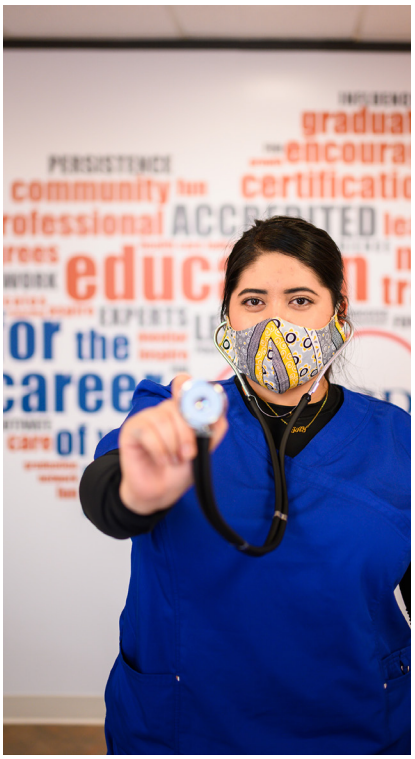
Beekeepers provide a classic example of positive externalities (sometimes called "neighborhood effects"). The beekeeper's intention is to make money selling honey. Like any other business, receipts must at least cover operating costs. If they don't, the business shuts down.

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.

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'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. We also include the operations spending impact discussed in Chapter 2 that was created in FY 2018-19.

Using this process, we calculate the present value of the future added income that occurs in the state, equal to $3.5 billion. Recall from the discussion of the student and taxpayer perspectives that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 1.5%.



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 CHCP. 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 $3.5 billion, from students' higher earnings and their multiplier effects, increases in non-labor income, and the operations spending impact. 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 $10.7 million. Crime savings amount to $1.2 million, including savings associated with a reduced number of crime victims, added worker productivity, and reduced expenditures for police and law enforcement, courts and administration of justice, and corrective services. Finally, the present value of the savings related to income assistance

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

Increased economic base	**$3,458,892**
Social savings	
Health	
Smoking	$12,081
Alcohol dependence	-$2,561
Obesity	$5,611
Depression	-$4,371
Drug abuse	-$19
Total health savings*	**$10,741**
Crime	
Criminal justice system savings	$1,004
Crime victim savings	$39
Added productivity	$154
Total crime savings	**$1,196**
Income assistance	
Welfare savings	$2,387
Unemployment savings	$1,686
Total income assistance savings	**$4,073**
Total social savings	**$16,010**
Total, increased economic base + social savings	**$3,474,901**

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

amount to $4.1 million, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to $16 million in benefits to communities and citizens in Texas.

The sum of the social savings and the increased state economic base is $3.5 billion, as shown in the bottom row of Table 3.5. These savings accrue in the future as long as the FY 2018-19 student population of CHCP remains in the workforce.

Return on investment for society

Table 3.6 presents the stream of benefits accruing to the Texas 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 30.1. This means that for every dollar invested in an education from CHCP, whether it is the money spent on operations of the college or money spent by students on tuition and fees, an average of $30.10 in benefits will accrue to society in Texas.[34]

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 CHCP. 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 CHCP. Recognizing the other point of view, Table 3.7 shows returns for both the taxpayer and social perspectives exclusive of social benefits. As indicated, taxpayers still receive financial benefits and for the social perspective, returns are still above threshold values (a benefit-cost ratio greater than 1.0), confirming that society receives value from investing in CHCP.

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

	Including social savings	Excluding social savings
Taxpayer perspective		
Present value benefits (millions)	$225.4	$218.6
Social perspective		
Net present value (millions)	$3,359.4	$3,343.4
Benefit-cost ratio	30.1	30.0

Source: Emsi impact model.

34 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 FOR 22.3 AVERAGE CREDITS TAKEN IN FY 2018-19, SOCIAL PERSPECTIVE

1	2	3	4
Year	Benefits to society (millions)	Social costs (millions)	Net cash flow (millions)
0	$60.3	$62.0	-$1.6
1	$82.4	$4.0	$78.4
2	$107.1	$4.0	$103.1
3	$122.0	$4.0	$118.0
4	$122.4	$4.0	$118.4
5	$122.9	$4.0	$118.9
6	$123.5	$4.0	$119.5
7	$124.1	$4.0	$120.1
8	$124.8	$4.0	$120.8
9	$125.5	$4.0	$121.5
10	$126.1	$4.0	$122.1
11	$126.6	$4.0	$122.6
12	$127.0	$4.0	$123.0
13	$127.3	$4.0	$123.3
14	$127.5	$4.0	$123.5
15	$127.6	$4.0	$123.6
16	$127.5	$0.0	$127.5
17	$127.3	$0.0	$127.3
18	$126.9	$0.0	$126.9
19	$126.4	$0.0	$126.4
20	$125.7	$0.0	$125.7
21	$124.8	$0.0	$124.8
22	$123.8	$0.0	$123.8
23	$122.6	$0.0	$122.6
24	$121.2	$0.0	$121.2
25	$119.6	$0.0	$119.6
26	$117.9	$0.0	$117.9
27	$116.0	$0.0	$116.0
28	$113.9	$0.0	$113.9
29	$111.7	$0.0	$111.7
30	$109.3	$0.0	$109.3
31	$106.7	$0.0	$106.7
32	$104.1	$0.0	$104.1
33	$101.3	$0.0	$101.3
34	$98.4	$0.0	$98.4
35	$95.4	$0.0	$95.4
36	$92.3	$0.0	$92.3
37	$89.2	$0.0	$89.2
38	$85.9	$0.0	$85.9
39	$82.7	$0.0	$82.7
Present value	**$3,474.9**	**$115.5**	**$3,359.4**

Source: Emsi impact model.

Benefit-cost ratio

30.1

CHAPTER 4:

Conclusion





WHILE CHCP'S VALUE to Texas is larger than simply its economic impact, understanding the dollars and cents value is an important asset to understanding the college's value as a whole. In order to fully assess CHCP's value to the state economy, this report has evaluated the college from the perspectives of economic impact analysis and return on investment analysis.

From an economic impact perspective, we calculated that CHCP generates a total economic impact of **$469.1 million** in total added income for the state economy. This represents the sum of a couple of different impacts, including the college's:

- Operations spending impact (**$35.5 million**) and
- Alumni impact (**$433.6 million**).

The total impact of $469.1 million is equivalent to supporting **5,732 jobs**.

Since CHCP's activity represents an investment by various parties, including students and society as a whole, we also considered the college as an investment to see the value it provides to these investors. For each dollar invested by students and society, CHCP offers a benefit of **$9.40** and **$30.10**, respectively. These results indicate that CHCP is an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the college expands the state economy and creates a wide range of positive social benefits that accrue to taxpayers and society in general within Texas. Finally, even though taxpayers do not invest in CHCP, taxpayers will receive **$225.4 million** in benefits throughout the students' working lives.

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

Emsi

Emsi is a leading provider of economic impact studies and labor market data to educational institutions, workforce planners, and regional developers in the U.S. and internationally. Since 2000, Emsi has completed over 2,200 economic impact studies for educational institutions in three countries. Visit www.economicmodeling.com for more information about Emsi's products and services.

RESOURCES AND REFERENCES

APPENDICES

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 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. "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 Labor Statistics. "Table 3.3. Civilian labor force participation rate, by age, sex, race, and ethnicity, 1999, 2009, 2019, and projected 2029 (in percent)." Employment Projections. Last modified September 2020. https://www.bls.gov/emp/tables/civilian-labor-force-participation-rate.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." 2020. https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201901.pdf.

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, Midyear 2019." *Tax Foundation* (July 2019). https://taxfoundation.org/state-sales-tax-rates-local-sales-tax-rates-midyear-2019/.

Card, David. "The Causal Effect 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, Amounts and Average Annual Growth from Previous Year Shown, by Type of Sponsor, Selected Calendar Years 2011-2027." *NHE Projections 2018-2027 – Tables*. February 2019. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected.html.

College Board. "Figure 1: Average Estimated Full-Time Undergraduate Budgets, 2018-19 (Enrollment-Weighted)." *The College Board, Annual Survey of Colleges, Average Estimated Undergraduate Budgets, 2018-19.* https://trends.collegeboard.org/college-pricing/figures-tables/average-estimated-undergraduate-budgets-2018-19.

Congressional Budget Office. "Table 4. Projection of Borrower Interest Rates: CBO's April 2018 Baseline." *Congressional Budget Office Publications CBO's April 2018 Baseline Projections for the Student Loan Program*. Last modified April 2018. https://www.cbo.gov/system/files?-file=2018-06/51310-2018-04-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.

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 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.

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.

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.

Kaeding, Nicole. "State Individual Income Tax Rates and Brackets for 2019." *Tax Foundation Fiscal Fact* no. 500 (March 2019). https://taxfoundation.org/state-individual-income-tax-rates-brackets-2019.

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.

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 Education Statistics. "Table 219.60 Number of People Taking the GED Test and Percentage Distribution of Those who Passed, by Age Group: 1971 through 2013." *Digest of Education Statistics*. 2015. https://nces.ed.gov/programs/digest/d15/tables/dt15_219.60.asp?current=yes.

National Center for Education Statistics. "Table 507.20 Participants in State-Administered Adult Basic Education, Secondary Education, and English as a Second Language Programs, by Type of Program and State or Jurisdiction: Selected Fiscal Years, 2000 through 2014." *Digest of Education Statistics*. 2015. https://nces.ed.gov/programs/digest/d15/tables/dt15_507.20.asp?current=yes.

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 September 2020. https://data.oecd.org/hha/household-savings.htm#indicator-chart.

Office of Management and Budget. "Discount Rates for Cost-Effectiveness Analysis of Federal Programs." *Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in Percent).* Last modified November 2018. https://www.whitehouse.gov/wp-content/uploads/2018/12/Discount-History.pdf.

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*. May 2016. 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.

Tax Foundation. "State Individual Income Tax Rates and Brackets, 2019." Last Revised March 2019. Accessed March 2018. https://taxfoundation.org/state-individual-income-tax-rates-brackets-2019.

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." 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, 2019 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: 2018 to 2019." https://www.census.gov/data/tables/2017/demo/geographic-mobility/cps-2017.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, Population Division. "Estimates of the Total Resident Population and Resident Population Age 18 Years and Older for the United States, States, and Puerto Rico: July 1, 2018." *Population Estimates.* December 2018. https://www.census.gov/newsroom/press-kits/2018/pop-estimates-national-state.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.

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

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, 2017. Accessed September 2020. https://www.cdc.gov/nchs/nvss/life-expectancy.htm.

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.

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

Walczak, Jared, Scott Drenkard. "State and Local Sales Tax Rates, Midyear 2018." *Tax Foundation Fiscal Fact* no. 600 (July 2018). https://files.taxfoundation.org/20180713135343/Tax-Foundation-FF600.pdf.

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

APPENDIX 1: SENSITIVITY ANALYSIS

Sensitivity analysis measures the extent to which a model's outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected. In this chapter we test the sensitivity of the model to the following input factors: 1) the alternative education variable, 2) the labor import effect variable, 3) the student employment variables, and 4) the discount rate.

Alternative education variable

The alternative education variable (10%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the college in the state. Given the difficulty in accurately specifying the alternative education variable, we test the sensitivity of the taxpayer and social return on investment analysis results to its magnitude. Variations in the alternative education assumption are calculated around base case results listed in the middle column of Table A1.1. Next, the model brackets the base case assumption on either side with a plus or minus 10%, 25%, and 50% variation in assumptions. Analyses are then repeated introducing one change at a time, holding all other variables constant. For example, an increase of 10% in the alternative education assumption (from 10% to 11%) reduces the taxpayer perspective rate of return from $225.4 million to $222.9 million. Likewise, a decrease of 10% (from 10% to 9%) in the assumption increases the rate of return from $225.4 million to $227.9 million.

Table A1.1: SENSITIVITY ANALYSIS OF ALTERNATIVE EDUCATION VARIABLE, TAXPAYER AND SOCIAL PERSPECTIVES

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Alternative education variable	**5%**	**8%**	**9%**	**10%**	**11%**	**13%**	**15%**
Taxpayer perspective							
Present value benefits (millions)	$238	$232	$228	$225	$223	$219	$213
Social perspective							
Net present value (millions)	$3,552	$3,456	$3,398	$3,359	$3,321	$3,263	$3,166
Benefit-cost ratio	31.8	30.9	30.4	30.1	29.8	29.3	28.4

Based on this sensitivity analysis, the conclusion can be drawn that CHCP return on investment analysis results from the taxpayer and social perspectives are not very sensitive to relatively large variations in the alternative education variable. As indicated, taxpayers will still receive financial benefits and results are still above their threshold levels for society (net present value greater than 0 and benefit-cost ratio greater than 1), even when the alternative education assumption is increased by as much as 50% (from 10% to 15%). The conclusion is that although the assumption is difficult to specify, its impact on overall return on 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 2.4. 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 CHCP. In other words, businesses that hired CHCP students could have substituted some of these workers with equally-qualified people from outside the state had there been no CHCP students to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the college.

Table A1.2 presents the results of the sensitivity analysis for the labor import effect 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 CHCP, for example, range from a high of $650.3 million at a -50% variation to a low of $216.8 million 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 Texas economy still remains sizeable.

Table A1.2: 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)	$650	$542	$477	$434	$390	$325	$217

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 college and 2) the percentage of earnings that working students receive relative to the earnings they would have received had they not chosen to attend the college. Both employment variables affect the return on investment analysis results from the student perspective.

Students incur substantial expense by attending CHCP 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 85% of students are employed.[35] This variable is tested in the sensitivity analysis by changing it first to 100% and then to 0%.

The second student employment variable is more difficult to estimate. In this study we estimate that students who are working while attending the college earn only 69%, on average, of the earnings that they statistically would have received if not attending CHCP. This suggests that many students hold part-time jobs that accommodate their CHCP attendance, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 69% variable is an estimation based on the average hourly wages of the most common jobs held by students while attending college relative to the average hourly wages of all occupations in the U.S. The model captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 69% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table A1.3, 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 85% and B equal to 69%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases A to 100% while holding B constant, Scenario 2 increases B to 100% while holding A constant, Scenario 3 increases both A and B to 100%, and Scenario 4 decreases both A and B to 0%.

Table A1.3: SENSITIVITY ANALYSIS OF STUDENT EMPLOYMENT VARIABLES

Variations in assumptions	Net present value (millions)	Internal rate of return	Benefit-cost ratio
Base case: A = 85%, B = 69%	$906.9	68.0%	9.4
Scenario 1: A = 100%, B = 69%	$904.2	65.3%	9.2
Scenario 2: A = 85%, B = 100%	$918.5	82.8%	10.5
Scenario 3: A = 100%, B = 100%	$930.5	n/a*	12.0
Scenario 4: A = 0%, B = 0%	$850.7	37.7%	6.2

Note: A = percent of students employed; B = percent earned relative to statistical averages
* In this scenario, costs are so low that it is not appropriate to measure an internal rate of return.

- **Scenario 1:** Increasing the percentage of students employed (A) from 85% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to $904.2 million, 65.3%, and 9.2, respectively, relative to base case results. Improved results are attributable to a lower opportunity cost of time; all students are employed in this case.

35 Based on data provided by CHCP.

- **Scenario 2:** Increasing earnings relative to statistical averages (B) from 69% to 100%, the net present value, internal rate of return, and benefit-cost ratio results improve to $918.5 million, 82.8%, and 10.5, 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 and benefit-cost ratio improve yet further to $930.5 million and 12.0, respectively, relative to base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to statistical averages) while attending classes.
- **Scenario 4:** Finally, decreasing both A and B to 0% reduces the net present value, internal rate of return, and benefit-cost ratio to $850.7 million, 37.7%, and 6.2, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[36]

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 CHCP 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 the return on 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 5.1% discount rate for students and a 1.5% discount rate for society and taxpayers.[37] Similar to the sensitivity analysis of the alternative education variable, we vary the base case discount rates for students, taxpayers,

36 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.

37 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 April 2018 Baseline" and the Office of Management and Budget "Discount Rates for Cost-Effectiveness of Federal Programs."

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 and society in Table A1.4.

Table A1.4: SENSITIVITY ANALYSIS OF DISCOUNT RATE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Student perspective							
Discount rate	2.5%	3.8%	4.5%	5.1%	5.6%	6.3%	7.6%
Net present value (millions)	$1,396	$1,116	$983	$907	$838	$749	$699
Benefit-cost ratio	13.9	11.3	10.1	9.4	8.8	7.9	7.5
Taxpayer perspective							
Discount rate	0.8%	1.1%	1.4%	1.5%	1.7%	1.9%	2.3%
Present value benefits (millions)	$257	$240	$231	$225	$220	$212	$199
Social perspective							
Discount rate	0.8%	1.1%	1.4%	1.5%	1.7%	1.9%	2.3%
Net present value (millions)	$3,842	$3,589	$3,449	$3,359	$3,273	$3,150	$2,959
Benefit-cost ratio	34.3	32.1	30.9	30.1	29.3	28.3	26.6

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 5.1% to 7.6%) reduces the students' benefit-cost ratio from 9.4 to 7.5. Conversely, reducing the discount rate for students by 50% (from 5.1% to 2.5%) increases the benefit-cost ratio from 9.4 to 13.9. The sensitivity analysis results for society and taxpayers show the same inverse relationship between the discount rate and benefits. This results in the social perspective benefit-cost ratio changing from a 26.6 ratio at a 50% variation from the base case to a 34.3 ratio at a -50% variation from the base case.

APPENDIX 2: GLOSSARY OF TERMS

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

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

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

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

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

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

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

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

Gross 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 college and the higher earnings of its students.

Input-output analysis: Relationship between a given set of demands for final goods and services and the implied amounts of manufactured inputs, raw materials, and labor that this requires. When educational institutions pay wages and salaries and spend money for supplies in the 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 college and its 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 college and its 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 3: FREQUENTLY ASKED QUESTIONS (FAQs)

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

What is an economic impact analysis?

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

What is a return on 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's proprietary MR-SAM model, the Census Bureau, and other sources to reflect the specific earnings levels, jobs numbers, unemployment rates, population demographics, and other key characteristics of the region served by the college. Therefore, model results for the college are specific to the given region.

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

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

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

In general, Emsi discourages comparisons between institutions since many factors, such as regional economic conditions, institutional differences, and student demographics are outside of the college's control. It is best to compare

the rate of return to the discount rates of 5.1% (for students) and 1.5% (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 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, 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 college (Table 1.5). 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 college to say that their single brick and mortar campus does just as much for Texas as the entire Utilities industry, for example. This powerful statement can help put the large total impact number into perspective.

APPENDIX 4: EXAMPLE OF SALES VERSUS INCOME

Emsi'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 5: EMSI MR-SAM

Emsi's MR-SAM represents the flow of all economic transactions in a given region. It replaces Emsi'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 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 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 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 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 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 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 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 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's gravitational flows model that estimates the amount of trade between counties in the country.

Overview of the MR-SAM model

Emsi'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 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'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'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 MR-SAM model

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

GRAVITATIONAL FLOWS MODEL

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

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

APPENDIX 6: THE MINCER FUNCTION

The $340 value per credit in Table 1.4 only tells part of the story. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[38] While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use state-specific and education level-specific Mincer coefficients.

Figure A6.1: LIFECYCLE CHANGE IN EARNINGS

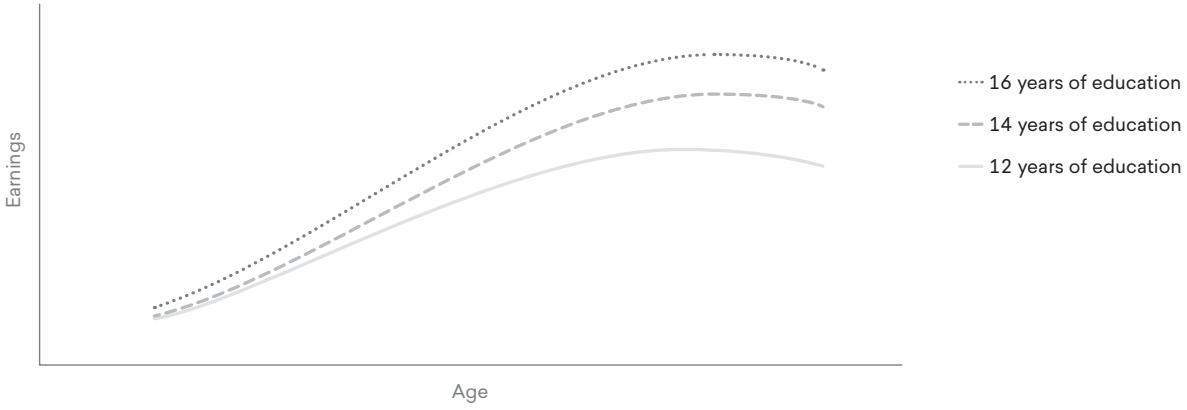


Figure A6.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum somewhere well after the midpoint of the working career,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

38 See Mincer (1958 and 1974).

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 $340 value per credit to the students' age and work experience. Because the earnings CHCP collected represent students at the start of their working careers, the $340 is the value per credit they will receive at the start of their careers. To the students in the latter half or approaching the end of their careers, we apply a higher value per credit.

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 credit is lower for students at the start of their career and higher near the end of it, in accordance with the scalars derived from the slope of the Mincer curve illustrated in Figure A6.1.

APPENDIX 7: ALTERNATIVE EDUCATION VARIABLE

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

Recall this analysis considers only relevant economic information regarding the college. Considering the existence of various other academic institutions surrounding the college, we have to assume that a portion of the students could find alternative education and either remain in or return to the 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 college—we discount the benefits attributed to the college. An important distinction must be made here: the benefits from students who would find alternative education outside the state and not return to the state are *not* discounted. Because these benefits would not occur in the state without the presence of the college, they must be included.

In the absence of the college, we assume 10% of the college's 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 10%. In other words, we assume 10% of the benefits created by the college's students would have occurred anyway in the counterfactual scenario where the college did not exist. A sensitivity analysis of this adjustment is presented in Appendix 1.

APPENDIX 8: OVERVIEW OF RETURN ON INVESTMENT ANALYSIS MEASURES

The appendix provides context to the return on investment analysis results using the simple hypothetical example summarized in Table A8.1 below. The table shows the projected benefits and costs for a single student over time and associated return on investment analysis results.[39]

Table A8.1: EXAMPLE OF THE BENEFITS AND COSTS OF EDUCATION FOR A SINGLE STUDENT

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

Benefit-cost ratio	Internal rate of return	Payback period (years)
1.7	18.0%	4.2

Assumptions are as follows:

- Benefits and costs are projected out 10 years into the future (Column 1).
- The student attends the college for one year, and the cost of tuition is $1,500 (Column 2).
- Earnings foregone while attending the college for one year (opportunity cost) come to $20,000 (Column 3).
- Together, tuition and earnings foregone cost sum to $21,500. This represents the out-of-pocket investment made by the student (Column 4).

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

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

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

Net present value

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

The question is simple: Will the prospective student be economically better off by choosing to enroll? If he adds up higher earnings of $5,000 per year for the remaining nine years in Table A8.1, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different. Benefits are far lower than $45,000 because future money is worth less than present money. Costs (tuition plus earnings foregone) are felt immediately because they are incurred today, in the present. Benefits, on the other hand, occur in the future. They are not yet available. All future benefits must be discounted by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[40]

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.

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

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

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

Internal rate of return

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

What does this mean? The internal rate of return of 18.0% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18.0%, higher earnings of $5,000 per year for the next nine years will earn back all investments of $21,500 made plus pay 18.0% for the use of that money ($21,500) in the meantime. Is this a good return? Indeed, it is. If it is compared to the 4% going rate of interest applied to the net present value calculations, 18.0% is far higher than 4%. It may be concluded, therefore, that the investment in this case is solid. Alternatively, comparing the 18.0% rate of return to the long-term 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 A8.1, it will take roughly 4.2 years of $5,000 worth of higher earnings to recapture his investment of $1,500 in tuition and the $20,000 in earnings foregone while attending the college. Higher earnings that occur beyond 4.2 years are the returns that make the investment in education in this example economically worthwhile. The payback period is a fairly rough, albeit common, means of choosing between investments. The shorter the payback period, the stronger the investment.

APPENDIX 9: SOCIAL EXTERNALITIES

Education has a predictable and positive effect on a diverse array of social benefits. These, when quantified in dollar terms, represent significant social savings that directly benefit society communities and citizens throughout the 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

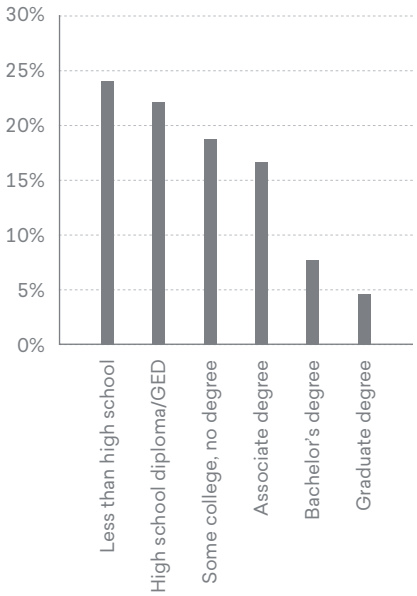
Statistics show a correlation between increased education and improved health. The manifestations of this are found in five health-related variables: smoking, alcohol dependence, obesity, depression, and drug abuse. There are other health-related areas that link to educational attainment, but these are 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 A9.1 shows the prevalence of cigarette smoking among adults, 25 years and over, based on data provided by the National Health Interview Survey.[41] 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.

Figure A9.1: PREVALENCE OF SMOKING AMONG U.S. ADULTS BY EDUCATION LEVEL



Source: Centers for Disease Control and Prevention.

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

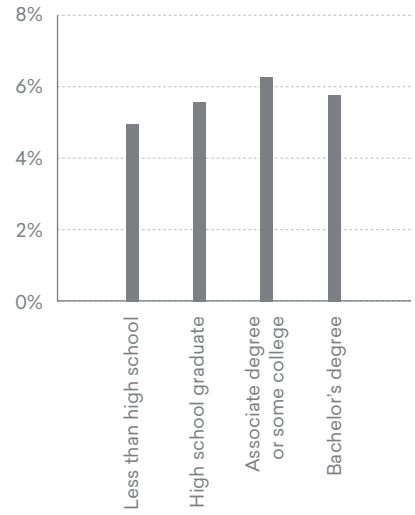
The Centers for Disease Control and Prevention (CDC) reports the percentage of adults who are current smokers by state.[42] We use this information to create an index value by which we adjust the national prevalence data on smoking to each state. For example, 14.4% of Texas adults were smokers in 2018, relative to 15.9% for the nation. We thus apply a scalar of 0.90 to the national probabilities of smoking in order to adjust them to the state of Texas.

ALCOHOL DEPENDENCE

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

Figure A9.2 compares the percentage of adults, 18 and older, that abuse or depend on alcohol by education level, based on data from the Substance Abuse and Mental Health Services Administration (SAMHSA).[43] These statistics give an indication of the correlation between education and the reduced probability of alcohol dependence. Adults with an associate degree or some college have higher rates of alcohol dependence than adults with a high school diploma or lower. Although the data do not maintain a pattern of decreased alcohol dependence at every level of increased education, we include these rates in our model to ensure we provide a comprehensive view of the social benefits and costs correlated with education.

Figure A9.2: PREVALENCE OF ALCOHOL DEPENDENCE OR ABUSE BY EDUCATION LEVEL



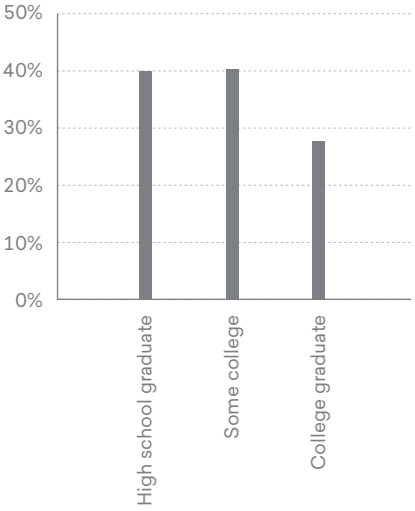
Source: Centers for Disease Control and Prevention.

OBESITY

The rise in obesity and diet-related chronic diseases has led to increased attention on how expenditures relating to obesity have increased in recent years. The average cost of obesity-related medical conditions is calculated using information from the *Journal of Occupational and Environmental Medicine*, which reports incremental medical expenditures and productivity losses due to excess weight.[44]

Data for Figure A9.3 is derived from the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over by education, gender, and ethnicity.[45] As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, the prevalence of obesity among adults with some college is actually greater than

Figure A9.3: PREVALENCE OF OBESITY BY EDUCATION LEVEL



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

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

43 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.

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

45 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).

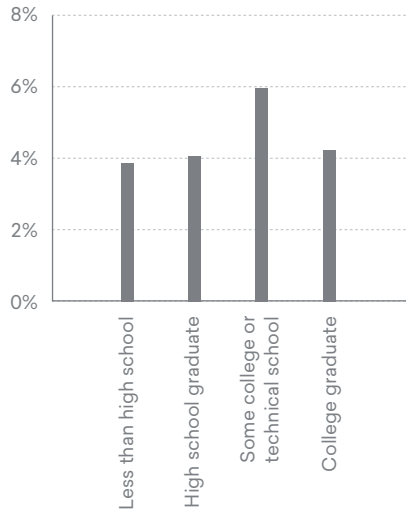
those with just a high school diploma. In general, though, obesity tends to decline with increasing levels of education.

DEPRESSION

Capturing the full economic cost of mental illness is difficult because not all mental disorders have a correlation with education. For this reason, we only examine the economic costs associated with major depressive disorder (MDD), which are comprised of medical and pharmaceutical costs, workplace costs such as absenteeism, and suicide-related costs.[46]

Figure A9.4 summarizes the prevalence of MDD among adults by education level, based on data provided by the CDC.[47] As shown, people with some college are most likely to have MDD compared to those with other levels of educational attainment. People with a high school diploma or less, along with college graduates, are all fairly similar in the prevalence rates.

Figure A9.4: PREVALENCE OF MAJOR DEPRESSIVE EPISODE BY EDUCATION LEVEL

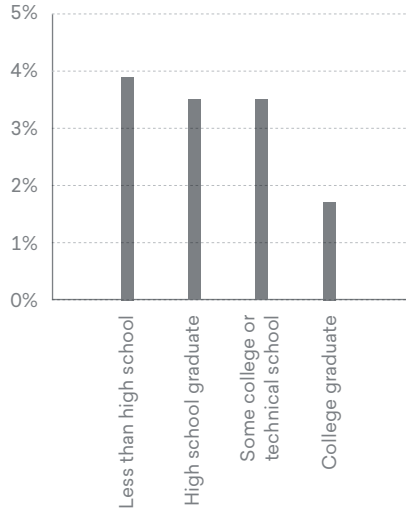


Source: National Survey on Drug Use and Health.

DRUG ABUSE

The burden and cost of illicit drug abuse is enormous in the U.S., but little is known about the magnitude of costs and effects at a national level. What is known is that the rate of people abusing drugs is inversely proportional to their education level. The higher the education level, the less likely a person is to abuse or depend on illicit drugs. The probability that a person with less than a high school diploma will abuse drugs is 3.9%, twice as large as the probability of drug abuse for college graduates (1.7%). This relationship is presented in Figure A9.5 based on data supplied by SAMHSA.[48] Similar to alcohol abuse, prevalence does not strictly decline at every education level. Health costs associated with illegal drug use are also available from SAMSHA, with costs to state government representing 40% of the total cost related to illegal drug use.[49]

Figure A9.5: PREVALENCE OF ILLICIT DRUG DEPENDENCE OR ABUSE BY EDUCATION LEVEL



Source: Substance Abuse and Mental Health Services Administration.

Crime

As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial

46 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.

47 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."

48 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.

49 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.*

and legal, and corrections, 2) victim costs, and 3) productivity lost as a result of time spent in jail or prison rather than working.

Figure A9.6 displays the educational attainment of the incarcerated population in the U.S. Data are derived from the breakdown of the inmate population by education level in federal, state, and local prisons as provided by the U.S. Census Bureau.[50]

Victim costs comprise material, medical, physical, and emotional losses suffered by crime victims. Some of these costs are hidden, while others are available in various databases. Estimates of victim costs vary widely, attributable to differences in how the costs are measured. The lower end of the scale includes only tangible out-of-pocket costs, while the higher end includes intangible costs related to pain and suffering.[51]

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

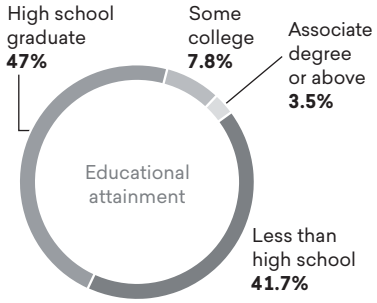
Income assistance

Statistics show that as education levels increase, the number of applicants for government-funded income assistance such as welfare and unemployment benefits decline. Welfare and unemployment claimants can receive assistance from a variety of different sources, including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Medicaid, Supplemental Security Income (SSI), and unemployment insurance.[52]

Figure A9.7 relates the breakdown of TANF recipients by education level, derived from data provided by the U.S. Department of Health and Human Services.[53] As shown, the demographic characteristics of TANF recipients are weighted heavily towards the less than high school and high school categories, with a much smaller representation of individuals with greater than a high school education.

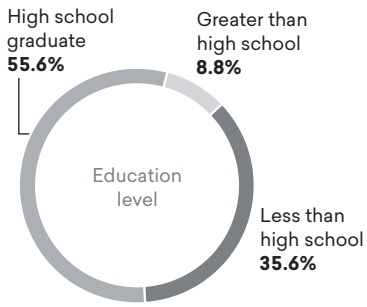
Unemployment rates also decline with increasing levels of education, as illustrated in Figure A9.8. These data are provided by the Bureau of Labor Statistics.[54] As shown, unemployment rates range from 5.4% for those with less than a high school diploma to 1.9% for those at the graduate degree level or higher.

Figure A9.6: EDUCATIONAL ATTAINMENT OF THE INCARCERATED POPULATION



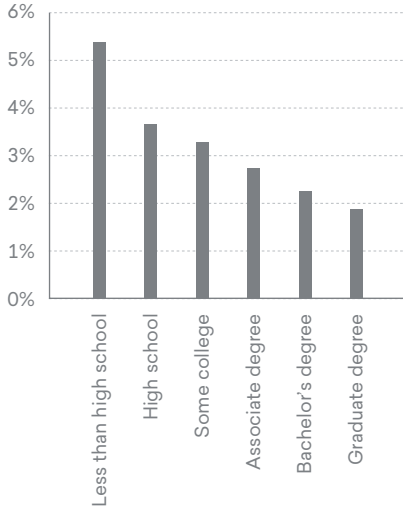
Source: Derived from data provided by the U.S. Census Bureau.

Figure A9.7: BREAKDOWN OF TANF RECIPIENTS BY EDUCATION LEVEL



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

Figure A9.8: UNEMPLOYMENT BY EDUCATION LEVEL



Source: Bureau of Labor Statistics.

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

51 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.

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

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

54 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.