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BOARD OF REGENTS
STATE OF IOWA

The Economic Value of Iowa's Regent Universities

MAIN REPORT

Emsi

Contents

Executive Summary

This report assesses the impact of Iowa's regent universities[1] on the state economy and the benefits generated by the universities for students, taxpayers, and society. The results of this study show that the universities create a significant positive net impact on the state economy and generate an enormous positive return on investment for students, taxpayers, and society.

1 Iowa's regent universities consist of Iowa State University of Science and Technology (ISU), the University of Iowa (UI), and the University of Northern Iowa (UNI).

📷: Iowa State University of Science & Technology

Economic impact analysis

During the analysis year, Iowa's regent universities spent $2.9 billion on payroll and benefits for 35,243 full-time and part-time employees, and spent another $1.7 billion on goods and services to carry out the universities' day-to-day operations, construction, hospital and clinical, and research activities. 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 Iowa's regent universities that directly takes into account the fact that state dollars spent on the universities could have been spent elsewhere in the state if not directed towards the universities. This spending would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of Iowa's regent universities.

The additional income of ***$11.8 billion*** *created by Iowa's regent universities is equal to approximately* ***6.2%*** *of the total gross state product of Iowa.*

This analysis shows that in fiscal year (FY) 2017-18, operations, construction, hospital and clinical, research, economic development, visitor, and student spending of the universities, together with the enhanced productivity of their alumni, generated **$11.8 billion** in added income for the Iowa economy. The additional income of **$11.8 billion** created by Iowa's regent universities is equal to approximately **6.2%** of the total gross state product (GSP) of Iowa. For

perspective, this impact from the universities is nearly as large as the entire Health Care & Social Assistance industry in the state. The impact of **$11.8 billion** is equivalent to supporting **149,980 jobs**. For further perspective, this means that **one out of every 14 jobs** in Iowa is supported by the activities of the universities and their students. These economic impacts break down as follows:

Operations spending impact

Payroll and benefits to support the universities' day-to-day operations (excluding payroll from hospital, clinic, and research employees) amounted to $1.7 billion.[2] The universities' non-pay expenditures amounted to $504.7 million (excluding construction, hospital, clinic, and research expenditures). The net impact of operations spending by the universities in Iowa during the analysis year was approximately **$1.9 billion** in added income, which is equivalent to supporting **21,776 jobs**.

Construction spending impact

Iowa's regent universities spend millions of dollars on construction each year to maintain their facilities, create additional capacities, and meet their growing educational demands. While the amount varies from year to year, these quick infusions of income and jobs have a substantial impact on the state economy. In FY 2017-18, the construction spending of the universities generated **$132.7 million** in added income, which is equivalent to supporting **2,025 jobs**.

University hospital & clinic spending impact

In FY 2017-18, the University of Iowa spent over $745 million on the University of Iowa Hospitals & Clinics (UIHC) faculty and staff and $760 million on other expenditures to support their operations. The total net impact of UIHC operations in the state was **$1.5 billion** in added income, which is equivalent to supporting **21,276 jobs**.

Research spending impact

Research activities of the universities impact the state economy by employing people and making purchases for equipment, supplies, and services. They also facilitate new knowledge creation throughout Iowa. In FY 2017-18, the universities spent $411.5 million on payroll and $465.3 million on other expenditures to support research activities. Research spending of the universities generated **$730 million** in added income for the Iowa economy, which is equivalent to supporting **9,682 jobs**.

2 Includes royalty payments to inventors related to Iowa's regent universities that still live in Iowa.

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.

Value of extension and outreach

Extension and outreach strengthen communities and their local economies by enhancing leadership structures, broadening engagement, teaching best practices, and providing hands-on assistance. Over the years, the extension and outreach offices and programs of the universities have helped more than **13,000 companies** and organizations across the state. The offices helped **tens of thousands of Iowa farmers**. Due to the specific nature of these extension and outreach activities, Emsi does not attempt to measure an impact. With that said, the value that these extension and outreach activities offer for state and local communities should be acknowledged.

Economic development impact

The universities create an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of start-up and spin-off companies related to the universities and companies that have grown in the state with the support of the universities. In FY 2017-18, start-up and spin-off companies created in the past five years and companies supported by the universities added **$1 billion** in income for the Iowa economy. The total added income of $1 billion is equivalent to supporting **14,575 jobs**.[3]

Visitor spending impact

Out-of-state visitors attracted to Iowa for activities at the universities brought new dollars to the economy through their spending at hotels, restaurants, gas stations, and other state businesses. The spending from these visitors added approximately **$38.1 million** in income for the Iowa economy, which is equivalent to supporting **1,081 jobs**.

Value of volunteerism

Beyond positively impacting the state through the activities, such as research, occurring at the universities, the universities also directly impact the state economy through their facilitation and support of student and employee volunteer activities. Volunteers are an important part of any society because they positively impact those less fortunate. In FY 2017-18 alone, **45,047 student and employee volunteers** supported non-profit organizations and causes across the state. These students and employees volunteered **2.3 million hours** of their time. Their volunteer activities added

3 To maintain an acceptable level of data reliability, this impact is limited to those companies that were created in the last five years. It is therefore conservative. This impact includes the positive effects the universities' Small Business Development Centers, UNI's Advance Iowa program, and ISU's Center for Industrial Research and Service have on businesses within Iowa.

$54.2 million in value[4] for the state and local communities. The impact of volunteerism is not measured in this analysis; however, the value volunteers offer should not be overlooked.

Student spending impact

Around 40% of students attending the universities originated from outside the state. While some of these students continued to live outside the state, many relocated to Iowa to attend the universities. In addition, some students are residents of Iowa who would have left the state if not for the existence of Iowa's regent universities. The money that these students spent toward living expenses in Iowa is attributable to the universities.

The expenditures of relocated and retained students in the state during the analysis year added approximately **$232.9 million** in income for the Iowa economy, which is equivalent to supporting **5,485 jobs**.

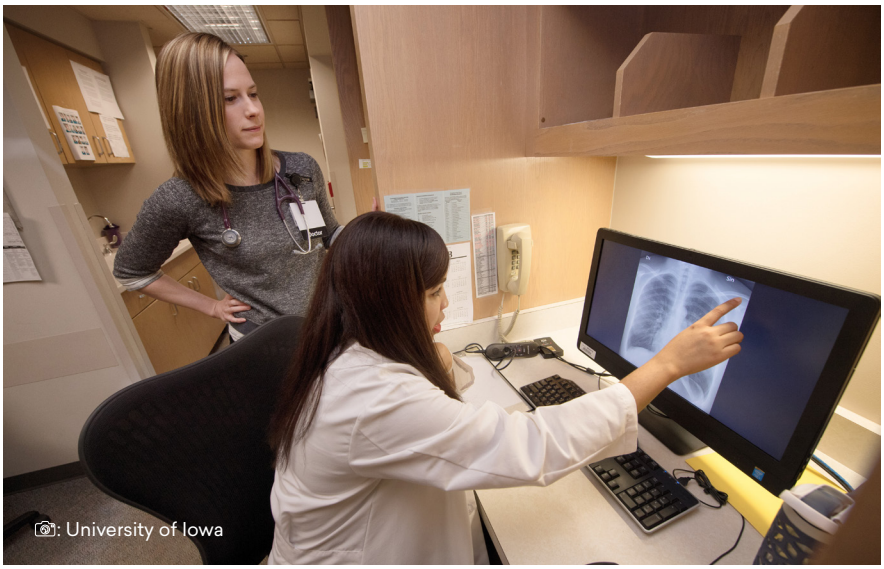
Alumni impact

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

The accumulated impact of former students currently employed in the Iowa workforce amounted to **$6.2 billion** in added income for the Iowa economy, which is equivalent to supporting **74,079 jobs**.

4 Value per volunteer hour per state provided by Independent Sector. See https://independentsector.org/resource/vovt_details/.

Investment analysis



Investment analysis is the practice of comparing the costs and benefits of an investment to determine whether or not it is profitable. This study considers Iowa's regent universities as an investment from the perspectives of students, taxpayers, and society.

Student perspective

Students invest their own money and time in their education to pay for tuition, books, and supplies. Many take out student loans to attend the universities, which they will pay back over time. While some students were employed while attending the universities, students overall forewent earnings that they would have generated had they been in full employment instead of learning. Summing these direct outlays, opportunity costs, and future student loan costs yields a total of **$1.8 billion** in present value student costs.

In return, students will receive a present value of **$6.8 billion** in increased earnings over their working lives. This translates to a return of **$3.70** in higher future earnings for every $1 that students pay for their education at the universities. The corresponding annual rate of return is **14.4%**.

Taxpayer perspective

Taxpayers provided **$710.9 million** of funding to Iowa's regent universities in FY 2017-18. In return, taxpayers will receive an estimated present value of **$1.8 billion** in added tax revenue stemming from

the students' higher lifetime earnings and the increased output of businesses. Savings to the public sector add another estimated **$287 million** in benefits due to a reduced demand for government-funded social services in Iowa. For every tax dollar spent educating students attending the universities, taxpayers will receive an average of **$2.90** in return over the course of the students' working lives. In other words, taxpayers enjoy an annual rate of return of **7.9%**.

For every tax dollar spent educating students attending the universities, taxpayers will receive an average of ***$2.90*** *in return over the course of the students' working lives.*

Social perspective

People in Iowa invested **$5.4 billion** in Iowa's regent universities in FY 2017-18. This includes the universities' expenditures, student expenses, and student opportunity costs. In return, the state of Iowa will receive an estimated present value of **$20.4 billion** in added state revenue over the course of the students' working lives. Iowa will also benefit from an estimated **$868.4 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 Iowa's regent universities, an average of **$4.50** in benefits will accrue to Iowa over the course of the students' careers.

Acknowledgments

Emsi gratefully acknowledges the excellent support of the staff at the Board of Regents, State of Iowa in making this study possible. Special thanks go to the individual research teams at the universities for their time and effort collecting 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 three universities comprising Iowa's regent universities have grown to serve a fall enrollment of 80,066 students in 2017. The universities are overseen by the Board of Regents, State of Iowa. The universities' service region, for the purpose of this report, is the entire state of Iowa.

While Iowa's regent universities affect the state in a variety of ways, many of them difficult to quantify, this study is concerned with considering their economic benefits. The universities naturally help students achieve their individual potential and develop the knowledge, skills, and abilities they need to have fulfilling and prosperous careers. However, Iowa's regent universities impact Iowa beyond influencing the lives of students. The universities' program offerings supply employers with workers to make their businesses more productive. The universities, their day-to-day, construction, hospital and clinic, and research operations, along with their economic development activities and the expenditures of their visitors and students, support the state economy through the output and employment generated by state vendors. The benefits created by the universities 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.

Iowa's regent universities impact Iowa beyond influencing the lives of students.

This report assesses the impact of Iowa's regent universities as a whole on the state economy and the benefits generated by the universities for students, taxpayers, and society. The approach is twofold. We begin with an economic impact analysis of the universities on the Iowa 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 Iowa 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 universities' day-to-day operations, 2) impact of the universities' construction spending, 3) impact of University of Iowa Hospitals & Clinics, 4) impact of research spending, 5) value of extension and outreach, 6) impact of economic development, 7) impact of visitor spending, 8) value of volunteerism, 9) impact of student spending, and 10) impact of alumni who are still employed in the Iowa workforce.

The second component of the study measures the benefits generated by Iowa's regent universities for the following stakeholder groups: students, taxpayers, and society. For students, we perform an investment analysis to determine how

the money spent by students on their education performs as an investment over time. The students' investment in this case consists of their out-of-pocket expenses, the cost of interest incurred on student loans, and the opportunity cost of attending the universities 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 Iowa as a whole.

The study uses a wide array of data that are based on several sources, including the FY 2017-18 academic and financial reports from the universities; 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 Iowa's Regent Universities and the Economy

: University of Northern Iowa

THE state of Iowa is home to a well-developed network of higher education institutions, an educational ecosystem led by three regent universities: Iowa State University of Science and Technology (ISU), the University of Iowa (UI), and the University of Northern Iowa (UNI). Together, these three regent universities offer tens of thousands of students a comprehensive array of educational possibilities. They conduct hundreds of millions of dollars of research activity, with a long history of pursuing innovations that have been crucial to the development of the modern world. In addition, by developing the skills and careers of their students, they help Iowa's economy grow, benefitting not only their students but the entire state and, indeed, the entire country.


: University of Iowa

The oldest university in Iowa is UI, which was established mere weeks after the state of Iowa itself in 1847. Based in Iowa City, UI has grown from 124 students to over 35,000 (including non-credit and off-campus students). Its long history of "firsts" includes opening the first coeducational medical school in 1870, being the first university in the country to award a Master of Fine Arts degree in 1940, and, in 1970, being the first American university to officially recognize a Lesbian, Gay, Bisexual, Transgender, and Queer (LGBTQ) student organization. It is particularly noted for housing the Iowa Writers' Workshop—one of the country's finest creative writing programs—and for its world class medical center and children's hospital.

Together, the three regent universities offer tens of thousands of students a comprehensive array of educational possibilities.

Only slightly younger is ISU in Ames, which was established in 1858 and became the first U.S. land grant university in the 1860s. ISU was home to the first extension office, now a feature of universities everywhere, and its Veterinary College was the first of its kind. Today, its almost 40,000 students (including non-credit and off-campus students, but not students served through extension) make it Iowa's largest university; its broad research is especially focused on technological and engineering innovation, and it is the only university to host a Department of Energy Laboratory on campus.

Even the most recent addition to Iowa's public university landscape, UNI, has a long history in the state; it was established in 1876. UNI, which calls the city of Cedar Falls home, provides a more intimate experience to its student body, with an FY 2017-18 enrollment of more than 14,000 students (including non-credit and off-campus students). Its 90+ programs provide students a full suite of academic choices for undergraduate and graduate work, with advanced degrees that include doctorates in education and industrial technology.

Iowa's regent universities' employee and finance data

The study uses two general types of information: 1) data collected from the universities and 2) state economic data obtained from various public sources and Emsi's proprietary data modeling tools.[5] This chapter presents the basic underlying information from the universities used in this analysis and provides an overview of the Iowa economy.

Employee data

Data provided by the universities include information on faculty and staff by place of work and by place of residence. These data appear in Table 1.1. As shown, the universities employed 25,965 full-time and 9,278 part-time faculty and staff in FY 2017-18 (including student workers and hospital and clinic employees). Of these, all 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.

Revenues

Figure 1.1 shows the universities' annual revenues by funding source (including hospital and clinic revenues)—a total of $5.7 billion in FY 2017-18. As indicated, tuition and fees comprised 15% of total revenue, and revenues from local, state, and federal government sources comprised another 21%. Gifts, grants and contracts made up another 4%. Sales and services of auxiliary enterprises comprised 9%, the sales and services of hospitals made up 36%, and the sales and services of education activities made up another 1%. The remaining 13% stemmed from other revenue sources. These data are critical in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

Expenditures

Figure 1.2 displays the universities' expense data (including hospital and clinic expenditures). The combined payroll at the universities, including student salaries and wages, amounted to $2.9 billion. This was equal to 54% of the universities' total expenses for FY 2017-18. Other expenditures, including operation and maintenance of plant, construction, depreciation, and purchases of

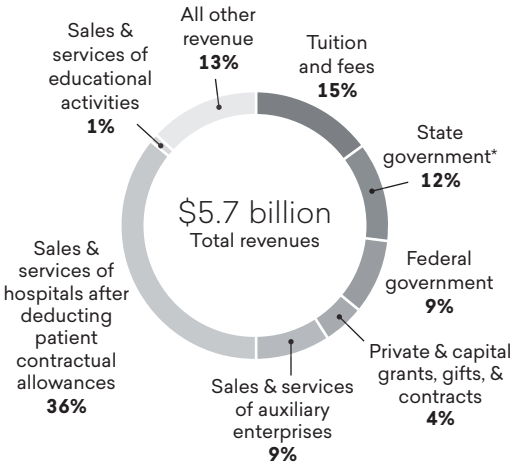
5 See Appendix 6 for a detailed description of the data sources used in the Emsi modeling tools.

TABLE 1.1: EMPLOYEE DATA, FY 2017-18

Full-time faculty and staff	25,965
Part-time faculty and staff	9,278
Total faculty and staff	**35,243**
% of employees who work in the state	100%
% of employees who live in the state	100%

Source: Data provided by Iowa's regent universities.

FIGURE 1.1: IOWA'S REGENT UNIVERSITIES' REVENUES BY SOURCE, FY 2017-18

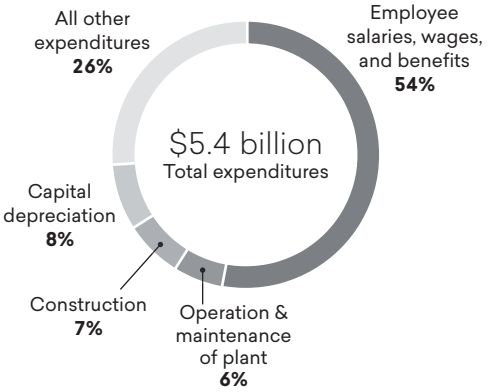


* Revenue from state government includes capital appropriations.

Percentages may not add due to rounding.

Source: Data provided by Iowa's regent universities.

FIGURE 1.2: IOWA'S REGENT UNIVERSITIES' EXPENSES BY FUNCTION, FY 2017-8



Percentages may not add due to rounding.

Source: Data provided by Iowa's regent universities.

supplies and services, made up $2.5 billion. When we calculate the impact of these expenditures in Chapter 2, we exclude expenses for depreciation and interest, as they represent a devaluing of the universities' assets rather than an outflow of expenditures.

Students

The universities reported a fall enrollment of 80,066 students in 2017. For the purpose of this analysis we consider the unduplicated annual FY 2017-18 student headcount. Iowa's regent universities served almost 90,000 students in FY 2017-18. The breakdown of the student body by gender was 51% male and 49% female. The breakdown by ethnicity was 74% white, 22% minority, and 4% unknown. The students' overall average age was 22 years old.[6] An estimated 55% of students remain in Iowa after finishing their time at the universities and the remaining 45% settle outside the state.[7]

Table 1.2 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In FY 2017-18, the universities served 632 professional graduates, 813 doctoral graduates, 2,628 master's degree graduates, 13,187 bachelor's degree graduates, and 146 certificate graduates. Another 68,885 students enrolled in courses for credit but did not complete a degree during the reporting year. The universities offered dual credit courses to high schools, serving a total of 838 students over the course of the year. The universities also served 234 basic education students enrolled in non-credit courses. Non-degree seeking students enrolled in workforce or professional development programs accounted for 435 students. Students not allocated to the other categories comprised the remaining 1,697 students.

Non-credit students, or students enrolled but not attempting to achieve a degree, play an important part at the universities and in the state economy. The universities feature extensive offerings to meet workforce and community needs through non-credit courses. Below is a description of the most sought non-credit courses offered at each of the universities.

ISU's 4-H Youth Development makes up more than half the total non-credit course registrations at ISU, with almost 300,000 registrations in FY 2017-18. Ag & Natural Resources and Human Sciences came in second and third, with close to 100,000 registrations each. The fourth and fifth places were taken by Multi/Interdisciplinary Studies (26,000 registrations) and Community & Economic Development (11,000 registrations).

UI's Health Professions & Related Clinical Services had the most course registrations at the university, with almost 100,000 registrations, making up almost

6 Unduplicated headcount, gender, ethnicity, and age data provided by Iowa's regent universities.

7 Settlement data provided by Iowa's regent universities.

half of the total non-credit course registrations in FY 2017-18. Health-Related Knowledge & Skills and Interpersonal & Social Skills came in second and third, with almost 20,000 registrations each. The fourth and fifth place non-credit courses with the most course registrations went to Education and Business, Management, Marketing, & Related Services, with around 10,000 course registrations each.

UNI's Physical Science had the most registrations at the university, making up more than a quarter of the total with over 3,500 registrations in FY 2017-18. Family & Consumer Sciences/Human Sciences and Education took the second and third places, with over 2,000 registrations each. Visual & Performing Arts had almost 1,700 registrations and Ag & Natural Sciences had 865 registrations.

We use credit hour equivalents (CHEs) to track the educational workload of the students. One CHE is equal to 15 contact hours of classroom instruction per semester. The average number of CHEs per student was 23.5.

TABLE 1.2: BREAKDOWN OF STUDENT HEADCOUNT AND CHE PRODUCTION BY EDUCATION LEVEL, FY 2017-18

Category	Headcount	Total CHEs	Average CHEs
Doctoral program graduates	632	25,427	40.2
PhD graduates	813	4,671	5.7
Master's degree graduates	2,628	38,450	14.6
Bachelor's degree graduates	13,187	305,745	23.2
Certificate graduates	146	1,654	11.3
Continuing students	68,885	1,713,366	24.9
Dual credit students	838	2,934	3.5
Basic education students	234	2,889	12.3
Workforce/professional development students	435	1,636	3.8
All other students	1,697	10,010	5.9
Total, all students	**89,495**	**2,106,782**	**23.5**

Source: Data provided by Iowa's regent universities.

The Iowa economy

Since the universities were first established, they have been serving Iowa by enhancing the workforce, providing local residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. Table 1.3 summarizes the breakdown of the state economy by major industrial sector, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the state's total income, which can also be considered as the state's gross state product (GSP).

TABLE 1.3: INCOME BY MAJOR INDUSTRY SECTOR IN IOWA, 2018*

Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)**	% of total income	Sales (millions)
Manufacturing	$17,118	$19,477	$36,595	19%	$111,576
Finance & Insurance	$10,711	$11,327	$22,038	11%	$37,827
Other Services (except Public Administration)	$2,856	$17,776	$20,631	11%	$28,965
Wholesale Trade	$5,387	$7,944	$13,332	7%	$21,795
Health Care & Social Assistance	$11,190	$1,487	$12,677	7%	$20,792
Government, Non-Education	$8,884	$2,458	$11,342	6%	$50,591
Retail Trade	$6,558	$4,409	$10,967	6%	$17,963
Construction	$6,984	$1,845	$8,829	5%	$17,123
Government, Education	$8,433	$0	$8,433	4%	$9,601
Professional & Technical Services	$5,343	$1,424	$6,767	4%	$10,178
Agriculture, Forestry, Fishing & Hunting	$4,280	$2,101	$6,381	3%	$17,747
Transportation & Warehousing	$4,618	$1,359	$5,977	3%	$12,361
Information	$1,775	$3,568	$5,343	3%	$8,792
Real Estate & Rental & Leasing	$2,482	$2,110	$4,592	2%	$10,876
Accommodation & Food Services	$2,554	$1,605	$4,159	2%	$7,804
Administrative & Waste Services	$3,156	$807	$3,963	2%	$6,445
Utilities	$948	$2,921	$3,868	2%	$6,049
Management of Companies & Enterprises	$2,085	$184	$2,269	1%	$3,372
Educational Services	$1,592	$364	$1,956	1%	$2,863
Arts, Entertainment, & Recreation	$672	$409	$1,082	1%	$1,835
Mining, Quarrying, & Oil and Gas Extraction	$245	$372	$617	<1%	$1,072
Total	**$107,870**	**$83,945**	**$191,815**	**100%**	**$405,627**

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

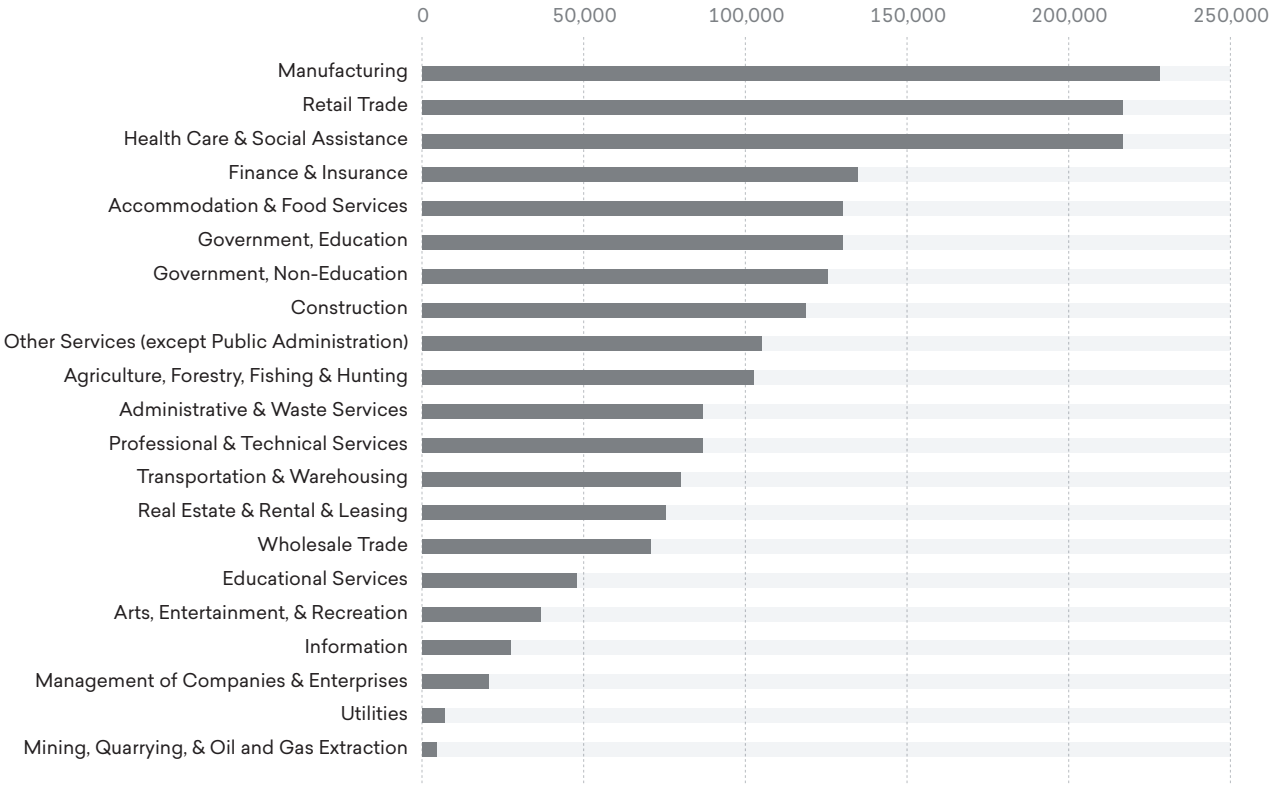
** Numbers may not add due to rounding.

Source: Emsi industry data.

As shown in Table 1.3, the total income, or GSP, of Iowa is approximately $191.8 billion, equal to the sum of labor income ($107.9 billion) and non-labor income ($83.9 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the universities on the state economy.

Figure 1.3 provides the breakdown of jobs by industry in Iowa. The Manufacturing sector is the largest employer, supporting 231,194 jobs or 11.2% of total employment in the state. The second largest employer is the Retail Trade sector, supporting 219,967 jobs or 10.6% of the state's total employment. Altogether, the state supports 2.1 million jobs.[8]

FIGURE 1.3: JOBS BY MAJOR INDUSTRY SECTOR IN IOWA, 2018*



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

8 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.

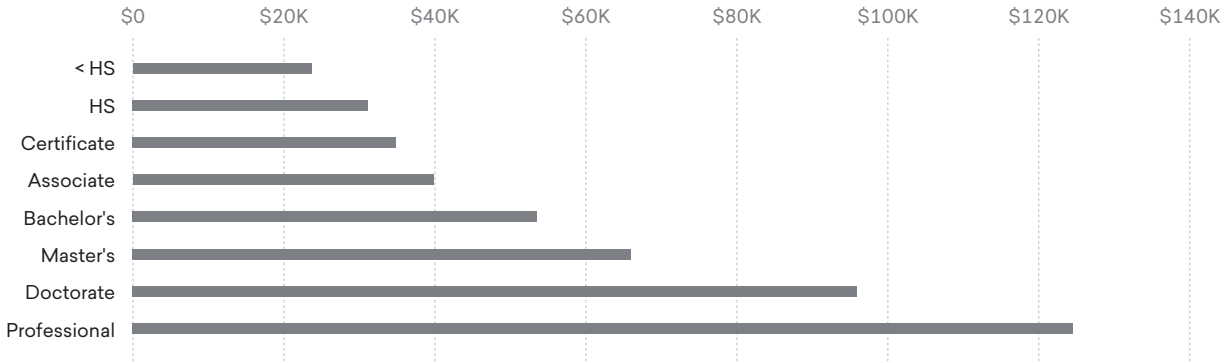
Table 1.4 and Figure 1.4 present the mean earnings by education level in Iowa at the midpoint of the average-aged worker's career. These numbers are derived from Emsi's complete employment data on average earnings per worker in the state.[9] The numbers are then weighted by the universities' demographic profiles. As shown, students have the potential to earn more as they achieve higher levels of education compared to maintaining a high school diploma. Students who earn a bachelor's degree from the universities can expect approximate wages of $54,000 per year within Iowa, approximately $22,500 more than someone with a high school diploma.

TABLE 1.4: AVERAGE EARNINGS BY EDUCATION LEVEL AT A STUDENT'S CAREER MIDPOINT

Education level	State earnings	Difference from next lowest degree
Less than high school	$23,400	n/a
High school or equivalent	$31,500	$8,100
Certificate	$35,400	$3,900
Associate degree	$39,900	$4,500
Bachelor's degree	$54,000	$14,100
Master's degree	$67,100	$13,100
Doctoral degree	$96,200	$29,100
Professional degree	$125,700	$29,500

Source: Emsi employment data.

FIGURE 1.4: AVERAGE EARNINGS BY EDUCATION LEVEL AT A STUDENT'S CAREER MIDPOINT



Source: Emsi employment data.

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

CHAPTER 2:

Economic Impacts on the Iowa Economy

Iowa's regent universities impact the Iowa economy in a variety of ways. The universities are employers and buyers of goods and services. They attract monies that otherwise would not have entered the state economy through their day-to-day, construction, hospital and clinic, and research operations, along with their economic development activities and the expenditures of their visitors and students. Further, they provide students with the knowledge, skills, and abilities they need to become productive citizens and add to the overall output of the state.

📷: Iowa State University of Science & Technology

IN this chapter, we estimate the following economic impacts of Iowa's regent universities: 1) the operations spending impact, 2) the construction spending impact, 3) the university hospital & clinic spending impact, 4) the research spending impact, 5) the value of extension and outreach, 6) the economic development impact, 7) the visitor spending impact, 8) value of volunteerism, 9) the student spending impact, and 10) 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 Iowa if Iowa's regent universities and all their alumni did not exist in FY 2017-18?

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 universities; 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 universities. Note that while we present the value of extension, outreach, and volunteer activities, given the nature of these activities we are not able to measure an impact in terms of this strict definition.

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. Jobs are calculated using industry-specific sales to jobs ratios. Given that each type of impact, such as operations spending, construction spending, and research spending, affects different types of industries and each industry has different jobs to sales ratios, or average earnings per worker, the jobs supported will be unique for each type of impact. For example, visitor spending will affect more Accommodation & Food Services industries, which can support one job with fewer sales than the Health Care & Social Assistance industries affected by university hospitals and clinics. 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.[10] 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:
    - 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.

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 universities.*

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

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

Multiplier effects in this analysis are derived using Emsi's 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 6.

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 universities themselves purchase supplies and services, and many of their vendors are located in Iowa. These expenditures create a ripple effect that generates still more jobs and higher wages throughout the economy.


Ⓒ: Iowa State University of Science & Technology

Table 2.1 presents the universities' expenditures (not including construction, hospital, clinic, and research 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 universities' assets rather than an outflow of expenditures.[11] The first step in estimating the multiplier effects of the universities' 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 the universities' 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. All of the university employees work in Iowa (see Table 1.1), and therefore we consider 100% of the salaries, wages, and benefits. For the other two expenditure categories (i.e., operation and maintenance of plant and all other expenditures), we assume the universities' spending patterns approximately match national averages and apply the national spending coefficients for NAICS 611310 (Colleges, Universities, and Professional Schools).[12] Operation and maintenance of plant

TABLE 2.1: IOWA'S REGENT UNIVERSITIES' EXPENSES BY FUNCTION (EXCLUDING DEPRECIATION & INTEREST), FY 2017-18

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Employee salaries, wages, and benefits*	$1,745,848	$0	$1,745,848
Operation and maintenance of plant	$194,543	$111,699	$306,242
All other expenditures	$93,589	$104,885	$198,474
Total	**$2,033,980**	**$216,584**	**$2,250,564**

This table does not include expenditures for construction, hospital, clinic, or research activities, as these are presented separately in the following sections.

* Includes royalty payments to inventors related to the universities that still live in Iowa.

Source: Data provided by Iowa's regent universities and the Emsi impact model.

11 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.

12 See Appendix 3 for a definition of NAICS.

expenditures are mapped to the industries that relate to capital construction, maintenance, and support, while the universities' remaining expenditures are mapped to the remaining industries.

We now have three vectors of expenditures for Iowa's regent universities: one for salaries, wages, and benefits; another for operation and maintenance of plant; and a third for the universities' 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.[13] 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 universities. 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 the universities' operations spending. The people employed by the universities and their salaries,[14] wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The

TABLE 2.2: OPERATIONS SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$1,745,848**	**$0**	**$1,745,848**	**$2,250,564**	**19,863**
Multiplier effect					
Direct effect	$80,759	$82,389	$163,147	$288,132	1,682
Indirect effect	$19,839	$16,503	$36,342	$71,367	465
Induced effect	$388,390	$434,656	$823,046	$1,366,601	9,585
Total multiplier effect	**$488,987**	**$533,548**	**$1,022,536**	**$1,726,100**	**11,732**
Gross impact (initial + multiplier)	**$2,234,835**	**$533,548**	**$2,768,384**	**$3,976,664**	**31,595**
Less alternative uses of funds	-$390,824	-$441,144	-$831,967	-$1,375,305	-9,819
Net impact	**$1,844,012**	**$92,404**	**$1,936,416**	**$2,601,359**	**21,776**

Source: Emsi impact model.

13 See Appendix 6 for a description of Emsi's MR-SAM model.

14 Note: royalties paid to faculty and scientific researchers are included in the salaries reported with the operations spending impact.

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 $2.2 billion in labor income and $533.5 million in non-labor income. This sums to a total impact of $2.8 billion in total added income associated with the spending of the universities and their employees in the state. This is equivalent to supporting 31,595 jobs.

The $2.8 billion in gross impact is often reported by researchers as the total impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event—in this case, the expenditure of in-state funds on Iowa's regent universities—had not occurred. Iowa's regent universities received an estimated 64% of their funding from sources within Iowa. These monies came from the tuition and fees paid by resident students, from the auxiliary revenue and donations from private sources located within the state, from state taxes, and from the financial aid issued to students by state government. We must account for the opportunity cost of this in-state funding. Had other industries received these monies rather than the universities, 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.

The total net impact of the universities' operations is **$1.9 billion** *in total added income, which is equivalent to supporting* **21,776 jobs**.

We estimate this counterfactual by simulating a scenario where in-state monies spent on the universities 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 Iowa's regent universities, 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 alternative uses of funds not only includes the alternative use of money, but also the alternative impact that could have been created if the universities did not exist.

The total net impact of the universities' operations is equal to the gross impact less the impact of the alternative use of funds—the opportunity cost of the state money. As shown in the last row of Table 2.2, the total net impact is approximately $1.8 billion in labor income and $92.4 million in non-labor income. This sums together to $1.9 billion in total added income and is equivalent to supporting 21,776 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of Iowa's regent universities.

Construction spending impact

In this section, we estimate the economic impact of the universities' construction spending. Because construction funding is separate from operations funding in the budgeting process, it is not captured in the operations spending impact estimated earlier. However, like operations spending, the construction spending creates subsequent rounds of spending and multiplier effects that generate still more jobs and income throughout the state. During FY 2017-18, the universities spent a total of $373.6 million on various construction projects.

During FY 2017-18, the universities spent a total of **$373.6 million** *on various construction projects.*

The universities use local contractors and suppliers when available and estimate that 95% of their spending occurs within the state. To estimate the multiplier effects, we assume the universities' construction spending approximately matches national construction spending patterns of NAICS 611310 (Colleges, Universities, and Professional Schools). We then map construction spending to the construction industries of the MR-SAM model. Next, we use the RPCs of the industries to estimate the portion of their spending that occurs in-state. Finally, the in-state spending is run through the multiplier matrix to estimate the direct, indirect, and induced effects. Because construction is so labor intensive, the non-labor income impact is relatively small.

To account for the opportunity cost of any in-state construction money, we estimate the impacts of a similar alternative uses of funds as found in the operations spending impact. This is done by simulating a scenario where in-state

monies spent on construction are instead spent on consumer goods.[15] These impacts are then subtracted from the gross construction spending impacts. Again, since construction is so labor intensive, most of the added income stems from labor income as opposed to non-labor income. As a result, the non-labor impacts associated with spending in the non-construction sectors are larger than in the construction sectors, so the net non-labor impact of construction spending is negative. This means that had the construction money instead been spent on consumer goods, more non-labor income would have been created at the expense of less labor income. The total net impact is still positive and substantial.

Table 2.3 presents the impacts of the universities' construction spending during FY 2017-18. Note the initial effect is purely a sales effect, so there is no initial change in labor or non-labor income. The FY 2017-18 construction spending creates a net total impact of $132.7 million in added income—the equivalent of supporting 2,025 jobs in Iowa.

TABLE 2.3: CONSTRUCTION SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$354,874**	**0**
Multiplier effect					
Direct effect	$112,723	$29,794	$142,517	$276,393	1,994
Indirect effect	$26,298	$6,949	$33,247	$64,477	463
Induced effect	$45,779	$12,098	$57,877	$112,246	809
Total multiplier effect	**$184,799**	**$48,841**	**$233,640**	**$453,117**	**3,267**
Gross impact (initial + multiplier)	**$184,799**	**$48,841**	**$233,640**	**$807,991**	**3,267**
Less alternative uses of funds	-$47,659	-$53,327	-$100,986	-$168,325	-1,242
Net impact	**$137,140**	**-$4,486**	**$132,654**	**$639,666**	**2,025**

Source: Emsi impact model.

15 In other words, if the universities did not exist, the in-state money spent on construction would have either stayed in private donors, state taxpayers, or in-state students' (revenue for construction received in the form of tuition) hands.

University hospital & clinic spending impact

In this section, we estimate the economic impact of the spending of the University of Iowa Hospitals & Clinics (UIHC). Note that the broader health-related impacts of health care provided through these hospitals and clinics are beyond the scope of this analysis and are not included.

In FY 2017-18, $1.5 billion was spent on UIHC operations, including the Iowa River Landing, University of Iowa Stead Family Children's Hospital, and pharmacy locations. To avoid any double counting, this spending was not included in the operations spending impacts previously reported. Any medical research expenses from the hospitals and clinics are accounted for in the research spending impact and are not included here. Similar to the operations spending impact, we exclude expenses for depreciation and interest.

TABLE 2.4: UIHC EXPENSES BY FUNCTION (EXCLUDING DEPRECIATION & INTEREST), FY 2017-18

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Salaries, wages and benefits	$745,931	$0	$745,931
All other expenses	$485,383	$274,733	$760,116
Total	**$1,231,314**	**$274,733**	**$1,506,047**

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

UI's College of Public Health supports healthier businesses and communities

The College of Public Health's Business Leadership Network (BLN) fosters ongoing, mutually beneficial relationships between the College of Public Health and small and medium-sized businesses and communities in Iowa. In 2018, the BLN Community Grants Program supported community public health related projects throughout Iowa. The BLN also held community forums on various public health topics in Clarinda, Oelwein, and Sioux City. The forums assembled community members such as leaders in business, economic development, school systems, public health and health care providers to meet with faculty and staff from the College.

Meanwhile, the Healthier Workforce Center of the Midwest is one of six Total Worker Health Centers of Excellence funded by the National Institute for Occupational Safety and Health. The Center, built upon extensive investigator experience in occupational health and safety, ergonomics, and health promotion, strives to protect and preserve worker health through knowledge generation and dissemination of evidence-based practices. Recently, the Center developed a series of short videos to assist small businesses seeking to improve worker health and well-being. Utilizing a peer-to-peer model, the videos focus on case studies from small business (less than 250 employees) that have adopted best practices and shown innovation with the goal of persuading and instructing other small businesses to implement a total worker health program.

The methodology used here is similar to that used when estimating the operations and construction spending impacts. Salaries, wages, and benefits are mapped to industries using national household expenditure coefficients. Assuming UIHC has a spending pattern similar to that of the national average of general and surgical hospitals, we map their capital and other expenses to the industries of the MR-SAM model using spending coefficients for NAICS 622110 (General Medical & Surgical Hospitals). Next, we remove the spending that occurs outside the state, and run the in-state expenses through the multiplier matrix. Unlike the previous section, we do not estimate the impacts that would have been created with an alternative use of these funds. This is because there is not a significant alternative to spending money on health care. Table 2.5 presents the impacts of UIHC.

The payroll and number of people employed by UI comprise the initial effect. The total impacts of UIHC expenses (the sum of the initial and multiplier effects) are $1.2 billion in labor income and $340.4 million in non-labor income. This totals to $1.5 billion in total added income and is equivalent to supporting 21,276 jobs.

TABLE 2.5: UIHC SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$745,931**	**$0**	**$745,931**	**$1,506,047**	**10,343**
Multiplier effect					
Direct effect	$174,803	$92,189	$266,992	$485,383	3,951
Indirect effect	$49,188	$31,254	$80,443	$160,094	1,069
Induced effect	$238,851	$216,930	$455,781	$774,494	5,912
Total multiplier effect	**$462,843**	**$340,373**	**$803,216**	**$1,419,971**	**10,933**
Total impact (initial + multiplier)	**$1,208,774**	**$340,373**	**$1,549,147**	**$2,926,018**	**21,276**

Source: Emsi impact model.

The College of Dentistry serves Iowa one bicuspid at a time

The College of Dentistry provides continuing education so dentists can remain licensed, supporting Iowa's entire dental industry. The College is the largest provider of continuing education (CE) as far as the number of CE instructors in the state. But just as importantly, it ensures underserved demographics have access to dental care. Pediatric dentists are active in care to the underserved, with about 90% of pediatric dentists accepting Medicaid and comprising around 30% of practices in Iowa. The College is the largest provider of care to Medicaid eligible citizens.

The College also supports a team that provides care across the state for children with cleft lip, cleft palate, and other craniofacial anomalies. Over the past few years, the orthodontics program has finished in the top four in a patient/case competition of over 50 programs nationally. The College also has the leading Geriatrics program in the country and is one of six schools delivering definitive care in nursing homes and offering an advanced program in Geriatrics.

With nearly 80% of State of Iowa's dentists as alumni, UI-trained dentists deliver an estimated $800 million in dental care year after year to Iowans. At the College itself, UI students, residents, and faculty see 160,000 patient visits per year, totaling to over $20 million per year, with over 90% of those patients coming from all across Iowa.

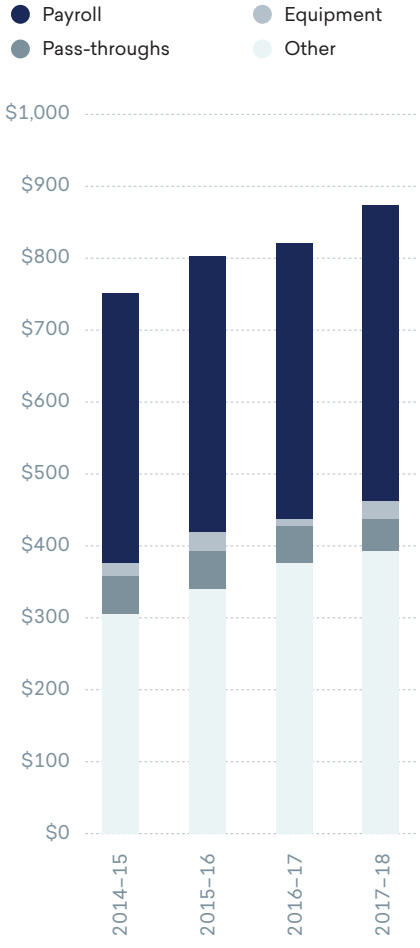
Research spending impact

Similar to the day-to-day operations of the universities, research activities impact the economy by employing people and requiring the purchase of equipment and other supplies and services. Figure 2.1 shows the universities' research expenses by function—payroll, equipment, pass-throughs, and other—for the last four fiscal years. In FY 2017-18, the universities spent over $876.8 million on research and development activities. These expenses would not have been possible without funding from outside the state—Iowa's regent universities received around 45% of their research funding from federal and other sources.

We employ a methodology similar to the one used to estimate the impacts of operational expenses. We begin by mapping total research expenses to the industries of the MR-SAM model, removing the spending that occurs outside the state, and then running the in-state expenses through the multiplier matrix. As with the operations and construction spending impacts, we also adjust the gross impacts to account for the opportunity cost of monies withdrawn from the state economy to support the research of the universities, whether through state-sponsored research awards or through private donations. Again, we refer to this adjustment as the alternative use of funds.

Mapping the research expenses by category to the industries of the MR-SAM model—the only difference from our previous methodology—requires some exposition. We asked the universities to provide information on expenditures by research and development field as the universities report to the National Science Foundation's Higher Education Research and Development Survey

FIGURE 2.1: RESEARCH EXPENSES BY FUNCTION (MILLIONS)



Source: Data provided by Iowa's regent universities.

(HERD).[16] We map these fields of study to their respective industries in the MR-SAM model. The result is a distribution of research expenses to the various 1,000 industries that follows a weighted average of the fields of study reported by the universities.

Initial, direct, indirect, and induced effects of the universities' research expenses appear in Table 2.6. As with the operations spending impact, the initial effect consists of the 5,037 research jobs and their associated salaries, wages, and benefits. The universities' research expenses have a total gross impact of $687 million in labor income and $186 million in non-labor income. This sums together to $873.1 million in added income, equivalent to 11,441 jobs. Taking into account the impact of the alternative uses of funds, net research expenditure impacts of Iowa's regent universities are $619.5 million in labor income and $110.5 million in non-labor income. This sums together to $730 million in total added income and is equivalent to supporting 9,682 jobs.

TABLE 2.6: RESEARCH SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$411,505**	**$0**	**$411,505**	**$876,803**	**5,037**
Multiplier effect					
Direct effect	$109,416	$52,844	$162,260	$289,439	2,393
Indirect effect	$27,222	$12,784	$40,006	$79,594	640
Induced effect	$138,860	$120,419	$259,279	$438,094	3,371
Total multiplier effect	**$275,498**	**$186,047**	**$461,545**	**$807,127**	**6,404**
Gross impact (initial + multiplier)	**$687,003**	**$186,047**	**$873,050**	**$1,683,929**	**11,441**
Less alternative uses of funds	-$67,501	-$75,529	-$143,030	-$238,405	-1,759
Net impact	**$619,502**	**$110,518**	**$730,021**	**$1,445,524**	**9,682**

Source: Emsi impact model.

Research and innovation play an important role in driving the Iowa economy. Some indicators of innovation are the number of invention disclosures, patent applications, and licenses and options executed. Over the last four years, the universities received 1,126 invention disclosures, filed 460 new U.S. patent applications, and produced 527 licenses (see Table 2.4). Without the research activities of the universities, this level of innovation and sustained economic growth would not have been possible.

16 The fields include environmental sciences, life sciences, math and computer sciences, physical sciences, psychology, social sciences, sciences not elsewhere classified, engineering, and all non-science and engineering fields.

TABLE 2.7: THE UNIVERSITIES' INVENTION DISCLOSURES, PATENT APPLICATIONS, LICENSES, AND LICENSE INCOME

Fiscal Year	Invention disclosures received	Patent applications filed	Licenses and options executed	Adjusted gross license income
2017-18	299	91	104	$6,145,762
2016-17	234	109	147	$5,727,240
2015-16	305	132	126	$5,273,716
2014-15	288	128	150	$4,729,179
Total	**1,126**	**460**	**527**	**$21,875,897**

Source: Data provided by Iowa's regent universities.

Value of extension and outreach

The extension and outreach activities of the universities strengthen communities and their local economies by enhancing leadership structures, broadening engagement, teaching best practices, and providing hands-on assistance. Communities are empowered to shape their own futures through research, education, community engagement, economic development, and community planning and design. Over the years, the extension and outreach offices and programs have helped more than 13,000 companies and organizations across the state. The universities have also helped tens of thousands of Iowa farmers to increase yields and maximize profits. Below are just a few examples of how the extension and outreach offices and programs are helping strengthen the Iowa economy and support the community.

UNI creates Small Business Opportunity Toolbox for urban neighborhoods

SMALL BUSINESS TOOLBOX

Small business owners in urban areas often feel isolated from local economic development efforts. While vital to local economies, these businesses may be unknown or have schedules that do not allow them to access assistance or participate in many traditional networking opportunities that could be beneficial to their operations. Issues, challenges, and opportunities facing these businesses often go unaddressed or owners fail to access support that may be readily available.

UNI's Institute for Decision Making and Center for Business Growth and Innovation (CBGI) developed the Small Business Opportunity Toolbox (SBOX) to assist community and economic developers in retention and expansion programming. Two-person teams of volunteers, community leaders, and economic development professionals conduct 10 to 15-minute visits with business owners. Teams thank each owner for their contributions to the local economy, e.g. jobs and tax base, and help the owner complete a questionnaire related to the area business climate, business challenges, employment trends, need for business training, and interest in one-on-one counseling.

The SBOX program was rolled out in North Waterloo with assistance from the City of Waterloo, ReNew Waterloo, and the Cedar Valley Alliance and Chamber. A core response team, together with UNI Entrepreneurship students and local neighborhood volunteers, made 112 visits to local businesses, reaching 57 business owners. Fourteen businesses are moving forward with one-on-one counseling, and the core response team immediately met to identify and connect the appropriate service provider to each business as well as to develop plans to address the common needs of the businesses in North Waterloo.

Paint training program supports military safety and readiness

PAINTER TRAINING

Corrosion damage to military vehicles costs the Department of Defense (DoD) between $10 billion to $20 billion each year. If not treated properly, this damage can affect the readiness and safety of our military who use these vehicles in combat.

One of the most effective ways of addressing this problem is by properly training coating applicators who must learn to apply a carefully prepared coating that prevents and controls corrosion. UNI has played a leading role in preparing military coating applicators who help keep our military safe and ready in the field.

The Iowa Waste Reduction Center (IWRC) at UNI has established Spray Technique Analysis and Research for Defense (STAR4D) as the premier comprehensive coating applicator training program in the U.S. for the DoD and its contractors. Trainees, supervisors, and instructors, as well as DoD members throughout all ranks, promote STAR4D training as integral to the continued success of coatings facilities across the country for improving applicator skills, decreasing hazardous emissions, and reducing corrosion, thus saving millions of dollars.

Today, over 3,300 DoD and contract employees from all branches of service have been certified by STAR4D. Training is conducted either at the 16,000 square foot STAR4D training facility, located in the Cedar Falls Industrial Park, or at one of six satellite sites strategically located at military facilities across the country.

Dental healthcare: improving well-being

DENTAL HEALTHCARE

Public-spirited values are at the core of UI's College of Dentistry. Each year, future dental leaders help bridge the gap between access and need when it comes to Iowans' dental health. The Iowa Mission of Mercy (IMOM) dental clinic is overseen by the Iowa Dental Association and co-sponsored by UI annually. The clinic rotates across the state in order to provide access to many Iowans. Each two-day clinic, whether in Dubuque, Waterloo, Sioux City, Cedar Rapids, or Council Bluffs, has UI volunteers donating their time and expertise. This collaborative effort allows for more patients to be served and specialized procedures to be offered. Free dental care, ranging from cleanings to oral surgeries, is provided to Iowans. The access to free dental care is particularly important to the many patients that are from low-income families, are immigrants, or Amish. Many patients are in serious pain and require treatment that they would not be able to afford without the clinic.

Teams of volunteers comprised of UI faculty, students, and alumni provide free dental services as dentists, hygienists, and students servicing those in need of oral health check-ups and delayed services. Since 2008, less than 15,000 patients from all areas throughout the state have received free dental care from Iowa Mission of Mercy, amounting to over $10 million. The impact is beyond monetary and economic; oral health is a critical part of a person's overall well-being, dental health serves as an indicator of other health diagnostics, the impact is cross-generational.

The exchange is mutually invaluable to the students of the UI College of Dentistry as it allows for applied learning with outreach being a significant part of future dentist leadership as they continue to remove barriers by providing care to those who need it most.

Initiative for sustainable communities: eastern Iowa's Lake Delhi

SUSTAINABLE COMMUNITIES

Preserving water quality and providing adequate water treatment are environmental goods that benefit all Iowans. The economy as well as residents' health depend on preserving water systems, such as the ones on the Maquoketa River and Lake Delhi dam. Eastern Iowa, in particular, is facing the aftermath effects from floods, and it has been through resilient partnerships with UI professors, staff, and students that constructive measures are being made to improve wastewater treatment. Student civil and environmental engineers and expert faculty eagerly immersed themselves in the opportunity to solve a looming environmental problem for a common good.

SUSTAINABLE COMMUNITIES (cont.)

Faced with complicated state regulations and strict civil codes, UI works to keep the best interest of the affected communities in mind. UI wants the community to be as involved as possible because decisions will directly affect residents. Engineers and collaborators presented the community with three different plans, each at different price points. Lake Delhi residents have until 2020 to upgrade its wastewater system. Throughout the process, UI students are applying expertise and knowledge-based problem solving to an ecological problem that will have positive implications for the entire state.

Iowa 4-H prepares youth for a successful future

IOWA 4-H

Iowa 4-H is the premiere youth development program of ISU Extension and Outreach and it reaches nearly 100,000 K-12 youth each year. There are more than 34,000 Iowa youth participants in 4-H STEM programs. The Iowa Governor's STEM Advisory Council notes that Iowa's economic growth depends on workers who are skilled in science, technology, engineering, and math. Overall, 4-H Youth Development connects with almost one in five Iowa K-12 students to improve their college and career readiness, provide them with community service opportunities, and prepare them as future young professionals in Iowa. In turn, all Iowans benefit when young people are prepared for college and careers and are ready to become Iowa's future workforce and successful, contributing members of society.

Strengthening through educational opportunities

IOWA WORKFORCE

Human sciences specialists at ISU teach ServSafe® food safety certification, an internationally recognized program from the National Restaurant Association Educational Foundation. Last year, more than 2,000 Iowans participated in these classes, with 86% successfully earning the Certified Food Protection Manager credential.

In FY 2017-18, more than 32,000 early childhood care and education professionals participated in more than 160,000 hours of educational programming. In post-training evaluations, 96% of participants reported or demonstrated new knowledge, skills, or program improvements.

During the 2018 tax season, ISU Extension and Outreach worked with community partners to recruit and train 55 volunteers to provide free tax preparation services to families through the Volunteer Income Tax Assistance (VITA) program. These VITA volunteers helped 1,369 Iowans in the 12 participating counties complete their 2017 income tax returns. As a result, 396 filers qualified for the Earned Income Tax Credit and received a total of $667,044, bolstering family incomes.

Each year, more than 200 municipal professionals participate in the Iowa Municipal Professional Institute, which provides educational credit toward certification by the International Institute of Municipal Clerks and the Iowa Municipal Finance Officers Association.

ISU Extension and Outreach annually trains representatives from about 600 businesses and their 2,400 employees in the commercial manure applicator program. Each year, these businesses handle and apply about 1.5 million tons of solid manure and 3 billion gallons of liquid/slurry manure that has a fertilizer value of about $250 million, while undertaking about $70 million of business. More than 70% of commercial applicators reported this information was useful to their business.

The Pesticide Safety Education Program (PSEP) provides recertification programs throughout Iowa and, in FY 2017-18, trained 10,934 commercial/noncommercial/public pesticide applicators and 14,468 private pesticide applicators through Continuing Instruction Course (CIC) programs. The certification focuses on safe and effective application of pesticides to lessen crop loss.

Influencing tens of millions of animals

SWINE VENTILATION TRAINING

ISU swine extension specialists partnered with the Iowa Pork Producers Association and other allied industry partners to develop and deliver hands-on ventilation training and education to pork producers throughout the state. A portable trailer demonstrating state-of-the-art technology was used to deliver seven training workshops. The number of animals influenced by those attending the workshop was over 63 million pigs and over 1.2 million sows. A total of 171 individual producers participated in the workshops. Participants estimated an average value of $4,341 per participant from the program.

Overall, extension and outreach has proven to be very valuable to the Iowa economy, specifically to state businesses. Beyond the impact from growth in employees of the companies supported, the impact from these activities is very difficult to accurately quantify through traditional economic impact measures. The financial activities of the offices, however, are included in the operations spending impact and the growth in employees of the companies is captured in the economic development impact below. Even though a complete impact cannot be calculated from these activities, the significant role the extension and outreach offices play in business success across the state should not be overlooked.

📷: Iowa State University of Science & Technology

Economic development impact

: University of Northern Iowa

The universities create an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of start-up and spin-off companies related to the universities that have been created and the growth of companies that have been supported by the universities. This section presents the economic impact of companies that would not have existed in the state but for the presence of the universities. In addition, the impact from the growth of companies that have been supported by the universities is captured. To estimate these impacts, we categorize companies according to the following types:

- **Start-up companies**: Companies created specifically to license and commercialize technology or knowledge of the universities.
- **Spin-off companies**: Companies created, fostered, and supported through programs offered by the universities that support entrepreneurial business development, or companies that were created by faculty, students, or alumni as a result of their experience at the universities.

We limit the scope of this impact to start-up and spin-off companies originating in the last five years. We also vary our methodology from the previous sections. Ideally, we would use detailed financial information for all start-up and spin-off companies to estimate their impacts. However, collecting that information would call into question the reliability of the data. As an alternative, we use the number of employees of each start-up and spin-off company that was collected and reported by the universities.

The universities create an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of start-up and spin-off companies related to the universities that have been created in the state in the last five years alone.

Table 2.8 presents the number of employees for start-up and spin-off companies related to the universities that were created in the past five years and active in Iowa during the analysis year.[17] Companies that benefited from the universities' Small Business Development Centers (SBDCs) are included under the count of spin-off companies. In addition, Advance Iowa, a UNI-based consulting program, and ISU's Center for Industrial Research and Service (CIRAS) have helped numerous companies with various endeavors and improvements. The support of Advance Iowa and CIRAS have helped state businesses grow, which also grows the state economy. The number of employees included in the spin-off companies is limited to just those employees that were provided jobs at the companies because of the support of the SBDC, Advance Iowa, and CIRAS.

TABLE 2.8: START-UP AND SPIN-OFF COMPANIES RELATED TO THE UNIVERSITIES THAT WERE ACTIVE IN IOWA IN FY 2017-18

	Number of companies*	Number of employees**
Start-up companies	93	468
Spin-off companies	3,275	9,489

* Number of companies reported are companies developed in the past five years and those supported by the SBDC, Advance Iowa, and CIRAS.
** The number of employees includes those hired at the start-up and spin-off companies and the growth in employees at companies supported by the SBDC, Advance Iowa, and CIRAS.
Source: Data provided by Iowa's regent universities.

First, we match each start-up and spin-off company to the closest NAICS industry. Next, we assume the companies have earnings and spending patterns—or production functions—similar to their respective industry averages. Given the number of employees reported for each company, we use industry-specific jobs-to-earnings and earnings-to-sales ratios to estimate the sales of each business. Once we have the sales estimates, we follow a similar methodology as outlined in the previous sections by running sales through the MR-SAM to generate the direct, indirect, and induced multiplier effects.

Table 2.9 presents the impact of the start-up companies. The initial effect is 468 jobs, equal to the number of employees at all start-up companies in the state (from Table 2.8). The corresponding initial effect on labor income is $39.3 million. The amount of labor income per job created by the start-up companies is much higher than in the previous sections. This is due to the higher average wages within the industries of the start-up companies. The total impacts (the sum of the initial, direct, indirect, and induced effects) are $66.9 million in added labor income and $32.8 million in non-labor income. This totals to $99.8 million in added income—or the equivalent of supporting 795 jobs.

17 When employee data was unavailable, a conservative assumption of one employee was used.

TABLE 2.9: IMPACT OF START-UP COMPANIES RELATED TO THE UNIVERSITIES, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported*
Initial effect	**$39,281**	**$20,285**	**$59,566**	**$104,438**	**468**
Multiplier effect					
Direct effect	$7,429	$2,505	$9,933	$18,742	87
Indirect effect	$1,980	$633	$2,613	$4,982	23
Induced effect	$18,251	$9,424	$27,676	$46,957	217
Total multiplier effect	**$27,660**	**$12,562**	**$40,222**	**$70,682**	**327**
Total impact (initial + multiplier)	**$66,941**	**$32,848**	**$99,789**	**$175,120**	**795**

* Number of jobs reported are representative of companies developed in the past five years.
Source: Emsi impact model.

Note that start-up companies have a strong and clearly defined link to the universities. The link between the universities and the existence of their spin-off companies, however, is less direct and is thus viewed as more subjective. Many of the spin-off companies included in this analysis were assisted through the SBDC, Advance Iowa, and CIRAS with customized, professional business advice. We include the impacts from spin-off companies in the grand total impact presented later in the report since they represent economic development activities of the universities. But we have included them separately here in case the reader would like to exclude the impacts from spin-off companies from the grand total impact.[18]

TABLE 2.10: IMPACT OF SPIN-OFF COMPANIES RELATED TO THE UNIVERSITIES, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported*
Initial effect	**$340,765**	**$209,509**	**$550,274**	**$1,131,015**	**9,489**
Multiplier effect					
Direct effect	$61,984	$34,991	$96,976	$201,950	1,120
Indirect effect	$16,443	$9,239	$25,683	$55,090	310
Induced effect	$156,867	$91,786	$248,653	$455,097	2,862
Total multiplier effect	**$235,295**	**$136,016**	**$371,311**	**$712,136**	**4,291**
Total impact (initial + multiplier)	**$576,060**	**$345,525**	**$921,585**	**$1,843,152**	**13,779**

* Number of jobs reported are representative of companies developed in the past five years.
Source: Emsi impact model.

As demonstrated in Table 2.10, the universities create exceptional environments that foster innovation and entrepreneurship. As a result, the impact of spin-off companies related to Iowa's regent universities is $576.1 million in added labor income and $345.5 million in non-labor income, totaling $921.6 million in added income—the equivalent of supporting 13,779 jobs.

18 The readers are ultimately responsible for making their own judgment on the veracity of the linkages between spin-off companies and Iowa's regent universities. At the very least, the impacts of the spin-off businesses provide important context for the broader effects of the universities.

Visitor spending impact

Hundreds of thousands of out-of-state visitors came to the universities in FY 2017-18 to participate in various activities, including commencement, sports events, and orientation. The universities estimated that 410,157 out-of-state visitors attended events hosted by the universities in FY 2017-18.[19] Table 2.11 presents the average expenditures per person-trip for accommodation, food, transportation, and other personal expenses (including shopping and entertainment). Based on these figures, the gross spending of out-of-state visitors totaled $84.7 million in FY 2017-18. However, some of this spending includes monies paid to the universities through non-textbook items (e.g., event tickets, food, etc.). These have already been accounted for in the operations impact and should thus be removed to avoid double-counting. We estimate that on-campus sales generated by out-of-state visitors totaled $14.2 million. The net sales from out-of-state visitors in FY 2017-18 thus come to $70.5 million.

Hundreds of thousands of out-of-state visitors *came to Iowa's regent universities in FY 2017-18 to participate in various activities, including commencement, sports events, and orientation.*

Calculating the increase in income as a result of visitor spending again requires use of the MR-SAM model. The analysis begins by discounting the off-campus sales generated by out-of-state visitors to account for leakage in the trade sector, and then bridging the net figures to the detailed sectors of the MR-SAM

19 See Appendix 1 for a sensitivity analysis of the number of visitors.

model. The model runs the net sales figures through the multiplier matrix to arrive at the multiplier effects. As shown in Table 2.12, the net impact of visitor spending in FY 2017-18 is $22.4 million in labor income and $15.7 million in non-labor income. This totals to $38.1 million in added income and is equivalent to supporting 1,081 jobs.

TABLE 2.11: AVERAGE PER-TRIP VISITOR COSTS AND SALES GENERATED BY OUT-OF-STATE VISITORS IN IOWA, FY 2017-18*

Accommodation	$31
Food	$82
Entertainment and shopping	$48
Transportation	$45
Total expenses per visitor	**$206**
Number of out-of-state visitors	410,157
Gross sales	$84,656,483
On-campus sales (excluding textbooks)	$14,189,502
Net off-campus sales	**$70,466,982**

* Costs have been adjusted to account for the length of stay of out-of-state visitors. Accommodation and transportation have been adjusted downward to recognize that, on average, two visitors share the costs of housing and transportation. Numbers may not add due to rounding.
Source: Sales calculations estimated by Emsi based on data provided by Iowa's regent universities.

TABLE 2.12: VISITOR SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$70,467**	**0**
Multiplier effect					
Direct effect	$13,067	$9,158	$22,225	$41,246	632
Indirect effect	$3,359	$2,411	$5,770	$10,916	164
Induced effect	$5,950	$4,132	$10,082	$18,530	285
Total multiplier effect	**$22,376**	**$15,701**	**$38,077**	**$70,691**	**1,081**
Total impact (initial + multiplier)	**$22,376**	**$15,701**	**$38,077**	**$141,158**	**1,081**

Source: Emsi impact model.

Value of volunteerism

Beyond positively impacting the state through the activities occurring at the universities, such as research, the universities also directly impact the state economy through their facilitation and support of student and employee volunteer activities. Volunteers are an important part of any society because they positively impact those less fortunate. Many non-profit organizations would not exist without the support of their volunteers. Volunteerism is often seen as a selfless act, but it can also provide personal benefits, such as decreasing the risk of depression, promoting an active mind and body, reducing stress, meeting new friends, and creating a feeling of self-fulfilment and belonging.

Many of the colleges and departments within the universities organize volunteer activities and events and encourage their students and employees to volunteer. In fact, in FY 2017-18 alone, 45,047 student and employee volunteers supported thousands of community organizations across the state. These students and employees volunteered 2.3 million hours of their time.[20]

According to Independent Sector,[21] the only national membership organization that brings together the charitable community, the average value of a volunteer hour in Iowa in FY 2017-18 is $23.41. Multiplying this by the hours that students and employees volunteered amounts to $54.2 million in value for the state and local communities. The impact of volunteerism is not quantified in this study

20 These are conservative estimates as this data is not collected systematically at the universities.

21 Value per volunteer hour per state was provided by Independent Sector, https://independentsector.org/resource/vovt_details/.

because accurately measuring the counterfactual scenarios associated with volunteerism is too difficult. For example, would some of these organizations hire employees if they no longer had university volunteers? Thus, we simply measure the gross value of employees and not the impact they have on Iowa society.

UNI works to help communities with energy conservation

University of Northern Iowa's (UNI's) Center for Energy and Environmental Education (CEEE) spent last year providing technical assistance to Iowa cities, counties, schools, teachers, farmers, businesses, elected officials, state agencies, community leaders, and citizen organizations. The assistance included educational programs, training, program implementation, and leadership in energy conservation and renewable energy, environmental conservation, and community-based agriculture. The CEEE-led Green Iowa AmeriCorps sites combined to weatherize over 600 homes, conduct over 500 education programs with over 8,000 people in attendance, implemented 350 team projects in the community, and garnered 7,250 volunteer hours.

UI provides dental care for the underserved

In each of the last six years, the University of Iowa's College of Dentistry has been awarded the Iowa Primary Care Association's "Underserved Champion Award" for its work with Iowans who need dental care. For many years, faculty and staff have regularly volunteered at the Iowa Mission of Mercy, an annual two-day community dental clinic where dental professionals and general volunteers donate their time to provide free dental care. Over 50 faculty and staff and between 100 and 150 students participate each year. The College also conducts broader outreach work and annually organizes a charity trip to provide services in Mexico.

Student spending impact

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

While there were 53,318 students attending the universities who originated from Iowa (not including dual credit high school students),[22] not all of them would have remained in the state if not for the existence of Iowa's regent universities. We apply a conservative assumption that 22% of these students would have left Iowa for other education opportunities if the universities did not exist.[23] Therefore, we recognize that the in-state spending of 11,730 students retained in the state is attributable to the universities. These students, called retained

22 For universities that were unable to provide origin data for their non-credit students, we assume that all non-credit students originated from within the state.

23 This was assumed using the fact that 22% of Iowa's high school students attend one of Iowa's regent universities. If Iowa's regent universities did not exist then these students would have left the state for other alternative education opportunities. See Appendix 2 for a sensitivity analysis of the retained student variable.

students, spent money at businesses in the state for everyday needs such as groceries, accommodation, and transportation. Of the retained students, we estimate 2,776 lived on campus while attending the universities. While these students spend money while attending the universities, we exclude most of their spending for room and board since these expenditures are already reflected in the impact of the universities' operations.

Relocated students are also accounted for in the universities' student spending impact. In fact, 23,290 students came from outside the state and lived off campus while attending the universities in FY 2017-18. Another 9,345 out-of-state students lived on campus while attending the universities. We apply the same adjustment as described above to the students who relocated and lived on campus during their time at the universities. Collectively, the off-campus expenditures of out-of-state students supported jobs and created new income in the state economy.[24]

The average costs for students appear in the first section of Table 2.13, equal to $11,408 per student. Note that this table excludes expenses for books and supplies, since many of these monies are already reflected in the operations impact discussed in the previous section. We multiply the $11,408 in annual costs by the 32,244 students who either were retained or relocated to the state because of Iowa's regent universities and lived in-state but off campus. This provides us with an estimate of their total spending. For students living on campus, we multiply the per-student cost of personal expenses, transportation,

TABLE 2.13: AVERAGE STUDENT COSTS AND TOTAL SALES GENERATED BY RELOCATED AND RETAINED STUDENTS IN IOWA, FY 2017-18

Room and board	$8,626
Personal expenses	$1,798
Transportation	$984
Total expenses per student	**$11,408**
Number of students retained	11,730
Number of students relocated	32,635
Total gross off-campus sales	**$429,056,782**
Net off-campus sales*	**$359,781,878**

* This figure is net of monies paid to relocated and retained student workers.
Source: Student costs and wages provided by Iowa's regent universities. The number of relocated and retained students who lived in the state off campus or on campus while attending is derived by Emsi from the student origin data and in-term residence data provided by Iowa's regent universities. The data is based on all students.

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

and off-campus food purchases (assumed to be equal to 25% of room and board) by the number of students who lived in the state but on campus while attending (12,121 students). Altogether, off-campus spending of relocated and retained students generated gross sales of $429.1 million. This figure, once net of the monies paid to student workers, yields net off-campus sales of $359.8 million, as shown in the bottom row of Table 2.13.

Estimating the impacts generated by the $359.8 million in student spending follows a procedure similar to that of the operations impact described above. We distribute the $359.8 million in sales to the industry sectors of the MR-SAM model, apply RPCs to reflect in-state spending, and run the net sales figures through the MR-SAM model to derive multiplier effects.

The total impact of student spending is **$232.9 million** *in total added income and is equivalent to supporting* **5,485** *jobs.*

Table 2.14 presents the results. The initial effect is purely sales-oriented and there is no change in labor or non-labor income. The impact of relocated and retained student spending thus falls entirely under the multiplier effect. The total impact of student spending is $141.6 million in labor income and $91.3 million in non-labor income. This sums together to $232.9 million in total added income and is equivalent to supporting 5,485 jobs. These values represent the direct effects created at the businesses patronized by the students, the indirect effects created by the supply chain of those businesses, and the effects of the increased spending of the household sector throughout the state economy as a result of the direct and indirect effects.

TABLE 2.14: STUDENT SPENDING IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$359,782**	**0**
Multiplier effect					
Direct effect	$83,256	$53,950	$137,205	$243,908	3,219
Indirect effect	$19,664	$12,511	$32,176	$59,355	813
Induced effect	$38,704	$24,791	$63,495	$111,172	1,453
Total multiplier effect	**$141,624**	**$91,252**	**$232,876**	**$414,435**	**5,485**
Total impact (initial + multiplier)	**$141,624**	**$91,252**	**$232,876**	**$774,216**	**5,485**

Source: Emsi impact model.

Alumni impact

In this section, we estimate the economic impacts stemming from the added labor income of alumni in combination with their employers' added non-labor income. This impact is based on the number of students who have attended the universities *throughout their history.* We then use this total number to consider the impact of those students in the single FY 2017-18. Former students who earned a degree as well as those who may not have finished their degree or did not take courses for credit are considered alumni.

The greatest economic impact of Iowa's regent universities stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in the universities' alumni.

While Iowa's regent universities create an economic impact through their operations, construction, hospital and clinic, research, economic development, visitor, and student spending, the greatest economic impact of the universities stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in the universities' alumni. While attending the universities, students gain experience, education, and the knowledge, skills, and abilities that increase their productivity and allow them to command a higher wage once they enter the workforce. But the reward of increased productivity does not stop there. Talented professionals make capital more productive too (e.g., buildings, production facilities, equipment). The employers of the universities' alumni enjoy the fruits of this increased productivity in the form of additional non-labor income

(i.e., higher profits). Simultaneously, Iowa's regent universities help meet the needs of Iowans especially in healthcare.

The methodology here differs from the previous impacts in one fundamental way. Whereas the previous spending impacts depend on an annually renewed injection of new sales into the state economy, the alumni impact is the result of years of past instruction and the associated accumulation of human capital. The initial effect of alumni is comprised of two main components. The first and largest of these is the added labor income of the universities' 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 the universities.

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;[25] 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 2017-18.

The next step is to quantify the skills and human capital that alumni acquired from the universities. We use the students' production of CHEs as a proxy for accumulated human capital. The average number of CHEs completed per student in FY 2017-18 was 23.5. To estimate the number of CHEs present in the workforce during the analysis year, we use the universities' historical student headcount over the past 30 years, from FY 1988-89 to FY 2017-18.[26] We multiply the 23.5 average CHEs per student by the headcounts that we estimate are still actively employed from each of the previous years.[27] Students who enroll at the universities more than one year are counted at least twice in the historical enrollment data. However, CHEs remain distinct regardless of when and by whom they were earned, so there is no duplication in the CHE counts. We estimate there are approximately 26.8 million CHEs from alumni active in the workforce.

Next, we estimate the value of the CHEs, or the skills and human capital acquired by the universities' alumni. This is done using the *incremental* added labor income stemming from the students' higher wages. The incremental added

25 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.

26 We apply a 30-year time horizon because the data on students who attended Iowa's regent universities prior to FY 1988-89 is less reliable, and because most of the students served more than 30 years ago had left the state workforce by FY 2017-18.

27 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.

labor income is the difference between the wage earned by the universities' alumni and the alternative wage they would have earned had they not attended the universities. Using the state incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average value per CHE to equal $199. This value represents the state average incremental increase in wages that the universities' alumni received during the analysis year for every CHE they completed.

Because workforce experience leads to increased productivity and higher wages, the value per CHE varies depending on the students' workforce experience, with the highest value applied to the CHEs of students who had been employed the longest by FY 2017-18, and the lowest value per CHE applied to students who were just entering the workforce. More information on the theory and calculations behind the value per CHE appears in Appendix 7. In determining the amount of added labor income attributable to alumni, we multiply the CHEs of former students in each year of the historical time horizon by the corresponding average value per CHE for that year, and then sum the products together. This calculation yields approximately $5.3 billion in gross labor income from increased wages received by former students in FY 2017-18 (as shown in Table 2.15).

TABLE 2.15: NUMBER OF CHES IN WORKFORCE AND INITIAL LABOR INCOME CREATED IN IOWA, FY 2017-18

Number of CHEs in workforce	26,789,567
Average value per CHE	$199
Initial labor income, gross	**$5,330,492,604**
Counterfactuals	
Percent reduction for alternative education opportunities	10%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$2,398,721,722**

Source: Emsi impact model.

The next two rows in Table 2.15 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 the universities 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 Iowa's regent universities do not exist, we assume a portion of the universities' alumni would have received a comparable education elsewhere in the state or would have left the state and received a comparable education and then returned to the state. The incremental added labor income that accrues to those students cannot

be counted towards the added labor income from the universities' alumni. The adjustment for alternative education opportunities amounts to a 10% reduction of the $5.3 billion in added labor income. This means that 10% of the added labor income from the universities' alumni would have been generated in the state anyway, even if the universities did not exist. For more information on the alternative education adjustment, see Appendix 8.

The other adjustment in Table 2.15 accounts for the importation of labor. Suppose Iowa's regent universities 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 Iowa. 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 universities did not exist.[28] 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 universities. We conduct a sensitivity analysis for this assumption in Appendix 2. With the 50% adjustment, the net added labor income added to the economy comes to $2.4 billion, as shown in Table 2.15.

The $2.4 billion in added labor income appears under the initial effect in the labor income column of Table 2.16. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of the universities 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 ($2.4 billion) to the six-digit NAICS industry sectors where students are most likely to be employed. This allocation entails a process that maps completers in the state to the detailed occupations for which those completers have been trained, and then maps the detailed occupations to the six-digit industry sectors in the MR-SAM model.[29] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics, we map the breakdown of the universities' completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from the MR-SAM model to map the occupational distribution of the $2.4 billion in initial labor income effects to the detailed industry sectors in the MR-SAM model.[30]

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

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

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

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 $1.3 billion in added non-labor income attributable to the universities' alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the Iowa economy, equal to approximately $3.7 billion. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix.

TABLE 2.16: ALUMNI IMPACT, FY 2017-18

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$2,398,722**	**$1,287,024**	**$3,685,746**	**$8,266,287**	**43,481**
Multiplier effect					
Direct effect	$361,038	$211,451	$572,489	$1,218,648	6,796
Indirect effect	$106,966	$65,053	$172,018	$372,192	2,043
Induced effect	$1,185,522	$562,936	$1,748,458	$3,462,299	21,759
Total multiplier effect	**$1,653,525**	**$839,440**	**$2,492,965**	**$5,053,139**	**30,598**
Total impact (initial + multiplier)	**$4,052,247**	**$2,126,464**	**$6,178,711**	**$13,319,426**	**74,079**

Source: Emsi impact model.

Table 2.16 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 universities' alumni. The final results are $1.7 billion in added labor income and $839.4 million in added non-labor income, for an overall total of $2.5 billion in multiplier effects. The grand total of the alumni impact is $6.2 billion in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 74,079 jobs.

Total impact of Iowa's regent universities

The total economic impact of Iowa's regent universities on Iowa can be generalized into two broad types of impacts. First, on an annual basis, the universities generate a flow of spending that has a significant impact on the Iowa economy. The impacts of this spending are captured by the operations, construction, hospital and clinic, research, economic development, visitor, and student spending impacts. While not insignificant, these impacts do not capture the true purpose of Iowa's regent universities. The basic mission of the universities is to foster human capital. Every year, a new cohort of the universities' former students adds to the stock of human capital in Iowa, and a portion of alumni continues to add to the Iowa economy. Table 2.17 displays the grand total impacts of Iowa's regent universities on the Iowa economy in FY 2017-18. For context, the percentages of the impacts compared to the total labor income, total non-labor income, combined total income, sales, and jobs in Iowa, as presented in Table 1.3 and Figure 1.3, are included. The total added value of Iowa's regent universities is **$11.8 billion**, equivalent to **6.2%** of the GSP of Iowa. By comparison, this contribution that the universities provide on their own is larger than the entire Health Care & Social Assistance industry in the state. Iowa's regent universities' total impact supported **149,980 jobs** in FY 2017-18. For perspective, this means that **one out of every 14 jobs** in Iowa is supported by the activities of the universities and their students.

Even though a $11.8 billion impact is significant, this figure does not take into account all the activities of the universities. More specifically, their extension, outreach, and volunteer activities should be recognized as adding significant value to the state of Iowa. Extension and outreach activities have helped thousands of companies with hiring, training, and other needs. University student and employee volunteers donated 2.3 million hours, amounting to $54.2 million in value being added to the economy. Even though the impact of the extension, outreach and volunteer activities are not quantitatively measured in terms of a true economic impact, they play a significant role in state and local economies and communities. In fact, we do not measure the impact from these activities not because these activities are insignificant, but because measuring the impact of these activities does not meet the Emsi standard of a robust economic impact methodology.

TABLE 2.17: TOTAL IMPACT OF IOWA'S REGENT UNIVERSITIES, FY 2017-18*

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	$1,844,012	$92,404	$1,936,416	$2,601,359	21,776
Construction spending	$137,140	-$4,486	$132,654	$639,666	2,025
Hospital and clinic spending	$1,208,774	$340,373	$1,549,147	$2,926,018	21,276
Research spending	$619,502	$110,518	$730,021	$1,445,524	9,682
Economic development	$643,001	$378,373	$1,021,374	$2,018,271	14,575
Visitor spending	$22,376	$15,701	$38,077	$141,158	1,081
Student spending	$141,624	$91,252	$232,876	$774,216	5,485
Alumni	$4,052,247	$2,126,464	$6,178,711	$13,319,426	74,079
Total impact	**$8,668,676**	**$3,150,599**	**$11,819,276**	**$23,865,639**	**149,980**
% of the Iowa economy	8.0%	3.8%	6.2%	5.9%	7.3%

* This table excludes the positive impacts of extension, outreach, and volunteer activities.
Source: Emsi impact model.

These impacts from the universities and their students stem from different industry sectors and spread throughout the state economy. Table 2.18 displays the total impact of Iowa's regent universities by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations, construction, hospital and clinic, research, economic development, visitors, students, and alumni, as shown in Table 2.17, 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 universities' spending and from where the

universities alumni are employed. For example, the universities' spending and alumni in the Health Care & Social Assistance industry sector generated an impact of $1.6 billion in FY 2017-18.

TABLE 2.18: TOTAL IMPACT OF IOWA'S REGENT UNIVERSITIES BY INDUSTRY, FY 2017-18

Industry sector	Total income (thousands)	Jobs supported
Government, Education	$2,933,924	36,924
Health Care & Social Assistance	$1,564,313	25,347
Manufacturing	$1,217,785	6,369
Finance & Insurance	$898,998	5,179
Professional & Technical Services	$852,594	11,403
Government, Non-Education	$715,379	7,602
Information	$603,412	3,513
Wholesale Trade	$349,127	1,830
Retail Trade	$318,224	6,583
Utilities	$312,135	661
Other Services (except Public Administration)	$290,237	6,448
Construction	$254,884	3,752
Administrative & Waste Services	$245,119	5,092
Accommodation & Food Services	$240,652	8,730
Real Estate & Rental & Leasing	$228,959	3,842
Educational Services	$176,366	4,330
Agriculture, Forestry, Fishing, & Hunting	$173,891	2,574
Arts, Entertainment, & Recreation	$156,336	7,159
Transportation & Warehousing	$156,085	1,387
Management of Companies & Enterprises	$127,395	1,232
Mining, Quarrying, & Oil and Gas Extraction	$3,460	24
Total impact	**$11,819,276**	**149,980**

Source: Emsi impact model.

CHAPTER 3:

Investment Analysis

The benefits generated by Iowa's regent universities affect the lives of many people. The most obvious beneficiaries are the universities' students; they give up time and money to go to the universities 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 Iowa 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.

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 Iowa's regent universities as a worthwhile investment from the perspectives of students, taxpayers, and society.

: University of Northern Iowa

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.

STUDENT COSTS

Out-of-Pocket Expenses

Opportunity Costs

STUDENT BENEFITS

Higher Earnings from Education

Calculating student costs

Student costs consist of three main items: direct outlays, opportunity costs, and future principal and interest costs incurred from student loans. Direct outlays include tuition and fees, equal to $867.6 million from Figure 1.1. Direct outlays also include the cost of books and supplies. On average, full-time students spent $961 each on books and supplies during the reporting year.[31] Multiplying this figure by the number of full-time equivalents (FTEs) produced by the universities in FY 2017-18[32] generates a total cost of $57.6 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 universities but also incur the interest cost of taking out loans. In FY 2017-18, students received a total of $489.7 million in loans to attend the universities. Students pay back these loans along with interest over the span of several years in the future. Since students pay off these loans over time, they accrue no initial cost during the analysis year. Hence, to avoid double counting, the $489.7 million in student loans is subtracted from the costs incurred by students in FY 2017-18.

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 universities 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 universities.

31 Based on the data provided by Iowa's regent universities.

32 A single FTE is equal to 30 CHEs for undergraduate students and 24 CHEs for graduate students, so there were 70,226 FTEs produced by students in FY 2017-18, equal to 2,106,782 CHEs divided by 30.

We derive the students' full earning potential by weighting the average annual earnings levels in Table 1.4 according to the education level breakdown of the student population when they first enrolled.[33] However, the earnings levels in Table 1.4 reflect what average workers earn at the midpoint of their careers, not while attending the universities. Because of this, we adjust the earnings levels to the average age of the student population (22) to better reflect their wages at their current age.[34] This calculation yields an average full earning potential of $21,189 per student.

In determining how much students earn while enrolled in postsecondary education, an important factor to consider is the time that they actually spend on postsecondary education, since this is the only time that they are required to give up a portion of their earnings. We use the students' CHE production as a proxy for time, under the assumption that the more CHEs students earn, the less time they have to work, and, consequently, the greater their foregone earnings. Overall, students attending the universities earned an average of 23.7 CHEs per student (excluding dual credit high school students), which is approximately equal to 83% of a full academic year.[35] We thus include no more than $17,496 (or 83%) 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 56% of students are employed.[36] 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 $17,496). The total value of their foregone earnings thus comes to $671.3 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 70% of what they would have earned had they chosen to work full-time rather than go to college.[37] The remaining 30% comprises the percentage of their full earning potential that they forego. Obviously this assumption varies

33 This is based on students who reported their prior level of education to Iowa's regent universities. The prior level of education data was then adjusted to exclude dual credit high school students.

34 Further discussion on this adjustment appears in Appendix 7.

35 Equal to 23.7 CHEs divided by 30 for the proportion of undergraduate students and 24 for the proportion of graduate students, the assumed number of CHEs in a full-time academic year.

36 Based on data provided by Iowa's regent universities. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

37 The 70% 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).

by person; some students forego more and others less. Since we do not know the actual jobs that students hold while attending, the 30% 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.[38] 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 $301.5 million, equal to the sum of their foregone earnings ($247.3 million) and foregone leisure time ($54.2 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 universities today. Students who take out loans are not only required to pay back the principal of the loan but to also pay back a certain amount in interest. The first step in calculating students' loan interest cost is to determine the payback time for the loans. The $489.7 million in loans was awarded to 36,364 students, averaging $13,465 per student in the analysis year. However, this figure represents only one year of loans. Because loan payback time is determined by total indebtedness, we assume that since the universities are four-year universities, students will be indebted four times that amount, or $53,861 on average. According to the U.S. Department of Education, this level of indebtedness will take 25 years to pay back under the standard repayment plan.[39]

This indebtedness calculation is used solely to estimate the loan payback period. Students will be paying back the principal amount of $489.7 million over time. After taking into consideration the time value of money, this means that students will pay off a discounted present value of $264.3 million in principal over the 25 years. In order to calculate interest, we only consider interest on the student loans awarded to students in FY 2017-18. Using the student discount rate of 4.5%[40] as our interest rate, we calculate that students will pay a total discounted present value of $220 million in interest on student loans throughout the first 25 years of their working lifetime. The stream of these

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

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

40 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 – April 2018 Baseline. https://www.cbo.gov/system/files?file=2018-06/51310-2018-04-studentloan.pdf.

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 $435.5 million, the sum of tuition and fees ($867.6 million) and books and supplies ($57.6 million), less student loans received ($489.7 million). Opportunity costs for working and non-working students amount to $904.7 million, excluding $68.1 million in offsetting residual aid that is paid directly to students.[41] Finally, we have the present value of future student loan costs, amounting to $484.3 million between principal and interest. Summing direct outlays, opportunity costs, and future student loan costs together yields a total of $1.8 billion in present value student costs.

TABLE 3.1: PRESENT VALUE OF STUDENT COSTS, FY 2017-18 (THOUSANDS)

Direct outlays in FY 2017-18	
Tuition and fees	$867,619
Less loans received	-$489,653
Books and supplies	$57,570
Total direct outlays	**$435,536**
Opportunity costs in FY 2017-18	
Earnings foregone by non-working students	$671,287
Earnings foregone by working students	$247,332
Value of leisure time foregone by working students	$54,167
Less residual aid	-$68,115
Total opportunity costs	**$904,670**
Future student loan costs (present value)	
Student loan principal	$264,262
Student loan interest	$220,044
Total present value student loan costs	**$484,306**
Total present value student costs	**$1,824,513**

Source: Based on data provided by Iowa's regent universities 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. The relationship between education and earnings is well documented and forms the basis for determining student benefits. As shown in Table 1.4, state mean earnings levels at the midpoint of the average-aged worker's career increase as people achieve higher

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

levels of education. The differences between state earnings levels define the incremental benefits of moving from one education level to the next.

A key component in determining the students' return on investment is the value of their future benefits stream; i.e., what they can expect to earn in return for the investment they make in education. We calculate the future benefits stream to the universities' FY 2017-18 students first by determining their average annual increase in earnings, equal to $449.1 million. This value represents the higher wages that accrue to students at the midpoint of their careers and is calculated based on the marginal wage increases of the CHEs that students complete while attending the universities. Using the state of Iowa earnings, the marginal wage increase per CHE is $213. For a full description of the methodology used to derive the $449.1 million, see Appendix 7.

The second step is to project the $449.1 million annual increase in earnings into the future, for as long as students remain in the workforce. We do this using the Mincer function to predict the change in earnings at each point in an individual's working career.[42] The Mincer function originated from Mincer's seminal work on human capital (1958). The function estimates earnings using an individual's years of education and post-schooling experience. While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Card (1999 and 2001) addresses a number of these criticisms using U.S. based research over the last three decades and concludes that any upward bias in the Mincer parameters is on the order of 10% or less. We use state-specific and education level-specific Mincer coefficients. To account for any upward bias, we incorporate a 10% reduction in our projected earnings, otherwise known as the ability bias.[43] With the $449.1 million representing the students' higher earnings at the midpoint of their careers, we apply scalars from the Mincer function to yield a stream of projected future benefits that gradually increase from the time students enter the workforce, peak shortly after the career midpoint, and then dampen slightly as students approach retirement at age 67. This earnings stream appears in Column 2 of Table 3.2.

As shown in Table 3.2, the $449.1 million in gross higher earnings occurs between years 16 and 17, which is the approximate midpoint of the students' future working careers given the average age of the student population and an assumed retirement age of 67. In accordance with the Mincer function, the gross higher earnings that accrue to students in the years leading up to the midpoint are less than $449.1 million and the gross higher earnings in the years after the midpoint are greater than $449.1 million.

42 Appendix 7 provides more information on the Mincer function and how it is used to predict future earnings growth.

43 A sensitivity analysis is performed around the ability bias in Appendix 2.

TABLE 3.2: PROJECTED BENEFITS AND COSTS, STUDENT PERSPECTIVE

1	2	3	4	5	6
Year	Gross higher earnings to students (millions)	% active in workforce*	Net higher earnings to students (millions)	Student costs (millions)	Net cash flow (millions)
0	$143.3	10%	$14.6	$1,340.2	-$1,325.7
1	$157.9	18%	$29.2	$31.7	-$2.5
2	$172.6	29%	$49.4	$31.7	$17.7
3	$189.4	45%	$84.5	$31.7	$52.8
4	$206.3	68%	$140.9	$31.7	$109.2
5	$224.2	96%	$215.4	$31.7	$183.7
6	$241.2	97%	$233.3	$31.7	$201.7
7	$260.3	97%	$251.3	$31.7	$219.7
8	$279.4	96%	$269.4	$31.7	$237.7
9	$298.6	97%	$288.4	$31.7	$256.8
10	$319.7	96%	$307.5	$31.7	$275.9
11	$339.0	97%	$327.7	$31.7	$296.0
12	$359.2	97%	$346.8	$31.7	$315.1
13	$380.4	96%	$365.9	$31.7	$334.2
14	$400.6	96%	$386.0	$31.7	$354.3
15	$419.8	96%	$405.1	$31.7	$373.4
16	$441.0	96%	$423.1	$31.7	$391.5
17	$460.1	96%	$442.1	$31.7	$410.5
18	$480.2	96%	$460.0	$31.7	$428.4
19	$498.2	96%	$476.9	$31.7	$445.2
20	$516.2	96%	$493.6	$31.7	$462.0
21	$533.0	95%	$508.3	$27.1	$481.2
22	$549.7	95%	$523.8	$27.1	$496.7
23	$565.4	95%	$537.2	$27.1	$510.1
24	$579.9	95%	$548.5	$27.1	$521.3
25	$593.3	94%	$559.6	$27.1	$532.5
26	$604.5	94%	$569.5	$14.1	$555.4
27	$615.6	94%	$576.3	$14.1	$562.2
28	$625.6	93%	$581.9	$14.1	$567.8
29	$632.4	93%	$587.3	$14.1	$573.2
30	$639.0	92%	$589.6	$14.1	$575.5
31	$644.4	92%	$591.6	$0.0	$591.6
32	$647.7	91%	$591.5	$0.0	$591.5
33	$648.9	91%	$589.2	$0.0	$589.2
34	$648.8	90%	$585.7	$0.0	$585.7
35	$647.6	90%	$580.1	$0.0	$580.1
36	$645.2	89%	$572.2	$0.0	$572.2
37	$640.7	88%	$564.2	$0.0	$564.2
38	$635.0	87%	$554.0	$0.0	$554.0
39	$628.1	86%	$541.6	$0.0	$541.6
40	$620.1	85%	$529.1	$0.0	$529.1
41	$610.0	84%	$514.5	$0.0	$514.5
42	$597.7	83%	$498.7	$0.0	$498.7
43	$585.4	82%	$481.8	$0.0	$481.8
44	$249.0	82%	$203.0	$0.0	$203.0
Present value			**$6,829.6**	**$1,824.7**	**$5,004.8**

Internal rate of return	Benefit-cost ratio	Payback period (no. of years)
14.4%	3.7	9.2

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

Percentages reflect aggregate values for all universities and are subject to fluctuations due to the universities' varying time horizons.

Source: Emsi impact model.

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 2017-18 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 universities 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.[44] The likelihood of leaving the workforce increases as students age, so the attrition rate is more aggressive near the end of the time horizon than in the beginning. Column 4 of Table 3.2 shows the net higher earnings to students after accounting for both the settling-in patterns and attrition.

Return on investment for students

Having estimated the students' costs and their future benefits stream, the next step is to discount the results to the present to reflect the time value of money. For the student perspective we assume a discount rate of 4.5% (see below). Because students tend to rely upon debt to pay for education—i.e. they are negative savers—their discount rate is based upon student loan interest rates.[45] In Appendix 2, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to student costs to derive the investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1, 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 4.5% discount rate from the student perspective and a 1.0% discount rate from the perspectives of taxpayers and society.

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

45 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 – April 2018 Baseline. https://www.cbo.gov/system/files?file=2018-06/51310-2018-04-studentloan.pdf.

In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately $6.8 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 2017-18 student body is rewarded for its investment in Iowa's regent universities with a capital asset valued at $6.8 billion.

The students' cost of attending the universities is shown in Column 5 of Table 3.2, equal to a present value of $1.8 billion. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 3.7 (equal to $6.8 billion in benefits divided by $1.8 billion in costs).

Another way to compare the same benefits stream and associated cost is to compute the rate of return. The rate of return indicates the interest rate that a bank would have to pay a depositor to yield an equally attractive stream of future payments.[46] Table 3.2 shows students of the universities earning average returns of 14.4% 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).

Iowa's regent universities' students see an average rate of return of ***14.4%*** *for their investment of time and money.*

Note that returns reported in this study are real returns, not nominal. When a bank promises to pay a certain rate of interest on a savings account, it employs an implicitly nominal rate. Bonds operate in a similar manner. If it turns out that the inflation rate is higher than the stated rate of return, then money is lost in real terms. In contrast, a real rate of return is on top of inflation. For example, if inflation is running at 3% and a nominal percentage of 5% is paid, then the real rate of return on the investment is only 2%. In Table 3.2, the 14.4% 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 16.6%, higher than what is reported in Table 3.2.

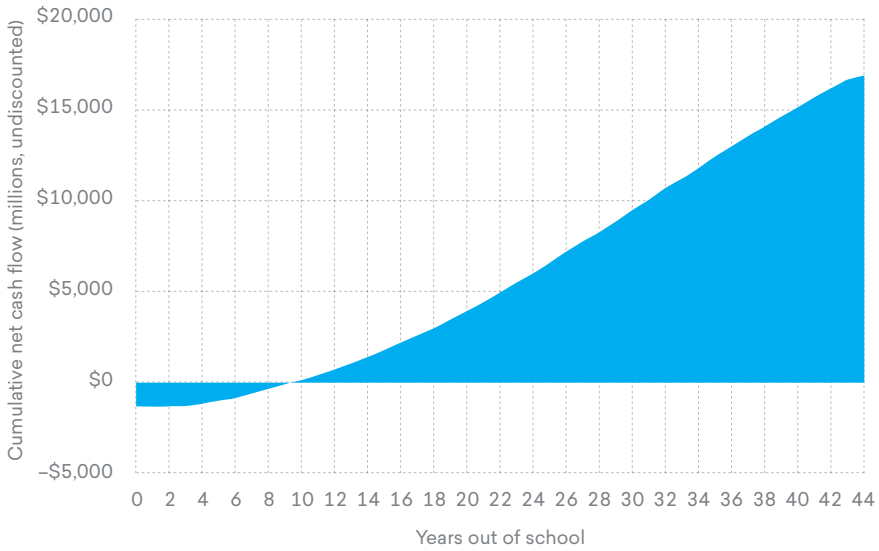
The payback period is defined as the length of time it takes to entirely recoup the initial investment.[47] Beyond that point, returns are what economists would

46 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.

47 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.

call pure costless rent. As indicated in Table 3.2, students at the universities see, on average, a payback period of 9.2 years, meaning 9.2 years after their initial investment of foregone earnings and out-of-pocket costs, they will have received enough higher future earnings to fully recover those costs (Figure 3.1).

FIGURE 3.1: STUDENT PAYBACK PERIOD



Source: Emsi impact model.

Taxpayer perspective

From the taxpayer perspective, the pivotal step here is to hone in on 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. In addition, in order to focus on the taxpayer costs and benefits that are more directly related to the universities, UIHC operational costs and benefits were removed from the taxpayer perspective.

TAXPAYER COSTS

State Funding

TAXPAYER BENEFITS

Increased Tax Revenue

Avoided Costs to State Government

Growth in state tax revenues

As a result of their time at the universities, students earn more because of the skills they learned while attending the universities, 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 Iowa's regent universities 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 this, 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.[48] 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 Iowa gross state product to total labor income in the state. We also include the spending impacts discussed in Chapter 2 that were created in FY 2017-18 from operations, construction, research, visitor, and student spending. To each of these, 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 earnings they receive as a result of their education leaves the state with

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

them. To account for this dynamic, we combine student settlement data from the universities 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 the universities do not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the universities 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 universities would have generated benefits anyway even without the universities. For more information on the alternative education variable, see Appendix 8.

We apply a final adjustment factor to account for the "shutdown point" that nets out benefits that are not directly linked to the state government costs of supporting the universities. As with the alternative education variable discussed under the alumni impact, the purpose of this adjustment is to account for counterfactual scenarios. In this case, the counterfactual scenario is where state government funding for Iowa's regent universities did not exist and the universities had to derive the revenue elsewhere. To estimate this shutdown point, we apply a sub-model that simulates the students' demand curve for education by reducing state support to zero and progressively increasing student tuition and fees. As student tuition and fees increase, enrollment declines. For Iowa's regent universities, the shutdown point adjustment is 0%, meaning that the universities could not operate without taxpayer support. As such, no reduction applies. For more information on the theory and methodology behind the estimation of the shutdown point, see Appendix 10. In addition, a sensitivity analysis around the shutdown point is illustrated in Appendix 2.

After adjusting for attrition, alternative education opportunities, and the shutdown point, we calculate the present value of the future added tax revenues that occur in the state, equal to $1.8 billion. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of 1.0%. This is the real treasury interest rate recommended by the Office of Management and Budget (OMB) for 30-year investments, and in Appendix 2, we conduct a sensitivity analysis of this discount rate.[49]

📷: University of Northern Iowa

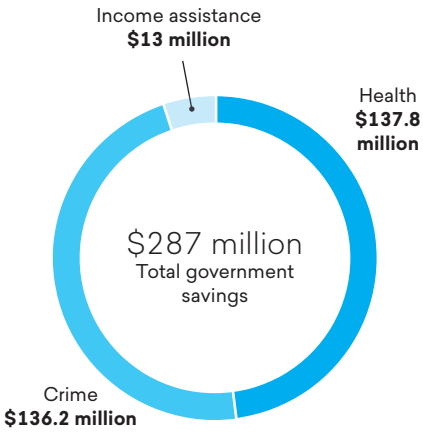
49 Office of Management and Budget. "Discount Rates for Cost-Effectiveness Analysis of Federal Programs." *Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in Percent).* Last modified November 2018. https://www.whitehouse.gov/wp-content/uploads/2018/12/Discount-History.pdf.

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 the universities. Government savings appear in Figure 3.2 and Table 3.3 and break down into three main categories: 1) health savings, 2) crime savings, and 3) income assistance savings. Health savings include avoided medical costs that would have otherwise been covered by state 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****.*

FIGURE 3.2: PRESENT VALUE OF GOVERNMENT SAVINGS



Source: Emsi impact model.

The model quantifies government savings by calculating the probability at each education level that individuals will have poor health, commit crimes, or claim welfare and unemployment benefits. Deriving the probabilities involves assembling data from a variety of studies and surveys analyzing the correlation between education and health, crime, and income assistance at the national and state level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved CHEs at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the universities, will not have poor health, commit crimes, or demand income assistance. We dampen these results by the ability bias adjustment discussed earlier in the student perspective section and in Appendix 7 to account for factors (besides education) that influence individual behavior. We then multiply the marginal effects of education times the associated costs of health, crime, and income assistance.[50] Finally, we apply the same adjustments for attrition, alternative education, and the shutdown point to derive the net savings to the government. Total government savings appear in Figure 3.2 and sum to $287 million.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to $1.8 billion, from students' higher earnings, increases in non-labor income, and spending impacts. The sum of the government savings and the added income in the state is $2.1 billion, as

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

shown in the bottom row of Table 3.3. These savings continue to accrue in the future as long as the FY 2017-18 student population of the universities remains in the workforce.

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

Added tax revenue	**$1,788,585**
Government savings	
Health-related savings	$137,847
Crime-related savings	$136,204
Income assistance savings	$12,970
Total government savings	**$287,022**
Total taxpayer benefits	**$2,075,607**

Source: Emsi impact model.

Return on investment for taxpayers

Taxpayer costs are reported in Table 3.4 and come to $710.9 million, equal to the contribution of the state government to Iowa's regent universities. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 2.9 (= $2.1 billion ÷ $710.9 million), indicating a profitable investment.

At 7.9%, the rate of return to state taxpayers is favorable. Given that the stakeholder in this case is the public sector, we use the discount rate of 1.0%, the real treasury interest rate recommended by the Office of Management and Budget for 30-year investments.[51] This is the return governments are assumed to be able to earn on generally safe investments of unused funds, or alternatively, the interest rate for which governments, as relatively safe borrowers, can obtain funds. A rate of return of 1.0% would mean that the universities just pay their own way. In principle, governments could borrow monies used to support Iowa's regent universities and repay the loans out of the resulting added taxes and reduced government expenditures. A rate of return of 7.9%, on the other hand, means that the universities not only pay their own way, but also generate a surplus of $1.4 billion that the state government can use to fund other programs. It is unlikely that other government programs could make such a claim.

*A rate of return of **7.9%** means that Iowa's regent universities not only pay thier own way, but also generate a surplus that the state government can use to fund other programs.*

51 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.

TABLE 3.4: PROJECTED BENEFITS AND COSTS, TAXPAYER PERSPECTIVE

1	2	3	4
Year	Benefits to taxpayers (millions)	State gov't costs (millions)	Net cash flow (millions)
0	$237.0	$710.9	-$473.9
1	$4.6	$0.0	$4.6
2	$7.5	$0.0	$7.5
3	$12.6	$0.0	$12.6
4	$20.5	$0.0	$20.5
5	$30.9	$0.0	$30.9
6	$32.8	$0.0	$32.8
7	$34.8	$0.0	$34.8
8	$36.8	$0.0	$36.8
9	$38.8	$0.0	$38.8
10	$40.9	$0.0	$40.9
11	$43.1	$0.0	$43.1
12	$45.2	$0.0	$45.2
13	$47.3	$0.0	$47.3
14	$49.5	$0.0	$49.5
15	$51.6	$0.0	$51.6
16	$53.7	$0.0	$53.7
17	$55.7	$0.0	$55.7
18	$57.7	$0.0	$57.7
19	$59.6	$0.0	$59.6
20	$61.4	$0.0	$61.4
21	$63.1	$0.0	$63.1
22	$64.7	$0.0	$64.7
23	$66.1	$0.0	$66.1
24	$67.4	$0.0	$67.4
25	$68.6	$0.0	$68.6
26	$69.6	$0.0	$69.6
27	$70.4	$0.0	$70.4
28	$71.0	$0.0	$71.0
29	$71.4	$0.0	$71.4
30	$71.7	$0.0	$71.7
31	$71.7	$0.0	$71.7
32	$71.6	$0.0	$71.6
33	$71.3	$0.0	$71.3
34	$70.7	$0.0	$70.7
35	$70.0	$0.0	$70.0
36	$69.1	$0.0	$69.1
37	$67.9	$0.0	$67.9
38	$66.6	$0.0	$66.6
39	$65.2	$0.0	$65.2
40	$63.5	$0.0	$63.5
41	$61.7	$0.0	$61.7
42	$59.7	$0.0	$59.7
43	$57.7	$0.0	$57.7
44	$21.9	$0.0	$21.9
Present value	**$2,074.5**	**$710.9**	**$1,363.6**

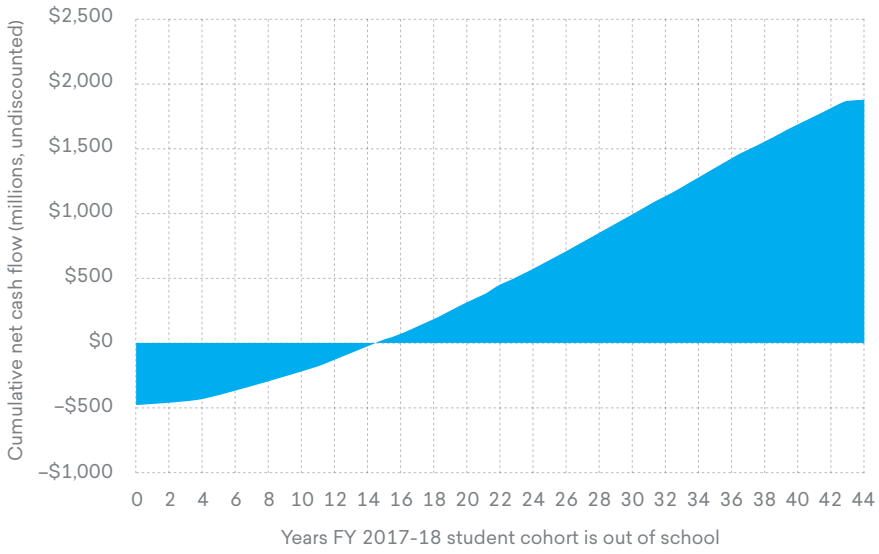
Internal rate of return	Benefit-cost ratio	Payback period (no. of years)
7.9%	2.9	14.6

Numbers reflect aggregate values for all universities and are subject to fluctuations due to the universities' varying time horizons.

Source: Emsi impact model.

As indicated in Table 3.4, state taxpayers, on average, see a payback period of 14.5 years, meaning 14.5 years after their initial investment in the universities, they will have received enough benefits in the form of added tax revenues and government savings to fully recover those costs (Figure 3.3).

FIGURE 3.3: TAXPAYER PAYBACK PERIOD



Source: Emsi impact model.

Social perspective

Iowa benefits from the education that the universities provide through the earnings that students create in the state and through the savings that they generate through their improved lifestyles. To receive these benefits, however, members of society must pay money and forego services that they otherwise would have enjoyed if Iowa's regent universities did not exist. Society's investment in the universities stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by Iowa's regent universities to these investor groups against the total social costs of generating those benefits. The total social costs include all universities' expenditures, all student expenditures (including interest on student loans) less tuition and fees, and all student opportunity costs, totaling a present value of $4.7 billion. Similar to the taxpayer perspective, in order to focus on the social costs and benefits that are more directly related to the universities, UIHC operational costs and benefits were removed from the social perspective.

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

SOCIAL COSTS

University Expenditures

Student Out-of-Pocket Expenses

Student Opportunity Costs

SOCIAL BENEFITS

Increased State Earnings

Avoided Costs to Society

Growth in state economic base

In the process of absorbing the newly acquired skills of students who attend the universities, not only does the productivity of the Iowa 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 universities, 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 Iowa's regent universities on the state's economic base follows the same process used when calculating increased tax revenues in the taxpayer perspective. However, instead of looking at just the tax revenue portion, we include all of the added earnings and business output. We again factor in student attrition and alternative education opportunities. The shutdown

point does not apply to the growth of the economic base because the social perspective captures not only the state taxpayer support to the universities, but also the support from the students and other non-governmental sources.

After adjusting for attrition and alternative education opportunities, we calculate the present value of the future added income that occurs in the state, equal to $20.4 billion. Recall from the discussion of the student and taxpayer return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 1.0%.

Social savings

Similar to the government savings discussed above, society as a whole sees savings due to external or incidental benefits of education. These represent the avoided costs that otherwise would have been drawn from private and public resources absent the education provided by the universities. 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 $20.4 billion, from students' higher earnings and their multiplier effects, increases in non-labor income, and spending impacts. Social savings appear next, beginning with a breakdown of savings related to health. These include savings due to a reduced demand for medical treatment and social services, improved worker productivity and reduced absenteeism, and a reduced number of vehicle crashes and fires induced by alcohol or smoking-related incidents. Although the prevalence of these health conditions generally declines as individuals attain higher levels of education, prevalence rates are sometimes higher for individuals with certain levels of education. For example, adults with college degrees may be more likely to spend more on alcohol and become dependent on alcohol. Thus, in some cases the social savings associated with a health factor can be negative. Nevertheless, the overall health savings for society are positive, amounting to $704.4 million.

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.

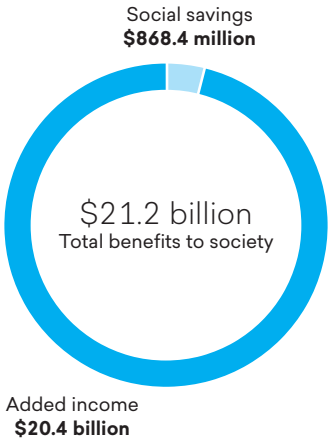
Crime savings amount to $151 million, including savings associated with a reduced number of crime victims, added worker productivity, and reduced expenditures for police and law enforcement, courts and administration of justice, and corrective services. Finally, the present value of the savings related to income assistance amount to $13 million, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to $868.4 million in benefits to communities and citizens in Iowa.

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

Increased economic base	**$20,359,425**
Social savings	
Health	
Smoking	$250,220
Alcohol dependence	-$19,050
Obesity	$218,673
Depression	$218,270
Drug abuse	$36,270
Total health savings*	**$704,383**
Crime	
Criminal justice system savings	$133,815
Crime victim savings	$2,536
Added productivity	$14,650
Total crime savings	**$151,001**
Income assistance	
Welfare savings	$5,270
Unemployment savings	$7,700
Total income assistance savings	**$12,970**
Total social savings	**$868,355**
Total, increased economic base + social savings	**$21,227,779**

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

FIGURE 3.4: PRESENT VALUE OF BENEFITS TO SOCIETY



Source: Emsi impact model.

The sum of the social savings and the increased state economic base is $21.2 billion, as shown in the bottom row of Table 3.5 and in Figure 3.4. These savings accrue in the future as long as the FY 2017-18 student population of the universities remains in the workforce.

Return on investment for society

Table 3.6 presents the stream of benefits accruing to the Iowa 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 4.5. This means that for every dollar invested in an education from the universities, whether it is the money spent on operations of the universities or money spent by students on tuition and fees, an average of $4.50 in benefits will accrue to society in Iowa.[52]

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 Iowa's regent universities. Some would question the legitimacy of including these benefits in the calculation of rates of return to education, arguing causation and that only the tangible benefits (higher earnings) should be counted. In other words, just because there is a correlation between education and committing fewer crimes, for example, does not necessarily mean that their education led them to commit fewer crimes. A person who commits fewer crimes may be more likely to obtain a postsecondary education. The direction, or causality, of these social benefits is often unclear.

Recognizing that correlation does not always equal causation, Table 3.4 and Table 3.6 are inclusive of social benefits reported as attributable to Iowa's regent universities. Recognizing the other point of view, Table 3.7 shows rates of return for both the taxpayer and social perspectives exclusive of social benefits. As indicated, returns are still above threshold values (a benefit-cost ratio greater than 1.0 and a rate of return greater than 1.0%), confirming that taxpayers receive value from investing in Iowa's regent universities.

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

TABLE 3.6: PROJECTED BENEFITS AND COSTS, SOCIAL PERSPECTIVE

1	2	3	4
Year	Benefits to society (millions)	Social costs (millions)	Net cash flow (millions)
0	$3,110.3	$3,972.6	-$862.2
1	$42.0	$31.7	$10.3
2	$68.9	$31.7	$37.3
3	$118.3	$31.7	$86.6
4	$194.0	$31.7	$162.4
5	$294.9	$31.7	$263.3
6	$315.3	$31.7	$283.7
7	$336.3	$31.7	$304.6
8	$357.6	$31.7	$325.9
9	$379.3	$31.7	$347.6
10	$401.2	$31.7	$369.5
11	$423.2	$31.7	$391.6
12	$445.3	$31.7	$413.6
13	$467.3	$31.7	$435.6
14	$489.1	$31.7	$457.4
15	$510.5	$31.7	$478.9
16	$531.5	$31.7	$499.9
17	$552.0	$31.7	$520.3
18	$571.7	$31.7	$540.0
19	$590.6	$31.7	$558.9
20	$608.4	$31.7	$576.7
21	$625.2	$27.1	$598.1
22	$640.7	$27.1	$613.6
23	$654.9	$27.1	$627.8
24	$667.6	$27.1	$640.5
25	$678.9	$27.1	$651.8
26	$688.4	$14.1	$674.3
27	$696.2	$14.1	$682.1
28	$702.3	$14.1	$688.1
29	$706.4	$14.1	$692.3
30	$708.7	$14.1	$694.6
31	$709.1	$0.0	$709.1
32	$707.6	$0.0	$707.6
33	$704.2	$0.0	$704.2
34	$698.9	$0.0	$698.9
35	$691.7	$0.0	$691.7
36	$682.6	$0.0	$682.6
37	$671.6	$0.0	$671.6
38	$658.8	$0.0	$658.8
39	$644.4	$0.0	$644.4
40	$628.3	$0.0	$628.3
41	$610.6	$0.0	$610.6
42	$591.5	$0.0	$591.5
43	$571.1	$0.0	$571.1
44	$221.6	$0.0	$221.6
Present value	**$21,228.4**	**$4,705.3**	**$16,523.1**

Benefit-cost ratio	Payback period (no. of years)
4.5	6.1

Numbers reflect aggregate values for all universities and are subject to fluctuations due to the universities' varying time horizons.

Source: Emsi impact model.

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

	Including social savings	Excluding social savings
Taxpayer perspective		
Net present value (millions)	$1,363.6	$1,077.3
Benefit-cost ratio	2.9	2.5
Internal rate of return	7.9%	6.6%
Payback period (no. of years)	14.6	18.1
Social perspective		
Net present value (millions)	$16,523.1	$15,654.2
Benefit-cost ratio	4.5	4.3

Source: Emsi impact model.

CHAPTER 4:

Conclusion

: University of Iowa

WHILE the value of Iowa's regent universities to Iowa is larger than simply their economic impact, understanding the dollars and cents value is an important asset to understanding the universities' value as a whole. In order to fully assess Iowa's regent universities' value to the state economy, this report has evaluated the universities from the perspectives of economic impact analysis and investment analysis.

From an economic impact perspective, we calculated that Iowa's regent universities generate a total economic impact of **$11.8 billion** in total added income for the state economy. This represents the sum of several different impacts, including:

- Operations spending impact (**$1.9 billion**);
- Construction spending impact (**$132.7 million**);
- University hospital & clinic spending impact (**$1.5 billion**);
- Research spending impact (**$730 million**);
- Economic development impact (**$1 billion**);
- Visitor spending impact (**$38.1 million**);
- Student spending impact (**$232.9 million**); and
- Alumni impact (**$6.2 billion**).

The total impact of $11.8 billion is equivalent to approximately **6.2%** of the total GSP of Iowa and is equivalent to supporting **149,980 jobs**. For perspective, this means that **one out of every 14 jobs** in Iowa is supported by the activities of the universities and their students. This $11.8 billion impact does not take into account the universities' extension, outreach, and volunteer activities. These activities benefit state and local communities and economies by helping thousands of companies, as well as those less fortunate.

Since the activity of Iowa's regent universities represents an investment by various parties, including students, taxpayers, and society as a whole, we also considered the universities as an investment to see the value they provide to these investors. For each dollar invested by students, taxpayers, and society, Iowa's regent universities offer a benefit of **$3.70**, **$2.90**, and **$4.50**, respectively. These results indicate that Iowa's regent universities is an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the universities expands the state economy and creates a wide range of positive social benefits that accrue to taxpayers and society in general within Iowa.

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

One out of every 14 jobs *in Iowa is supported by the activities of Iowa's regent universities and their students.*

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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 2,000 economic impact studies for educational institutions in three countries. Visit www.economicmodeling.com for more information about Emsi's products and services.

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Appendix 1: Iowa's Regent Universities

Institution	City of main campus	Headcount in FY 2017-18
Iowa State University of Science and Technology	Ames	39,108
University of Iowa	Iowa City	35,876
University of Northern Iowa	Cedar Falls	14,511

Appendix 2: Sensitivity Analysis

Sensitivity analysis measures the extent to which a model's outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected. In this chapter we test the sensitivity of the model to the following input factors: 1) number of out-of-state visitors, 2) the alternative education variable, 3) the labor import effect variable, 4) the ability bias variable, 5) the shutdown point variable, 6) the ability bias and shutdown point variables matrix, 7) the student employment variables, 8) the discount rate, and 9) the retained student variable.

Number of out-of-state visitors

While we can calculate the impact of visitors, it can be difficult for universities to determine how many originated from outside the state. Table A2.1 presents a sensitivity analysis for the annual number of out-of-state visitors. The assumption increases and decreases relative to the base case of 410,157 visitors by the increments indicated in the table. The visitor spending impact is then recalculated with each number of out-of-state visitors, holding all else constant. Visitor spending impacts attributable to the universities' events range from a high of $57.1 million with 615,236 visitors to a low of $19.0 million with 205,079 visitors.

TABLE A2.1: SENSITIVITY ANALYSIS OF ANNUAL NUMBER OF OUT-OF-STATE VISITORS

% variation in assumption	-50%	-25%	-10%	Base Case	10%	25%	50%
Annual out-of-state visitors	205,079	307,618	369,141	410,157	451,173	512,696	615,236
Visitor spending impact (million)	$19,039	$28,558	$34,269	$38,077	$41,885	$47,596	$57,116

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 publicly-funded universities in the state. Given the difficulty in accurately specifying the alternative education variable, we test the sensitivity of the taxpayer and social investment analysis results to its magnitude. Variations in the alternative education assumption are calculated around base case results listed in the middle column of Table A2.2. 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 7.9% to 7.8%. Likewise, a decrease of 10% (from 10% to 9%) in the assumption increases the rate of return from 7.9% to 8.0%.

TABLE A2.2: 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%**	**7%**	**9%**	**10%**	**11%**	**12%**	**15%**
Taxpayer perspective							
Net present value (millions)	$1,479	$1,421	$1,387	$1,364	$1,341	$1,306	$1,248
Rate of return	8.4%	8.2%	8.0%	7.9%	7.8%	7.6%	7.4%
Benefit-cost ratio	3.1	3.0	3.0	2.9	2.9	2.8	2.8
Social perspective							
Net present value (millions)	$18,360	$17,753	$17,389	$16,523	$16,904	$16,539	$15,932
Benefit-cost ratio	4.9	4.8	4.7	4.5	4.6	4.5	4.4

Based on this sensitivity analysis, the conclusion can be drawn that the universities' investment analysis results from the taxpayer and social perspectives are not very sensitive to relatively large variations in the alternative education variable. As indicated, results are still above their threshold levels (net present value greater than 0, benefit-cost ratio greater than 1, and rate of return greater than the discount rate of 1.0%), 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 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 2.16. 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 Iowa's regent universities. In other words, businesses that hired the universities' students could have substituted some of these workers with equally-qualified people from outside the state had there been no students from Iowa's regent universities to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the universities.

Table A2.3 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 Iowa's regent universities, for example,

range from a high of $9.3 billion at a -50% variation to a low of $3.1 billion at a +50% variation from the base case assumption. This means that if the labor import effect variable increases, the impact that we claim as attributable to alumni decreases. Even under the most conservative assumptions, the alumni impact on the Iowa economy still remains sizeable.

TABLE A2.3: 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)	$9,268	$7,723	$6,797	$6,179	$5,561	$4,634	$3,089

Ability bias variable

The ability bias variable (10%) accounts for factors (besides education) that influence individual behavior. The ability bias stemmed from those critical of the Mincer function. Critics point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings and social behavior. 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%. With that said, the universities have expressed a concern that this estimate may be too low. In other words, other factors, besides education, may have a heavier influence on earnings and individual behavior than is accounted for in the model. The sensitivity analysis below therefore provides the results of the alumni impact and benefit-cost ratios from the student, taxpayer, and social perspectives if we were to increase the ability bias from 10% up to 40%. We also included a scenario where the ability bias is reduced to 5%. Notice that the increased ability bias decreased the alumni impact and investment results; however, they are still significantly positive (each benefit-cost ratio is still above 2.0).

TABLE A2.4: SENSITIVITY ANALYSIS OF ABILITY BIAS VARIABLE

% variation in assumption	-50%	Base Case	100%	200%	300%
Ability bias variable	5%	10%	20%	30%	40%
Alumni impact (millions)	$6,523	$6,179	$5,492	$4,806	$4,119
Student benefit-cost ratio	4.0	3.7	3.3	2.9	2.5
Taxpayer benefit-cost ratio	3.1	2.9	2.6	2.3	2.1
Social benefit-cost ratio	4.7	4.5	4.1	3.7	3.2

Shutdown point variable

The shutdown point in the taxpayer perspective considers the benefits that the universities would have been able to generate anyway, even without state taxpayer support. This adjustment is used to establish a direct link between what taxpayers pay and what they receive in return. If the universities are able to generate benefits without taxpayer support, then it would not be a true investment.

This analysis relies on its own sub-model that simulates the effect on student enrollment if the universities lose their state funding and must raise student tuition and fees in order to stay open. If the universities can still operate without state support, then any benefits they generate at that level are discounted from total benefit estimates. If the simulation indicates that the universities cannot stay open, however, then benefits are directly linked to costs, and no discounting applies.

For this analysis, it was found that Iowa's regent universities could not operate without the support of the state taxpayers (a shutdown point of 0%), thus the taxpayer benefits do not need to be discounted. Given that this is a hypothetical scenario, it would be worth the reader's time to consider the scenario where the universities were able to operate at some level without the support of state taxpayers. In Table A2.5 below, we outline the taxpayer investment analysis results given the shutdown point of 20%, 40%, or 60%. A shutdown point of 20%, for example, means that the universities would be able to operate at 20% of their current operations without state taxpayer support. Even with a shutdown point of 60%, meaning that we discount the taxpayer benefits by 60% since 60% of the benefits could have occurred anyway without taxpayer funding, the benefit-cost ratio for taxpayers is 1.2 and the internal rate of return is 2.1%, with both measures illustrating a positive return on investment.

TABLE A2.5: SENSITIVITY ANALYSIS OF SHUTDOWN POINT VARIABLE

% variation in assumption	Base Case	20%	40%	60%
Shutdown point variable	0%	20%	40%	60%
Taxpayer benefit-cost ratio	2.9	2.3	1.8	1.2
Taxpayer internal rate of return	7.9%	6.4%	4.5%	2.1%

Ability bias and shutdown point variables matrix

The ability bias variable and shutdown point variable both look at benefits that would have been created if Iowa's regent universities did not exist. The ability bias variable satisfies the idea that students may have created some benefits for taxpayers even without their education at the universities. The shutdown point variable satisfies the idea that even without state funding the universities may be able to operate, still creating some benefits for taxpayers. Using

research, the ability bias variable is set to 10% in our model, and using our shutdown point sub-model, the shutdown point for Iowa's regent universities was found to be 0%. The sensitivity analyses of these individual variables are found above, holding all else constant. However, let's consider the idea that these variables may both be different than what was used in this analysis. Only the most extreme scenario results in a negative taxpayer benefit-cost ratio. When we increase the ability bias from 10% to 40% and the shutdown point from 0% to 60%, the taxpayer benefit-cost ratio drops to 0.9. In this scenario, taxpayers are still receiving benefits for their investment in the universities, just not enough to offset the cost of their investment.

TABLE A2.6: SENSITIVITY ANALYSIS OF ABILITY BIAS AND SHUTDOWN POINT VARIABLES, TAXPAYER BENEFIT-COST RATIO

		Ability Bias				
		5%	**10%**	**20%**	**30%**	**40%**
Shutdown point variable	**0%**	3.1	2.9	2.6	2.3	2.1
	20%	2.5	2.3	2.1	1.9	1.7
	40%	1.8	1.8	1.6	1.4	1.3
	60%	1.2	1.2	1.1	1.0	0.9

Student employment variables

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

Students incur substantial expense by attending the universities 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 56% of students are employed.[53] 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 universities earn only 70%, on average, of the earnings that they statistically would have received if not attending the universities. This suggests that many students hold part-time jobs that accommodate their attendance at the universities,

53 Based on data provided by Iowa's regent universities. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 70% 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 70% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table A2.7, 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 56% and B equal to 70%. 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 A2.7: SENSITIVITY ANALYSIS OF STUDENT EMPLOYMENT VARIABLES

Variations in assumptions	Net present value (millions)	Internal rate of return	Benefit-cost ratio
Base case: A = 56%, B = 70%	$5,004.8	14.4%	3.7
Scenario 1: A = 100%, B = 70%	$5,428.5	18.0%	4.9
Scenario 2: A = 56%, B = 100%	$5,252.4	16.3%	4.3
Scenario 3: A = 100%, B = 100%	$5,879.2	26.4%	7.2
Scenario 4: A = 0%, B = 0%	$4,489.9	11.8%	2.9

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

- **Scenario 1:** Increasing the percentage of students employed (A) from 56% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to $5.4 billion, 18.0%, and 4.9, respectively, relative to base case results. Improved results are attributable to a lower opportunity cost of time; all students are employed in this case.
- **Scenario 2:** Increasing earnings relative to statistical averages (B) from 70% to 100%, the net present value, internal rate of return, and benefit-cost ratio results improve to $5.3 billion, 16.3%, and 4.3, respectively, relative to base case results; a strong improvement, again attributable to a lower opportunity cost of time.
- **Scenario 3:** Increasing both assumptions A and B to 100% simultaneously, the net present value, internal rate of return, and benefit-cost ratio improve yet further to $5.9 billion, 26.4%, and 7.2, 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 $4.5 billion, 11.8%, and 2.9, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[54]

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 Iowa's regent universities generate excellent returns, well above the long-term average percent rates of return in stock and bond markets.

Discount rate

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

In this study, we assume a 4.5% discount rate for students and a 1.0% discount rate for society and taxpayers.[55] Similar to the sensitivity analysis of the alternative education variable, we vary the base case discount rates for students, taxpayers, and society on either side by increasing the discount rate by 10%, 25%, and 50%, and then reducing it by 10%, 25%, and 50%. Note that, because the rate of return and the payback period are both based on the undiscounted cash flows, they are unaffected by changes in the discount rate. As such, only variations in the net present value and the benefit-cost ratio are shown for students, taxpayers, and society in Table A2.8.

54 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.

55 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."

TABLE A2.8: SENSITIVITY ANALYSIS OF DISCOUNT RATE

% variation in assumption	-50%	-25%	-10%	Base Case	10%	25%	50%
Student perspective							
Discount rate	2.2%	3.3%	4.0%	4.5%	4.9%	5.6%	6.7%
Net present value (millions)	$9,043	$6,712	$5,626	$5,005	$4,453	$3,737	$3,468
Benefit-cost ratio	6.0	4.7	4.1	3.7	3.4	3.0	2.9
Taxpayer perspective							
Discount rate	0.5%	0.8%	0.9%	1.0%	1.1%	1.3%	1.5%
Net present value (millions)	$1,604	$1,479	$1,409	$1,364	$1,320	$1,256	$1,157
Benefit-cost ratio	3.3	3.1	3.0	2.9	2.9	2.8	2.6
Social perspective							
Discount rate	0.5%	0.8%	0.9%	1.0%	1.1%	1.3%	1.5%
Net present value (millions)	$18,846	$17,640	$16,960	$16,523	$16,100	$15,488	$14,528
Benefit-cost ratio	5.0	4.8	4.6	4.5	4.4	4.3	4.1

As demonstrated in the table, an increase in the discount rate leads to a corresponding decrease in the expected returns, and vice versa. For example, increasing the student discount rate by 50% (from 4.5% to 6.7%) reduces the students' benefit-cost ratio from 3.7 to 2.9. Conversely, reducing the discount rate for students by 50% (from 4.5% to 2.2%) increases the benefit-cost ratio from 3.7 to 6.0. The sensitivity analysis results for society and taxpayers show the same inverse relationship between the discount rate and the benefit-cost ratio, with the variance in results being the greatest under the social perspective (from a 5.0 benefit-cost ratio at a -50% variation from the base case, to a 4.1 benefit-cost ratio at a 50% variation from the base case).

Retained student variable

The retained student variable only affects the student spending impact calculation in Table 2.14. For this analysis, we assume a retained student variable of 22%, which means that 22% of the universities' students who originated from Iowa would have left the state for other opportunities, whether that be education or employment, if Iowa's regent universities did not exist. The money these retained students spent in the state for accommodation and other personal and household expenses is attributable to Iowa's regent universities.

Table A2.9 presents the results of the sensitivity analysis for the retained student variable. The assumption increases and decreases relative to the base case of 22% by the increments indicated in the table. The student spending impact is recalculated at each value of the assumption, holding all else constant. Student spending impacts attributable to Iowa's regent universities range from a high of $264.4 million when the retained student variable is 33% to a low of $200.5 million when the retained student variable is 11%. This means as the retained student variable decreases, the student spending attributable to Iowa's regent

universities decreases. Even under the most conservative assumptions, the student spending impact on the Iowa economy remains substantial.

TABLE A2.9: SENSITIVITY ANALYSIS OF RETAINED STUDENT VARIABLE

% variation in assumption	-50%	-25%	-10%	Base Case	10%	25%	50%
Retained student variable	11%	17%	20%	22%	24%	28%	33%
Student spending impact (thousands)	$200,459	$216,440	$226,028	$232,876	$238,813	$248,402	$264,383

Appendix 3: Glossary of Terms

Alternative education A "with" and "without" measure of the percent of students who would still be able to avail themselves of education if the universities 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 universities in order to obtain their education.

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

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

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

Discounting Expressing future revenues and costs in present value terms.

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

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

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

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

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

Initial effect Income generated by the initial injection of monies into the economy through the payroll of the universities and the higher earnings of their students.

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

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

Multiplier effect Additional income created in the economy as the universities and their students spend money in the state. It consists of the income created by the supply chain of the industries initially affected by the spending of the universities and their students (i.e., the direct effect), income created by the supply chain of the initial supply chain (i.e., the indirect effect), and the income created by the increased spending of the household sector (i.e., the induced effect).

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

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

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

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

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

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

Payback period = cost of investment/net return per period

Appendix 4: Frequently Asked Questions (FAQs)

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

What is economic impact analysis?

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

What is investment analysis?

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

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

How do my universities' rates of return compare to that of other institutional systems?

In general, Emsi discourages comparisons between systems or institutions since many factors, such as regional economic conditions, institutional differences, and student demographics are outside of the universities' control. It is best to compare the rate of return to the discount rates of 4.5% (for students) and 1.0% (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 institutions (Table 1.3). This percentage represents its portion of the total gross state product in the state (similar to the nationally recognized gross domestic product but at a state level). This allows the Board of Regents to say that the universities' brick and mortar campuses do just as much for Iowa as the entire Utilities *industry*, for example. This powerful statement can help put the large total impact number into perspective.

Appendix 5: Example of Sales versus Income

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

Income = Sales – Intermediary Costs

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

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

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

Income = $5.00 – $3.00 = $2.00

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

Appendix 6: Emsi 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 7: Value per Credit Hour Equivalent and the Mincer Function

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

Value per CHE

Typically, the educational achievements of students are marked by the credentials they earn. However, not all students who attended the universities in the 2017-18 analysis year obtained a degree or certificate. Some returned the following year to complete their education goals, while others took a few courses and entered the workforce without graduating. As such, the only way to measure the value of the students' achievement is through their credit hour equivalents, or CHEs. This approach allows us to see the benefits to all students who attended the universities, not just those who earned a credential.

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

The second step is to assign a unique value to the CHEs in the education ladder based on the wage differentials presented in Table 1.4. For example, the difference in state earnings between a high school diploma and a bachelor's degree is $22,500. We spread this $22,500 wage differential across the 60 CHEs that occur between a high school diploma and a bachelor's degree, applying a ceremonial "boost" to the last CHE in the stage to mark the achievement of the degree.[56] We repeat this process for each education level in the ladder.

Next we map the CHE production of the FY 2017-18 student population to the education ladder. Table 1.2 provides information on the CHE production of students attending the universities, broken out by educational achievement. In total, students completed 2,106,782 CHEs during the analysis year. We map

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

each of these CHEs to the education ladder depending on the students' education level and the average number of CHEs they completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate degree and the bachelor's degree, and the average number of CHEs they completed informs the shape of the distribution curve used to spread out their total CHE production within that stage of the progression.

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

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

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

Table A7.1 displays the result for the students' aggregate annual increase in income (*ΔE)*, a total of $449.1 million. By dividing this value by the students' total production of 2,106,782 CHEs during the analysis year, we derive an overall value of $213 per CHE.

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

Aggregate annual increase in income	$449,132,860
Total credit hour equivalents (CHEs) in FY 2017-18	2,106,782
Value per CHE	**$213**

Source: Emsi impact model.

Mincer Function

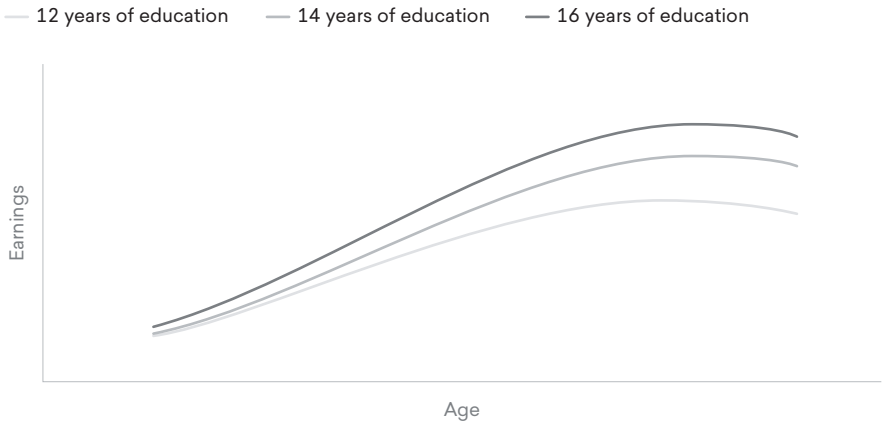
The $213 value per CHE in Table A7.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[57] 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

57 See Mincer (1958 and 1974).

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. We perform a sensitivity analysis around the ability bias in Appendix 2.

Figure A7.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum somewhere well after the midpoint of the working career, and then decline in later years. Second, individuals with higher levels of education reach their maximum earnings at an older age compared to individuals with lower levels of education (recall that age serves as a proxy for years of experience). And third, the benefits of education, as measured by the difference in earnings between education levels, increase with age.

FIGURE A7.1: LIFECYCLE CHANGE IN EARNINGS



In calculating the alumni impact in Chapter 2, we use the slope of the curve in Mincer's earnings function to condition the $213 value per CHE to the students' age and work experience. To the students just starting their career during the analysis year, we apply a lower value per CHE; to the students in the latter half or approaching the end of their careers we apply a higher value per CHE. The original $213 value per CHE applies only to the CHE production of students precisely at the midpoint of their careers during the analysis year.

In Chapter 3 we again apply the Mincer function, this time to project the benefits stream of the FY 2017-18 student population into the future. Here too the value per CHE is lower for students at the start of their career and higher near the end of it, in accordance with the scalars derived from the slope of the Mincer curve illustrated in Figure A7.1.

Appendix 8: Alternative Education Variable

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

Recall this analysis considers only relevant economic information regarding the universities. Considering the existence of various other academic institutions surrounding the universities, 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 universities—we discount the benefits attributed to the universities. 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 universities, they must be included.

In the absence of the universities, we assume 10% of the universities' 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 universities' students would have occurred anyways in the counterfactual scenario where the universities did not exist. A sensitivity analysis of this adjustment is presented in Appendix 2.

Appendix 9: Overview of Investment Analysis Measures

The appendix provides context to the investment analysis results using the simple hypothetical example summarized in Table A9.1 below. The table shows the projected benefits and costs for a single student over time and associated investment analysis results.[58]

TABLE A9.1: EXAMPLE OF THE BENEFITS AND COSTS OF EDUCATION FOR A SINGLE STUDENT

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

Internal rate of return	Benefit-cost ratio	Payback period (no. of years)
18.0%	1.7	4.2

Assumptions are as follows:

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

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

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

Results are expressed in standard investment analysis terms, which are as follows: the net present value, the internal rate of return, the benefit-cost ratio, and the payback period. Each of these is briefly explained below in the context of the cash flow numbers presented in Table A9.1.

Net present value

The student in Table A9.1 can choose either to attend college or to forego post-secondary education and maintain his present employment. If he decides to enroll, certain economic implications unfold. Tuition and fees must be paid, and earnings will cease for one year. In exchange, the student calculates that with post-secondary education, his earnings will increase by at least the $5,000 per year, as indicated in the table.

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 A9.1, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different. Benefits are far lower than $45,000 because future money is worth less than present money. Costs (tuition plus earnings foregone) are felt immediately because they are incurred today, in the present. Benefits, on the other hand, occur in the future. They are not yet available. All future benefits must be discounted by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[59]

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

59 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.

10 years from today given the going rate of interest of 4%. The process of discounting—finding the present value of future higher earnings—allows the model to express values on an equal basis in future or present value terms.

The goal is to express all future higher earnings in present value terms so that they can be compared to investments incurred today (in this example, tuition plus earnings foregone). As indicated in Table A9.1 the cumulative present value of $5,000 worth of higher earnings between years 2 and 10 is $35,753 given the 4% interest rate, far lower than the undiscounted $45,000 discussed above.

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

Internal rate of return

The internal rate of return is another way of measuring the worth of investing in education using the same cash flows shown in Table A9.1. In technical terms, 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 A9.1. Or, if a discount rate of 18.0% were applied to the net present value calculations instead of the 4%, then the net present value would reduce to zero.

What does this mean? The internal rate of return of 18.0% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18.0%, higher earnings of $5,000 per year for the next nine years will earn back all investments of $21,500 made plus pay 18.0% for the use of that money ($21,500) in the meantime. Is this a good return? Indeed, it is. If it is compared to the 4% going rate of interest applied to the net present value calculations, 18.0% is far higher than 4%. It may be concluded, therefore, that the investment in this case is solid. Alternatively, comparing the 18.0% rate of return to the long-term 10% rate or so obtained from investments in stocks and bonds also indicates that the investment in education is strong relative to the stock market returns (on average).

Benefit-cost ratio

The benefit-cost ratio is simply the present value of benefits divided by present value of costs, or $35,753 ÷ $21,500 = 1.7 (based on the 4% discount rate). Of course, any change in the discount rate would also change the benefit-cost ratio. Applying the 18.0% internal rate of return discussed above would reduce the benefit-cost ratio to 1.0, the breakeven solution where benefits just equal costs. Applying a discount rate higher than the 18.0% would reduce the ratio to lower than 1.0, and the investment would not be feasible. The 1.7 ratio means that a dollar invested today will return a cumulative $1.70 over the ten-year time period.

Payback period

This is the length of time from the beginning of the investment (consisting of tuition and earnings foregone) until higher future earnings give a return on the investment made. For the student in Table A9.1, it will take roughly 4.2 years of $5,000 worth of higher earnings to recapture his investment of $1,500 in tuition and the $20,000 in earnings foregone while attending the universities. 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 10: Shutdown Point

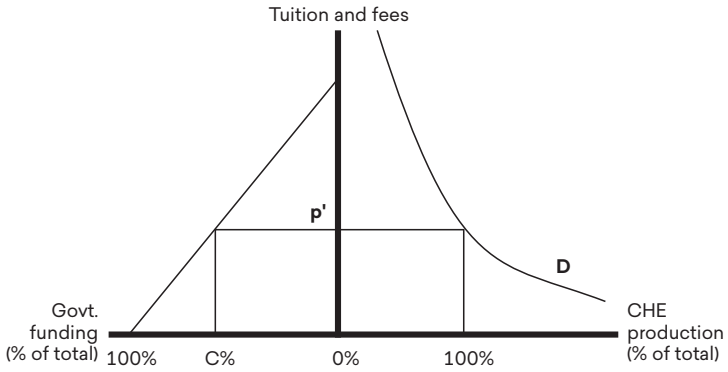
The investment analysis in Chapter 3 weighs the benefits generated by the universities against the state taxpayer funding that the universities receive to support their operations. An important part of this analysis is factoring out the benefits that the universities would have been able to generate anyway, even without state taxpayer support. This adjustment is used to establish a direct link between what taxpayers pay and what they receive in return. If the universities are able to generate benefits without taxpayer support, then it would not be a true investment.[60]

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

State government support versus student demand for education

Figure A10.1 presents a simple model of student demand and state government support. The right side of the graph is a standard demand curve (*D*) showing student enrollment as a function of student tuition and fees. Enrollment is

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

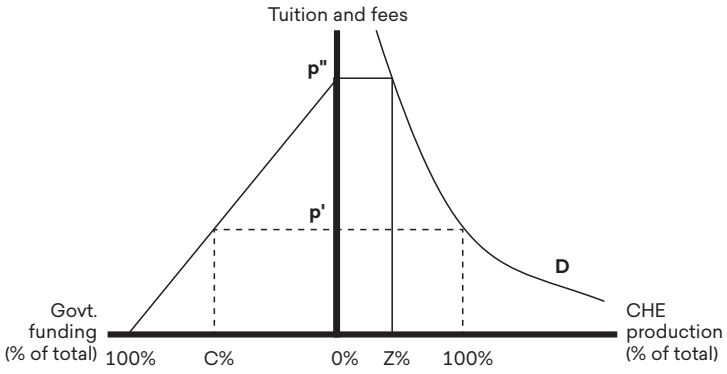


60 Of course, as public training providers, the universities would not be permitted to continue without public funding, so the situation in which they would lose all state support is entirely hypothetical. The purpose of the adjustment factor is to examine the universities in standard investment analysis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

measured in terms of total credit hour equivalents (CHEs) and expressed as a percentage of the universities' current CHE production. Current student tuition and fees are represented by *p'*, and state government support covers *C%* of all costs. At this point in the analysis, it is assumed that the universities have only two sources of revenues: 1) student tuition and fees and 2) state government support.

Figure A10.2 shows another important reference point in the model—where state government support is 0%, student tuition and fees are increased to *p"*, and CHE production is at *Z%* (less than 100%). The reduction in CHEs reflects the price elasticity of the students' demand for education, *i.e.*, the extent to which the students' decision to attend the universities is affected by the change in tuition and fees. Ignoring for the moment those issues concerning the universities' minimum operating scale (considered below in the section called "Calculating benefits at the shutdown point"), the implication for the investment analysis is that benefits to state government must be adjusted to net out the benefits that the universities can provide absent state government support, represented as *Z%* of the universities' current CHE production in Figure A10.2.

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



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

$$1) \quad B = B\,(100\%)$$

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

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

$$2) \quad B = B\,(Z\%)$$

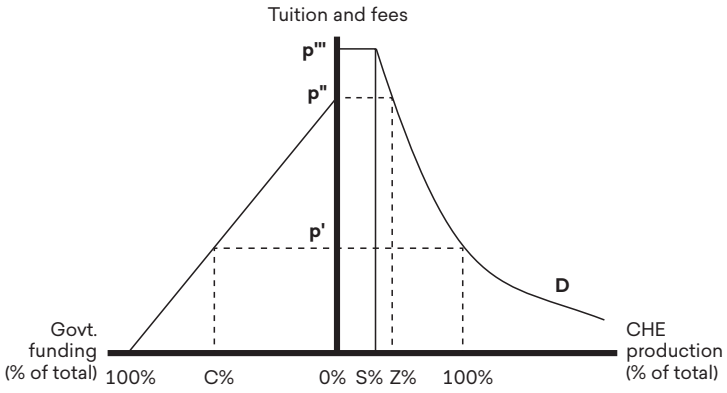
Inasmuch as the benefits in equation 2 occur with or without state government support, the benefits appropriately attributed to state government support are given by equation 3 as follows:

$$3) \quad B = B\,(100\%) - B\,(Z\%)$$

Calculating benefits at the shutdown point

Colleges and universities cease to operate when the revenue they receive from the quantity of education demanded is insufficient to justify their continued operations. This is commonly known in economics as the shutdown point.[61] The shutdown point is introduced graphically in Figure A10.3 as *S%*. The location of point *S%* indicates that the universities can operate at an even lower enrollment level than *Z%* (the point at which the universities receive zero state government funding). State government support at point *S%* is still zero, and student tuition and fees have been raised to *p'"*. State government support is thus credited with the benefits given by equation 3, or *B = B (100%) − B (Z%)*. With student tuition and fees still higher than *p'"*, the universities would no longer be able to attract enough students to keep their doors open, and they would shut down.

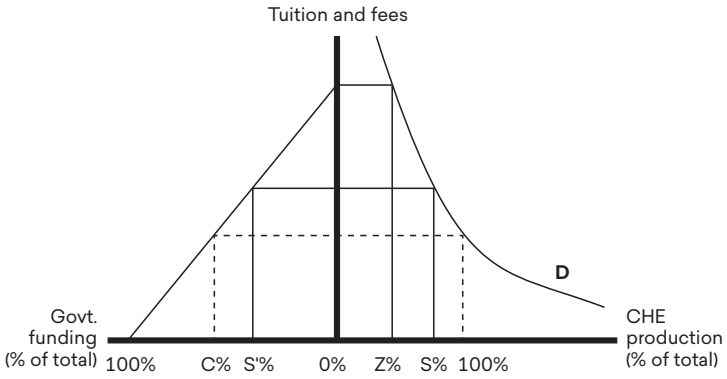
FIGURE A10.3: SHUTDOWN POINT AFTER ZERO GOVERNMENT FUNDING



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

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

FIGURE A10.4: SHUTDOWN POINT BEFORE ZERO GOVERNMENT FUNDING



Appendix 11: Social Externalities

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

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

Health

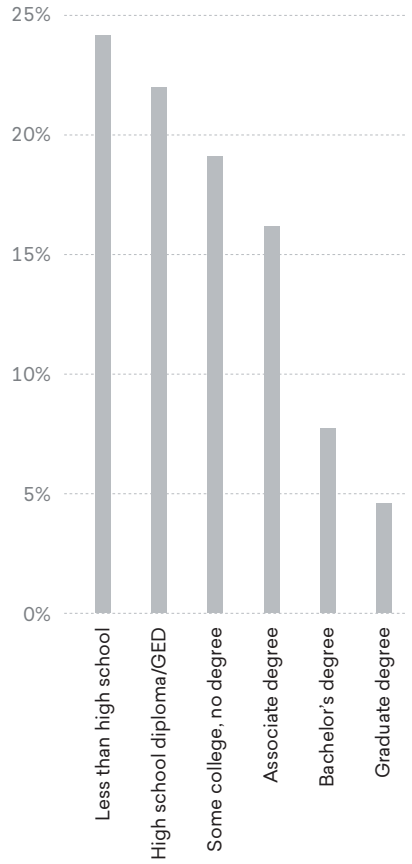
Statistics show a correlation between increased education and improved health. The manifestations of this are found in five health-related variables: smoking, alcohol dependence, obesity, depression, and drug abuse. There are other health-related areas that link to educational attainment, but these are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

SMOKING

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

Figure A11.1 shows the prevalence of cigarette smoking among adults, 25 years and over, based on data provided by the National Health Interview Survey.[62] 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 A11.1: PREVALENCE OF SMOKING AMONG U.S. ADULTS BY EDUCATION LEVEL



Source: Centers for Disease Control and Prevention.

62 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.[63] We use this information to create an index value by which we adjust the national prevalence data on smoking to each state. For example, 16.7% of Iowa adults were smokers in 2016, relative to 15.5% for the nation. We thus apply a scalar of 1.08 to the national probabilities of smoking in order to adjust them to the state of Iowa.

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 A11.2 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).[64] These statistics give an indication of the correlation between education and the reduced probability of alcohol dependence. Adults with an associate degree or some college have higher rates of alcohol dependence than adults with a high school diploma or lower. Prevalence rates are lower for adults with a bachelor's degree or higher than those with an associate degree or some college. Although the data do not maintain a pattern of decreased alcohol dependence at every level of increased education, we include these rates in our model to ensure we provide a comprehensive view of the social benefits and costs correlated with education.

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.[65]

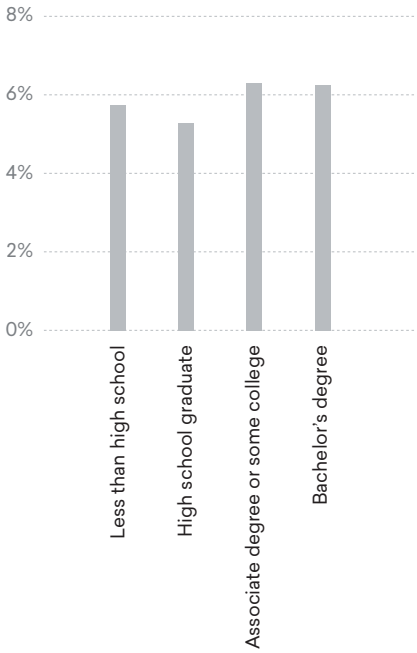
Data for Figure A11.3 is derived from the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over

63 Centers for Disease Control and Prevention. "Current Cigarette Use Among Adults (Behavior Risk Factor Surveillance System) 2016." *Behavioral Risk Factor Surveillance System Prevalence and Trends Data*, 2016.

64 Substance Abuse and Mental Health Services Administration. "Table 5.5B - Alcohol Use Disorder in the Past Year among Persons Aged 18 or Older, by Demographic Characteristics: Percentages, 2015 and 2016." SAMSHA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2015 and 2016.

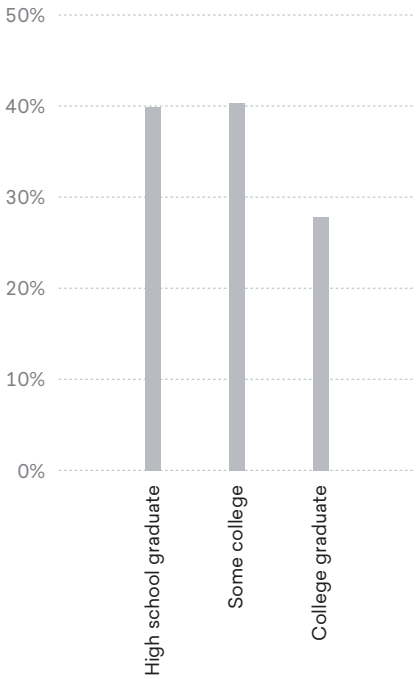
65 Eric A. Finkelstein, Marco da Costa DiBonaventura, Somali M. Burgess, and Brent C. Hale, "The Costs of Obesity in the Workplace," *Journal of Occupational and Environmental Medicine* 52, no. 10 (October 2010): 971-976.

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



Source: Centers for Disease Control and Prevention.

FIGURE A11.3: PREVALENCE OF OBESITY BY EDUCATION LEVEL



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

by education, gender, and ethnicity.[66] As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, the prevalence of obesity among adults with some college is actually greater than those with just a high school diploma. In general, though, obesity tends to decline with increasing levels of education.

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.[67]

Figure A11.4 summarizes the prevalence of MDD among adults by education level, based on data provided by the CDC.[68] 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.

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 3.4%, twice as large as the probability of drug abuse for college graduates (1.7%). This relationship is presented in Figure A11.5 based on data supplied by SAMHSA.[69] 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.[70]

66 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).

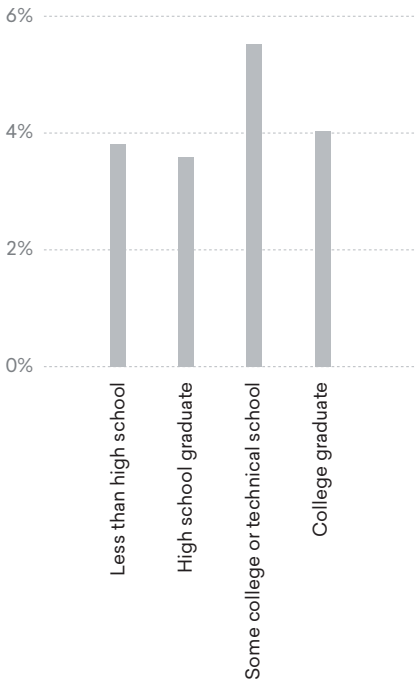
67 Greenberg, Paul, Andree-Anne Fournier, Tammy Sisitsky, Crystal Pike, and Ronald Kesslaer. "The Economic Burden of Adults with Major Depressive Disorder in the United States (2005 and 2010)" Journal of Clinical Psychiatry 76:2, 2015.

68 National Survey on Drug Use and Health. "Table 8.59B: Had at Least One 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: Percentages, 2015 and 2016."

69 Substance Abuse and Mental Health Services Administration, National Survey on Drug Use and Health, 2010 and 2011.

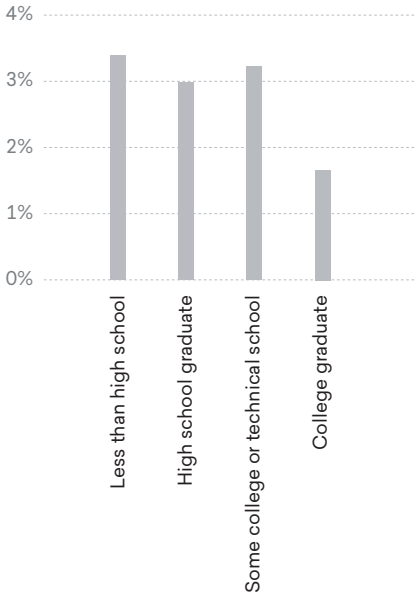
70 Substance Abuse and Mental Health Services Administration. "Table A.2. Spending by Payer: Levels and Percent Distribution for Mental Health and Substance Abuse (MHSA), Mental Health (MH), Substance Abuse (SA), Alcohol Abuse (AA), Drug Abuse (DA), and All-Health, 2014." *Behavioral Health Spending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

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



Source: National Survey on Drug Use and Health.

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



Source: Substance Abuse and Mental Health Services Administration.

Crime

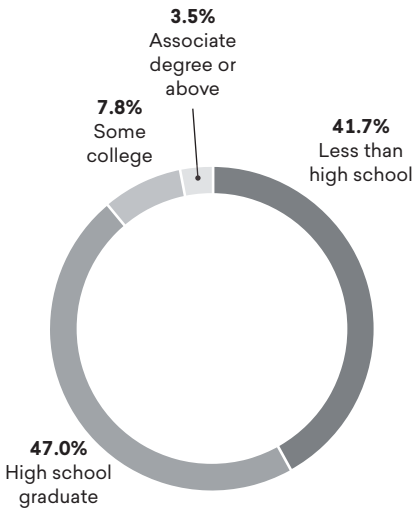
As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial and legal, and corrections, 2) victim costs, and 3) productivity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

Figure A11.6 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.[71]

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.[72]

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.

FIGURE A11.6: EDUCATIONAL ATTAINMENT OF THE INCARCERATED POPULATION



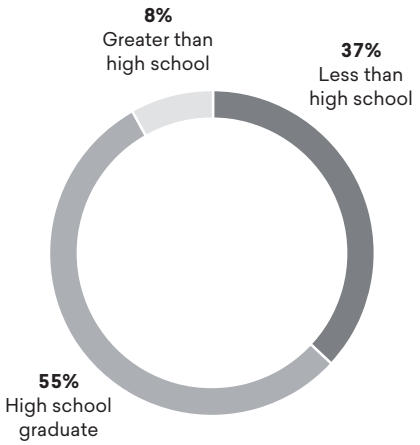
Source: Derived from data provided by the U.S. Census Bureau.

Income Assistance

Statistics show that as education levels increase, the number of applicants for government-funded income assistance such as welfare and unemployment benefits declines. Welfare and unemployment claimants can receive assistance from a variety of different sources, including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Medicaid, Supplemental Security Income (SSI), and unemployment insurance.[73]

Figure A11.7 relates the breakdown of TANF recipients by education level, derived from data provided by the U.S. Department of Health and Human Services.[74] As shown, the demographic characteristics of TANF recipients are weighted heavily

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



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

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

72 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.

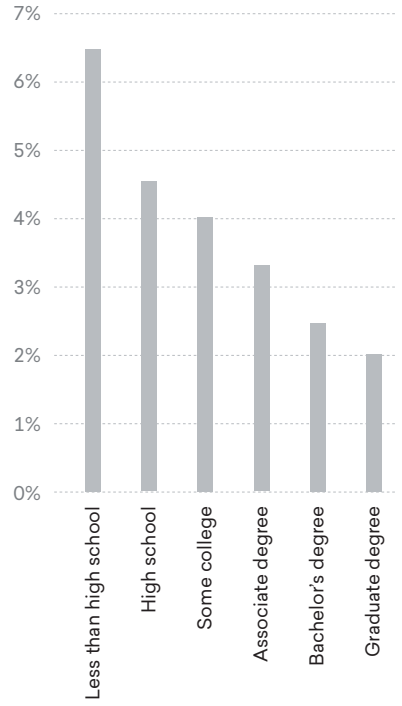
73 Medicaid is not considered in this analysis because it overlaps with the medical expenses in the analyses for smoking, alcohol dependence, obesity, depression, and drug abuse. We also exclude any welfare benefits associated with disability and age.

74 U.S. Department of Health and Human Services, Office of Family Assistance. "Characteristics and Financial Circumstances of TANF Recipients, Fiscal Year 2016."

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 A11.8. These data are provided by the Bureau of Labor Statistics.[75] As shown, unemployment rates range from 6.5% for those with less than a high school diploma to 2.0% for those at the graduate degree level or higher.

FIGURE A11.8: UNEMPLOYMENT BY EDUCATION LEVEL



Source: Bureau of Labor Statistics.

75 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, 2017.