IOWA

Main Report
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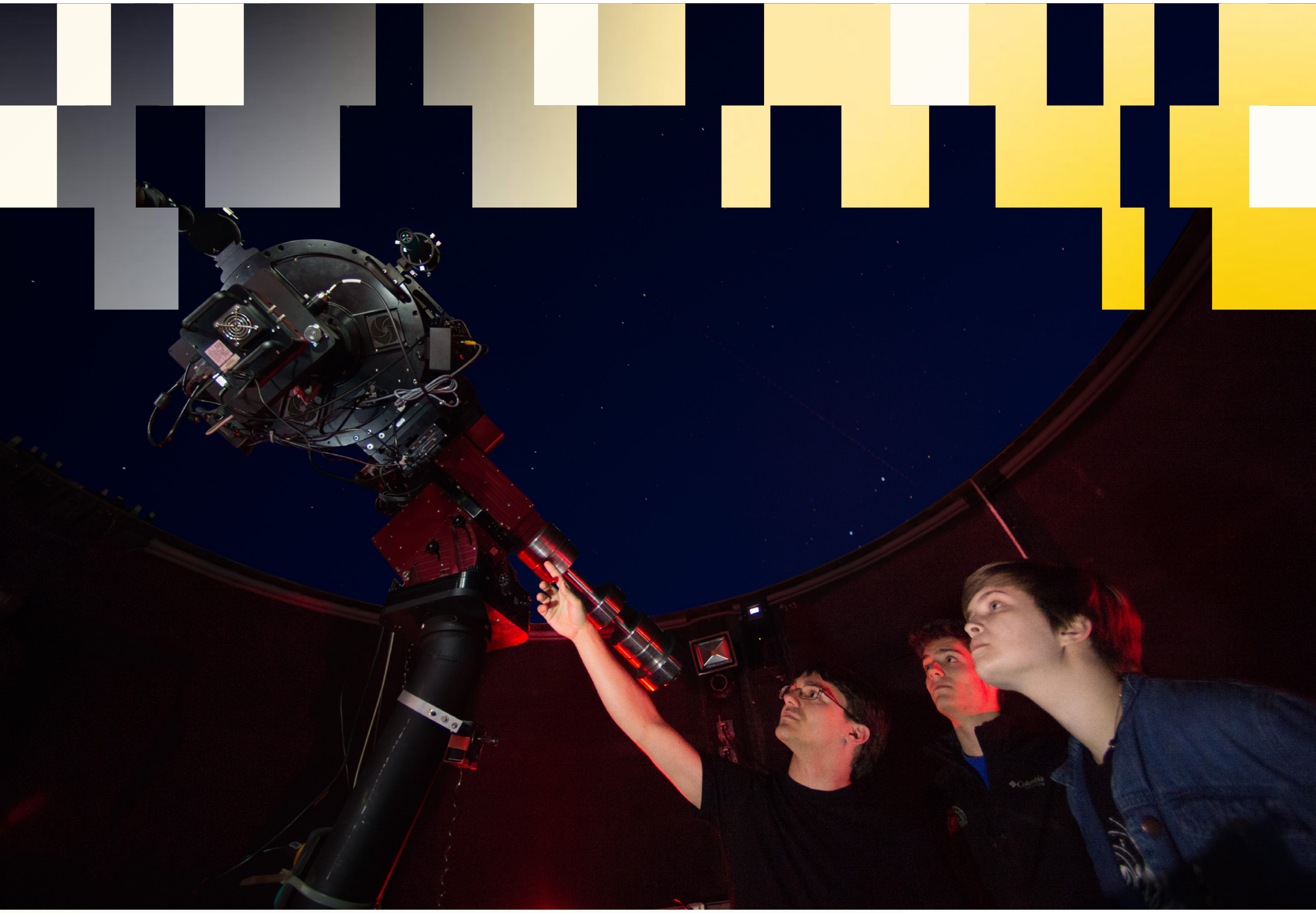


The Economic Value of the University of Iowa

Lightcast

Contents

Preface

Lightcast 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, Lightcast has completed over 2,800 economic impact studies for educational institutions in three countries. Along the way, we have worked to continuously update and improve our methodologies to ensure that they conform to best practices.

The present study reflects the latest version of our model, representing the most up-to-date theory for conducting human capital economic impact analyses. The model is consistently being updated as more data becomes available. For example, in prior studies the alumni impact only included the alumni served over the past 30 years. Historical headcount data beyond 30 years oftentimes did not exist and estimates were unreliable. However, historical headcount data reliability has increased over the years, making the historical headcount estimates by Lightcast more accurate. Therefore, the impact from alumni has been expanded to include all alumni active in the state workforce who have not reached the average retirement age of 67.

This model, as with previous versions, has various external data inputs which reflect the most current economic activity and data. These data include (but are not limited to): the taxpayer discount rate; the student discount rate; the consumer savings rate; the consumer price index; national health expenditures; state and local industry earnings as a percent of total industry earnings; income tax brackets and sales tax by state; and unemployment, migration, and life tables. All data sets are maintained quarterly, although most updates occur only once a year.

These and other changes mark a considerable upgrade to the Lightcast economic impact model. Our hope is that these improvements will provide a better product for our clients—reports that are more transparent and streamlined, methodology that is more comprehensive and robust, and findings that are more relevant and meaningful to today's audiences.

While this report is useful in demonstrating the current value of the UI, it is not intended for comparison with the UI's previous study conducted by Lightcast in 2019. Due to the extent of the changes to Lightcast's model since 2019, differences between results from the 2019 study and the present study do not necessarily indicate changes in the value of the university. For example, the source of migration data has been updated to the Internal Revenue Service, which provides more granular and reliable data on migration, making the state outmigration rate used in the study reflective of actual recent migration patterns.

Lightcast encourages our readers to approach us directly with any questions or comments they may have about the study so that we can continue to improve our model and keep the public dialogue open about the positive impacts of education.

A note on comparing studies

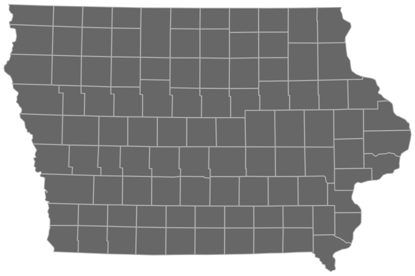
It is important to note that the changes outlined above represent important improvements to our methodology, ultimately providing more accurate and robust results. However, these changes make it difficult to directly compare past studies to the current study, with the effectiveness of the comparison decreasing as the age of the previous study increases.

Additionally, in general Lightcast discourages comparisons between individual institutions and between educational systems since many factors, such as regional economic and political conditions, institutional differences, and student demographics are outside of the institution's control. In addition, every institution is unique, meaning the results and types of impact or investment measures are tailored to the specific institution or educational system.

Executive summary

This report assesses the impact of the University of Iowa (UI) on the state economy and the benefits generated by the university for students, taxpayers, and society. The results of this study show that the UI creates a positive net impact on the state economy and generates a positive return on investment for students, taxpayers, and society.

Economic impact analysis



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During the analysis year, the UI spent $2.2 billion on payroll and benefits for 31,902 full-time and part-time employees (including graduate assistants and student employees), and spent another $1.6 billion on goods and services to carry out its day-to-day operations, construction, hospital, clinic, 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 the UI that directly takes into account the fact that state dollars spent on the UI could have been spent elsewhere in the state if not directed towards the UI and would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of the UI.

> The additional income of **$8 billion** created by the UI is equal to approximately **3.8%** of the total gross state product of Iowa.

This analysis shows that in fiscal year (FY) 2021-22, operations, construction, UI Hospitals & Clinics, research, economic development, visitor, and student spending of the UI, together with volunteerism and the enhanced productivity of its alumni, generated **$8 billion** in added income for the Iowa economy. The additional income of $8 billion created by the UI is equal to approximately **3.8%** of the total gross state product (GSP) of Iowa. For perspective, this impact from the university is larger than the entire Transportation & Warehousing industry in the state. The impact of $8 billion is equivalent to supporting **109,694 jobs**. For further perspective, this means that **one out of every 19 jobs** in Iowa is supported by the activities of the UI and its students. These economic impacts break down as follows:

Operations spending impact

Payroll and benefits to support the UI's day-to-day operations (excluding payroll from hospital and clinic and research employees) amounted to $1.1 billion.[1] The university's non-pay expenditures (excluding construction, hospital and clinic, and research) amounted to $266.6 million. The net impact of operations spending by the university in Iowa during the analysis year was approximately **$1.4 billion** in added income, which is equivalent to supporting **19,440 jobs**.

Construction spending impact

The UI invests in construction each year to maintain its facilities, create additional capacities, and meet its 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 2021-22, the UI's construction spending generated **$72.3 million** in added income, which is equivalent to supporting **961 jobs**.

UI Hospitals and Clinics spending impact

In FY 2021-22, the UI spent $2.1 billion on UI Hospitals & Clinics faculty and staff and other expenditures to support their operations. The total net impact of the UI Hospitals & Clinics operations in the state was **$2 billion** in added income, which is equivalent to supporting **25,673 jobs**.

Research spending impact

Research activities of the UI 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 2020-21, the UI spent $242.7 million on payroll to support research activities. This along with $133.6 million in other research spending (excluding indirect costs) created a net total of **$369.5 million** in added income for the state economy. This added income is equivalent to supporting **5,002 jobs**. Note that at the time of this study, FY 2021-22 research expenditure data were being verified, so FY 2020-21 research expenditure data were used as the reference. Actual FY 2021-22 research awards are equal to or higher than FY 2020-21.

Value of outreach programs

The UI impacts Iowa beyond its principal mission of educating students and training the next generation of professionals. As the home of Iowa's premier hospital, the UI and its faculty, staff, and students provide healthcare to tens of thousands of Iowans each year. Hospitals and healthcare providers across Iowa send their most complicated cases to the UI to take advantage of the specialized care their

1 Includes royalty payments to inventors related to the UI who still live in Iowa.

Important note

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

patients can only receive there. Mobile programs and other clinics take preventative care into Iowa communities. The State Hygienic Lab, operated at the UI, provides critical services for every mother and child born in Iowa while also detecting disease and environmental pollution. Other capabilities resident at the UI are working to improve Iowa's response to floods, assisting communities in tackling their unique challenges, and providing expertise and support to Iowa's entrepreneurs.

Economic development impact[2]

The UI creates an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of start-up and spin-off companies related to the UI and companies that have grown in the state with the support of the university. In FY 2021-22, start-up and spin-off companies created or supported by the UI added **$551.4 million** in income for the Iowa economy, which is equivalent to supporting **6,626 jobs**.[3]

Visitor spending impact

Out-of-state visitors attracted to Iowa for activities at the UI 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 **$91.2 million** in income for the Iowa economy, which is equivalent to supporting **2,164 jobs**.

Student spending impact

Around 41% of students attending the UI originated from outside the state. Most of these students relocated to Iowa to attend the university. In addition, some students, referred to as retained students, are residents of Iowa who would have left the state if not for the existence of the UI. The money that these students spent toward living expenses in Iowa is attributable to the UI.

The expenditures of relocated and retained students in the state during the analysis year added approximately **$64.2 million** in income for the Iowa economy, which is equivalent to supporting **1,218 jobs**.

Volunteerism impact

The UI encourages its students and employees to volunteer in Iowa, where they can work with businesses and organizations to help meet their goals. The work of these student and employee volunteers allows businesses and organizations to grow, increasing their output and impacting the economy at large. UI students and employees volunteered nearly 251,000 hours of their time in FY 2021-22. Using the

2 The following three impacts (economic development and volunteerism) are based off data that are not tracked regularly or captured completely. Thus, the results that follow are conservative.

3 To maintain an acceptable level of data reliability, this impact is limited to those companies that were created or supported by the UI after FY 2011-12 and were still active in Iowa in FY 2021-22.

value per volunteer hour for Iowa as provided by the Independent Sector,[4] the work of UI student and employee volunteers is equivalent to **$6.3 million** in earnings.

In terms of actual impact to the Iowa economy, UI student and employee volunteers generated an impact of **$12.2 million** in added income for the state in FY 2021-22, equivalent to supporting **495 jobs**.[5]

Alumni impact

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

The accumulated impact of former students currently employed in the Iowa workforce amounted to **$3.5 billion** in added income for the Iowa economy, which is equivalent to supporting **48,113 jobs**.

4 By state value per volunteer hour was provided by Independent Sector (see https://independentsector.org/resource/vovt_details/).

5 The impact of volunteerism is grossly undercounted because the number of volunteer hours was self-reported to the UI and only includes a small sample of UI student and employee volunteers.

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 the UI 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 university, which they will pay back over time. While some students were employed while attending the university, 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 **$732.5 million** in present value student costs.

In return, students will receive a present value of **$3.9 billion** in increased earnings over their working lives. This translates to a return of **$5.40** in higher future earnings for every dollar that students invest in their education at the UI. The corresponding annual rate of return is **15.6%**.

Taxpayer perspective[6]

Taxpayers provided **$261.2 million** of state funding to the UI in FY 2021-22. In return, taxpayers will receive an estimated present value of **$799.1 million**

6 The modeling approach used for the taxpayer and social investment analyses centers on the benefits and costs arising from the UI's core mission—educating students. As such, it does not consider the taxpayer or social benefits arising from the UI Hospitals & Clinics' provision of healthcare to Iowans and the study removes the operational costs and benefits of the UI Hospitals & Clinics from its analysis.

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 **$122.5 million** in benefits due to a reduced demand for government-funded social services in Iowa. For every tax dollar spent educating students attending the UI, taxpayers will receive an average of **$3.50** in return over the course of the students' working lives. In other words, taxpayers enjoy an annual rate of return of 11.4%.

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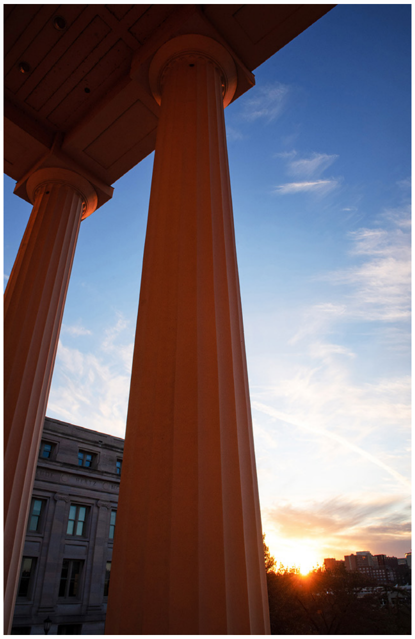
Social perspective

People in Iowa invested **$2.3 billion** in the UI in FY 2021-22. This includes the university's expenditures, student expenses, and student opportunity costs. In return, the state of Iowa will receive an estimated present value of **$8.9 billion** in added state revenue over the course of the students' working lives. Iowa will also benefit from an estimated **$411.9 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 the UI, an average of **$4.10** in benefits will accrue to Iowa over the course of the students' careers.

Acknowledgments

Lightcast gratefully acknowledges the excellent support of the staff at the University of Iowa in making this study possible. Special thanks go to Dr. Barbara J. Wilson, President, who approved the study, and to Jeff Kueter, Director of Strategic Initiatives and External Relations, Office of Innovation; Deb Tiemens, Associate Director, Institutional Data, Office of the Provost; and Rachel McGuire, Assistant Vice President and University Controller, Office of Finance & Operations, who collected much of the data and information requested. Any errors in the report are the responsibility of Lightcast and not of any of the above-mentioned individuals.

Introduction



The University of Iowa (UI), established in 1847, has today grown to serve more than 32,000 students. The university is led by Dr. Barbara J. Wilson, President. The university's service region, for the purpose of this report, is the state of Iowa.

While the UI affects the state in a variety of ways, many of them difficult to quantify, this study considers the university's economic benefits. The university naturally helps students achieve their individual potential and develop the knowledge, skills, and abilities they need to have fulfilling and prosperous careers. However, the UI impacts Iowa beyond influencing the lives of students. The university's program offerings supply employers with workers to make their businesses more productive. The university, its day-to-day and construction operations, the UI Hospitals & Clinics, it's research and economic development activities, the expenditures of its visitors and students, and its student and employee volunteers support the state economy through the output and employment generated by state vendors. The benefits created by the university 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.

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

The second component of the study measures the benefits generated by the UI 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 university 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 2021-22 academic and financial reports from the UI; industry and employment data from the Bureau of Labor Statistics and Census Bureau; outputs of Lightcast's impact model and MR-SAM model; and a variety of published materials relating education to social behavior.

Chapter 1:

Profile of the University of Iowa and the economy

THE UNIVERSITY OF IOWA (UI) is a highly-regarded, research-oriented public university providing a wide range of academic programs to students in Iowa City, Iowa. A member of the Iowa University System, the UI offers a variety of undergraduate, graduate, and professional course and degree options while cultivating community and sharing its rich history and traditions with each new class of students. In FY 2021-22, the University of Iowa enrolled more than 32,800 undergraduate and graduate students. In Fall 2021, the UI enrolled 31,206 undergraduate and graduate students.

Founded in 1847, the UI is the state's oldest institution of higher education and was the first public school in the nation to admit men and women on an equal basis. Since its establishment 175 years ago, the UI has grown to become an international leader in academics and research supported by more than 31,900 faculty and staff. Additionally, the university boasts a robust network of hundreds of thousands of alumni worldwide.

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The University of Iowa provides exceptional educational opportunities in a variety of formats, including hybrid, online, and in-person options. With more than 200 areas of study and 100+ graduate, doctoral, and professional programs, the UI's flexible learning models and diverse disciplines make it easy for students to explore interests and gain skills. The university's varied program offerings include Business Analytics and Information Systems, Dance, Education, Industrial and Systems Engineering, English and Creative Writing, Medical Laboratory Science, Sport and Recreation Management, and many more. In addition, the University of Iowa is also known for its world-class medical center, one of the top health care centers in the U.S. and a leader in both patient care and medical research.

The UI provides a multitude of opportunities for students to connect and engage on campus, including more than 600 student clubs and organizations and 20 NCAA Division 1 sports. Additionally, students enjoy a student-to-faculty ratio of 15:1 and receive personalized attention from dedicated, world-class faculty. As a Carnegie R1 (very high research activity) university, the UI prioritizes and supports relevant applied research aimed at solving contemporary, real-world problems and engages in a wide variety of research activities with $553.9 million in research expenditures in FY 2020-21. Research opportunities for students abound at the university, and participation in cutting-edge projects is encouraged. The university's Office of the Vice President for Research supports the advancement of research, scholarship, and creativity on campus. Further, Iowa's Center for Research by Undergraduates promotes undergraduate involvement in research through facilitating mentorship of students involved in research and provides platforms for students to explore research communication.

In addition to providing excellent academic opportunities for students, the UI enhances the lives of community members through connection, engagement, and service. Local residents and visitors alike are encouraged to explore the University of Iowa Museum of Natural History, enjoy exhibits at the Stanley Museum of Art, take in a show at Hancher Auditorium, and cheer on the Hawkeyes at Kinnick Stadium and the Carver-Hawkeye Arena. The UI is also a vital asset to Iowa employers. Through key partnerships with industry and organizations, the university provides enrichment opportunities for the Iowa City community and supports economic development in the state and beyond.

UI employee and finance data

The study uses two general types of information: 1) data collected from the university and 2) state economic data obtained from various public sources and Lightcast's proprietary data modeling tools.[7] This chapter presents the basic underlying information from the UI used in this analysis and provides an overview of the Iowa economy.

Employee data

Data provided by the UI 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 UI employed 20,532 full-time and 11,370 part-time faculty and staff in FY 2021-22 (including graduate assistants and student employees and the UI Hospitals & Clinics employees). Of these, all worked in the state and 97% 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 university's annual revenues by funding source—a total of $4.6 billion in FY 2021-22 (including the UI Hospitals & Clinics revenue). As indicated, tuition and fees comprised 9% of total revenue, and revenues from state and federal government sources comprised another 17%. The sales and services of hospitals after deducting patient contractual allowances made up another 66%, and grants and contracts made up another 2%. Sales and services of auxiliary enterprises comprised 4%, with the remaining 2% stemming from other revenue sources. These data are critical

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

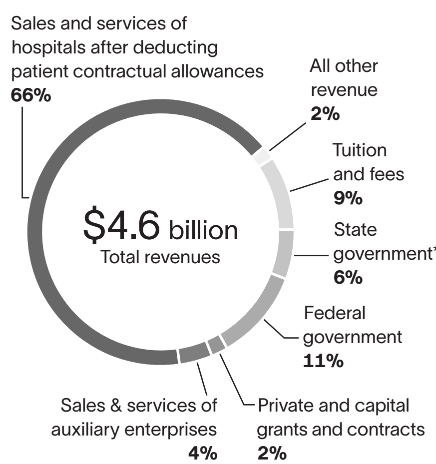
Table 1.1: Employee data, FY 2021-22*

Full-time faculty and staff	20,532
Part-time faculty and staff	11,370
Total faculty and staff	**31,902**
% of employees who work in the state	100%
% of employees who live in the state	97%

*Includes graduate assistants and student employees.

Source: Data provided by the UI.

Figure 1.1: UI revenues by source, FY 2021-22



*Revenue from state government includes capital appropriations.

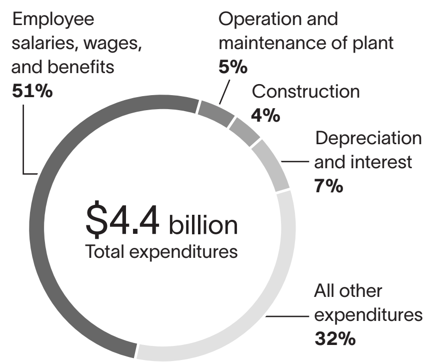
Source: Data provided by the UI.

in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

Expenditures

Figure 1.2 displays the UI's expense data (including UI Hospitals & Clinics expenditures). The combined payroll at the UI, including student salaries and wages, amounted to $2.2 billion. This was equal to 51% of the university's total expenses for FY 2021-22. Other expenditures, including operation and maintenance of plant, construction, depreciation and interest, and other expenditures, made up $2.1 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 university's assets rather than an outflow of expenditures.

Figure 1.2: UI expenses by function, FY 2021-22



Source: Data provided by the UI.

Percentages may not add due to rounding.

Students

The UI Office of the Registrar reported a fall enrollment of 31,206, students in 2021. For the purpose of this analysis, we consider the unduplicated annual FY 2021-22 student headcount. The UI served more than 32,000 students in FY 2021-22. The breakdown of the student body by gender was 55% female and 45% male. The breakdown by race was 72% white, 20% students of color,[8] and 8% unknown. The students' overall average age was 24 years old.[9] An estimated 51% of students remain in Iowa after finishing their time at the UI and the remaining 49% settle outside the state.[10]

Table 1.2 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In FY 2021-22, the UI served 480 professional graduates, 425 doctorate graduates, 1,504 master's degree graduates, 190 postbaccalaureate certificate completers, and 4,819 bachelor's degree graduates. Another 24,111 students enrolled in courses for credit but did not complete a degree during the reporting year. The university offered dual credit courses to high schools, serving a total of 115 students over the course of the year. The university also served 63 basic education students. Other non-degree seeking students enrolled in workforce or professional development programs accounted for 183 students. Students not allocated to the other categories comprised the remaining 928 students.

Non-credit students, or students enrolled but not attempting to achieve a degree, play an important part at the university and in the state economy. The university features extensive offerings to meet workforce and community needs through non-credit courses. The UI's Health Professions & Related Clinical Services had the most course registrations, with 134,948 registrations, making up almost half of the total non-credit course registrations in FY 2020-21. Health-Related Knowledge & Skills was second with more than 30,000 registrations. Basic Skills (12,476), Visual and Performing Arts (9,968), and Education (7,181) each garnered significant interest.

8 Students of color are defined as the IPEDS categories Black or African American, Hispanic/Latino, Asian, American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, Two or more races, and Non-resident Alien.

9 Unduplicated headcount, gender, race, and age data provided by the UI.

10 Settlement data provided by the UI.

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 24.4.

Table 1.2: Breakdown of student headcount and CHE production by education level, FY 2021-22

Category	Headcount	Total CHEs	Average CHEs
Professional graduates	480	18,544	38.6
PhD graduates	425	2,148	5.1
Master's degree graduates	1,504	23,583	15.7
Postbaccalaureate certificate completers	190	2,336	12.3
Bachelor's degree graduates	4,819	115,326	23.9
Continuing students	24,111	630,136	26.1
Dual credit students	115	582	5.1
Basic education students	63	1,872	29.7
Workforce/professional development students	183	1,701	9.3
All other students	928	3,853	4.2
Total students	**32,818**	**800,081**	**24.4**

Source: Data provided by the UI.

The Iowa economy

Since the university was first established, it has been serving Iowa by enhancing the workforce, providing state 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 ordered by total income, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the state's total income, which can also be considered as the state's gross state product (GSP).

Table 1.3: **Income by major industry sector in Iowa, 2021***

Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)**	% of total income	Sales (millions)
Manufacturing	$18,174	$22,047	$40,221	19%	$112,540
Finance & Insurance	$12,471	$13,191	$25,662	12%	$43,129
Other Services (except Public Administration)	$3,112	$18,287	$21,399	10%	$30,145
Wholesale Trade	$5,921	$7,653	$13,574	6%	$22,524
Health Care & Social Assistance	$12,294	$1,170	$13,464	6%	$22,147
Retail Trade	$7,532	$5,365	$12,897	6%	$21,504
Government, Non-Education	$9,848	$2,912	$12,760	6%	$63,899
Construction	$7,797	$2,213	$10,010	5%	$19,764
Government, Education	$8,907	$0	$8,907	4%	$10,353
Professional & Technical Services	$5,955	$1,293	$7,248	3%	$10,660
Agriculture, Forestry, Fishing & Hunting	$5,023	$2,122	$7,145	3%	$19,057
Transportation & Warehousing	$5,256	$1,174	$6,430	3%	$13,389
Real Estate & Rental & Leasing	$3,556	$2,138	$5,694	3%	$12,811
Information	$1,761	$3,243	$5,004	2%	$8,477
Administrative & Waste Services	$3,768	$885	$4,654	2%	$8,025
Accommodation & Food Services	$2,783	$1,619	$4,402	2%	$8,298
Utilities	$895	$2,772	$3,667	2%	$5,510
Management of Companies & Enterprises	$2,845	$230	$3,075	1%	$5,110
Educational Services	$1,601	$169	$1,770	1%	$2,548
Arts, Entertainment, & Recreation	$697	$297	$994	<1%	$1,638
Mining, Quarrying, & Oil and Gas Extraction	$195	$297	$491	<1%	$888
Total	**$120,392**	**$89,075**	**$209,467**	**100%**	**$442,415**

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

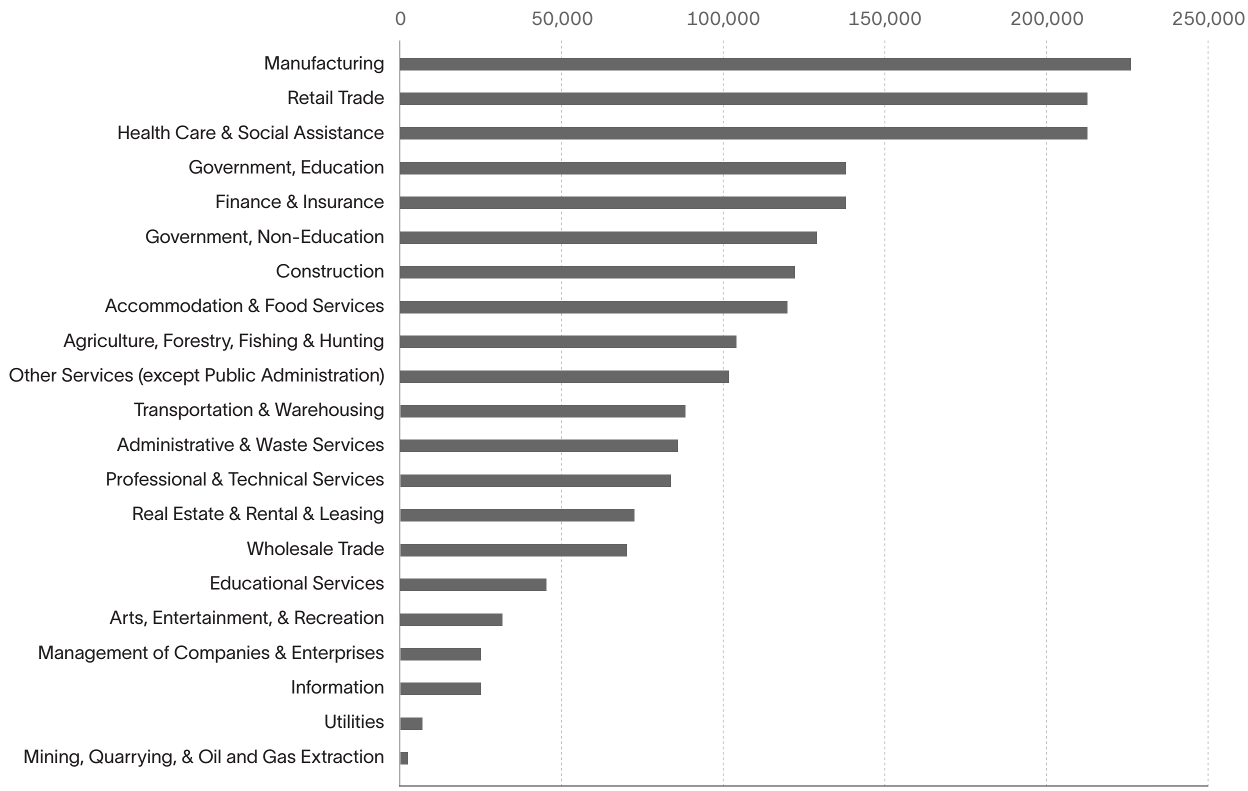
** Numbers may not add due to rounding.

Source: Lightcast industry data.

As shown in Table 1.3, the total income, or GSP, of Iowa is approximately $209.5 billion, equal to the sum of labor income ($120.4 billion) and non-labor income ($89.1 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the university on the state economy.

Figure 1.3 provides the breakdown of jobs by industry in Iowa. The Manufacturing sector is the largest employer, supporting 225,818 jobs or 11.1% of total employment in the state. The second largest employer is the Retail Trade sector, supporting 212,266 jobs or 10.4% of the state's total employment. Altogether, the state supports 2 million jobs.[11]

Figure 1.3: Jobs by major industry sector in Iowa, 2021*



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

Source: Lightcast employment data.

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

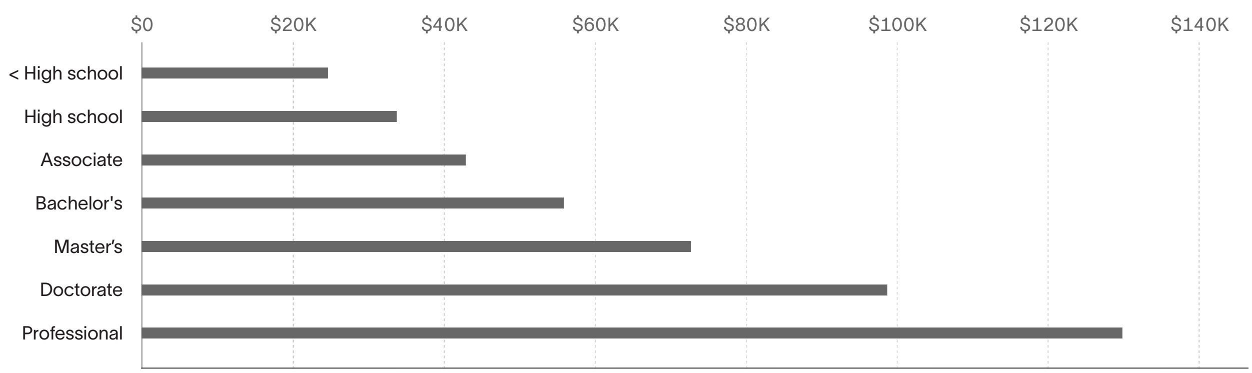
Table 1.4 and Figure 1.4 present the mean earnings by education level in Iowa at the midpoint of the average-aged worker's career. These numbers are derived from Lightcast's complete employment data on average earnings per worker in the state.[12] The numbers are then weighted by the university's demographic profile. 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 UI can expect approximate wages of $55,900 per year within Iowa, approximately $22,800 more than someone with a high school diploma.

Table 1.4: Average earnings by education level at a UI student's career midpoint

Education level	State earnings	Difference from next lowest degree
Less than high school	$24,700	n/a
High school or equivalent	$33,100	$8,400
Associate degree	$42,100	$9,000
Bachelor's degree	$55,900	$13,800
Master's degree	$72,500	$16,600
Doctoral degree	$98,200	$25,700
Professional degree	$129,500	$31,300

Source: Lightcast employment data.

Figure 1.4: Average earnings by education level at a UI student's career midpoint



Source: Lightcast employment data.

12 Wage rates in the Lightcast 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, Lightcast industry earnings-per-worker numbers are generally higher than those reported by other sources.

Chapter 2:

Economic impacts on the Iowa economy

The UI impacts the Iowa economy in a variety of ways. The university is an employer and buyer of goods and services. It attracts monies that otherwise would not have entered the state economy through its day-to-day and construction operations, the UI Hospitals & Clinics, its research, its outreach programs, and economic development activities, and the expenditures of its visitors and students. The UI also encourages its students and employees to volunteer in Iowa, where they can work with businesses and organizations to help meet their goals. Further, it provides students with the knowledge, skills, and abilities they need to become productive citizens and add to the overall output of the state.

IN THIS CHAPTER, we estimate the following economic impacts of the UI: 1) the operations spending impact, 2) the construction spending impact, 3) the UI Hospitals & Clinics spending impact, 4) the research spending impact, 5) the value of outreach programs, 6) the economic development impact, 7) the visitor spending impact, 8) the student spending impact, 9) the volunteerism 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.

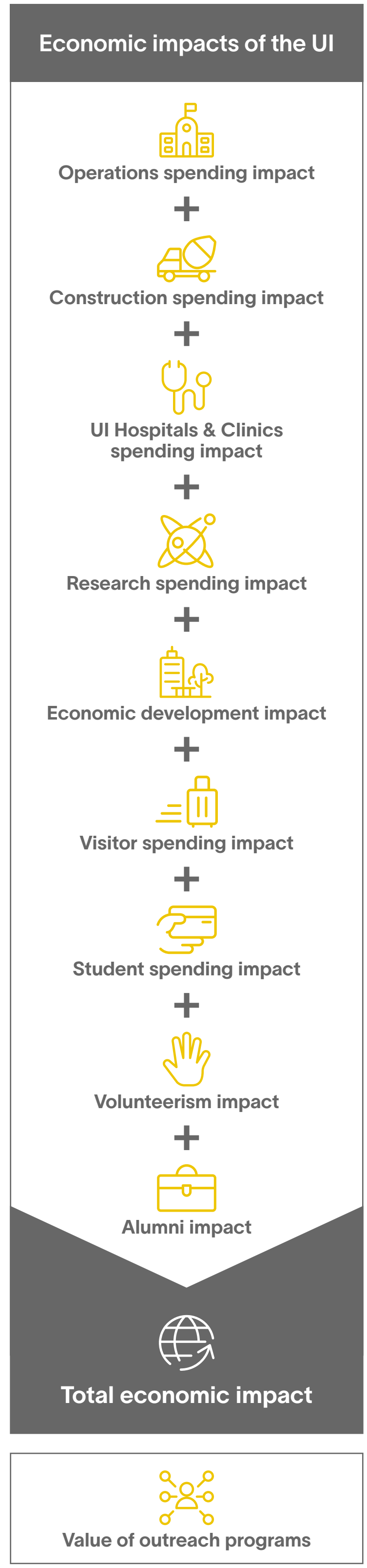
When exploring each of these economic impacts, we consider the following hypothetical question:

How would economic activity change in Iowa if the UI and all its alumni did not exist in FY 2021-22?

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 university; 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 university. Note that while we present the value of outreach 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 the UI Hospitals & Clinics spending impact and the visitor spending impact, affect 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 the UI Hospitals & 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.[13] All of these measures—added labor and



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

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.

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

Lightcast	Initial	Direct	Indirect	Induced
IMPLAN	Direct	Indirect		Induced

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

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

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

Table 2.1 presents university expenditures (excluding construction, the UI Hospitals & Clinics, and research) for the following three categories: 1) salaries, wages, and benefits, 2) operation and maintenance of plant, and 3) all other expenditures, including purchases for supplies and services. Also included in all other expenditures are expenses associated with grants and scholarships. Many students receive grants and scholarships that exceed the cost of tuition and fees. The university then dispenses this residual financial aid to students, who spend it on living expenses. Some of this spending takes place in the state, and is therefore an injection of new money into the state economy that would not have happened if the UI did not exist. In this analysis, we exclude expenses for depreciation and interest due to the way those measures are calculated in the national input-output accounts, and because depreciation represents the devaluing of the university's assets rather than an outflow of expenditures.[14]

Table 2.1: UI expenses by function (excluding depreciation & interest), FY 2021-22

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Employee salaries, wages, and benefits*	$1,112,169	$0	$1,112,169
Operation and maintenance of plant	$153,417	$48,000	$201,417
All other expenditures	$17,605	$47,591	$65,195
Total	**$1,283,191**	**$95,591**	**$1,378,782**

This table does not include expenditures for construction, the UI Hospitals & Clinics, or research activities, as these are presented separately in the following sections.

* Includes royalty payments to inventors related to the UI who still live in Iowa.

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

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

The first step in estimating the multiplier effects of the university's operational expenditures is to map these categories of expenditures to the approximately 1,000 industries of the Lightcast MR-SAM model. Assuming that the spending patterns of university personnel approximately match those of the average U.S. consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure coefficients provided by Lightcast's national SAM. All UI employees work in Iowa (see Table 1.1), and therefore we consider all 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 university's spending patterns approximately match national averages and apply the national spending coefficients for NAICS 902612 (Colleges, Universities, and Professional Schools (State Government)).[15] Operation and maintenance of plant expenditures are mapped to the industries that relate to capital construction, maintenance, and support, while the university's remaining expenditures are mapped to the remaining industries.

We now have three vectors of expenditures for the UI: one for salaries, wages, and benefits; another for operation and maintenance of plant; and a third for the university's purchases of supplies and services. The next step is to estimate the portion of these expenditures that occur inside the state. The expenditures occurring outside the state are known as leakages. We estimate in-state expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by state suppliers, for each of the approximately 1,000 industries in the MR-SAM model.[16] 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 university. 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 university operations spending. The people employed by the UI and their salaries, wages, and benefits comprise the initial effect,[17] shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled *multiplier effect*. Summing the initial and multiplier effects, the gross impacts are $1.4 billion in labor income and $262.5 million in non-labor income. This sums to a total impact of $1.6 billion in total added income associated with the spending of the university and its employees in the state. This is equivalent to supporting 22,929 jobs.

15 See Appendix 2 for a definition of NAICS.

16 See Appendix 5 for a description of Lightcast's MR-SAM model.

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

Table 2.2: **Operations spending impact, FY 2021-22**

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$1,112,169**	**$0**	**$1,112,169**	**$1,378,782**	**16,658**
Multiplier effect					
Direct effect	$66,591	$22,592	$89,183	$171,022	1,035
Indirect effect	$14,855	$4,846	$19,701	$38,114	231
Induced effect	$234,049	$235,037	$469,086	$793,210	5,005
Total multiplier effect	**$315,495**	**$262,475**	**$577,970**	**$1,002,346**	**6,271**
Gross impact (initial + multiplier)	**$1,427,664**	**$262,475**	**$1,690,140**	**$2,381,128**	**22,929**
Less alternative uses of funds	-$157,665	-$171,395	-$329,060	-$668,814	-3,489
Net impact	**$1,269,999**	**$91,081**	**$1,361,080**	**$1,712,314**	**19,440**

Source: Lightcast impact model.

The $1.7 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 the UI—had not occurred. The UI received an estimated 62% of its funding from sources within Iowa. This portion of the university's funding came from the tuition and fees paid by resident students, from the auxiliary revenue and donations from private sources located within the state, from state 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 UI, 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 university's operations is **$1.4 billion** in total added income, which is equivalent to supporting **19,440 jobs**.

We estimate this counterfactual by simulating a scenario where in-state monies spent on the university 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 the UI, map this to the detailed industries of the MR-SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-state spending, and run the in-state spending through the MR-SAM model's multiplier matrix to derive multiplier effects. The results of this exercise are shown as negative values in the row labeled *less alternative uses of funds* in Table 2.2.

The total net impact of the university's operations is equal to the gross impact less the impact of the alternative use of funds—the opportunity cost of the state money. As shown in the last row of Table 2.2, the total net impact is approximately $1.3 billion in labor income and $91.1 million in non-labor income. This sums together to $1.4 billion in total added income and is equivalent to supporting 19,440 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of the UI.

Construction spending impact

In this section, we estimate the economic impact of the construction spending of the UI. 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 2021-22, the UI spent a total of $171 million on various construction projects. Construction projects included the purchase of Pharmaceuticals Fit Out and Manufacturing Equipment ($28 million); replacement of the PoolPak air handling units at the Campus Recreation and Wellness Center ($7 million) and the UI Hospitals & Clinics; expansion of the Heart and Vascular Cath Labs ($31 million); construction of the UI Hospitals & Clinics facility at Forevergreen Road ($526 million); renovation of the student living space in Hillcrest Residence Hall ($23 million); expansion of the UI Hospitals & Clinics Colloton Pavilion Observation Unit ($14 million); construction of the Iowa Wrestling Training Facility ($32 million); and the expansion of the UI Hospitals & Clinics Pappajohn Pavilion Level 5 Main Operating Room ($29 million).

During FY 2021-22, the UI spent a total of **$171 million** on various construction projects.

Assuming UI construction spending approximately matches national construction spending patterns of NAICS 902612 (Colleges, Universities, and Professional Schools (State Government)), we map UI construction spending to the construction industries of the MR-SAM model. Next, we use the RPCs to estimate the portion of this spending that occurs in-state. Finally, the in-state spending is run through the multiplier matrix to estimate the direct, indirect, and induced effects. Because construction is so labor intensive, the non-labor income impact is relatively small.

To account for the opportunity cost of any in-state construction money, we estimate the impact of a similar alternative uses of funds as found in the operations and research spending impacts. This is done by simulating a scenario where in-state monies spent on construction are instead spent on consumer goods. These impacts are then subtracted from the gross construction spending impacts. Again, since construction is so labor intensive, most of the added income stems from labor income as opposed to non-labor income.

Table 2.3 presents the impacts of UI construction spending during FY 2021-22. Note the initial effect is purely a sales effect, so there is no initial change in labor or non-labor income. The FY 2021-22 UI construction spending creates a net total short-run impact of $72.3 million in added income—the equivalent of supporting 961 jobs in Iowa.

Table 2.3: Construction spending impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$170,958**	**0**
Multiplier effect					
Direct effect	$51,951	$14,784	$66,735	$131,672	829
Indirect effect	$11,633	$3,315	$14,948	$29,483	185
Induced effect	$19,880	$5,657	$25,537	$50,386	317
Total multiplier effect	**$83,464**	**$23,755**	**$107,219**	**$211,542**	**1,331**
Gross impact (initial + multiplier)	**$83,464**	**$23,755**	**$107,219**	**$382,500**	**1,331**
Less alternative uses of funds	-$16,723	-$18,179	-$34,902	-$70,938	-370
Net impact	**$66,741**	**$5,576**	**$72,317**	**$311,562**	**961**

Source: Lightcast impact model.

UI Hospitals & Clinics spending impact

In this section, we estimate the economic impact of the spending of the UI Hospitals & Clinics. 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 2021-22, $2.1 billion was spent on the UI Hospitals & Clinics operations (see Table 2.4), 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: UI Hospitals & Clinics expenses by function (excluding depreciation & interest), FY 2021-22

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Salaries, wages, and benefits	$872,951	$1,749	$874,701
Operation and maintenance of plant	$21,421	$6,426	$27,847
All other expenses	$777,218	$432,569	$1,209,788
Total	**$1,671,590**	**$440,745**	**$2,112,335**

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

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 the UI Hospitals & Clinics 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 the UI Hospitals & Clinics.

The payroll and number of people employed by the UI Hospitals & Clinics comprise the initial effect. The total impacts of UI Hospitals & Clinics expenses (the sum of the initial and multiplier effects) are $1.6 billion in labor income and $384 million in non-labor income. This totals to $2 billion in total added income and is equivalent to supporting 25,673 jobs.

Table 2.5: UI Hospitals & Clinics spending impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$872,951**	**$0**	**$872,951**	**$2,112,335**	**11,747**
Multiplier effect					
Direct effect	$314,188	$113,257	$427,445	$798,639	5,829
Indirect effect	$97,336	$38,364	$135,700	$274,594	1,759
Induced effect	$309,933	$232,355	$542,288	$939,284	6,338
Total multiplier effect	**$721,457**	**$383,976**	**$1,105,434**	**$2,012,517**	**13,925**
Total impact (initial + multiplier)	**$1,594,409**	**$383,976**	**$1,978,385**	**$4,124,852**	**25,673**

Source: Lightcast impact model.

Helping patients with clubfoot

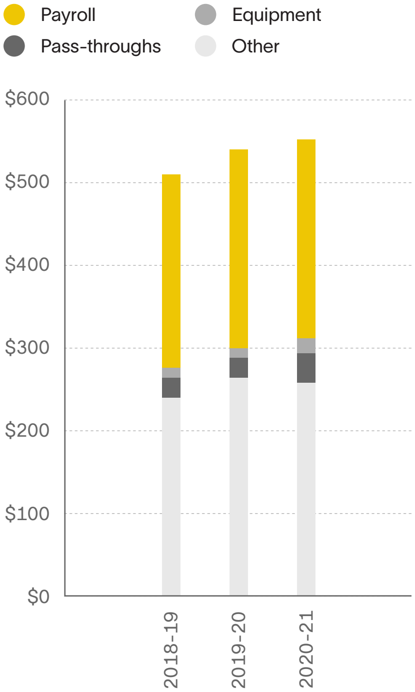
The most common musculoskeletal deformity among newborn babies around the world is a condition commonly referred to as clubfoot. The medical term for this condition is congenital talipes equinovarus, meaning the foot is abnormally turned downward and inward. The resulting posture resembles a club. If left untreated, clubfoot persists as a rigid, unsightly deformity and is one of the most common causes of physical disability. The critical final phase of treatment for clubfoot, using the Ponseti Method, developed at the University of Iowa, requires parents to use a brace in order to maintain the correct foot posture for 12–14 hours each night until four years of age. Parents have been vocal about a desire to allow their children some mobility while maintaining correct alignment for the treatment of this deformity. To that end, UI's medical device prototyping facility Protostudios utilized 3D CAD design, rapid prototyping principles, and state of the art 3D printers to quickly iterate upon the concept of a reciprocating brace that allows the prescribed posture of abduction and dorsiflexion in a corrected clubfoot while allowing more mobility and higher degrees of comfort for the child. Clubfoot Solutions now distributes the Iowa Brace to help the more than 200,000 children born annually with congenital clubfoot birth defect.

Research spending impact

Similar to the day-to-day operations of the UI, research activities impact the economy by employing people and requiring the purchase of equipment and other supplies and services. Figure 2.1 shows the UI's research expenses by function—payroll, equipment, pass-throughs, and other (excluding indirect costs[18])—for the last three fiscal years. In FY 2020-21, the UI spent $376.3 million on research and development activities. These expenses would not have been possible without funding from outside the state—the UI received around 51% of its research funding from federal and other sources. It should be noted that indirect costs listed under the "other" category are excluded from the impact analysis because these costs were not necessarily spent during the analysis year and are more representative as revenue than expenditures. Note that at the time of this study, FY 2021-22 research expenditure data were being verified, so FY 2020-21 research expenditure data were used as the reference. Actual FY 2021-22 research awards are equal to or higher than FY 2020-21.

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

Figure 2.1: Research expenses by function (millions) (excluding indirect costs)



Source: Data provided by the UI.

18 Because indirect costs are not necessarily spent during the analysis year, they are excluded from this analysis. Ultimately, excluding these measures results in more conservative and defensible estimates.

research of the UI, 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 UI to provide information on expenditures by research and development field as they report to the National Science Foundation's Higher Education Research and Development Survey (HERD).[19] 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 UI.

Initial, direct, indirect, and induced effects of the UI's research expenses appear in Table 2.3. As with the operations spending impact, the initial effect consists of the 3,473 research jobs and their associated salaries, wages, and benefits. The university's research expenses have a total gross impact of $365.7 million in labor income and $73.2 million in non-labor income. This sums together to $438.9 million in added income, equivalent to 5,738 jobs. Taking into account the impact of the alternative uses of funds, net research expenditure impacts of the UI are $332.4 million in labor income and $37.1 million in non-labor income. This sums together to $369.5 million in total added income and is equivalent to supporting 5,002 jobs.

Table 2.6: Research spending impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$242,722**	**$0**	**$242,722**	**$376,343**	**3,473**
Multiplier effect					
Direct effect	$45,999	$14,387	$60,385	$92,110	748
Indirect effect	$9,040	$2,734	$11,773	$19,166	148
Induced effect	$67,911	$56,076	$123,986	$202,564	1,369
Total multiplier effect	**$122,949**	**$73,196**	**$196,145**	**$313,840**	**2,265**
Gross impact (initial + multiplier)	**$365,671**	**$73,196**	**$438,867**	**$690,183**	**5,738**
Less alternative uses of funds	-$33,244	-$36,138	-$69,382	-$141,018	-736
Net impact	**$332,428**	**$37,057**	**$369,485**	**$549,164**	**5,002**

Source: Lightcast 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 UI received 382 invention disclosures, filed 617 new US patent applications, and produced 180 licenses (see Table 2.7). Without the research activities of the UI, this level of innovation and sustained economic growth would not have been possible.

19 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.

The UI's research activities create an economic impact beyond spending. There are impacts created through the entrepreneurial and innovative activities stemming from the UI's research. Research activities such as advancing the field of photonics at the interface of optical engineering, quantum physics, and electromagnetics add general productivity and have immense value in the state economy. However, the full magnitude of their value is difficult to quantify. Some of this value may be captured in the economic development and alumni impacts, presented later in this chapter. The broader spill-over effects, however, remain as additional value created beyond the scope of this analysis.

Table 2.7: UI invention disclosures, patent applications, licenses, and license income

Fiscal year	Invention disclosures received	Patent applications filed	Licenses and options executed	Adjusted gross license income (millions)
2021-22	103	188	48	$2.3
2020-21	101	123	47	$1.1
2019-20	95	146	37	$1.1
2018-19	83	160	48	$1.2
Total	**382**	**617**	**180**	**$5.7**

Source: Data provided by the UI.

Digital Diagnostics helps identify diseases of thousands of patients

Digital Diagnostics has raised $130 million in venture capital making it one of the most successful recent commercial outgrowths of UI research. In April 2018, Digital Diagnostics (formerly known as IDx) became the first company to ever receive Food and Drug Administration (FDA) clearance for an Artificial Intelligence (AI) diagnostic platform that makes a diagnosis without physician input at the point-of-care. This achievement did not happen overnight—it was the culmination of decades of research by founder Dr. Michael Abramoff on automated image analysis, combined with decades of research on how clinicians diagnose disease. Digital Diagnostics is in use at over 20 health systems, and its customers have tested thousands of patients and identified hundreds of patients with disease who were previously undiagnosed. Dr. Abramoff is the MD Professor of Ophthalmology and Visual Sciences at the University of Iowa, with a joint appointment in the College of Engineering.

Value of outreach programs

The UI impacts Iowa beyond its principal mission of educating students and training the next generation of professionals. As the home of Iowa's premier hospital, the UI and its faculty, staff, and students provide healthcare to tens of thousands of Iowans each year. Hospitals and healthcare providers across Iowa send their most complicated cases to the UI to take advantage of the specialized care their patients can only receive there. Mobile programs and other clinics take preventative care into Iowa communities. The State Hygienic Lab, operated at the UI, provides critical services for every mother and child born in Iowa while also detecting disease and environmental pollution. Other capabilities resident at the UI are working to improve Iowa's response to floods, assisting communities in tackling their unique challenges, and providing expertise and support to Iowa's entrepreneurs. The following are just some of the many examples that illustrate how the research and knowledge produced at the UI extends out to impact communities and businesses across Iowa.

The UI Hospitals & Clinics serve patients from each of Iowa's 99 counties. Serving more than 1.3 million patients, the UI Hospitals & Clinics operate out of 78 locations across Iowa, enabling them to provide high quality healthcare in every corner of Iowa. Additionally, the Virtual Hospitalist Service uses telemedicine to provide co-management of patients from the emergency department to inpatient units at a regional hospital, allowing local providers and nurses collaborate with a UI hospitalist through secure video conferencing and a shared electronic health record (EHR).

The UI Hospitals & Clinics and UI's College of Medicine also further the education and training of medical professionals across Iowa through continuing education while also running programs seeking to inspire the next generation of healthcare professionals. For example, students from 51 counties participated in UI Health Care STEM programs offered for K-12 students and UI Hospitals & Clinics and College of Medicine personnel participated in over 100 community engagement programs.

The College of Dentistry manages 26 community programs focused on children, patients with special needs, and seniors, including an award-winning Geriatrics Mobile Dental Unit, each designed to take high quality dental care into communities across Iowa.

The College of Nursing's Simulation in Motion (Iowa (SIM-IA)) is a mobile education program designed to bring state-of the art clinical education to pre-hospital (EMS) and hospital professionals throughout the state using high-fidelity human patient simulators and trainers. These simulators allow healthcare professionals to perform hands-on education and skill performance for illnesses and traumas they encounter frequently, as well as those that occur less commonly but are high stakes. By using mobile simulation labs (i.e., trucks) the College is able to deliver high-quality, evidence-based education to providers who might not have opportunities to attend simulation training due to cost, distance, or coverage. More than 700 Iowa healthcare professionals have already tackled the many emergency situations that can be simulated in it. Plans call for the deployment of two more simulation labs to be based in central and western Iowa.

The College of Public Health is a key partner in a number of activities designed to improve health and safety of Iowa's manufacturing and agricultural workforce. The Great Plains Center for Agricultural Health is tasked with researching health challenges affecting farmers and providing tangible resources to help meet those needs. For example, the Center at the UI has toolkits addressing techniques to avoid hearing loss, tips and techniques to improve rural roadway safety, and a gas monitoring training kit to reduce release hydrogen sulfide by livestock producers. The Heartland Center for Occupational Health and Safety offers continuing education and outreach to Iowa employers on industrial and agricultural safety and injury prevention.

The Equity in Health Science Practice program draws on talent from across the UI's healthcare capabilities to provide information and direct access to care for underserved communities. The project connects directly with community leaders in minority communities to tailor educational programming and healthcare services to those communities. A recent program in Storm Lake began with assessments of healthcare needs and resulted in visits by UI faculty, staff, and students to administer care.

The UI's Institute for Clinical and Translational Sciences (ICTS) is focused on moving medical research into practice by patients, healthcare professionals, and the healthcare industry. The program's Science Café and Mobile Technology Lab go out into Iowa communities to collect information about healthcare needs and then link appropriate responses to those needs.

Since 1904, the State Hygienic Laboratory (SHL) has been at the forefront of public health issues in Iowa. As the state's public health and environmental laboratory, the Hygienic Laboratory serves all of Iowa's 99 counties through disease detection, environmental monitoring, and newborn and maternal screening. The SHL provides potentially lifesaving screening for every child born in Iowa. The Iowa Maternal Prenatal Screening Program—based in Coralville—and the Iowa Neonatal Metabolic Screening Program—based in Ankeny—are part of the Iowa Department of Public Health's (IDPH) Center for Congenital and Inherited Disorders. The SHL is the designated testing facility for both programs. In addition to IDPH, the SHL partners with the UI Hospitals & Clinics, which provide physician consultation, counseling, and follow-up services. SHL's testing capabilities were on full display during the COVID-19 pandemic and they are Iowa's principal testing facility for a full range of diseases. SHL's Environmental Health Program, which operates out of its locations in Coralville, Ankeny, and Okoboji, is available to test everything from air to wastewater, including human tissue samples, fish, foods, soil, drinking water, groundwater, and other materials, including unknown powders. The SHL also operates a network of monitors around the state to understand the potential impact that the ambient air quality could have on the citizens of Iowa.

IIHR-Hydroscience and Engineering at the UI's College of Engineering recently completed the first detailed look at the flood risk to farmland statewide. The new maps seek to address objectively the flood stress points, by showing farmland that is prone to chronic flooding and has low productivity yields compared to other areas. The work enables Iowa farmers and policymakers to better assess risks and make more informed decisions about land usage.

The Iowa Initiative for Sustainable Communities (IISC) is an engaged-learning program focused on partnership building between institutions of higher education and communities. Since 2009, IISC has brought faculty, staff, and students to urban and rural communities throughout the state. The UI brings teams of faculty and students with multidisciplinary skills to tackle problems brought forward by Iowa communities. More than 50 Iowa communities have participated in more than 300 projects. In FY 2021-22, IISC worked on two projects: one with the Maquoketa River Watershed Management Authority and other with the Jackson County Economic Alliance.

The College of Business's John Pappajohn Entrepreneurial Center (JPEC) operates several programs that illustrate how the UI also aids businesses across Iowa. The Jacobson Institute for Youth Entrepreneurship is a comprehensive program that enriches K-12 students' lives through classroom and practical educational experiences. Programming and impact include:

- **BizInnovator Program:** Curriculum and teacher training focused on entrepreneurship and business. In FY 2021-22, 289 teachers from 231 schools in 42 states used the curriculum nationwide and impacted 12,668 students.
- **STEM Innovator Program:** This professional development program for teachers infuses innovation and entrepreneurship into K-12 classrooms. In FY 2021-22, 378 educators from 147 schools in 17 states received curriculum, training, and support, impacting 40,091 students.

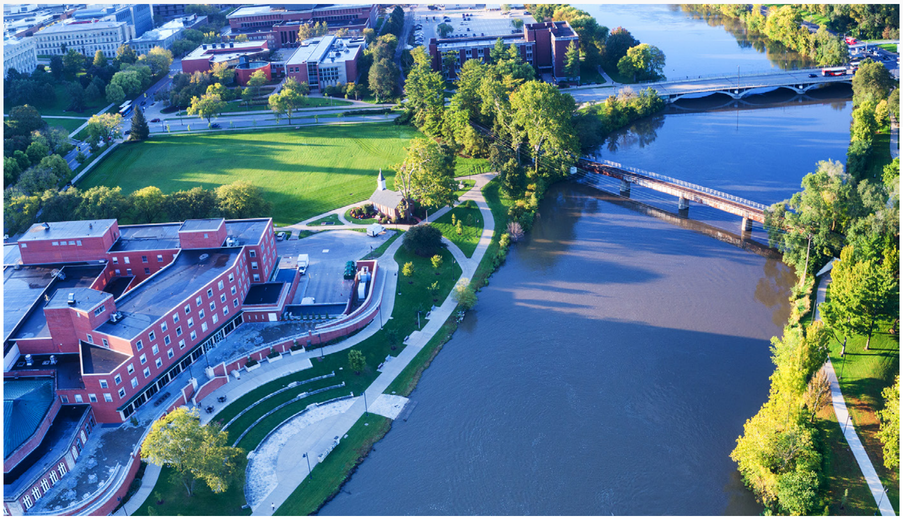
The UI's JPEC offers an immersive "Lean LaunchPad," business model canvas, seven-week boot camp training program named Venture School to accelerate start-ups.

Venture School is offered in multiple locations across Iowa. The program emphasizes real-world entrepreneurship through experiential learning, a flipped classroom, and immediate feedback. During FY 2021-22, workshops were offered in Coralville/UI, Davenport/Eastern Iowa Community College, Iowa City, Cedar Falls/University of Northern Iowa, Des Moines, Sioux City, Dubuque and Mason City/North Iowa Area Community College. There were 86 teams made up of 118 entrepreneurs.

JPEC also oversees the UI Small Business Development Center (SBDC) that serves a five-county area (Cedar, Johnson, Iowa, Poweshiek, and Washington counties). During FY 2021-22, the UI SBDC served 314 start-ups. This contributed to the creation of 103 jobs and $12.7 million in equity being raised. Business consulting services are provided to entrepreneurial and start-up companies around the state. During FY 2021-22, 88 projects were completed for 52 clients in 19 counties. Finally, the Iowa Innovation Associates Internship Program provides funding support enabling Iowa start-ups to hire UI student interns as they work to grow their businesses. In FY 2021-22, 19 students were placed in 15 start-ups in five Iowa counties: Linn, Johnson, Polk, Dubuque, and Scott.

Overall, UI's outreach programs have proven to be very valuable to the Iowa economy. However, the impact from these programs is difficult to accurately quantify through traditional economic impact measures. With that said, the financial activities of the outreach programs are included in the operations spending impact. Even though a complete impact cannot be calculated from these programs, the significant role the programs play in business success and Iowan's well-being across the state should not be overlooked.

Economic development impact



The UI creates an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of UI start-up and spin-off companies that have been created and the growth of companies that have been supported by the university. This subsection presents the economic impact of companies that would not have existed in the state but for the presence of the UI. In addition, the impact from the growth of companies that have been supported by the university 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 UI.
- **Spin-off companies**: Companies created, fostered, and supported through programs offered by the UI that support entrepreneurial business development, or companies that were created by faculty, students, or alumni as a result of their experience at the UI.

The UI creates an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of UI start-up and spin-off companies related to the university that have been created in the state.

To maintain an acceptable level of data reliability, this impact is limited to those companies that were created or supported by the UI after FY 2011-12 and were still active in Iowa in FY 2021-22. We 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 university.

Table 2.8 presents the number of employees for start-up and spin-off companies related to the universities that were created and supported by the universities since FY 2011-12 and active in Iowa during the analysis year.[20] Companies that benefited from the university, for example, UI's Small Business Development Center (SBDC), are included under the count of spin-off companies. However, there are a number of companies on which the UI does not have data, hence they cannot be included in the impact analysis below.

Table 2.8: Start-up and spin-off companies related to the UI that were active in Iowa in FY 2021-22*

	Number of companies	Number of employees**
Start-up companies	51	237
Spin-off companies	836	3,669

* To maintain an acceptable level of data reliability, this impact is limited to those companies that were created or supported by the UI after FY 2011-12 and were still active in Iowa in FY 2021-22.

** The number of employees includes those hired at the start-up and spin-off companies and the growth in FY 2021-22 employees at companies supported by the SBDC.

Source: Data provided by the UI.

UI student reduces herbicide costs of farmers

Founded by UI Computer Science student, Holly Bennett, Spayer Mods allows farmers to reduce their herbicide costs by 80% by ensuring the herbicide is only applied to weeds. A retrofit kit detects weeds in crop fields and applies herbicide only when the weed passes underneath the sprayer. Spayer Mods won the Summer 2021 Hawkeye Startup Accelerator Pitch Competition sponsored by the UI's John Pappajohn Entrepreneurial Center.

To measure the economic development impact, 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.

20 Start-up and spin-off companies are not tracked regularly. Thus, the results are conservative. When employee data were unavailable, a conservative assumption of one employee was used.

Table 2.9 presents the impact of the start-up companies. The initial effect is 237 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 $25.6 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 $43.1 million in added labor income and $32.4 million in non-labor income. This totals to $75.5 million in added income—or the equivalent of supporting 396 jobs.

Table 2.9: Impact of start-up companies related to the UI, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$25,605**	**$19,957**	**$45,562**	**$69,098**	**237**
Multiplier effect					
Direct effect	$4,594	$2,268	$6,862	$11,454	40
Indirect effect	$1,218	$585	$1,803	$3,052	11
Induced effect	$11,687	$9,593	$21,280	$31,841	109
Total multiplier effect	**$17,498**	**$12,447**	**$29,945**	**$46,347**	**159**
Total impact (initial + multiplier)	**$43,104**	**$32,404**	**$75,507**	**$115,445**	**396**

Source: Lightcast impact model.

UI professors found company to improve cancer treatment

Viewpoint Molecular Targeting, Inc., a radiopharmaceutical company developing precision lead-212-based alpha-particle oncology therapeutics and complementary diagnostic imaging agents, entered into a definitive agreement to merge with Isoray, Inc, a medical technology company and innovator in seed brachytherapy, in fall 2022, ensuring the company will continue its research and manufacturing work in Iowa. The company was founded by Dr. Frances Johnson, formerly Adjunct Associate Professor of Internal Medicine, and Michael K. Schultz, concurrently an Associate Professor of Radiology and Free Radical and Radiation Biology at the University of Iowa.

Dr. Schultz, via a competitive NIH Research Project Grant (R01), performed the non-clinical research and development needed to advance Viewpoint's alpha-particle therapy for neuroendocrine tumors to a Phase 1 clinical imaging and therapy trial to be conducted at the University of Iowa. Dr. Schultz is Principal Investigator or Co-Investigator (with CEO and CMO Frances Johnson, MD of Viewpoint) on over $10 million of NCI funded Small Business Innovation Research grant projects. Viewpoint sits on the UI Research Park and has worked closely with the UI Office of Innovation and the John Pappajohn Entrepreneurial Center.

Note that start-up companies have a strong and clearly defined link to the UI. The link between the university and the existence of its spin-off companies, however, is less direct and is thus viewed as more subjective. Many of the UI's spin-off companies included in this analysis were assisted through the university's SBDC with customized, professional business advice. We include the impacts from spin-off companies and the UI's SBDC in the grand total impact presented later in the report since they represent economic development activities of the university. 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.[21] As demonstrated in Table 2.10, the university creates an exceptional environment that fosters innovation and entrepreneurship. As a result, the impact of spin-off companies related to the UI is $313 million in added labor income and $162.9 million in non-labor income, totaling $475.9 million in added income—the equivalent of supporting 6,230 jobs.

Table 2.10: Impact of spin-off companies related to the UI, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$185,294**	**$97,831**	**$283,125**	**$523,315**	**3,669**
Multiplier effect					
Direct effect	$34,153	$18,222	$52,375	$99,691	688
Indirect effect	$9,735	$4,955	$14,689	$28,211	205
Induced effect	$83,831	$41,862	$125,693	$218,338	1,668
Total multiplier effect	**$127,719**	**$65,039**	**$192,758**	**$346,240**	**2,561**
Total impact (initial + multiplier)	**$313,013**	**$162,869**	**$475,883**	**$869,555**	**6,230**

Source: Lightcast impact model.

Beyond the start-up and spin-off companies, the UI supports thousands more companies through its various colleges. These services range from legal support for non-profit organizations to continuing education options for dentists and to onsite health care services for business employees. The support that the UI provides for these companies positively impacts the state economy; however, due to data constraints, the impact is not measured in this analysis.

University of Northern Iowa student starts up an ethical and sustainable sources company

As a student at the University of Northern Iowa, Russel Karim put his interest in improving the world to the test by forming his first start-up while only a sophomore. Originally from Bangladesh and from a family in the apparel industry, Karim, with his latest business venture, intends to address the struggles of people who work in the fashion and apparel industry from the worker and manufacturing sides. This issue sparked the idea of Dhakai, an ethical and sustainable sourcing company that connects small to mid-sized apparel businesses to verified manufacturers. With Dhakai, Karim is simplifying the supply chain by directly connecting brands and manufacturers, which results in responsible, sustainable, and more affordable sourcing. Karim participated in the UI's John Pappajohn Entrepreneurial Center's Venture School, a statewide program to work with emerging businesses, and subsequently was accepted into the Techstars Iowa Accelerator.

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

Visitor spending impact

Hundreds of thousands of out-of-state visitors came to the UI in FY 2021-22 to participate in various activities, including commencement, sports events, and business conferences. The UI estimated that 638,444 out-of-state visitors attended events it hosted in FY 2021-22. 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

Table 2.11: Average per-trip visitor costs and sales generated by out-of-state visitors in Iowa, FY 2021-22*

Accommodation	$47
Food	$115
Entertainment and shopping	$56
Transportation	$55
Total expenses per visitor	**$273**
Number of out-of-state visitors	*638,444*
Gross sales	$174,166,873
On-campus sales (excluding textbooks)	-$10,905,469
Net off-campus sales	**$163,261,403**

* 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 Lightcast based on data provided by the UI.

visitors totaled $174.2 million in FY 2021-22.[22] However, some of this spending includes monies paid to the university through non-textbook items (e.g., event tickets, food, etc.). These have already been accounted for in the operations spending impact and should thus be removed to avoid double-counting. We estimate that on-campus sales generated by out-of-state visitors totaled $10.9 million. The net sales from out-of-state visitors in FY 2021-22 thus come to $163.3 million.

Hundreds of thousands of out-of-state visitors came to the UI in FY 2021-22 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 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 2021-22 is $53.6 million in labor income and $37.6 million in non-labor income. This totals to $91.2 million in added income and is equivalent to supporting 2,164 jobs.

Table 2.12: Visitor spending impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$163,261**	**0**
Multiplier effect					
Direct effect	$31,266	$21,909	$53,175	$96,538	1,262
Indirect effect	$8,117	$5,902	$14,019	$25,984	330
Induced effect	$14,207	$9,773	$23,981	$43,136	573
Total multiplier effect	**$53,590**	**$37,584**	**$91,175**	**$165,658**	**2,164**
Total impact (initial + multiplier)	**$53,590**	**$37,584**	**$91,175**	**$328,919**	**2,164**

Source: Lightcast impact model.

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

Student spending impact

Both in-state and out-of-state students contribute to the student spending impact of the UI; 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 UI, 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 UI. In addition, only the out-of-state students who relocated to Iowa to attend the university 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 19,208 students attending the UI who originated from Iowa (excluding dual credit high school students), not all of them would have remained in the state if not for the existence of the UI. We apply a conservative assumption that 10% of these students would have left Iowa for other education opportunities if the UI did not exist.[23] Therefore, we recognize that the in-state spending of 1,921 students retained in the state is attributable to the UI. These students, called retained students, spent money at businesses in the state for everyday needs such as groceries, accommodation, and transportation. Of the retained students, we estimate 308 lived on campus while attending the university. While these students spend money while attending the university, we exclude most of their spending for room and board since these expenditures are already reflected in the impact of the university's operations.

23 See Appendix 1 for a sensitivity analysis of the retained student variable.

Relocated students are also accounted for in the UI's student spending impact. An estimated 6,748 students came from outside the state and lived off campus while attending the UI in FY 2021-22. Another estimated 2,564 out-of-state students lived on campus while attending the university. We apply the same adjustment as described above to the students who relocated and lived on campus during their time at the university. 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 $13,794 per student. Note that this table excludes expenses for books and supplies, since many of these costs are already reflected in the operations impact discussed in the previous section. We multiply the $13,794 in annual costs by the 8,361 students who either were retained or relocated to the state because of the UI 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, 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 (2,872 students). Altogether, off-campus spending of relocated and retained students generated gross sales of $134.1 million. This figure, once net of the monies paid to student workers, yields net off-campus sales of $100.2 million, as shown in the bottom row of Table 2.13.

Table 2.13: Average student costs and total sales generated by relocated and retained students in Iowa, FY 2021-22

Room and board	$9,652
Personal expenses	$2,644
Transportation	$1,498
Total expenses per student	**$13,794**
Number of students retained	*1,921*
Number of students relocated	*9,312*
Gross retained student sales	$24,267,387
Gross relocated student sales	$109,882,363
Total gross off-campus sales	**$134,149,750**
Wages and salaries paid to student workers*	$33,983,317
Net off-campus sales	**$100,166,433**

* This figure reflects only the portion of payroll that was used to cover the living expenses of relocated and retained student workers who lived in the state.

Source: Student costs and wages provided by the UI. The number of relocated and retained students who lived in the state off campus or on campus while attending is derived by Lightcast from the student origin data and in-term residence data provided by the UI. The data are based on all students.

Estimating the impacts generated by the $100.2 million in student spending follows a procedure similar to that of the operations impact described above. We distribute the $100.2 million in sales to the industry sectors of the MR-SAM model, apply RPCs

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.

to reflect in-state spending, and run the net sales figures through the MR-SAM model to derive multiplier effects.

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 $38.3 million in labor income and $25.9 million in non-labor income. This sums together to $64.2 million in total added income and is equivalent to supporting 1,218 jobs. These values represent the direct effects created at the businesses patronized by the students, the indirect effects created by the supply chain of those businesses, and the effects of the increased spending of the household sector throughout the state economy as a result of the direct and indirect effects.

The total impact of student spending is **$64.2 million** in total added income and is equivalent to supporting **1,218 jobs**.

Table 2.14: Student spending impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$100,166**	**0**
Multiplier effect					
Direct effect	$22,562	$15,374	$37,936	$66,388	714
Indirect effect	$5,502	$3,737	$9,239	$16,756	187
Induced effect	$10,204	$6,806	$17,010	$29,460	317
Total multiplier effect	**$38,268**	**$25,917**	**$64,185**	**$112,604**	**1,218**
Total impact (initial + multiplier)	**$38,268**	**$25,917**	**$64,185**	**$212,771**	**1,218**

Source: Lightcast impact model.

Volunteerism impact

Beyond positively impacting the state through the activities occurring at the UI, the UI directly impacts the state economy through its facilitation and support of student and employee volunteer activities. Volunteers are an important part of 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 an altruistic 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-fulfillment and belonging.

UI students and employees participated in numerous volunteer activities across the state including volunteering at K-12 school districts, helping with volunteer income tax assistance, running health mobile clinics in rural locations, raising major gift support for the UI Children's faculty position, and raising funds for numerous organizations. Overall, 17,047 UI student and employee volunteers supported non-profit organizations and causes across the state in FY 2021-22.[25] Altogether, UI students and employees volunteered 250,979 hours of their time.[26] According to Independent Sector,[27] the only national membership organization that brings together the charitable community, the average value of a volunteer hour in Iowa is $25.16. Multiplying this by the hours UI students and employees volunteered amounts to $6.3 million in value to the community.

UI student and employee volunteer hours are valued at **$6.3 million**.

Next, we convert the $6.3 million in value or, for the purposes of economic impact modeling, earnings by industry to sales using the MR-SAM model's earnings-to-sales ratios, and run the sales figures through the MR-SAM model to derive multiplier effects. Unlike other components of this analysis, we do not include the initial effect. This is because volunteers are not paid employees of the businesses and organizations, so there is no initial labor income associated with

25 Employee and student volunteer data provided by the UI.

26 The number of hours volunteered is grossly undercounted because the number of volunteer hours was self-reported to the UI and only includes a small sample of UI student and employee volunteers. The volunteerism impact is best viewed as a low estimate arising from UI students and employees.

27 By state value per volunteer hour was provided by Independent Sector (see https://independentsector.org/resource/vovt_details/).

their increased productivity or increased initial non-labor income associated with the business output. Therefore, we only include the multiplier effects from the volunteers in the total impact. The UI volunteers' productivity allows leaders of the businesses and organizations to devote resources to other projects, generating effects throughout the economy—the multiplier effects.

Table 2.15 outlines this process. In FY 2021-22, UI student and employee volunteers added $11.1 million in labor income and $1.1 million in non-labor income. The total added income from UI volunteers to the Iowa economy sums to $12.2 million in FY 2021-22.[28] This $12.2 million is equivalent to supporting 495 jobs in the state.

Table 2.15: Volunteerism impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$0**	**$0**	**$0**	**$0**	**0**
Multiplier effect					
Direct effect	$6,315	$639	$6,954	$14,929	278
Indirect effect	$2,098	$220	$2,318	$5,426	102
Induced effect	$2,687	$264	$2,951	$6,117	114
Total multiplier effect	**$11,100**	**$1,124**	**$12,224**	**$26,471**	**495**
Total impact (initial + multiplier)	**$11,100**	**$1,124**	**$12,224**	**$26,471**	**495**

Source: Lightcast impact model.

Health students participate in a day of service in the community

Students at the UI's College of Public Health kicked off FY 2021-22 by performing a day of service in the community. Some harvested vegetables at a local farm dedicated to combating food insecurity. Others volunteered with a local agency that rescues surplus food from area restaurants and grocery stores and delivers it to homeless shelters, soup kitchens, and food pantries. Others cleaned kitchens and kids' playrooms at community centers serving some of Iowa City's most diverse neighborhoods.

Organizations supported by their efforts include: Iowa Valley Habitat for Humanity – Restore; Iowa Valley Habitat for Humanity – Construction; Iowa City Free Medical Clinic; Wild Woods Farm; University of Iowa Food Pantry; Community Food Bank; and Neighborhood Centers of Johnson County.

28 See the Important note on page 9 and Appendix 4 for an explanation of why it is important to distinguish between the added income (or the income impact) and the sales impact.

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 UI *throughout its history*. We then use this total number to consider the impact of those students in the single FY 2021-22. 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.

While the UI creates an economic impact through its operations, construction, the UI Hospitals & Clinics, research, outreach programs, economic development, visitor, and student spending, as well as volunteerism the greatest economic impact of the UI stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni. While attending the UI, 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 UI alumni enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits). In fact, UI-trained K-12 teachers are found in 93 Iowa counties. The UI is also a leader in serving the healthcare needs of Iowa. The College of Dentistry has trained 77% of the dentists practicing across Iowa. Half of all the physicians in Iowa were educated at the UI's College of Medicine and 48% of Iowa's pharmacists studied at the UI's College of Pharmacy.

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 UI's former students. The second component of the initial effect is comprised of the added non-labor income of the businesses that employ former students of the UI.

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;[29] 2) death, retirement, and unemployment rates from the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics; and 3) state migration data from the Internal Revenue Service.[30] The result is the estimated portion of alumni from each previous year who were still actively employed in the state as of FY 2021-22.

The next step is to quantify the skills and human capital that alumni acquired from the university. We use the students' production of CHEs as a proxy for accumulated human capital. The average number of CHEs completed per student in FY 2021-22 was 24.4. To estimate the number of CHEs present in the workforce during the analysis year, we use the university's historical student headcount over the past 44 years, from FY 1978-79 to FY 2021-22. We apply a 44-year time horizon to include all alumni active in the state workforce who have not reached the average retirement age of 67. The time horizon, or number of years in the workforce, is calculated by subtracting

The UI is the top trainer of Iowa professionals:

- #35 Best Public Universities (USNWR)
- Top 200 Best Global Universities (USNWR)
- #1 Public University for "Writing in Disciplines"
- 33 consecutive years as one of the best academic hospitals in the U.S.
- 8 specialties at the UI Hospitals & Clinics rank in the top 10% nationally
- The UI earns a record $867 million in external research funding

29 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.

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

UI students' average age from the retirement age of 67. However, because the alumni impact is based on credits achieved and not headcount, we calculate and use an average age per credit rather than per student. We then inform this average age by the historical student average age from the UI's economic impact study conducted by Lightcast for FY 2017-18.

We multiply the 24.4 average CHEs per student by the headcounts that we estimate are still actively employed from each of the previous years.[31] Students who enroll at the university 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 11.7 million CHEs from alumni active in the workforce.

Next, we estimate the value of the CHEs, or the skills and human capital acquired by UI alumni. This is done using the *incremental* added labor income stemming from the students' higher wages. The incremental added labor income is the difference between the wage earned by UI alumni and the alternative wage they would have earned had they not attended the UI. 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 $281. This value represents the state average incremental increase in wages that alumni of UI 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 2021-22, 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 6. 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 $3.3 billion in gross labor income from increased wages received by former students in FY 2021-22 (as shown in Table 2.16).

Table 2.16: Number of CHEs in workforce and initial labor income created in Iowa, FY 2021-22

Number of CHEs in workforce	11,710,529
Average value per CHE	$281
Initial labor income, gross	**$3,294,400,693**
Adjustments for counterfactual scenarios	
Percent reduction for alternative education opportunities	15%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$1,400,120,294**

Source: Lightcast impact model.

31 This assumes the average level of study from past years is equal to the level of study of students today. Lightcast used data provided by the UI for a previous study to estimate students' credit load in prior years.

The next two rows in Table 2.16 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 UI 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 the UI does not exist, we assume a portion of UI 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 UI alumni. The adjustment for alternative education opportunities amounts to a 15% reduction of the $3.3 billion in added labor income. This means that 15% of the added labor income from UI alumni would have been generated in the state anyway, even if the university did not exist. For more information on the alternative education adjustment, see Appendix 7.

The other adjustment in Table 2.16 accounts for the importation of labor. Suppose the UI 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 university did not exist.[32] 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 university. We conduct a sensitivity analysis for this assumption in Appendix 1. With the 50% adjustment, the net added labor income added to the economy comes to $1.4 billion, as shown in Table 2.16.

The $1.4 billion in added labor income appears under the initial effect in the labor income column of Table 2.17. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of the UI 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 ($1.4 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.[33] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics, we map the breakdown of the university's completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from

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

33 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).

the MR-SAM model to map the occupational distribution of the $1.4 billion in initial labor income effects to the detailed industry sectors in the MR-SAM model.[34]

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 $665.2 million in added non-labor income attributable to the university's alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the Iowa economy, equal to approximately $2.1 billion. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix.

Table 2.17: Alumni impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$1,400,120**	**$665,156**	**$2,065,276**	**$4,176,698**	**28,284**
Multiplier effect					
Direct effect	$229,614	$113,804	$343,418	$675,539	4,759
Indirect effect	$71,588	$36,929	$108,517	$216,271	1,503
Induced effect	$664,458	$288,281	$952,739	$1,773,406	13,568
Total multiplier effect	**$965,659**	**$439,014**	**$1,404,673**	**$2,665,216**	**19,829**
Total impact (initial + multiplier)	**$2,365,780**	**$1,104,170**	**$3,469,950**	**$6,841,914**	**48,113**

Source: Lightcast impact model.

Table 2.17 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 university's alumni. The final results are $965.7 million in added labor income and $439 million in added non-labor income, for an overall total of $1.4 billion in multiplier effects. The grand total of the alumni impact is $3.5 billion in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 48,113 jobs.

34 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.

Total UI impact

The total economic impact of the UI on Iowa can be generalized into two broad types of impacts. First, on an annual basis, the UI generates a flow of spending that has a significant impact on the state economy. The impacts of this spending are captured by the operations, construction, the UI Hospitals & Clinics, research, economic development, visitor, and student spending impacts, along with the volunteerism impacts. While not insignificant, these impacts do not capture the true purpose of the UI. The basic mission of the UI is to foster human capital. Every year, a new cohort of former UI students adds to the stock of human capital in the state, and a portion of alumni continues to add to the state economy.

Table 2.18 displays the grand total impacts of the UI on the Iowa economy in FY 2021-22. For context, the percentages of the UI 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 the UI is **$8 billion**, equivalent to **3.8%** of the GSP of Iowa. By comparison, this contribution that the university provides on its own is larger than the entire Transportation & Warehousing industry in the state. The UI's total impact supported **109,694 jobs** in FY 2021-22. For perspective, this means that **one out of every 19 jobs** in Iowa is supported by the activities of the UI and its students.

Even though a $8 billion impact is significant, this figure does not take into account all the activities of UI. More specifically, UI outreach activities should be recognized as adding significant value to the state of Iowa. UI's outreach programs have helped thousands of individuals and companies. Even though the impact of the outreach 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 Lightcast standard of a robust economic impact methodology.

Table 2.18: Total UI impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	$1,269,999	$91,081	$1,361,080	$1,712,314	19,440
Construction spending	$66,741	$5,576	$72,317	$311,562	961
UI Hospitals & Clinics spending	$1,594,409	$383,976	$1,978,385	$4,124,852	25,673
Research spending	$332,428	$37,057	$369,485	$549,164	5,002
Economic development	$356,117	$195,273	$551,390	$985,000	6,626
Visitor spending	$53,590	$37,584	$91,175	$328,919	2,164
Student spending	$38,268	$25,917	$64,185	$212,771	1,218
Volunteerism	$11,100	$1,124	$12,224	$26,471	495
Alumni	$2,365,780	$1,104,170	$3,469,950	$6,841,914	48,113
Total impact	**$6,088,430**	**$1,881,760**	**$7,970,190**	**$15,092,967**	**109,694**
% of the Iowa economy	5.1%	2.1%	3.8%	3.4%	5.4%

* This table excludes the positive impacts of UI outreach activities

Source: Lightcast impact model.

These impacts from the university and its students stem from different industry sectors and spread throughout the state economy. Table 2.19 displays the total impact of the UI by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations, construction, the UI Hospitals & Clinics, research, economic development, visitors, students, volunteerism, and alumni, as shown in Table 2.18, 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 university's spending and from where UI alumni are employed. For example, activities of the UI and alumni in the Health Care & Social Assistance industry sector generated an impact of $1.4 billion in FY 2021-22.

Table 2.19: Total UI impact by industry, FY 2021-22

Industry sector	Total income (thousands)	Jobs supported
Government, Education	$1,668,137	24,968
Health Care & Social Assistance	$1,380,084	19,678
Finance & Insurance	$733,269	4,034
Manufacturing	$503,251	2,889
Professional & Technical Services	$494,427	6,390
Information	$369,397	2,071
Government, Non-Education	$338,397	3,574
Construction	$325,776	4,113
Other Services (except Public Administration)	$323,010	6,589
Administrative & Waste Services	$319,474	5,097
Retail Trade	$287,877	5,283
Real Estate & Rental & Leasing	$242,434	3,030
Wholesale Trade	$206,943	1,074
Accommodation & Food Services	$200,506	5,482
Arts, Entertainment, & Recreation	$178,683	8,037
Educational Services	$170,528	5,268
Management of Companies & Enterprises	$98,627	777
Transportation & Warehousing	$55,936	880
Utilities	$47,995	81
Agriculture, Forestry, Fishing, & Hunting	$24,010	371
Mining, Quarrying, & Oil and Gas Extraction	$1,427	9
Total impact	**$7,970,190**	**109,694**

Source: Lightcast impact model.

Chapter 3:

Investment analysis

The benefits generated by the UI affect the lives of many people. The most obvious beneficiaries are the university's students; they give up time and money to go to the university 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 and local government.

Investment analysis is the process of evaluating total costs and measuring these against total benefits to determine whether or not a proposed venture will be profitable. If benefits outweigh costs, then the investment is worthwhile. If costs outweigh benefits, then the investment will lose money and is thus considered infeasible. In this chapter, we evaluate the UI as a worthwhile investment from the perspectives of students, taxpayers, and society.

Student perspective

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

Student costs

Out-of-pocket expenses

Opportunity costs

Student benefits

Higher earnings from education

Calculating student costs

Student costs consist of three main items: direct outlays, opportunity costs, and future principal and interest costs incurred from student loans. Direct outlays include tuition and fees, equal to $433.2 million from Figure 1.1. Direct outlays also include the cost of books and supplies. On average, full-time students spent $950 each on books and supplies during the reporting year.[35] Multiplying this figure by the number of full-time equivalents (FTEs) produced by the UI in FY 2021-22[36] generates a total cost of $21.6 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 university but also incur the interest cost of taking out loans. In FY 2021-22, students received a total of $57.2 million in federal loans to attend the UI.[37] 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 $57.2 million in federal loans is subtracted from the costs incurred by students in FY 2021-22.

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 university rather than work. To calculate

35 Based on the data provided by the UI.

36 A single FTE is equal to 30 CHEs for undergraduate students and 24 CHEs for graduate students, so there were 27,058 FTEs produced by students in FY 2021-22.

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

it, we need to know the difference between the students' full earning potential and what they actually earn while attending the university.

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 at the start of the analysis year.[38] However, the earnings levels in Table 1.4 reflect what average workers earn at the midpoint of their careers, not while attending the university. Because of this, we adjust the earnings levels to the average age of the student population (24) to better reflect their wages at their current age.[39] This calculation yields an average full earning potential of $23,592 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 UI in FY 2021-22 earned an average of 24.4 CHEs per student (excluding dual credit high school students), which is approximately equal to 87% of a full academic year.[40] We thus include no more than $20,548 (or 87%) 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 66% of students are employed.[41] 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 $20,548). The total value of their foregone earnings thus comes to $228.5 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 79% of what they would have earned had they chosen to work full-time rather than go to college.[42] The remaining 21% comprises the percentage of their full earning potential that they forego. Obviously, this assumption varies by person; some students forego more and others less.

38 This is based on students who reported their prior level of education to the UI. The prior level of education data was then adjusted to exclude dual credit high school students.

39 Further discussion on this adjustment appears in Appendix 6.

40 Equal to 24.4 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.

41 Based on data provided by the UI. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

42 The 79% assumption is based on the average hourly wage of jobs commonly held by working students divided by the state average hourly wage. Occupational wage estimates are published by the Bureau of Labor Statistics (see http://www.bls.gov/oes/current/oes_nat.htm).

Since we do not know the actual jobs that students hold while attending, the 21% 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 0.3 hours of leisure time per day.[43] 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 $108.1 million, equal to the sum of their foregone earnings ($92.1 million) and foregone leisure time ($16 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 university 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 $57.2 million in loans was awarded to 8,740 students, averaging $6,547 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 UI is a four-year university, students will be indebted four times that amount, or $26,189 on average. According to the U.S. Department of Education, this level of indebtedness will take 20 years to pay back under the standard repayment plan.[44]

This indebtedness calculation is used solely to estimate the loan payback period. Students will be paying back the principal amount of $57.2 million over time. After taking into consideration the time value of money, this means that students will pay off a discounted present value of $38.1 million in principal over the 20 years. In order to calculate interest, we only consider interest on the federal loans awarded to students in FY 2021-22. Using the student discount rate of 3.7%[45] as our interest rate, we calculate that students will pay a total discounted present value of $18.5 million in interest on student loans throughout the first 20 years of their working lifetime. The stream of these future interest costs together with the stream of loan payments is included in the costs of Column 5 of Table 3.2.

The steps leading up to the calculation of student costs appear in Table 3.1. Direct outlays amount to $397.6 million, the sum of tuition and fees ($433.2 million) and books and supplies ($21.6 million), less federal loans received ($57.2 million). Opportunity costs for working and non-working students amount to $278.3 million, excluding $58.3 million

43 American Time Use Survey. 2017-2019. Last modified November 30, 2021. Accessed March 2022. https://www.bls.gov/tus/data.htm.

44 Repayment period based on total education loan indebtedness, U.S. Department of Education, 2022. https://studentaid.ed.gov/sa/repay-loans/understand/plans/standard.

45 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—July 2021 Baseline. https://www.cbo.gov/system/files/2021-07/51310-2021-07-studentloan.pdf.

in offsetting residual aid that is paid directly to students.[46] Finally, we have the present value of future student loan costs, amounting to $56.6 million between principal and interest. Summing direct outlays, opportunity costs, and future student loan costs together yields a total of $732.5 million in present value student costs.

Table 3.1: Present value of student costs, FY 2021-22 (thousands)

Direct outlays in FY 2021-22	
Tuition and fees	$433,246
Less federal loans received	-$57,222
Books and supplies	$21,619
Total direct outlays	**$397,643**
Opportunity costs in FY 2021-22	
Earnings foregone by non-working students	$228,474
Earnings foregone by working students	$92,105
Value of leisure time foregone by working students	$16,019
Less residual aid	-$58,279
Total opportunity costs	**$278,319**
Future student loan costs (present value)	
Student loan principal	$38,072
Student loan interest	$18,504
Total present value student loan costs	**$56,576**
Total present value student costs	**$732,537**

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

Linking education to earnings

Having estimated the costs of education to students, we weigh these costs against the benefits that students receive in return. The relationship between education and earnings is well documented and forms the basis for determining student benefits. As shown in Table 1.4, state mean earnings levels at the midpoint of the average-aged worker's career increase as people achieve higher 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 university's FY 2021-22 students first by determining their average annual increase in earnings, equal to $210.9 million. This value represents the higher wages that accrue to students at

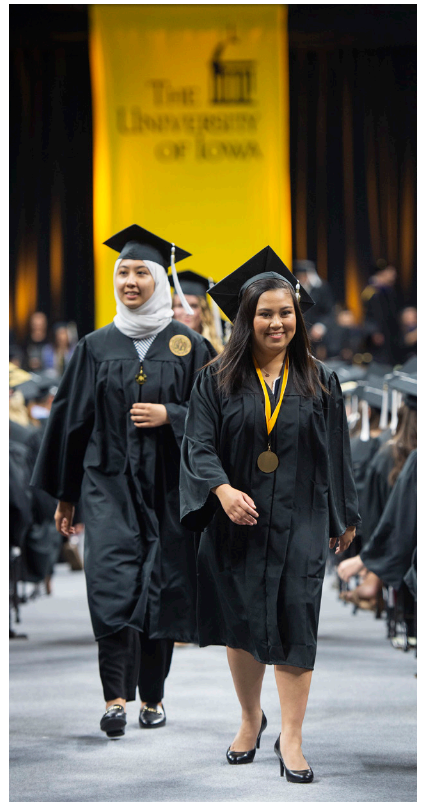
46 Residual aid is the remaining portion of scholarship or grant aid distributed directly to a student after the university applies tuition and fees.

the midpoint of their careers and is calculated based on the marginal wage increases of the CHEs that students complete while attending the university. Using the state of Iowa earnings, the marginal wage increase per CHE is $264. For a full description of the methodology used to derive the $210.9 million, see Appendix 6.

The second step is to project the $210.9 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.[47] The Mincer function originated from Mincer's seminal work on human capital (1958). The function estimates earnings using an individual's years of education and post-schooling experience. While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Card (1999 and 2001) addresses a number of these criticisms using U.S. based research over the last three decades and concludes that any upward bias in the Mincer parameters is on the order of 10% or less. We use state-specific and education level-specific Mincer coefficients. To account for any upward bias, we incorporate a 10% reduction in our projected earnings, otherwise known as the ability bias. With the $210.9 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 $210.9 million in gross higher earnings occurs around Year 15, 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 $210.9 million and the gross higher earnings in the years after the midpoint are greater than $210.9 million.

The final step in calculating the students' future benefits stream is to net out the potential benefits generated by students who are either not yet active in the workforce or who leave the workforce over time. This adjustment appears in Column 3 of Table 3.2 and represents the percentage of the FY 2021-22 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 university 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.



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

Table 3.2: **Projected benefits and costs, student perspective**

1	2	3	4	5	6
Year	**Gross higher earnings to students (millions)**	**% active in workforce***	**Net higher earnings to students (millions)**	**Student costs (millions)**	**Net cash flow (millions)**
0	$69.6	12%	$8.4	$676.0	-$667.6
1	$77.0	22%	$17.1	$4.1	$13.0
2	$84.7	32%	$27.1	$4.1	$23.1
3	$92.8	48%	$45.0	$4.1	$40.9
4	$101.3	71%	$71.9	$4.1	$67.9
5	$110.1	98%	$107.6	$4.1	$103.6
6	$119.3	98%	$116.5	$4.1	$112.4
7	$128.7	98%	$125.6	$4.1	$121.5
8	$138.5	97%	$134.9	$4.1	$130.8
9	$148.4	97%	$144.4	$4.1	$140.3
10	$158.6	97%	$154.1	$4.1	$150.0
11	$168.9	97%	$163.9	$4.1	$159.8
12	$179.4	97%	$173.7	$4.1	$169.7
13	$189.9	97%	$183.6	$4.1	$179.6
14	$200.4	97%	$193.5	$4.1	$189.4
15	$210.9	96%	$203.2	$4.1	$199.2
16	$221.3	96%	$212.9	$4.1	$208.8
17	$231.6	96%	$222.3	$4.1	$218.3
18	$241.6	96%	$231.5	$4.1	$227.4
19	$251.4	96%	$240.4	$4.1	$236.3
20	$260.9	95%	$248.8	$4.1	$244.8
21	$270.1	95%	$256.9	$0.0	$256.9
22	$278.8	95%	$264.5	$0.0	$264.5
23	$287.0	95%	$271.5	$0.0	$271.5
24	$294.7	94%	$277.9	$0.0	$277.9
25	$301.9	94%	$283.6	$0.0	$283.6
26	$308.4	94%	$288.6	$0.0	$288.6
27	$314.3	93%	$292.9	$0.0	$292.9
28	$319.5	93%	$296.4	$0.0	$296.4
29	$324.0	92%	$299.1	$0.0	$299.1
30	$327.7	92%	$300.9	$0.0	$300.9
31	$330.7	91%	$301.7	$0.0	$301.7
32	$332.9	91%	$301.7	$0.0	$301.7
33	$334.2	90%	$300.9	$0.0	$300.9
34	$334.8	89%	$299.1	$0.0	$299.1
35	$334.6	89%	$296.4	$0.0	$296.4
36	$333.6	88%	$292.8	$0.0	$292.8
37	$331.8	87%	$288.4	$0.0	$288.4
38	$329.3	86%	$283.2	$0.0	$283.2
39	$326.0	85%	$277.3	$0.0	$277.3
40	$322.0	84%	$270.6	$0.0	$270.6
41	$317.2	83%	$263.3	$0.0	$263.3
42	$311.9	82%	$255.4	$0.0	$255.4
Present value			**$3,937.8**	**$732.5**	**$3,205.3**

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

Source: Lightcast impact model.

Benefit-cost ratio

5.4

Internal rate of return

15.6%

Payback period (years)

8.4

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.[48] 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 3.7% (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.[49] In Appendix 1, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to

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 3.7% discount rate from the student perspective and a -0.3% discount rate from the perspectives of taxpayers and society.

student costs to derive the investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1.0, a rate of return that exceeds the discount rate, and a reasonably short payback period.

In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately $3.9 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 2021-22 student body is rewarded for its investment in the UI with a capital asset valued at $3.9 billion.

48 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.

49 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—July 2021 Baseline. https://www.cbo.gov/system/files/2021-07/51310-2021-07-studentloan.pdf.

The students' cost of attending the university is shown in Column 5 of Table 3.2, equal to a present value of $732.5 million. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 5.4 (equal to $3.9 billion in benefits divided by $732.5 million in costs).

Another way to compare the same benefits stream and associated cost is to compute the rate of return. The rate of return indicates the interest rate that a bank would have to pay a depositor to yield an equally attractive stream of future payments.[50] Table 3.2 shows students of the UI earning average returns of 15.6% on their investment of time and money. This is a favorable return compared, for example, to approximately 1% on a standard bank savings account, or 10.5% on stocks and bonds (30-year average return).

UI students see an average rate of return of **15.6%** for their investment of time and money.

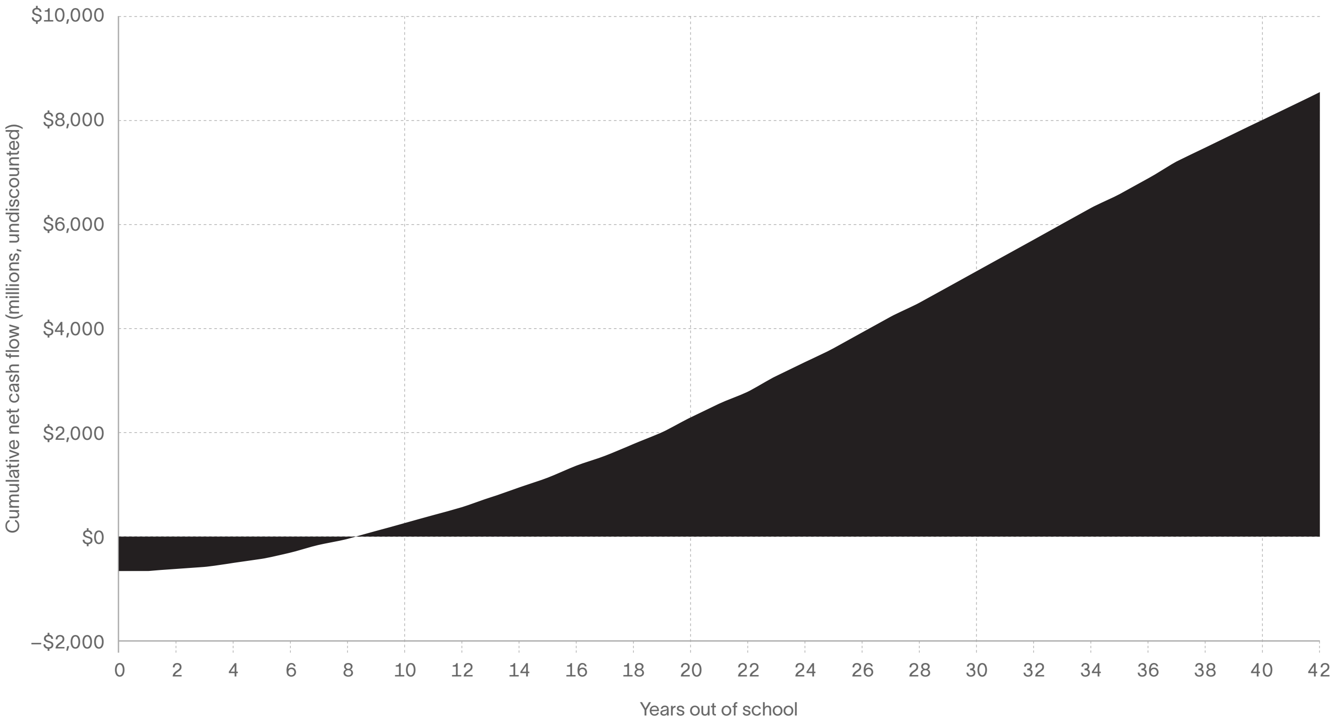
Note that returns reported in this study are real returns, not nominal. When a bank promises to pay a certain rate of interest on a savings account, it employs an implicitly nominal rate. Bonds operate in a similar manner. If it turns out that the inflation rate is higher than the stated rate of return, then money is lost in real terms. In contrast, a real rate of return is on top of inflation. For example, if inflation is running at 3% and a nominal percentage of 5% is paid, then the real rate of return on the investment is only 2%. In Table 3.2, the 15.6% 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 17.7%, 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.[51] Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at the UI see, on average, a payback period of 8.4 years, meaning 8.4 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).

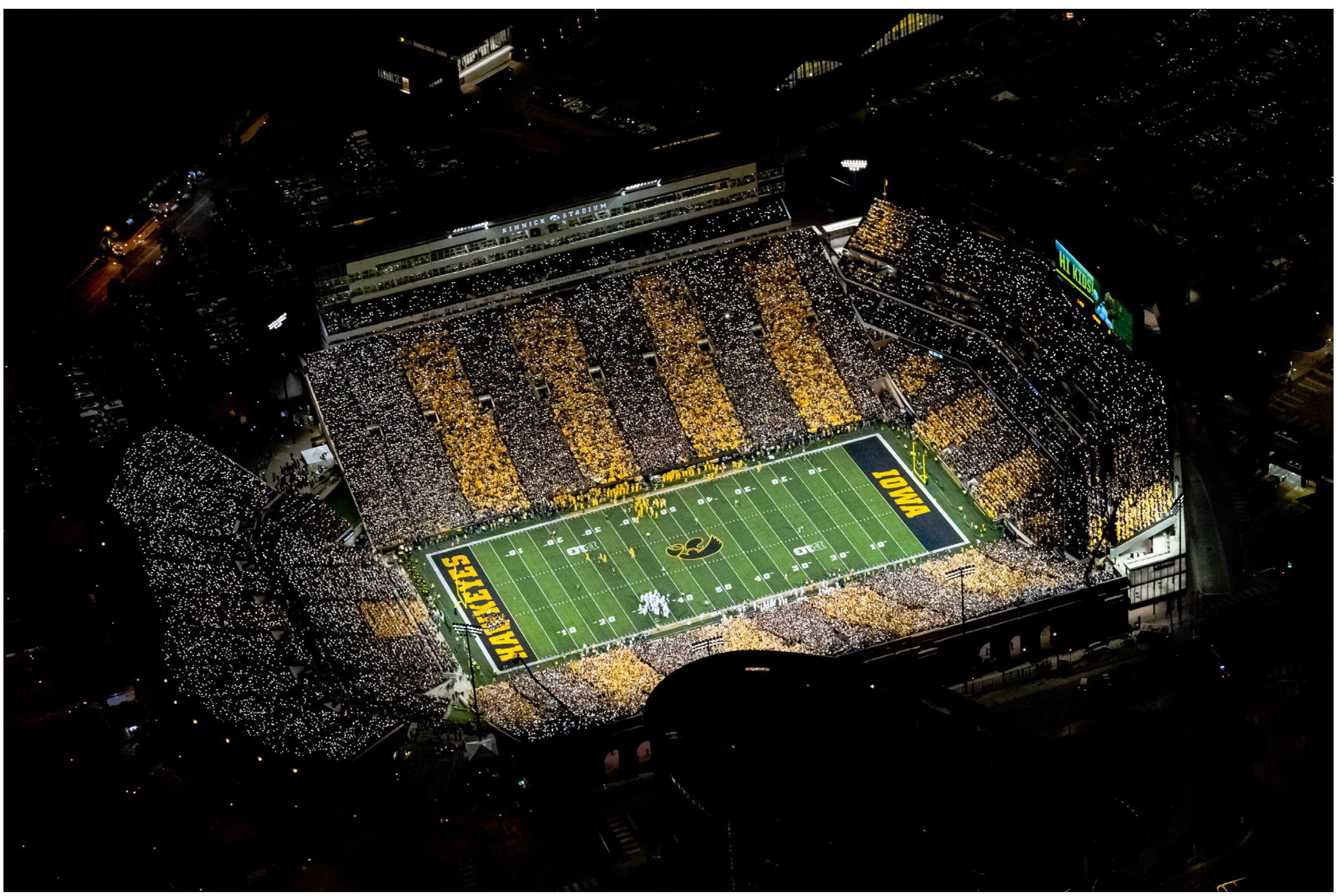
50 Rates of return are computed using the familiar internal rate-of-return calculation. Note that, with a bank deposit or stock market investment, the depositor puts up a principal, receives in return a stream of periodic payments, and then recovers the principal at the end. Someone who invests in education, 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.

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

Figure 3.1: **Student payback period**



Source: Lightcast impact model.



Taxpayer perspective

From the taxpayer perspective, the pivotal step is to determine the public benefits that specifically accrue to state and local government. For example, benefits resulting from earnings growth are limited to increased state and local tax payments. Similarly, savings related to improved health, reduced crime, and fewer welfare and unemployment claims, discussed below, are limited to those received strictly by state and local government. In all instances, benefits to private residents, local businesses, or the federal government are excluded. In addition, to focus on the taxpayer costs and benefits that arise directly from the central mission of the university—the education of students, the analysis does not consider the benefits or costs resulting from the UI Hospitals & Clinics provision of healthcare to Iowans.

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 UI, students earn more because of the skills they learned while attending the university, and businesses earn more because student skills make capital more productive (buildings, machinery, and everything else). This in turn raises profits and other business property income. Together, increases in labor and non-labor (i.e., capital) income are considered the effect of a skilled workforce. These in turn increase tax revenues since state and local government is able to apply tax rates to higher earnings.

Estimating the effect of the UI on increased tax revenues begins with the present value of the students' future earnings stream, which is displayed in Column 4 of Table 3.2. To these net higher earnings, we apply a multiplier derived from Lightcast's MR-SAM model to estimate the added labor income created in the state as students and businesses spend their higher earnings.[52] 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 2021-22 from operations, construction, research, visitor, and student spending. To each of these, we apply the

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

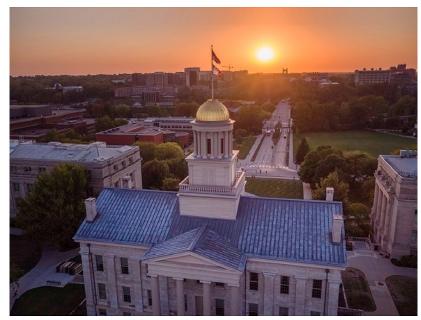
prevailing tax rates so we capture only the tax revenues attributable to state and local government from this additional revenue.

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 them. To account for this dynamic, we combine student settlement data from the university with data on migration patterns from the Internal Revenue Service to estimate the number of students who will leave the state workforce over time.

We apply another reduction factor to account for the students' alternative education opportunities. This is the same adjustment that we use in the calculation of the alumni impact in Chapter 2 and is designed to account for the counterfactual scenario where the UI does not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the university cannot be counted as new benefits to society. For this analysis, we assume an alternative education variable of 15%, meaning that 15% of the student population at the university would have generated benefits anyway even without the university. For more information on the alternative education variable, see Appendix 7.

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 university. 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 the UI did not exist and the UI 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 the UI, the shutdown point adjustment is 0%, meaning that the university 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 9.

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 $799.1 million. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of -0.3%. This is the real treasury interest rate reported by the Office of Management and Budget (OMB) for 30-year investments, and in Appendix 1, we conduct a sensitivity analysis of this discount rate.[53]



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

Government savings

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

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

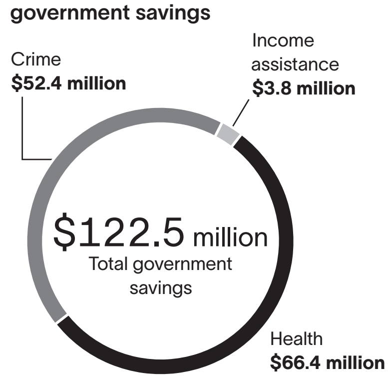
The model quantifies government savings by calculating the probability at each education level that individuals will have poor health, commit crimes, or claim welfare and unemployment benefits. Deriving the probabilities involves assembling data from a variety of studies and surveys analyzing the correlation between education and health, crime, and income assistance at the national and state level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved CHEs at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the university, will not have poor health, commit crimes, or demand income assistance. We dampen these results by the ability bias adjustment discussed earlier in the student perspective section and in Appendix 6 to account for factors (besides education) that influence individual behavior. We then multiply the marginal effects of education times the associated costs of health, crime, and income assistance.[54] Finally, we apply the same adjustments for attrition, alternative education,

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

Added tax revenue	**$799,141**
Government savings	
Health-related savings	$66,380
Crime-related savings	$52,355
Income assistance savings	$3,766
Total government savings	**$122,500**
Total taxpayer benefits	**$921,642**

Source: Lightcast impact model.

Figure 3.2: Present value of government savings



Source: Lightcast impact model.

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

and the shutdown point to derive the net savings to the government. Total government savings appear in Figure 3.2 and sum to $122.5 million.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to $799.1 million, 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 $921.6 million, as shown in the bottom row of Table 3.3. These savings continue to accrue in the future as long as the FY 2021-22 student population of the UI remains in the workforce.

Return on investment for taxpayers

Taxpayer costs are reported in Table 3.4 and come to $261.2 million, equal to the contribution of state government to the UI. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 3.5 (= $921.6 million ÷ $261.2 million), indicating a profitable investment.

A benefit-cost ratio of **3.5** means the UI is a good public investment since the taxes from UI student higher earnings and reduced government expenditures not only recover taxpayer costs but grow Iowa's tax base.

Given that the stakeholder in this case is the public sector, we use the discount rate of -0.3%, the real treasury interest rate reported by the Office of Management and Budget for 30-year investments.[55] However, due to the abnormal recent Treasury interest rate, U.S. inflation rate, and amount of government economic incentives, it is more reasonable to look at the benefit-cost ratio than the internal rate of return. A benefit-cost ratio greater than 1.0 indicates a good public investment since the taxes from UI student higher earnings and reduced government expenditures not only recover taxpayer costs but grow Iowa's tax base.

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

Table 3.4: Projected benefits and costs, taxpayer perspective

1	2	3	4
Year	**Benefits to taxpayers (millions)**	**State government costs (millions)**	**Net cash flow (millions)**
0	$154.6	$261.1	$106.5
1	$2.5	$0.0	$2.5
2	$3.6	$0.0	$3.6
3	$5.8	$0.0	$5.8
4	$9.0	$0.0	$9.0
5	$12.9	$0.0	$12.9
6	$13.4	$0.0	$13.4
7	$13.8	$0.0	$13.8
8	$14.3	$0.0	$14.3
9	$14.8	$0.0	$14.8
10	$15.3	$0.0	$15.3
11	$15.8	$0.0	$15.8
12	$16.3	$0.0	$16.3
13	$16.8	$0.0	$16.8
14	$17.3	$0.0	$17.3
15	$17.7	$0.0	$17.7
16	$18.2	$0.0	$18.2
17	$18.6	$0.0	$18.6
18	$19.0	$0.0	$19.0
19	$19.4	$0.0	$19.4
20	$19.7	$0.0	$19.7
21	$20.0	$0.0	$20.0
22	$20.3	$0.0	$20.3
23	$20.5	$0.0	$20.5
24	$20.7	$0.0	$20.7
25	$20.9	$0.0	$20.9
26	$20.9	$0.0	$20.9
27	$21.0	$0.0	$21.0
28	$21.0	$0.0	$21.0
29	$20.9	$0.0	$20.9
30	$20.8	$0.0	$20.8
31	$20.6	$0.0	$20.6
32	$20.4	$0.0	$20.4
33	$20.1	$0.0	$20.1
34	$19.8	$0.0	$19.8
35	$19.4	$0.0	$19.4
36	$19.0	$0.0	$19.0
37	$18.6	$0.0	$18.6
38	$18.1	$0.0	$18.1
39	$17.5	$0.0	$17.5
40	$17.0	$0.0	$17.0
41	$16.4	$0.0	$16.4
42	$15.8	$0.0	$15.8
Present value	**$921.6**	**$261.1**	**$660.5**

Source: Lightcast impact model.

Benefit-cost ratio	Internal rate of return	Payback period (years)
3.5	11.4%	10.1

Social perspective

Iowa benefits from the education that the UI provides through the earnings that students create in the state and through the savings that they generate through their improved lifestyles. To receive these benefits, however, members of society must pay money and forego services that they otherwise would have enjoyed if the UI did not exist. Society's investment in the UI stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by the UI to these investor groups against the total social costs of generating those benefits. The total social costs include all UI expenditures, all student expenditures (including interest on student loans) less tuition and fees, and all student opportunity costs, totaling a present value of $2.3 billion. Similar to the taxpayer perspective, in order to focus on the social costs and benefits directly arise from the central mission of the university—the education of students, UI Hospitals & Clinics benefits and costs are not considered in 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 the UI—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

- **UI expenditures**
- **Student out-of-pocket expenses**
- **Student opportunity costs**

Social benefits

- **Increased tax revenue**
- **Avoided costs to state/local government**

Growth in state economic base

In the process of absorbing the newly acquired skills of students who attend the UI, 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 university, 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 the UI on the state's economic base follows a similar process used when calculating increased tax revenues in the taxpayer perspective. However,

Beekeeper analogy

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

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

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

instead of looking at just the tax revenue portion, we include all of the added earnings and business output. First, we calculate the students' future higher earnings stream. We factor in student attrition and alternative education opportunities to arrive at net higher earnings. We again apply multipliers derived from Lightcast's MR-SAM model to estimate the added labor and non-labor income created in the state as students and businesses spend their higher earnings and as businesses generate additional profits from this increased output (added student and business income in Figure 3.3). We also include the operations, construction, research, visitor, and student spending impacts discussed in Chapter 2 that were created in FY 2021-22 (added income from university activities in Figure 3.3). The shutdown point does not apply to the growth of the economic base because the social perspective captures not only the state taxpayer support to the university, but also the support from the students and other non-government sources.

Using this process, we calculate the present value of the future added income that occurs in the state, equal to $8.9 billion. Recall from the discussion of the student and taxpayer return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of -0.3%.

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 UI. 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 $8.9 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. These savings amount to $349.4 million. Crime savings amount to $58.7 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 $3.8 million, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to $411.9 million in benefits to communities and citizens in Iowa.

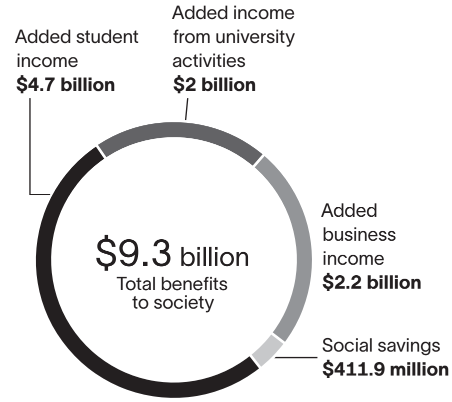
Table 3.5: Present value of the future increased economic base and social savings in the state (thousands)

Increased economic base	**$8,878,595**
Social savings	
Health	
Smoking	$61,410
Alcohol dependence	$58,226
Obesity	$87,195
Depression	$128,531
Drug abuse	$14,029
Total health savings	**$349,392**
Crime	
Criminal justice system savings	$51,491
Crime victim savings	$1,113
Added productivity	$6,110
Total crime savings	**$58,714**
Income assistance	
Welfare savings	$1,870
Unemployment savings	$1,895
Total income assistance savings	**$3,766**
Total social savings	**$411,872**
Total, increased economic base + social savings	**$9,290,466**

Source: Lightcast impact model.

The sum of the social savings and the increased state economic base is $9.3 billion, as shown in the bottom row of Table 3.5 and in Figure 3.3. These savings accrue in the future as long as the FY 2021-22 student population of the UI remains in the workforce.

Figure 3.3: Present value of benefits to society



Source: Lightcast impact model.

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 4.1. This means that for every dollar invested in an education from the UI, whether it is the money spent on operations of the university or money spent by students on tuition and fees, an average of $4.10 in benefits will accrue to society in Iowa.[56]

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 the UI. Some would question the legitimacy of including these benefits in the calculation of rates of return to education, arguing that only the tangible benefits (higher earnings) should be counted. Table 3.4 and Table 3.6 are inclusive of social benefits reported as attributable to the UI. 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 levels (net present value greater than zero and a benefit-cost ratio greater than 1.0), confirming that taxpayers and society as a whole receive value from investing in the UI.

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

	Including social savings	Excluding social savings
Taxpayer perspective		
Net present value (millions)	$660.5	$538.0
Benefit-cost ratio	3.5	3.1
Internal rate of return	11.4%	9.2%
Payback period (no. of years)	10.1	13.5
Social perspective		
Net present value (millions)	$7,038.3	$6,626.4
Benefit-cost ratio	4.1	3.9

Source: Lightcast impact model.

56 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	$1,979.5	$2,168.3	$188.7
1	$21.7	$4.1	$17.7
2	$32.8	$4.1	$28.7
3	$53.1	$4.1	$49.0
4	$82.7	$4.1	$78.6
5	$119.9	$4.1	$115.8
6	$124.9	$4.1	$120.9
7	$130.1	$4.1	$126.1
8	$135.4	$4.1	$131.3
9	$140.7	$4.1	$136.6
10	$145.9	$4.1	$141.8
11	$151.0	$4.1	$146.9
12	$155.9	$4.1	$151.9
13	$160.8	$4.1	$156.7
14	$165.5	$4.1	$161.4
15	$170.0	$4.1	$166.0
16	$174.4	$4.1	$170.3
17	$178.5	$4.1	$174.4
18	$182.3	$4.1	$178.2
19	$185.8	$4.1	$181.8
20	$189.1	$4.1	$185.0
21	$191.9	$0.0	$191.9
22	$194.4	$0.0	$194.4
23	$196.5	$0.0	$196.5
24	$198.2	$0.0	$198.2
25	$199.4	$0.0	$199.4
26	$200.2	$0.0	$200.2
27	$200.5	$0.0	$200.5
28	$200.3	$0.0	$200.3
29	$199.6	$0.0	$199.6
30	$198.5	$0.0	$198.5
31	$196.8	$0.0	$196.8
32	$194.7	$0.0	$194.7
33	$192.1	$0.0	$192.1
34	$189.0	$0.0	$189.0
35	$185.5	$0.0	$185.5
36	$181.5	$0.0	$181.5
37	$177.2	$0.0	$177.2
38	$172.5	$0.0	$172.5
39	$167.4	$0.0	$167.4
40	$162.1	$0.0	$162.1
41	$156.5	$0.0	$156.5
42	$150.6	$0.0	$150.6
Present value	**$9,290.5**	**$2,252.2**	**$7,038.3**

Source: Lightcast impact model.

Benefit-cost ratio

4.1

Chapter 4:

Conclusion

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

From an economic impact perspective, we calculated that the UI generates a total economic impact of **$8 billion** in total added income for the state economy. This represents the sum of several different impacts, including the university's:

- Operations spending impact (**$1.4 billion**);
- Construction spending impact (**$72.3 million**);
- UI Hospitals & Clinics spending impact (**$2 billion**);
- Research spending impact (**$369.5 million**);
- Economic development impact (**$551.4 million**);
- Visitor spending impact (**$91.2 million**);
- Student spending impact (**$64.2 million**);
- Volunteerism impact (**$12.2 million**); and
- Alumni impact (**$3.5 billion**).

One out of every 19 jobs in Iowa is supported by the activities of the UI and its students.

The total impact of $8 billion is equivalent to approximately **3.8%** of the total GSP of Iowa and is equivalent to supporting **109,694 jobs**. For perspective, this means that **one out of every 19 jobs** in Iowa is supported by the activities of the UI and its students. This $8 billion impact does not take into account UI's outreach activities. These activities benefit state and local communities and economies, by helping thousands of individuals and businesses in Iowa.

Since the UI's activity represents an investment by various parties, including students, taxpayers, and society as a whole, we also considered the university as an investment to see the value it provides to these investors. For each dollar invested by students, taxpayers, and society, the UI offers a benefit of **$5.40**, **$3.50**, and **$4.10**, respectively. These results indicate that the UI is an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the university 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 university is subject to many factors, the variability of which we considered in our sensitivity analysis (Appendix 1). With this variability accounted for, we present the findings of this study as a robust picture of the economic value of the UI.

Lightcast

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

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Appendix 1: Sensitivity analysis

Sensitivity analysis measures the extent to which a model's outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected. In this chapter we test the sensitivity of the model to the following input factors: 1) the number of out-of-state visitors, 2) the alternative education variable, 3) the labor import effect variable, 4) the student employment variables, 5) the discount rate, and 6) 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 A1.1 presents a sensitivity analysis for the annual number of out-of-state visitors. The assumption increases and decreases relative to the base case of 638,444 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 UNI's event hosting range from a high of $136.8 million with 957,666 visitors to a low of $45.6 million with 319,222 visitors.

Table A1.1: Sensitivity analysis of annual number of out-of-state visitors

% variation	-50%	-25%	-10%	Base case	10%	25%	50%
Annual out-of-state visitors	319,222	478,833	574,600	638,444	702,288	798,055	957,666
Visitor spending impact (million)	$45.6	$68.4	$82.1	$91.2	$100.3	$114.0	$136.8

Alternative education variable

The alternative education variable (15%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the publicly-funded university 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 A1.1. Next, the model brackets the base case assumption on either side with a plus or minus 10%, 25%, and 50% variation in assumptions. Analyses are then repeated introducing one change at a time, holding all other variables constant. For example, an increase of 10% in the alternative education assumption (from 15% to 17%) reduces the taxpayer perspective rate of return from 11.4% to 11.0%. Likewise, a decrease of 10% (from 15% to 14%) in the assumption increases the rate of return from 11.4% to 11.7%.

Table A1.2: Sensitivity analysis of alternative education variable, taxpayer and social perspectives

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Alternative education variable	**8%**	**11%**	**14%**	**15%**	**17%**	**19%**	**23%**
Taxpayer perspective							
Net present value (millions)	$742	$701	$677	$661	$644	$620	$579
Rate of return	13.4%	12.4%	11.7%	11.4%	11.0%	10.4%	9.6%
Benefit-cost ratio	3.8	3.7	3.6	3.5	3.5	3.4	3.2
Social perspective							
Net present value (millions)	$7,858	$7,448	$7,202	$7,038	$6,874	$6,628	$6,219
Benefit-cost ratio	4.5	4.3	4.2	4.1	4.1	3.9	3.8

Based on this sensitivity analysis, the conclusion can be drawn that the UI 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 threshold levels (net present value greater than zero and a benefit-cost ratio greater than 1.0), even when the alternative education assumption is increased by as much as 50% (from 15% to 23%). The conclusion is that although the assumption is difficult to specify, its impact on overall investment analysis results for the taxpayer and social perspectives is not very sensitive.

Labor import effect variable

The labor import effect variable only affects the alumni impact calculation in Table 2.17. 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 the UI. In other words, businesses that hired UI students could have substituted some of these workers with equally-qualified people from outside the state had there been no UI students to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the university.

Table A1.3: 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)	$5,205	$4,337	$3,817	$3,470	$3,123	$2,602	$1,735

Table A1.2 presents the results of the sensitivity analysis for the labor import effect variable. As explained earlier, the assumption increases and decreases relative to the base case of 50% by the increments indicated in the table. Alumni productivity impacts attributable to the UI, for example, range from a high of $5.2 billion at a -50% variation to a low of $1.7 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.

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 university 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 university. Both employment variables affect the investment analysis results from the student perspective.

Students incur substantial expense by attending the UI 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 66% of students are employed.[57] 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 university earn only 79%, on average, of the earnings that they statistically would have received if not attending the UI. This suggests that many students hold part-time jobs that accommodate their UI attendance, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 79% 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 Iowa. The model captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 79% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

Table A1.4: Sensitivity analysis of student employment variables

Variations in assumptions	Net present value (millions)	Internal rate of return	Benefit-cost ratio
Base case: A = 66%, B = 79%	$3,205.3	15.6%	5.4
Scenario 1: A = 100%, B = 79%	$3,378.0	18.7%	7.0
Scenario 2: A = 66%, B = 100%	$3,297.4	17.1%	6.1
Scenario 3: A = 100%, B = 100%	$3,517.6	22.8%	9.4
Scenario 4: A = 0%, B = 0%	$2,869.9	12.0%	3.7

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

57 Based on data provided by the UI. This figure excludes dual credit high school students, who are not included in the opportunity cost calculations.

The changes generate results summarized in Table A1.3, with *A* defined as the percent of students employed and *B* defined as the percent that students earn relative to their full earning potential. Base case results appear in the shaded row; here the assumptions remain unchanged, with *A* equal to 66% and *B* equal to 79%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases *A* to 100% while holding *B* constant, Scenario 2 increases *B* to 100% while holding *A* constant, Scenario 3 increases both *A* and *B* to 100%, and Scenario 4 decreases both *A* and *B* to 0%.

- **Scenario 1:** Increasing the percentage of students employed (A) from 66% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to $3.4 billion, 18.7%, and 7.0, 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 79% to 100%, the net present value, internal rate of return, and benefit-cost ratio results improve to $3.3 billion, 17.1%, and 6.1, 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 $3.5 billion, 22.8%, and 9.4, 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 $2.9 billion, 12.0%, and 3.7, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[58]

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 the UI 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

58 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.

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 3.7% discount rate for students and a -0.3% discount rate for society and taxpayers.[59] 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 A1.4.

Table A1.5: Sensitivity analysis of discount rate

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Student perspective							
Discount rate	1.9%	2.8%	3.4%	3.7%	4.1%	4.7%	5.6%
Net present value (millions)	$5,168	$4,060	$3,522	$3,205	$2,919	$2,539	$2,015
Benefit-cost ratio	8.1	6.5	5.8	5.4	5.0	4.5	3.8
Taxpayer perspective							
Discount rate	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	-0.5%
Net present value (millions)	$633	$647	$655	$661	$666	$675	$689
Benefit-cost ratio	3.4	3.5	3.5	3.5	3.6	3.6	3.6
Social perspective							
Discount rate	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	-0.5%
Net present value (millions)	$6,781	$6,908	$6,986	$7,038	$7,091	$7,171	$7,307
Benefit-cost ratio	4.0	4.1	4.1	4.1	4.1	4.2	4.2

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 3.7% to 5.6%) reduces the students' benefit-cost ratio from 5.4 to 3.8. Conversely, reducing the discount rate for students by 50% (from 3.7% to 1.9%) increases the benefit-cost ratio from 5.38 to 8.06. The sensitivity analysis results for taxpayers and society show the same inverse relationship between the discount rate and the benefit-cost ratio.

59 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 reported by the Office of Management and Budget for 30-year investments. See the Congressional Budget Office "Table 5. Federal Student Loan Programs: Projected Interest Rates: CBO's July 2021 Baseline" and the Office of Management and Budget "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses."

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 10%, which means that 10% of the UI's students who originated from Iowa would have left the state for other opportunities, whether that be education or employment, if the UI did not exist. The money these retained students spent in the state for accommodation and other personal and household expenses is attributable to the UI.

Table A1.5 presents the results of the sensitivity analysis for the retained student variable. The assumption increases and decreases relative to the base case of 10% by the increments indicated in the table. The student spending impact is recalculated at each value of the assumption, holding all else constant. Student spending impacts attributable to the UI range from a high of $70.1 million when the retained student variable is 15% to a low of $58.3 million when the retained student variable is 5%. This means as the retained student variable decreases, the student spending attributable to the UI decreases. Even under the most conservative assumptions, the student spending impact on the Iowa economy remains substantial.

Table A1.6: Sensitivity analysis of retained student variable

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Retained student variable	5%	8%	9%	10%	11%	13%	15%
Student spending impact (thousands)	$58,265	$61,225	$63,001	$64,185	$65,369	$67,145	$70,105

Appendix 2: Glossary of terms

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

Alternative use of funds: A measure of how monies that are currently used to fund the university might otherwise have been used if the university 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: The rate at which students leave the workforce due to out-migration, unemployment, retirement, or death.

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

Counterfactual scenario: What would have happened if a given event had not occurred. In the case of this economic impact study, the counterfactual scenario is a scenario where the university 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 university and the higher earnings of its students.

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

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

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

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

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

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

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

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

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

Payback period = cost of investment/net return per period

Appendix 3: Frequently asked questions (FAQs)

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

What is economic impact analysis?

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

What is investment analysis?

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

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

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

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

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

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

In general, Lightcast discourages comparisons between institutions since many factors, such as regional economic conditions, institutional differences, and student demographics are outside of the university's control. It is best to compare the rate of return to the discount rates of 3.7% (for students) and -0.3% (for society and taxpayers), which can also be seen as the opportunity cost of the investment (since these stakeholder groups could be spending their time and money in other investment schemes besides education). If the rate of return is higher than the discount rate, the stakeholder groups can expect to receive a positive return on their educational investment.

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

Lightcast conducted an economic impact study for my university a few years ago. Why have results changed?

Lightcast 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, Lightcast has completed over 2,800 economic impact studies for educational institutions in three countries. Along the way we have worked to continuously update and improve our methodologies to ensure that they conform to best practices and stay relevant in today's economy. The present study reflects the latest version of our model, representing the most up-to-date theory, practices, and data for conducting economic impact and investment analyses. Many of our former assumptions have been replaced with observed data, and we have researched the latest sources in order to update the background data used in our model. Additionally, changes in the data the university provides to Lightcast can influence the results of the study.

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 university (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 university to say that their single brick and mortar campus does 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 4: Example of sales versus income

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

Income = Sales – Intermediary Costs

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

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

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

Income = $5.00 – $3.00 = $2.00

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

Appendix 5: Lightcast MR-SAM

Lightcast's MR-SAM represents the flow of all economic transactions in a given region. It replaces Lightcast's previous input-output (IO) model, which operated with some 1,000 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (i.e., multipliers) in the 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 Lightcast MR-SAM model relies on a number of internal and external data sources, mostly compiled by the federal government. What follows is a listing and short explanation of our sources. The use of these data will be covered in more detail later in this appendix.

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

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

BEA Gross Domestic Product 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 Lightcast MR-SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

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

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

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

Census of Government's (CoG) 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 Lightcast 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 Lightcast to fill the holes in the CPS data.

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

Overview of the MR-SAM model

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

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

National SAM

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

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

Multi-regional aspect of the MR-SAM

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

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

Components of the Lightcast MR-SAM model

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

County earnings distribution matrix

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

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

Commuting model

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

National SAM

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

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

Gravitational flows model

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

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

Appendix 6: Value per credit 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 UI in the 2021-22 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 university, 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 $22,800. We spread this $22,800 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.[60] We repeat this process for each education level in the ladder.

Next, we map the CHE production of the FY 2021-22 student population to the education ladder. Table 1.2 provides information on the CHE production of students attending the UI, broken out by educational achievement. In total, students completed 800,081 CHEs during the analysis year. We map each of these CHEs to the education ladder depending on the students' education level and the average number of CHEs they

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

completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate degree and the bachelor's degree, and the average number of 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:

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

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 A6.1 displays the result for the students' aggregate annual increase in income (ΔE), a total of $210.9 million. By dividing this value by the students' total production of 800,081 CHEs during the analysis year, we derive an overall value of $264 per CHE.

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

Aggregate annual increase in income	$210,886,675
Total credit hour equivalents (CHEs) in FY 2021-22	800,081
Value per CHE	**$264**

Source: Lightcast impact model.

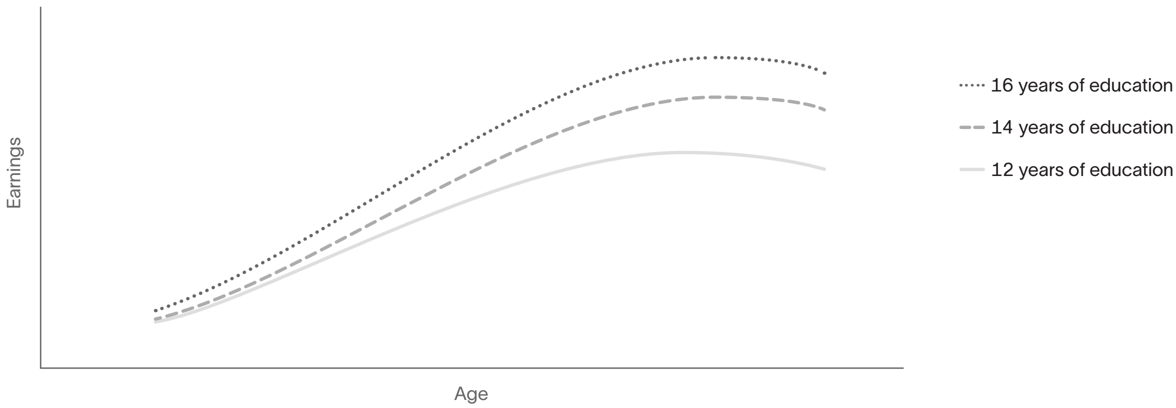
Mincer function

The $264 value per CHE in Table A6.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[61] While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use state-specific and education level-specific Mincer coefficients.

61 See Mincer (1958 and 1974).

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

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



In calculating the alumni impact in Chapter 2, we use the slope of the curve in Mincer's earnings function to condition the $264 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 $264 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 2021-22 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 A6.1.

Appendix 7: Alternative education variable

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

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

In the absence of the university, we assume 15% of the university's students would find alternative education opportunities and remain in or return to the state. We account for this by discounting the alumni impact, the benefits to taxpayers, and the benefits to society in the state in Chapters 2 and 3 by 15%. In other words, we assume 15% of the benefits created by the university's students would have occurred anyway in the counterfactual scenario where the university did not exist. A sensitivity analysis of this adjustment is presented in Appendix 1.

Appendix 8: Overview of investment analysis measures

The appendix provides context to the investment analysis results using the simple hypothetical example summarized in Table A8.1 below. The table shows the projected benefits and costs for a single student over time and associated investment analysis results.[62]

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

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

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

Assumptions are as follows:

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

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

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

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

Net present value

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

The question is simple: Will the prospective student be economically better off by choosing to enroll? If he adds up higher earnings of $5,000 per year for the remaining nine years in Table A8.1, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different. Benefits are far lower than $45,000 because future money is worth less than present money. Costs (tuition plus earnings foregone) are felt immediately because they are incurred today, in the present. Benefits, on the other hand, occur in the future. They are not yet available. All future benefits must be discounted by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[63]

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

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

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

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

Internal rate of return

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

What does this mean? The internal rate of return of 18.0% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18.0%, higher earnings of $5,000 per year for the next nine years will earn back all investments of $21,500 made plus pay 18.0% for the use of that money ($21,500) in the meantime. Is this a good return? Indeed, it is. If it is compared to the 4% going rate of interest applied to the net present value calculations, 18.0% is far higher than 4%. It may be concluded, therefore, that the investment in this case is solid. Alternatively, comparing the 18.0% rate of return to the long-term 10.5% rate or so obtained from investments in stocks and bonds also indicates that the investment in education is strong relative to the stock market returns (on average).

Benefit-cost ratio

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

Payback period

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

Appendix 9: Shutdown point

The investment analysis in Chapter 3 weighs the benefits generated by the university against the state taxpayer funding that the university receives to support its operations. An important part of this analysis is factoring out the benefits that the university 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 university is able to generate benefits without taxpayer support, then it would not be a true investment.[64]

The overall approach includes a sub-model that simulates the effect on student enrollment if the university loses its state funding and has to raise student tuition and fees in order to stay open. If the university can still operate without state support, then any benefits it generates at that level are discounted from total benefit estimates. If the simulation indicates that the university 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 A9.1 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 measured in terms of total credit hour equivalents (CHEs) and expressed as a percentage of the university's 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 university has only two sources of revenues: 1) student tuition and fees and 2) state government support.

Figure A9.2 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 university is affected by the change in tuition and fees. Ignoring for the moment those issues concerning the university's minimum operating scale (considered below in the section called "Calculating benefits at the shutdown point"), the implication for the investment analysis is that benefits to state and local government must be adjusted to

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

net out the benefits that the university can provide absent state government support, represented as *Z%* of the university's current CHE production in Figure A9.2.

Figure A9.1:
Student demand and government funding by tuition and fees

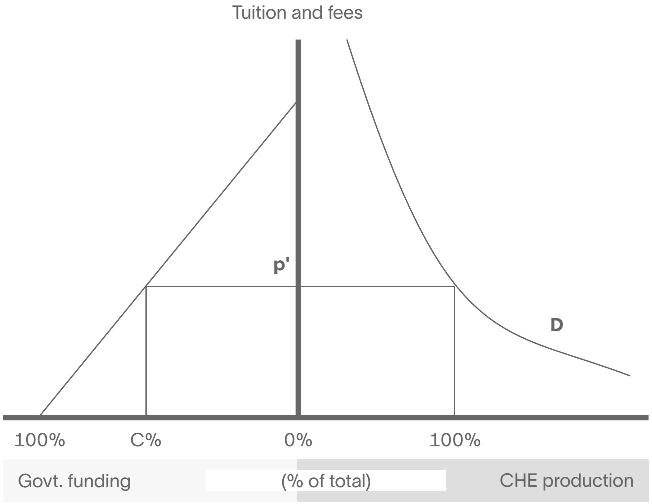
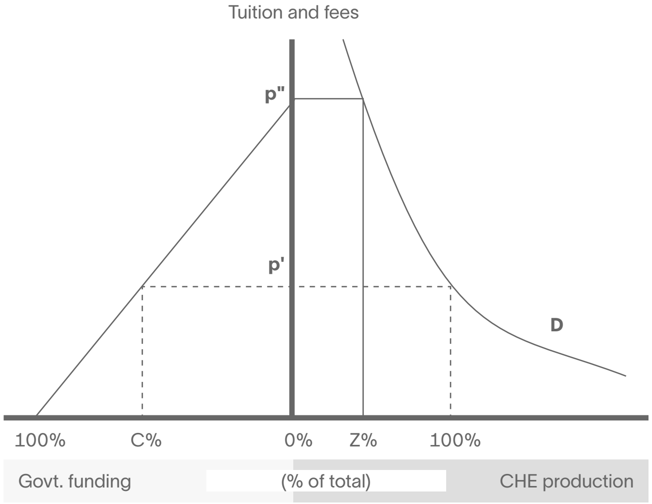


Figure A9.2:
CHE production and government funding by tuition and fees



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 university's 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.[65] The shutdown point is introduced graphically in Figure A9.3 as *S%*. The location of point *S%* indicates that the university can operate at an even lower enrollment level than *Z%* (the point at which the university receives 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 university would no longer be able to attract enough students to keep the doors open, and it would shut down.

Figure A9.4 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 university 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 university's CHE production, or *B = B (100%)*.

Figure A9.3: Shutdown point after zero government funding

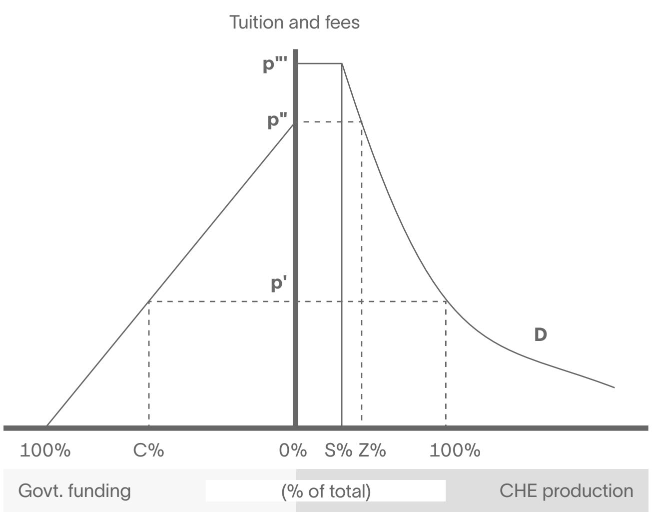
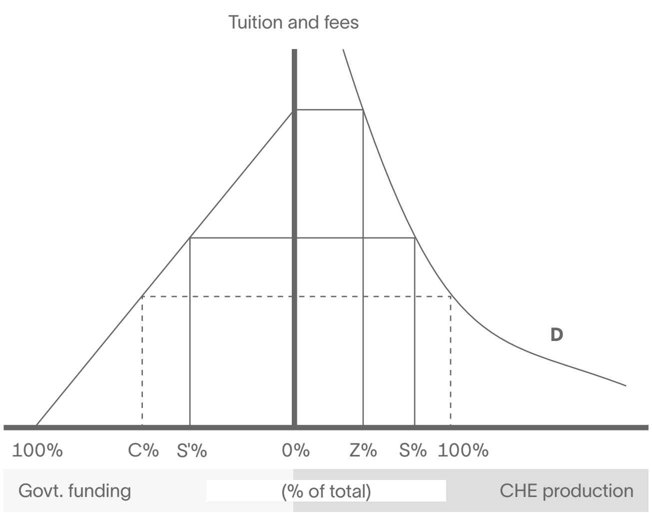


Figure A9.4: Shutdown point before zero government funding



65 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.

Appendix 10: 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.

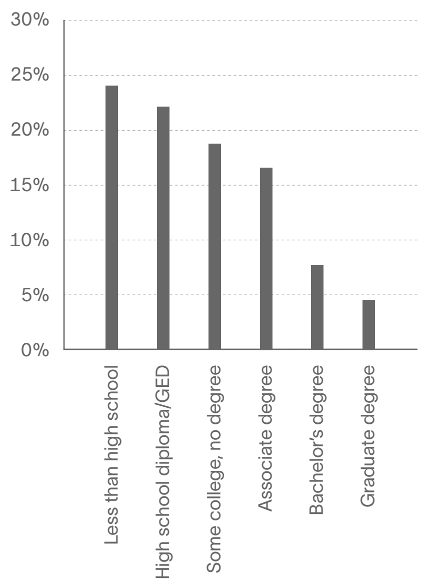
Smoking

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 A10.1 shows the prevalence of cigarette smoking among adults, 25 years and over, based on data provided by the National Health Interview Survey.[66] The data include adults who reported smoking more than 100 cigarettes during their lifetime and who, at the time of interview, reported smoking every day or some days. As indicated, the percent of who smoke begins to decline beyond the level of high school education.

The Centers for Disease Control and Prevention (CDC) reports the percentage of adults who are current smokers by state.[67] We use this information to create an index

Figure A10.1: Prevalence of smoking among U.S. adults by education level



Source: Centers for Disease Control and Prevention.

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

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

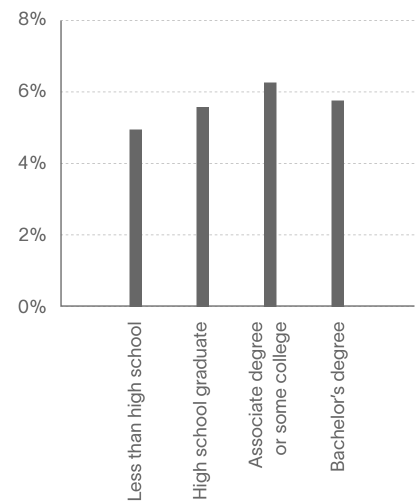
value by which we adjust the national prevalence data on smoking to each state. For example, 16.6% of Iowa adults were smokers in 2018, relative to 15.9% for the nation. We thus apply a scalar of 1.04 to the national probabilities of smoking in order to adjust them to the state of Iowa.

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 A10.2 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).[68] These statistics give an indication of the correlation between education and the reduced probability of alcohol dependence. Adults with an associate degree or some college have higher rates of alcohol dependence than adults with a high school diploma or lower. Prevalence rates are lower for adults with a bachelor's degree or higher than those with an associate degree or some college. Although the data do not maintain a pattern of decreased alcohol dependence at every level of increased education, we include these rates in our model to ensure we provide a comprehensive view of the social benefits and costs correlated with education.

Figure A10.2: Prevalence of alcohol dependence or abuse by education level



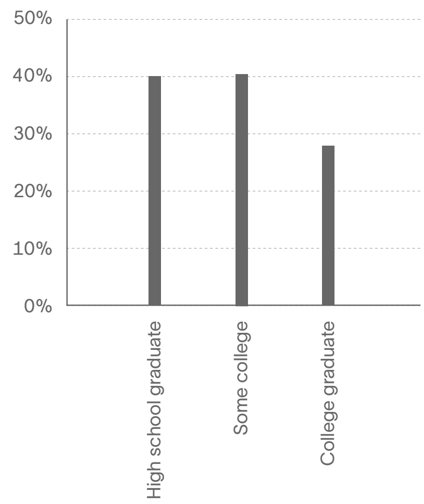
Source: Centers for Disease Control and Prevention.

Obesity

The rise in obesity and diet-related chronic diseases has led to increased attention on how expenditures relating to obesity have increased in recent years. The average cost of obesity-related medical conditions is calculated using information from the *Journal of Occupational and Environmental Medicine*, which reports incremental medical expenditures and productivity losses due to excess weight.[69]

Data for Figure A10.3 is derived from the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over by education, gender, and ethnicity.[70] As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, the prevalence of obesity among adults with some college is actually greater than those with just a high school diploma. In general, though, obesity tends to decline with increasing levels of education.

Figure A10.3: Prevalence of obesity by education level



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

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

69 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.

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

Depression

Capturing the full economic cost of mental illness is difficult because not all mental disorders have a correlation with education. For this reason, we only examine the economic costs associated with major depressive disorder (MDD), which are comprised of medical and pharmaceutical costs, workplace costs such as absenteeism, and suicide-related costs.[71]

Figure A10.4 summarizes the prevalence of MDD among adults by education level, based on data provided by the CDC.[72] 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.

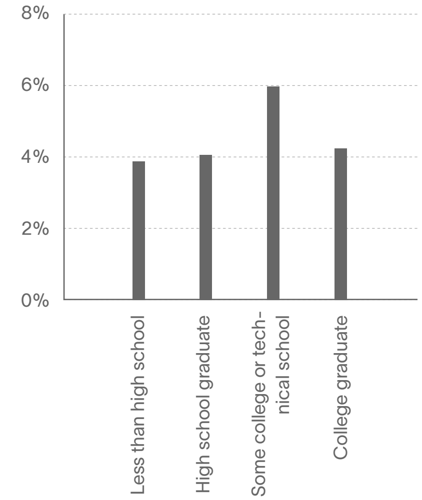
Drug abuse

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 3.9%, twice as large as the probability of drug abuse for college graduates (1.7%). This relationship is presented in Figure A10.5 based on data supplied by SAMHSA.[73] 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 and local government representing 40% of the total cost related to illegal drug use.[74]

Crime

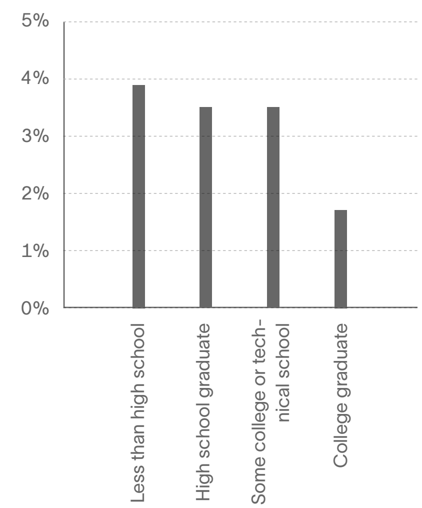
As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial and legal, and corrections, 2) victim costs, and 3) productivity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

Figure A10.4: Prevalence of major depressive episode by education level



Source: National Survey on Drug Use and Health.

Figure A10.5: Prevalence of illicit drug dependence or abuse by education level



Source: Substance Abuse and Mental Health Services Administration.

71 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.

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

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

74 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 A10.6 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.[75]

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.[76]

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

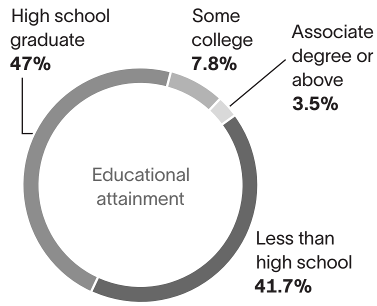
Income assistance

Statistics show that as education levels increase, the number of applicants for government-funded income assistance such as welfare and unemployment benefits declines. Welfare and unemployment claimants can receive assistance from a variety of different sources, including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Medicaid, Supplemental Security Income (SSI), and unemployment insurance.[77]

Figure A10.7 relates the breakdown of TANF recipients by education level, derived from data provided by the U.S. Department of Health and Human Services.[78] As shown, the demographic characteristics of TANF recipients are weighted heavily towards the less than high school and high school categories, with a much smaller representation of individuals with greater than a high school education.

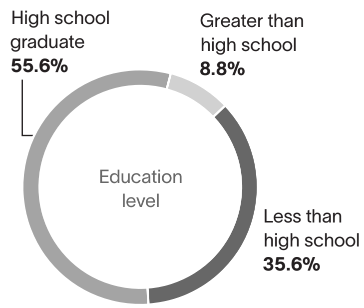
Unemployment rates also decline with increasing levels of education, as illustrated in Figure A10.8. These data are provided by the Bureau of Labor Statistics.[79] As shown, unemployment rates range from 5.4% for those with less than a high school diploma to 1.9% for those at the graduate degree level or higher.

Figure A10.6:
Educational attainment of the incarcerated population



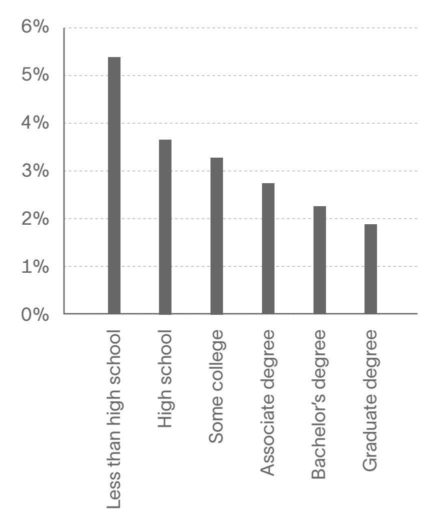
Source: Derived from data provided by the U.S. Census Bureau.

Figure A10.7:
Breakdown of TANF recipients by education level



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

Figure A10.8: Unemployment by education level



Source: Bureau of Labor Statistics.

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

76 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.

77 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.

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

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