







The Economic Value of Appalachian State University to the Five-County Region

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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 3,000 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. For example, due to increased data availability we have improved the accuracy of the Mincer Function, a function used to calculate former students' change in earnings as they gain more experience throughout their working lives. As part of updating the Mincer, the age at which students reach their career midpoint in earnings was updated. We have also made the Mincer more specific in that it is now state specific and thus accounts for state conditions (rather than national, which is what it was previously). Further, we have also made the Mincer specific to students' education levels.

Some changes are due to our efforts to conform to best practices for economic impact analyses. For example, the economic impact guidelines set by the Association for Public Land-Grant Universities discourage the inclusion of depreciation and interest expenses in operations spending impacts. Previous iterations of our model have used this measure as a proxy for capital maintenance. However, in an effort to provide more conservative and defensible results, we now exclude those expenditures from the operations spending impact.

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 regional 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 Appalachian State University (App State), it is not intended for comparison with App State's previous study conducted by Lightcast in 2015. Due to the extent of the changes to external data and Lightcast's model since 2015, differences between results from the 2015 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 regional and state outmigration rates used in the study reflective of actual historical 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.

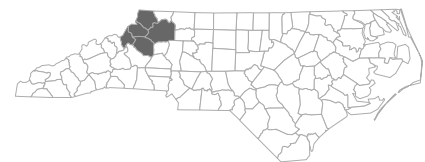


Executive summary

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



Economic impact analysis



The Five-County Region,
North Carolina

During the analysis year, App State spent \$246.9 million on payroll and benefits for 3,232 full-time and part-time employees, and spent another \$281.9 million on goods and services to carry out its day-to-day and construction operations. This initial round of spending creates more spending across other businesses throughout the regional economy, resulting in the commonly referred to multiplier effects. This analysis estimates the net economic impact of App State that directly accounts for the fact that state and local dollars spent on App State could have been spent elsewhere in the region if not directed towards App State 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 App State.

This analysis shows that in fiscal year (FY) 2021-22, operations, construction, visitor, and student spending of App State, together with volunteerism and the enhanced productivity of its alumni, generated **\$572.8 million** in added income for the Five-County Region¹ economy. The additional income of \$572.8 million created by App State is equal to approximately **5.9%** of the total gross regional product (GRP) of the Five-County Region. For perspective, this impact from the university is larger than the entire Real Estate & Rental & Leasing industry in the region. The impact of

The additional income of **\$572.8 million** created by App State is equal to approximately **5.9%** of the total gross regional product of the Five-County Region.

¹ For the purposes of this analysis, the Five-County Region is comprised of Ashe, Avery, Caldwell, Watauga, and Wilkes Counties.



\$572.8 million is equivalent to supporting **8,902 jobs**. For further perspective, this means that **one out of every 14 jobs** in the Five-County Region is supported by the activities of App State and its students. These economic impacts break down as follows:

Operations spending impact



Payroll and benefits to support App State's day-to-day operations amounted to \$246.9 million. The university's non-pay expenditures (excluding construction) amounted to \$190.6 million. The net impact of operations spending by the university in the Five-County Region during the analysis year was approximately **\$308.2 million** in added income, which is equivalent to supporting **3,905 jobs**.

Construction spending impact



App State invests in construction each year to maintain and renovate its facilities, create additional building 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 regional economy.

In FY 2021-22, App State's construction spending generated **\$31.6 million** in added income, which is equivalent to supporting **611 jobs**.

Visitor spending impact



Tens of thousands of out-of-region visitors attracted to the Five-County Region for activities at App State brought new dollars to the economy through their spending at hotels, restaurants, gas stations, and other regional businesses. The spending from these visitors added approximately **\$9.5 million** in income for the Five-County Region economy, which is equivalent to supporting **179 jobs**. Out of this impact, **\$7.2 million** in added income is attributable to the Athletics and Arts visitor value added, with its largest portion of **\$6.4 million** stemming from Athletics.²

Student spending impact



Around 82% of students attending App State originated from outside the region. All of these students relocated to the Five-County Region to attend the university. In addition, some students, referred to as retained students, are residents of the Five-County Region who would have left the region if not for the existence of App State. The money that these students spent towards living expenses in the Five-County Region is attributable to App State.

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 region as it is spent at out-of-region businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages and is synonymous with gross regional product (GRP) and value added. For this reason, it is a more meaningful measure of new economic activity than sales.

"At App State, supporting our region has always been central to our history and our educational mission."

—App State Chancellor Sheri Everts

² Note that the recovery period from COVID-19 effects in terms of athletics visitor attendance ended in FY 2022-23, which significantly reduced the FY 2021-22 visitor spending impact. Had the analysis year had the same inflow of out-of-region visitors as in the following FY 2022-23, the total impact of visitor spending would have been \$11.1 million in added income, or 211 jobs supported, in the Five-County Region. For more details, see the visitor spending impact section.



The expenditures of relocated and retained students in the region during the analysis year added approximately **\$79.5 million** in income for the Five-County Region economy, which is equivalent to supporting **1,690 jobs**.

Volunteerism impact



App State encourages its students and employees to volunteer in the Five-County Region, 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. App State students and employees volunteered nearly 78,500 hours of their time in FY 2021-22. The work of App State student and employee volunteers is equivalent to **\$2.2 million** in earnings.³

In terms of actual impact to the Five-County Region economy, App State student and employee volunteers generated an impact of **\$3.4 million** in added income for the region in FY 2021-22, equivalent to supporting **161 jobs**.

Alumni impact



Over the years, students gained new skills, making them more productive workers, by studying at App State. Today, thousands of these former students are employed in the Five-County Region.

The accumulated impact of former students currently employed in the Five-County Region workforce amounted to **\$140.7 million** in added income for the Five-County Region economy, which is equivalent to supporting **2,356 jobs**.

³ By state value per volunteer hour was provided by Independent Sector (see https://independentsector.org/resource/vovt_details/).





Investment analysis is the practice of comparing the costs and benefits of an investment to determine whether or not it is profitable. This study evaluates App State 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 **\$331.3 million** in present value student costs.

In return, students will receive a present value of **\$1.9 billion** in increased earnings over their working lives. This translates to a return of **\$5.80** in higher future earnings for every dollar that students invest in their education at App State. The corresponding annual rate of return is **17.8%**.



Taxpayer perspective



Taxpayers provided **\$189.5 million** of state and local funding to App State in FY 2021-22. In return, taxpayers will receive an estimated present value of **\$528.4 million** in added tax revenue stemming from the students' higher lifetime earnings and the increased output of businesses. Savings to the public sector add another estimated **\$81.1 million** in benefits due to a reduced demand for government-funded social services in North Carolina. Total taxpayer benefits amount to **\$609.5 million**, the present value sum of the added tax revenue and public sector savings. For every tax dollar spent educating students attending App State, taxpayers will receive an

For every tax dollar spent educating students attending App State, taxpayers will receive an average of **\$3.20** in return over the course of the students' working lives.



average of **\$3.20** in return over the course of the students' working lives. In other words, taxpayers receive an annual rate of return of **7.1%**.

Social perspective



People in North Carolina invested **\$741.1 million** in App State in FY 2021-22.

This includes the university's expenditures, student expenses, and student opportunity costs. In return, the state of North Carolina will receive an estimated present value of **\$6.4 billion** in added state revenue over the course of the students' working lives. North Carolina will also benefit from an estimated **\$263.1 million** in present value social savings related to reduced crime, lower welfare and unemployment assistance, and increased health and well-being across the state. For every dollar society invests in App State, an average of **\$9.00** in benefits will accrue to North Carolina over the course of the students' careers.

"The opportunities for so many North Carolinians to have access to education is something we need to continue to expand. This being present in Hickory... I can think of no better place to expand. (App State's purchase of the Hickory campus building) has to be like one of the deals of the century, so for the taxpayers wondering about the use of tax dollars, this gets an A+."

— N.C. House Speaker Tim Moore

Acknowledgments

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Introduction

Appalachian State University (App State), established in 1899, served 19,854 degree-seeking and 101 non-degree-seeking students on its Boone campus in FY 2021-22. The university is led by Dr. Sheri Everts, Chancellor. The university's service region, for the purpose of this report, is referred to as the Five-County Region and consists of Ashe, Avery, Caldwell, Watauga, and Wilkes Counties.

While App State affects the region 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, App State impacts the Five-County Region 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 expenditures of its visitors and students, as well as student and employee volunteer activities, support the regional economy through the output and employment generated by regional 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.

This report assesses the impact of App State as a whole on the regional 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 Five-County Region 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 Five-County Region 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 spending, 2) impact of the university's construction spending, 3) impact of visitor spending, 4) impact of student spending, 5) impact of the university's student and employee volunteers, and 6) impact of alumni who are still employed in the Five-County Region workforce.



App State impacts the Five-County Region beyond influencing the lives of students.

The second component of the study measures the benefits generated by App State 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 North Carolina 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 App State; 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 Appalachian State University and the economy





APPALACHIAN STATE UNIVERSITY (App State) is a comprehensive four-year university, with campuses located in Boone, North Carolina, and Hickory, North Carolina. Established in 1899, App State has a rich history of serving students and community members through flexible course offerings in relevant, in-demand fields. The university offers a variety of bachelor's, master's, doctoral, and graduate certificate programs. In FY 2021-22, App State served nearly 20,000 students.

App State provides exceptional educational opportunities in a variety of formats, including online and in-person options. With more than 150 undergraduate and graduate degree program offerings, App State's flexible learning models make it easy for students to explore their interests and gain valuable skills. The university's diverse program offerings include Anthropology, Chemistry, Computer Information Systems, Finance and Banking, and many more.

In addition, App State offers a robust assortment of graduate certificate programs designed to enhance students' professional skills and provide them with the advanced technical knowledge and leadership training to bring them to the next level of their careers.

App State opens Hickory campus, expanding educational access in Western North Carolina. App State marked a significant milestone in its 124-year history by opening the new Hickory campus in August 2023—expanding higher education access in what was previously the largest metropolitan area in the state without a public university campus. Upon its opening, more than 100 undergraduate degree programs were available to students attending App State at the Hickory campus. On-site services and facilities at the campus, which continue to expand, include advising, tutoring and career development services; admissions

With more than 150 undergraduate and graduate degree program offerings, App State's flexible learning models make it easy for students to explore their interests and gain valuable skills.

National recognition for support of transfer students

App State's sustained commitment to the success of its transfer student population consistently lands the university on Phi Theta Kappa's Transfer Honor Roll. Phi Theta Kappa, a national honor society, recognizes four-year colleges and universities across the country for developing dynamic and innovative pathways that lead to success among community college transfer students.

The Honor Roll uses 40 key metrics related to the support and success of transfer students—including college cost and financial aid, campus life for transfer students, admissions practices and bachelor's degree completion.

Approximately 2,000 new transfer students join App State each academic year, representing more than 50 community colleges. The degree completion rate for North Carolina community college students who transferred to App State is more than 20% above the national average.



and financial aid; a library, writing center and testing center; study areas and computer labs; disability services; health care and counseling; and a fitness center for students, faculty and staff.

Positioning an App State campus in the Hickory-Lenoir-Morganton Metro Area aligns with the university's mission to increase access to higher education and with the University of North Carolina System Strategic Plan priorities of increasing access to underserved populations, maximizing affordability and expanding the UNC System's contribution to the state's critical workforces.

App State has had a presence in Hickory since as early as 1968, with distance education courses offered at the Catawba Valley Community College campus and resources such as the N.C. Center for Engineering Technologies and the Small Business and Technology Development Center. On November 19, 2021, Chancellor Sheri Everts closed on the \$1 million purchase of a 225,800-square-foot, six-story building left unoccupied by Corning Optical Communications. During a legislative visit to the campus in spring 2022, North Carolina House Speaker Tim Moore described the purchase as "one of the deals of the century."

App State's Hickory campus expansion comes amid a challenging higher education environment nationwide, with declining college enrollments and dozens of closures reported in recent years.

"We are steadfast in our belief in the power of higher education—and in our determination to help others experience the difference a college degree makes, not only for first-generation graduates but for each subsequent generation," Chancellor Sheri Everts said. "We are committed to reaching students from rural areas and from low-income families, and those who otherwise must work harder to access educational resources."

App State places among national publications' 'best' and 'top' lists for academics, value, innovation and more

App State's status as both a leader and an innovator in higher education is consistently highlighted in annual college rankings and reviews, with the university named among the "best" and "top" schools in the nation—and the Southeast. National publications recognize App State for its academics, innovation, value, benefits for student veterans and programs to enhance the first-year experience. App State ranks among:

- "Best Colleges" by U.S. News & World Report.
- "The Best 389 Colleges" and "Best Colleges: Region by Region" by The Princeton Review.
- "America's Top Colleges" by Forbes magazine.
- "Best Colleges in America," for value by Money.com.
- "Best Colleges in the U.S." by The Wall Street Journal.
- "Best Bang for the Buck" college rankings by Washington Monthly magazine.



App State sustains steady enrollment growth. From fall 2013 to fall 2023, App State's total enrollment has grown by approximately 19%—on average, nearly 2% each year. The university exceeded 21,000 students for the first time in 2023, while maintaining the number of full-time students attending on the Boone campus at around 18,000 from 2021 to 2023. The university continued to see increasing portions of its growth coming from students enrolling online and at the new Hickory campus.

The university's continued growth—through its Boone campus and newly opened Hickory campus, as well as through App State Online—helps support the myFutureNC goal of ensuring that 2 million North Carolinians will have a postsecondary degree or credential by 2030 that meets the demands of the state's businesses and industries.

"In Boone and Hickory, and online, App State continues its mission to extend access to higher education, to serve our region and to better the futures of all North Carolinians," said App State Chancellor Sheri Everts. "Our strong enrollment numbers signify that students recognize the value and high quality of an App State education and its power to change lives."

In fall 2023, nearly one-third of undergraduate students enrolled at App State were first-generation students, and nearly one-third were from rural populations. As a rural-serving institution, App State is committed to increasing enrollment of students from the state's rural populations and ensuring the timely graduation of these students. Racially or ethnically underrepresented students comprised one-fifth of the total student population in fall 2023—a 77% increase since 2014.

More than 100,000 of App State's 146,000-plus alumni live and work in North Carolina, contributing to the state's growing economy.



Each year, iBackAPP galvanizes alumni and friends across the country

App State's annual two-day giving celebration, iBackAPP, which began in 2014, celebrates the people, programs and transformational experiences that make App State a truly incredible place. Alumni and friends are encouraged to give a gift of any size, wear their black and gold and share the word about their App State pride with the hashtag #iBackAPP.

The university recently set a new record for iBackAPP funds raised—nearly \$1.75 million, with 45% of gifts going to endowment funds to be invested for use in perpetuity.



App State is also a vital asset to regional and state employers. The university provides access to well-accomplished and highly knowledgeable and qualified human capital to businesses and organizations at the Career Development Center. The center provides employers with a broad spectrum of services designed to meet their recruiting goals and attract the right talent they need, either through offering job or internship opportunities or engaging students in career fairs and hosted events. By building strong partnerships with various regional companies and entrepreneurs, App State continuously contributes to regional economic prosperity and communities' well-being.



Mountaineer student-athletes achieve athletic and academic success

App State joined the Sun Belt Athletic Conference in 2014, and 15 of App State's 17 varsity sports compete in the conference. The football, women's indoor track and field, men's and women's cross-country, women's tennis and men's basketball teams have claimed a combined 11 conference titles since 2016.

Chancellor Sheri Everts served as vice president of the conference during a time in which the Sun Belt expanded to 14 institutions and realigned to be more geographically concentrated in the Southeast, resulting in reduced travel times and costs for the league's athletics teams. In 2023, Everts began a two-year term as president of the conference.

App State regularly earns top national rankings for academic excellence, including a streak of 22 consecutive semesters that Mountaineer student-athletes have achieved a cumulative 3.0 grade-point average, as of spring 2023. App State has also been recognized multiple times by the Sun Belt for having the highest overall graduation rate and highest student-athlete graduation rate in the conference.



App State employee and finance data



The study uses two general types of information: 1) data collected from the university and 2) regional economic data obtained from various public sources and Lightcast's proprietary data modeling tools.⁴ This chapter presents the basic underlying information from App State used in this analysis and provides an overview of the Five-County Region economy.

Employee data

Data provided by App State include information on faculty and staff by place of work and by place of residence. These data appear in Table 1.1. As shown, App State employed 2,821 full-time and 411 part-time faculty and staff in FY 2021-22 (including student workers). Of these, all worked in the region and 81% lived in the region. These data are used to isolate the portion of the employees' payroll and household expenses that remains in the regional economy.

"National recognition and accolades underscore App State as a leader and an innovator in higher education. They are a testament to the value of an App State education and to the efforts of the faculty and staff who work each day to enhance the quality of the student experience."

— App State Chancellor Sheri Everts

Revenues

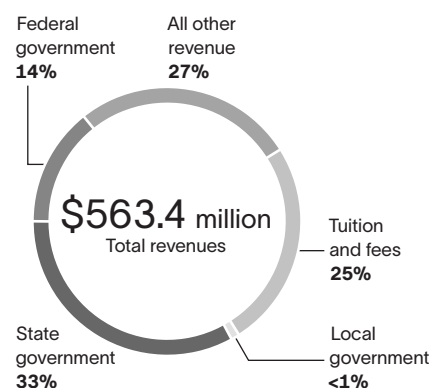
Figure 1.1 shows the university's annual revenues by funding source—a total of \$563.4 million in FY 2021-22. As indicated, tuition and fees comprised 25% of total revenue, and revenues from local, state, and federal government sources comprised another 48%. All other revenue (i.e., auxiliary revenue, sales and services, interest, and donations) comprised the remaining 27%. These data are critical in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

Table 1.1: Employee data, FY 2021-22

Full-time faculty and staff	2,821
Part-time faculty and staff	411
Total faculty and staff	3,232
% of employees who work in the region	100%
% of employees who live in the region	81%

Source: Data provided by App State.

Figure 1.1: App State revenues by source, FY 2021-22



Source: Data provided by App State.

Percentages do not sum to 100% due to rounding.

⁴ See Appendix 5 for a detailed description of the data sources used in the Lightcast modeling tools.



"When we opened the Hickory campus to students, we crossed an important milestone, extending the vision of increasing access to education begun by our founders, B.B., D.D. and Lille Shull Dougherty, from the mountains to the foothills. This expansion comes amid a challenging higher education environment nation-wide, with declining college enrollments and dozens of closures reported in recent years. It demonstrates a strong market position and tremendous support from the City of Hickory, as well as our steadfast belief in the power of higher education."

— App State Chancellor Sheri Everts



Expenditures

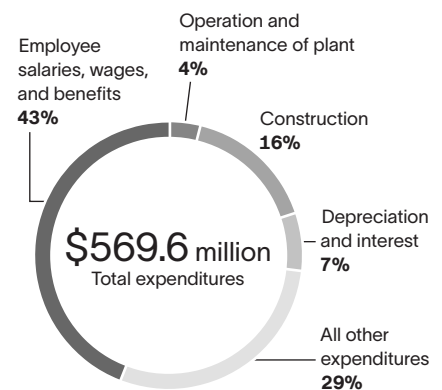
Figure 1.2 displays App State's expense data. The combined payroll at App State, including student salaries and wages, amounted to \$246.9 million. This was equal to 43% of the university's total expenses for FY 2021-22. Other expenditures, including capital construction, operation and maintenance of plant, depreciation and interest, and purchases of supplies and services, made up \$322.7 million. When we calculate the impact of these expenditures in Chapter 2, we exclude expenses for depreciation and interest, as they represent a devaluing of the university's assets rather than an outflow of expenditures.

Students

App State served 19,854 degree-seeking and 101 non-degree-seeking students in FY 2021-22. These numbers represent unduplicated student headcounts. The breakdown of the student body by gender was 58% female and 42% male. The breakdown by ethnicity was 81% white, 18% students of color, and 1% unknown and non-resident aliens. The students' overall average age was 21 years old.⁵ An estimated 18% of students remain in the Five-County Region after finishing their time at App State, another 74% settle outside the region but in the state, and the remaining 8% settle outside the state.⁶

Table 1.2 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In FY 2021-22, App State served six doctoral degree graduates, 490 master's degree graduates, 10 postbaccalaureate certificate completers, and 3,840 bachelor's degree graduates. Another 15,508 students enrolled in courses but did not complete a degree during the reporting year. Students not allocated to the other categories comprised the remaining 101 students.

Figure 1.2: App State expenses by function, FY 2021-22



Source: Data provided by App State.
Percentages do not sum to 100% due to rounding.

⁵ Unduplicated headcount, gender, ethnicity, and age data provided by App State.

⁶ Settlement data provided by App State.



We use credits to track the educational workload of the students. The average number of credits per student was 28.0.

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

Category	Headcount	Total credits	Average credits
Doctoral graduates	6	38	6.3
Master's degree graduates	490	10,347	21.1
Postbaccalaureate certificate completers	10	110	11.0
Bachelor's degree graduates	3,840	99,067	25.8
Continuing students	15,508	448,474	28.9
All other students	101	1,213	12.0
Total students	19,955	559,249	28.0

Source: Data provided by App State.

"In Boone and Hickory, and online, App State continues its mission to extend access to higher education, to serve our region and to better the futures of all North Carolinians. Our strong enrollment numbers signify that students recognize the value and high quality of an App State education and its power to change lives."

— App State Chancellor Sheri Everts



The Five-County Region economy



App State serves a region referred to as the Five-County Region in North Carolina.⁷ Since the university was first established, it has been serving the Five-County Region by enhancing the workforce, providing local residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. Table 1.3 summarizes the breakdown of the regional 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

Table 1.3: Income by major industry sector in the Five-County Region, 2022*

Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)**	% of total income	Sales (millions)
Manufacturing	\$740	\$627	\$1,367	14%	\$3,456
Other Services (except Public Administration)	\$192	\$1,047	\$1,239	13%	\$1,686
Health Care & Social Assistance	\$818	\$95	\$914	9%	\$1,474
Retail Trade	\$529	\$360	\$889	9%	\$1,502
Wholesale Trade	\$380	\$341	\$720	7%	\$1,236
Government, Education	\$669	\$0	\$669	7%	\$775
Real Estate & Rental & Leasing	\$270	\$276	\$547	6%	\$1,158
Construction	\$433	\$82	\$514	5%	\$1,053
Government, Non-Education	\$406	\$106	\$512	5%	\$2,541
Accommodation & Food Services	\$244	\$180	\$424	4%	\$801
Finance & Insurance	\$190	\$138	\$328	3%	\$554
Professional & Technical Services	\$243	\$52	\$294	3%	\$440
Agriculture, Forestry, Fishing & Hunting	\$180	\$104	\$284	3%	\$699
Information	\$94	\$164	\$258	3%	\$453
Administrative & Waste Services	\$188	\$36	\$224	2%	\$417
Transportation & Warehousing	\$127	\$23	\$150	2%	\$329
Utilities	\$32	\$99	\$131	1%	\$224
Management of Companies & Enterprises	\$114	\$9	\$123	1%	\$200
Arts, Entertainment, & Recreation	\$89	\$27	\$117	1%	\$192
Educational Services	\$20	\$1	\$21	<1%	\$30
Mining, Quarrying, & Oil and Gas Extraction	\$6	\$12	\$18	<1%	\$34
Total	\$5,963	\$3,780	\$9,743	100%	\$19,255

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

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

Source: Lightcast industry data.

⁷ The following counties comprise the Five-County Region: Ashe, Avery, Caldwell, Watauga, and Wilkes.



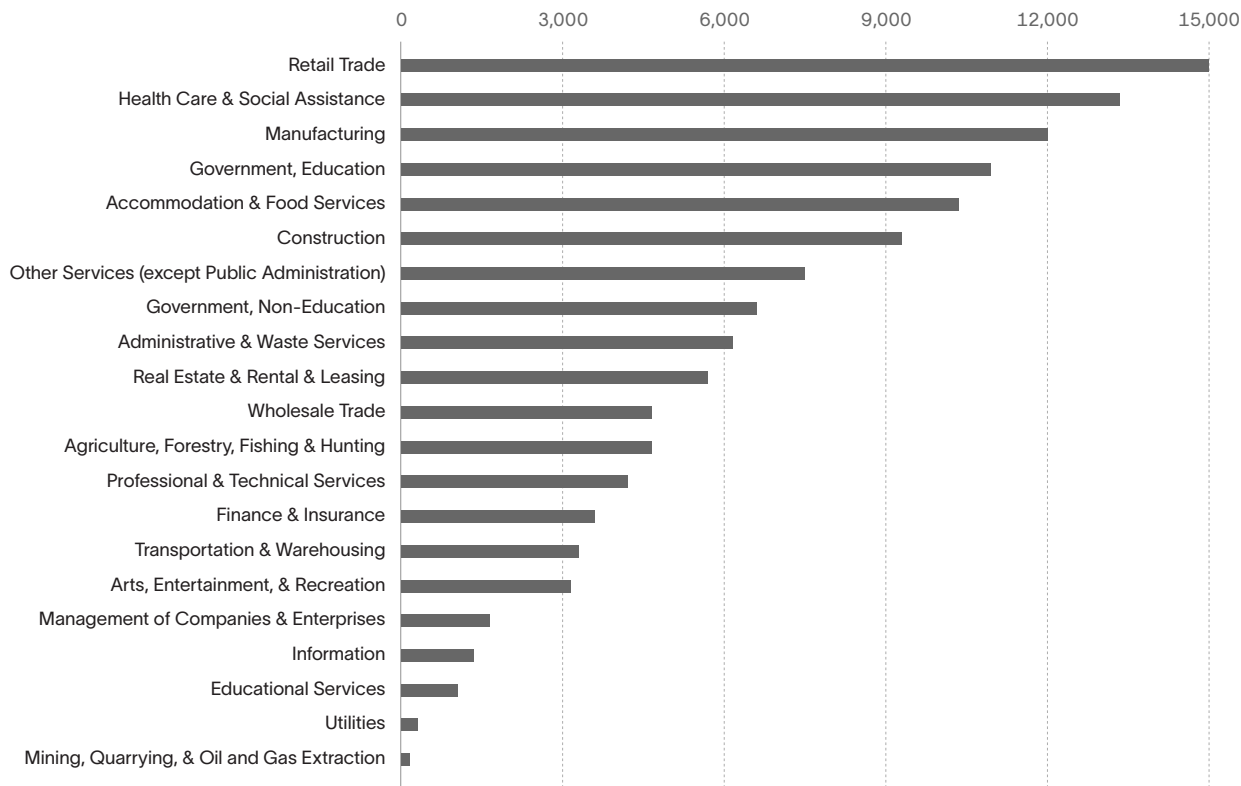


comprise the region's total income, which can also be considered the region's gross regional product (GRP).

As shown in Table 1.3, the total income, or GRP, of the Five-County Region is approximately \$9.7 billion, equal to the sum of labor income (\$6 billion) and non-labor income (\$3.8 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the university on the regional economy.

Figure 1.3 provides the breakdown of jobs by industry in the Five-County Region. The Retail Trade sector is the largest employer, supporting 14,956 jobs or 12.0% of total employment in the region. The second largest employer is the Health Care & Social Assistance sector, supporting 13,362 jobs or 10.7% of the region's total employment. Altogether, the region supports 124,389 jobs.⁸

Figure 1.3: Jobs by major industry sector in the Five-County Region, 2022*



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

8 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.



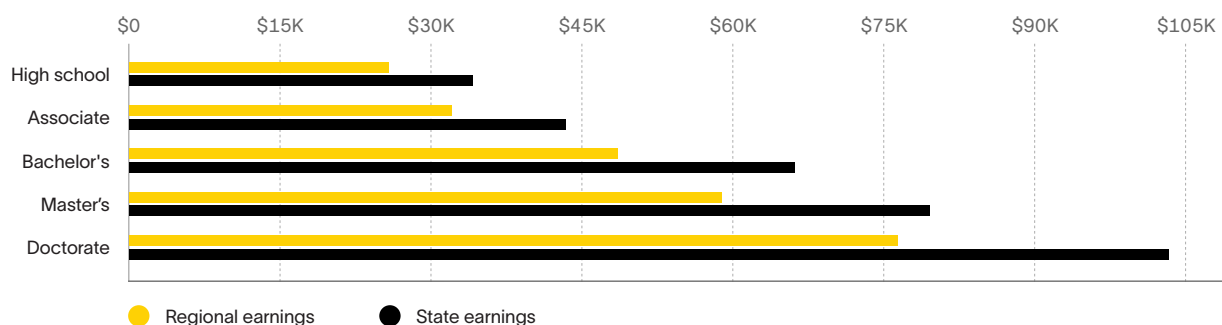
Table 1.4 and Figure 1.4 present the mean earnings by education level in the Five-County Region and the state of North Carolina at the midpoint of the average-aged worker's career. These numbers are derived from Lightcast's complete employment data on average earnings per worker in the region and the state.⁹ The numbers are then weighted by the university's demographic profile, and state earnings are weighted by students' settlement patterns. As shown, students have the potential to earn more as they achieve higher levels of education compared to maintaining a high school diploma. Students who earn a bachelor's degree from App State can expect approximate wages of \$48,200 per year within the Five-County Region, approximately \$23,000 more than someone with a high school diploma.

Table 1.4: Average earnings by education level at an App State student's career midpoint

Education level	Regional earnings	Difference from next lowest degree	State earnings	Difference from next lowest degree
High school or equivalent	\$25,200	n/a	\$34,000	n/a
Associate degree	\$32,000	\$6,800	\$43,300	\$9,300
Bachelor's degree	\$48,200	\$16,200	\$65,100	\$21,800
Master's degree	\$58,300	\$10,100	\$78,800	\$13,700
Doctoral degree	\$75,700	\$17,400	\$102,200	\$23,400

Source: Lightcast employment data.

Figure 1.4: Average earnings by education level at an App State student's career midpoint



Source: Lightcast employment data.

⁹ 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 regional or 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.





Economic impacts on the Five-County Region economy

App State impacts the Five-County Region 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 regional economy through its day-to-day and construction operations, and the expenditures of its visitors and students. App State also encourages its students and employees to volunteer in the Five-County Region, 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 region.



I N THIS CHAPTER, we estimate the following economic impacts of App State: 1) the operations spending impact, 2) the construction spending impact, 3) the visitor spending impact, 4) the student spending impact, 5) the volunteerism impact, and 6) the alumni impact, measuring the income added in the region as former students expand the regional 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 the Five-County Region if App State and all its alumni did not exist in FY 2021-22?

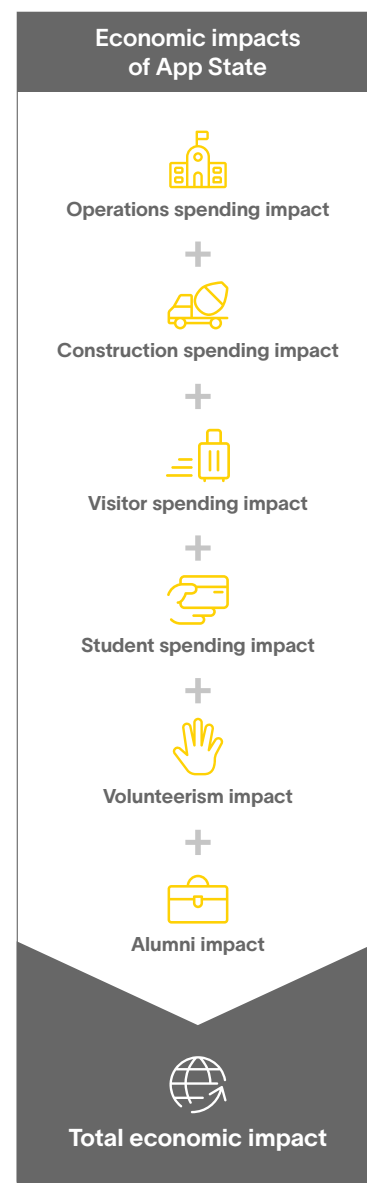
Each of the economic impacts should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure net impacts, not gross impacts. Gross impacts represent an upper-bound estimate in terms of capturing all activity stemming from the university;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

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 regional product (GRP). Income may be further broken out into the **labor income impact**, also known as earnings, which assesses the change in employee compensation; and the **non-labor income impact**, which assesses the change in business profits. Together, labor income and non-labor income sum to total income.

Another way to state the impact is in terms of **jobs**, a measure of the number of full- and part-time jobs that would be required to support the change in income. Finally, a frequently used measure is the **sales impact**, which comprises the change in business sales revenue in the economy as a result of increased economic activity. It is important to bear in mind, however, that much of this sales revenue leaves the regional economy through intermediary transactions and costs.¹⁰ All of these measures—added labor and non-labor income, total income, jobs, and sales—are used to estimate the economic impact results presented in this chapter. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

- The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses.

¹⁰ See Appendix 4 for an example of the intermediary costs included in the sales impact but not in the income impact.





- 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 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 region. 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. The multi-regional capacity of the MR-SAM allows impacts to be measured in the region and state simultaneously, accounting for App State’s activity in each area, as well as each area’s economic characteristics. In this analysis, impacts on the region include impacts from the university’s regional activity, as well as the indirect and induced multiplier effects that reach the region from the university’s activity in the rest of the state. 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 regional economy if not for the university.



App State small business centers assist 1,000 clients with \$65M in capital formation

Since 2018, App State's Small Business and Technology Development Centers in Boone and Hickory have served nearly 1,000 clients, helping create or retain over 1,600 jobs and assisting with \$65.6 million in capital formation.

The SBTDC is an advisory resource for growing and developing businesses hosted by campuses of the University of North Carolina System. The organization operates in partnership with the U.S. Small Business Administration, making it a valuable asset in the economic development infrastructure of North Carolina. The staff help businesses address a broad spectrum of issues, including planning, financial management, human resources, marketing and operations. The experienced, knowledgeable and professional staff—many of whom have business ownership and executive

leadership experience—combine real-life expertise with industry knowledge, education and advanced training to match services with client needs and provide industry-specific advice and counseling.

The Boone SBTDC office serves Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes and Yancey counties, while the Hickory SBTDC office serves Alexander, Burke, Caldwell, Catawba, Cleveland, Gaston and Lincoln counties.

During the pandemic, the centers served as a "first responder" as many business owners needed a third party to help them pivot their business. For instance, one local printing company experienced a large decline in its regular orders. The center helped the company develop a new business stream: producing

COVID-related retail signage and floor stickers to promote physical distancing and the wearing of face coverings.

The primary issue for the center's clients early in the pandemic was how to raise capital to cover costs as their sales were disrupted.

In addition to handling incoming calls, SBTDC reached out directly to chambers of commerce, providing webinar content and expert resources to share with local businesses.

During the first five months of the pandemic, SBTDC's team of consultants—in partnership with App State faculty, staff and graduate students—handled more than four times their normal caseload.



Operations spending impact



Faculty and staff payroll is part of the region's total earnings, and the spending of employees for groceries, apparel, and other household expenditures helps support regional businesses. The university itself purchases supplies and services, and many of its vendors are located in the Five-County Region. 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) 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 region, and is therefore an injection of new money into the regional economy that would not have happened if App State did not exist. In this analysis, we exclude expenses for

Reich College of Education staff coach Northwestern NC's new teachers

Through the North Carolina New Teacher Support Program in App State's Reich College of Education, App State employs new teacher support coaches to work with beginning teachers in K–12 schools. The goal of the program is to improve beginning teacher effectiveness and promote teacher retention, both of which contribute to student achievement. The program provides three core services for beginning teachers:

- Weekly coaching for each teacher enrolled.
- Professional development with workshops and educational presentations targeted to beginning teachers, led by Dr. Bestsy Rosenbalm, director of App State's Public School Partnership, and the new teacher support coaches.
- A statewide Beginning Teacher Institute each year with keynote speakers and customized breakout sessions.





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.¹¹

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

Expense category	In-region expenditures (thousands)	Out-of-region expenditures (thousands)	Total expenditures (thousands)
Employee salaries, wages, and benefits	\$246,860	\$0	\$246,860
Operation and maintenance of plant	\$14,443	\$9,289	\$23,732
All other expenditures	\$25,869	\$140,964	\$166,833
Total	\$287,172	\$150,253	\$437,425

This table does not include expenditures for construction, as they are presented separately in the following section.

Source: Data provided by App State and the Lightcast impact model.

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 App State employees work in the Five-County Region (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

University's Child Development Center nearly doubles in capacity

App State's five-star accredited Child Development Center plays a key role in recruiting and retaining highly qualified faculty, staff and students, and in allowing students to continue their education as they raise their families. An assessment by the university's Wellness and Prevention Services indicates an increasing number of students have dependents and need additional support, such as childcare options, to thrive at App State.

The center, which has space for over 120 students, completed an expansion in 2022 that added five additional classrooms, providing space for an additional 54 students—with priority given to children of App State faculty, staff and students. This nearly doubled the center's enrollment capacity. Prior to the expansion, the center had a waitlist of more than 200 children/families.



¹¹ This aligns with the economic impact guidelines set by the Association of Public and Land-Grant Universities. Ultimately, excluding these measures results in more conservative and defensible estimates.





Schools (State Government)).¹² 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 App State: 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 occurs inside the region. The expenditures occurring outside the region are known as leakages. We estimate in-region expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by regional suppliers, for each of the approximately 1,000 industries in the MR-SAM model.¹³ For example, if 40% of the demand for NAICS 541211 (Offices of Certified Public Accountants) is satisfied by regional suppliers, the RPC for that industry is 40%. The remaining 60% of the demand for NAICS 541211 is provided by suppliers located outside the region. The three vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-region expenditures associated with the university. See Table 2.1 for a breakdown of the expenditures that occur in-region. Finally, in-region 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 regional 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 App State and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled *multiplier effect*. Summing the initial and multiplier effects, the gross impacts are \$289.5 million in labor income and \$43.7 million in non-labor income. This sums to a total impact of \$333.2 million in total added income associated with the spending of the university and its employees in the region. This is equivalent to supporting 4,185 jobs.

The \$333.2 million in gross impact is often reported by researchers as the total impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event—in this case, the expenditure of in-region funds on App State—had not occurred. App State received an estimated 16% of its funding from sources within the Five-County Region. 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 region, from state and local taxes, and from the financial aid issued to students by state and local government. We must account for the opportunity cost of this in-region funding. Had other

The total net impact of the university's operations is **\$308.2 million** in total added income, which is equivalent to supporting **3,905 jobs**.

¹² See Appendix 2 for a definition of NAICS.

¹³ See Appendix 5 for a description of Lightcast's MR-SAM model.





industries received these monies rather than App State, income impacts would have still been created in the economy. In economic analysis, impacts that occur under counterfactual conditions are used to offset the impacts that actually occur in order to derive the true impact of the event under analysis.

We estimate this counterfactual by simulating a scenario where in-region monies spent on the university are instead spent on consumer goods and savings. This simulates the in-region monies being returned to the taxpayers and being spent by the household sector. Our approach is to establish the total amount spent by in-region students and taxpayers on App State, map this to the detailed industries of the MR-SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-region spending, and run the in-region 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 regional money. As shown in the last row of Table 2.2, the total net impact is approximately \$278.2 million in labor income and \$30 million in non-labor income. This sums together to \$308.2 million in total added income and is equivalent to supporting 3,905 jobs. These impacts represent new economic activity created in the regional economy solely attributable to the operations of App State.

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	\$246,860	\$0	\$246,860	\$437,425	3,232
Multiplier effect					
Direct effect	\$13,440	\$9,613	\$23,053	\$40,312	254
Indirect effect	\$1,912	\$1,060	\$2,972	\$5,573	37
Induced effect	\$27,273	\$33,011	\$60,284	\$94,735	662
Total multiplier effect	\$42,626	\$43,684	\$86,309	\$140,619	953
Gross impact (initial + multiplier)	\$289,486	\$43,684	\$333,169	\$578,044	4,185
Less alternative uses of funds	-\$11,319	-\$13,666	-\$24,985	-\$72,610	-280
Net impact	\$278,167	\$30,018	\$308,184	\$505,434	3,905

Source: Lightcast impact model.



Construction spending impact



In this section, we estimate the economic impact of the construction spending of App State. 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 region. During FY 2021-22, App State spent a total of \$91.3 million on various construction projects that included the construction of Laurel Creek and New River Residence Halls; construction of athletics facilities such as track, tennis, and softball facilities, as well as the North End Zone facility at Kidd Brewer Stadium; HVAC upgrades to Appalachian Heights Residence Hall; along with the construction and renovation of academic buildings, such as Sanford and Levine Halls; and various other building renovations.

During FY 2021-22, App State spent a total of **\$91.3 million** on various construction projects.

Assuming App State construction spending approximately matches national construction spending patterns of NAICS 902612 (Colleges, Universities, and Professional Schools (State Government)), we map App State construction spending to

University and community partner for App Builds a Home

App Builds a Home is a partnership between Appalachian State University and Watauga County Habitat for Humanity to help local partner families build safe, affordable homes. App Builds a Home—a campuswide initiative involving students, faculty, staff and alumni—works in partnership with App State's student-run Habitat for Humanity Club in fundraising and construction efforts.

To date, four local families have been supported through the program, which launched in 2019. App State Builds a Home raised approximately \$286,000 to help fund the construction of the four homes, and has raised more than \$10,000 toward the development of its latest home project.



App State replaces aging residence halls and plans new housing to meet demand

In 2022, App State completed a multiphase student housing project that provided nearly 2,300 new beds, raising the total campus housing capacity by about 500 beds and replacing nearly 1,800 beds in six outdated residence halls. Four new residence halls feature suite-style and apartment-style units—a departure from the two-bed dorm rooms and communal bathrooms of the past—with significantly more space for common areas and quiet study.

The project, which began in 2019, continued as planned throughout the COVID-19 pandemic, supporting jobs and spurring economic activity during a challenging time for the local business community and tourism sector.

The university is continuing efforts to provide more affordable housing for faculty, staff and students. In summer 2023, developers began construction of 156 below-market-rate faculty and staff housing units to help meet App State employees' housing needs amid housing scarcity and cost inflation in the Boone area.

Additionally, in fall 2023, App State issued a request for qualifications from developers for a public-private partnership to build new student housing, parking and potential student support

facilities with a goal of providing approximately 1,850 new beds in new residence halls and apartments on App State's Boone campus and the Appalachian 105 property.



the construction industries of the MR-SAM model. Next, we use the RPCs to estimate the portion of this spending that occurs in-region. Finally, the in-region 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-region construction money, we estimate the impact of a similar alternative uses of funds as found in the operations spending impact. This is done by simulating a scenario where in-region 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 App State 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 App State construction spending creates a net total short-run impact of \$31.6 million in added income—the equivalent of supporting 611 jobs in the Five-County Region.



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	\$91,340	0
Multiplier effect					
Direct effect	\$23,210	\$4,374	\$27,585	\$56,484	508
Indirect effect	\$2,897	\$546	\$3,443	\$7,050	64
Induced effect	\$3,884	\$732	\$4,616	\$9,453	85
Total multiplier effect	\$29,991	\$5,652	\$35,643	\$72,987	657
Gross impact (initial + multiplier)	\$29,991	\$5,652	\$35,643	\$164,327	657
Less alternative uses of funds	-\$1,836	-\$2,217	-\$4,053	-\$11,777	-46
Net impact	\$28,155	\$3,436	\$31,591	\$152,550	611

Source: Lightcast impact model.

One of the largest infrastructure investments across the entire UNC system

As of fall 2023, App State had 42 active capital construction projects, representing nearly \$300 million in improvements—one of the largest infrastructure investments across the entire

University of North Carolina System. Through these projects, the university aims to enhance teaching, research and scholarship, contribute toward universitywide sustainability goals, address a need for high-quality, affordable housing for App State employees, improve the overall experience for student-athletes, enhance campus parking and dining amenities and expand regional access to an App State education.

Recently completed, upcoming and in-progress projects include:

- Phase 1 and 2 renovations for the App State Hickory campus.

- Phase 1 construction of the Innovation District, including the Conservatory for Biodiversity Education and Research, a zero-carbon energy system and housing for App State faculty and staff.
- An addition to and a partial renovation of Kenneth E. Peacock Hall.
- Construction of the Holmes Convocation Center Parking Deck.
- The renovation and modernization of Wey Hall.
- Renovations for Edwin Duncan Hall.
- Phase 2 construction at the Appalachian 105 property.



Visitor spending impact



Tens of thousands of out-of-region visitors came to App State in FY 2021-22 to participate in various activities, including sports events such as football, basketball, and volleyball games; performing arts, art museum, and other entertainment activities; graduation ceremonies and new student orientation; and various camps and business conferences. App State estimated that 122,254 out-of-region visitors attended events it hosted in FY 2021-22. It is important to note that the recovery period from the COVID-19 effects in terms of athletics visitor attendance only ended in FY 2022-23, which significantly reduced the potential FY 2021-22 visitor spending impact.

Table 2.4: Average per-trip visitor costs and sales generated by out-of-region visitors in the Five-County Region, FY 2021-22*

Accommodation	\$99
Food	\$48
Entertainment and shopping	\$31
Transportation	\$23
Total expenses per visitor	\$201
<i>Number of out-of-region visitors</i>	122,254
Gross sales	\$24,511,927
On-campus sales (excluding textbooks)	-\$2,985,406
Net off-campus sales	\$21,526,521

* Costs have been adjusted to account for the length of stay of out-of-region visitors per data provided by App State. Accommodation and transportation have been adjusted downward to recognize that, on average, two visitors share these costs. Numbers may not sum to total due to rounding.

Source: Sales calculations estimated by Lightcast based on data provided by App State.



App State implements new teams to support health and safety at campus events

In 2023, App State implemented two new teams, ELITE and Mountaineer Medics, to support security, customer service and emergency services at campus events.

The new ELITE (events, logistics, implementation, technology and excellence) team, managed by the Holmes Convocation Center, supports a variety of campus events, including concerts, athletics events and commencement ceremonies ranging from 250 to 40,000 in attendance. The ELITE team, made up of students, staff and community members, consists of nearly 200 employees.

App State students are also gaining career experience in emergency medical services and supporting campus events as part of a new program, Mountaineer Medics. Through the program, undergraduate and graduate students who are Emergency Medical Technician (EMT)-credentialed within the Watauga County EMS system work part time to provide basic life support services to the App State Community, which helps to reduce the demands placed on community resources during large events while also enabling these students to gain professional experience in public safety and health care settings.

Mountaineer Medics are managed by full-time staff members of App State's Environmental Health, Safety and Emergency Management team.



Table 2.4 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-region visitors totaled \$24.5 million in FY 2021-22. 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-region visitors totaled \$3 million. The net sales from out-of-region visitors in FY 2021-22 thus come to \$21.5 million.

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-region 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 2.5, the net impact of visitor spending in FY 2021-22 is \$5 million in labor income and \$4.5 million in non-labor income. This totals to \$9.5 million in added income and is equivalent to supporting 179 jobs.

The \$9.5 million of total visitor spending impact broken down by the type of activities is as follows: \$6.4 million in added income is attributable to Athletics; \$0.8 million is associated with Arts; and the remaining \$2.3 million of value added to the regional economy stems from other visitor activities hosted by App State in FY 2021-22.¹⁴

App State estimated that **122,254 out-of-region visitors** attended events it hosted in FY 2021-22.

¹⁴ The numbers of visitors attending athletics and arts events were provided by App State.

Table 2.5: 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	\$21,527	0
Multiplier effect					
Direct effect	\$3,434	\$3,115	\$6,549	\$11,388	124
Indirect effect	\$600	\$537	\$1,137	\$2,029	22
Induced effect	\$927	\$859	\$1,786	\$3,069	33
Total multiplier effect	\$4,961	\$4,512	\$9,472	\$16,486	179
Total impact (initial + multiplier)	\$4,961	\$4,512	\$9,472	\$38,012	179

Source: Lightcast impact model.

As mentioned earlier, the FY 2021-22 visitor attendance was not representative of the regular App State visitor activities due to the lingering effects of the COVID-19 pandemic at that time, resulting in the decreased visitor spending and making the respective added income to the region a conservative measure of their typical annual impact.

Lightcast worked with App State to estimate an alternative impact from App State's visitors of what it could have been had the analysis year been a typical year in terms of the inflow of out-of-region visitors who came to attend the university's events, including football games.

We analyzed visitor data provided by App State for FY 2022-23—a year when most of the public activities resumed. In FY 2022-23, the spending of out-of-region visitors produced a total impact of **\$11.1 million** in added income—\$5.8 million in labor income and \$5.3 million in non-labor income—which is equivalent to supporting **211 jobs** in the Five-County Region.

Given that these results are reflective of a year different from the study analysis year, this impact cannot be added to the FY 2021-22 impact. Nonetheless, it is an important metric to keep in mind when communicating the economic impact created by App State on the regional economy.

"Since the beginning of the pandemic, our campus remained open with emergency management protocols activated, operational modifications and precautions in place and implementation of strategies to mitigate financial impacts on our students, faculty and staff and maximize opportunities for savings," said App State Chancellor Sheri Everts, adding that she and her leadership team spared no effort to keep App State employees working during the pandemic, including reassigning staff in receipt-supported areas to assist with the important work of safely returning students, faculty and staff to campus.

Student spending impact



Both in-region and out-of-region students contribute to the student spending impact of App State. However, not all of these students can be counted towards the impact. Of the in-region students, only the impact from those students who were retained, or who would have left the region to seek education elsewhere had they not attended App State, is measured. Students who would have stayed in the region anyway are not counted towards the impact since their monies would have been added to the Five-County Region economy regardless of App State. In addition, only the out-of-region students who relocated to the Five-County Region to attend the university are considered. Students who commute from outside the region or take courses online are not counted towards the student spending impact because they are not adding money from living expenses to the region.

While there were 3,532 students attending App State who originated from the Five-County Region, not all of them would have remained in the region if not for the existence of App State. We apply a conservative assumption that 10% of these students would have left the Five-County Region for other education opportunities if App State did not exist.¹⁵ Therefore, we recognize that the in-region spending of 353 students retained in the region is attributable to App State. These students, called retained students, spent money at businesses in the region for everyday needs such as groceries, accommodation, and transportation. Of the retained students, we estimate six 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.

¹⁵ See Appendix 1 for a sensitivity analysis of the retained student variable.





Relocated students are also accounted for in App State's student spending impact. An estimated 10,511 students came from outside the region and lived off campus while attending App State in FY 2021-22. Another estimated 5,912 out-of-region 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-region students supported jobs and created new income in the regional economy.

The average costs for students appear in the first section of Table 2.6, equal to \$14,010 per student. Note that this table excludes expenses for books and supplies, since many of these costs are already reflected in the operations spending impact discussed in the previous section. We multiply the \$14,010 in annual costs by the 10,858 students who either were retained or relocated to the region because of App State and lived in-region 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 off-campus food purchases (assumed to be equal to 25% of room and board), personal expenses, and transportation by the number of students who lived in the region but on campus while attending (5,918 students). Altogether, off-campus spending of relocated and retained students generated gross sales of \$189 million. This figure, once net of the monies paid to student workers, yields net off-campus sales of \$181.1 million, as shown in the bottom row of Table 2.6.

Table 2.6: Average student costs and total sales generated by relocated and retained students in the Five-County Region, FY 2021-22

Room and board	\$10,382
Personal expenses	\$2,316
Transportation	\$1,312
Total expenses per student	\$14,010
<i>Number of students retained</i>	353
<i>Number of students relocated</i>	16,423
Gross retained student sales	\$4,902,610
Gross relocated student sales	\$184,050,262
Total gross off-campus sales	\$188,952,871
Wages and salaries paid to student workers*	\$7,852,999
Net off-campus sales	\$181,099,872

* 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 region.

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

Estimating the impacts generated by the \$181.1 million in student spending follows a procedure similar to that of the operations spending impact described above. We distribute the \$181.1 million in sales to the industry sectors of the MR-SAM model, apply RPCs to reflect in-region spending, and run the net sales figures through the MR-SAM model to derive multiplier effects.





Table 2.7 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 \$47.8 million in labor income and \$31.8 million in non-labor income. This sums together to \$79.5 million in total added income and is equivalent to supporting 1,690 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 regional economy as a result of the direct and indirect effects.

The total impact of student spending is **\$79.5 million** in total added income and is equivalent to supporting **1,690 jobs**.

Table 2.7: 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	\$181,100	0
Multiplier effect					
Direct effect	\$33,683	\$22,064	\$55,747	\$104,051	1,179
Indirect effect	\$6,363	\$4,348	\$10,711	\$20,752	240
Induced effect	\$7,714	\$5,343	\$13,057	\$24,209	271
Total multiplier effect	\$47,760	\$31,755	\$79,515	\$149,013	1,690
Total impact (initial + multiplier)	\$47,760	\$31,755	\$79,515	\$330,113	1,690

Source: Lightcast impact model.

New River Light and Power Scholarship supports Watauga County students

For more than 100 years, Appalachian State University, through its nonprofit electric utility, New River Light and Power, has provided power to Boone area residents. The utility contributes approximately \$650,000 each year to the university's general scholarship fund, which supports the Chancellor's Scholarship as well as other university scholarships. Additionally, the utility funds a dedicated scholarship every year to support future Mountaineers who live in Watauga County—home to the town of Boone and App State's Boone campus. Through this program, the university has awarded more than \$1.7 million in scholarships to App State students from Watauga County.



Volunteerism impact



Beyond positively impacting the region through the activities occurring at App State, such as sports and arts events, App State directly impacts the regional 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.

Overall, 3,591 App State student and employee volunteers supported non-profit organizations and causes across the region in FY 2021-22. Altogether, App State students volunteered 78,457 hours of their time. According to Independent Sector,¹⁶ the only national membership organization that brings together the charitable community, the average value of a volunteer hour in North Carolina in 2021 was \$27.63. Multiplying this by the hours App State students and employees volunteered amounts to \$2.2 million in value to the community.

App State student volunteer hours are valued at **\$2.2 million**.

¹⁶ By state value per volunteer hour was provided by Independent Sector (see https://independentsector.org/resource/vovt_details/).



Annual AppKIDS event supports area youth in need

Each year, the Appalachian Kindness In Donations and Service (AppKIDS) service project—organized by App State Staff Senate—supports 100 local students in need with an annual shopping trip, providing them with winter clothing, school supplies and hygiene items.

Using donated funds, App State faculty and staff volunteer their time to host the students, who are in grades kindergarten through 12—spending the day getting to know them and ensuring they are able to take home items that they need. Additionally, App State Chancellor Sheri Everts provides each child with a book.

The project, established in 1980, has helped generations of local children, and some App State staff who were beneficiaries of this program as children now volunteer as shoppers. App State supports staff who wish to participate in community service activities, offering 24 hours of paid community service leave each year.



App State holds new speech therapy camp—the only one of its kind in North Carolina

Approximately 5% to 10% of children stutter during their childhood—though most outgrow the condition. However, for about 1% of the population, the communication disorder persists, according to the National Institute on Deafness and Other Communication Disorders.

App State's summer camp for people who stutter will be designed for adolescents ages 11–16 and will incorporate both individual and group sessions. The speech therapy camp—North Carolina's only residential, intensive summer camp of its kind—will be held annually on App State's Boone campus.

The camp, staffed by App State graduate student clinicians in the university's speech-language pathology program, faculty and licensed speech-language pathologists, is designed to work on managing moments of stuttering, increasing fluency and decreasing negative attitudes about stuttering.

Next, we convert the \$2.2 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 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. App State volunteers' productivity allows leaders of the businesses and organizations to devote resources to other projects, generating effects throughout the economy—the multiplier effects. Table 2.8 outlines this process. In FY 2021-22, App State volunteers added \$3.2 million in labor income and \$233.3 thousand in non-labor income. The total added income



from App State volunteers to the Five-County Region economy sums to \$3.4 million in FY 2021-22.¹⁷ This \$3.4 million is equivalent to supporting 161 jobs in the region.

Table 2.8: 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	\$2,168	\$159	\$2,327	\$5,082	108
Indirect effect	\$579	\$44	\$622	\$1,476	33
Induced effect	\$412	\$30	\$442	\$935	19
Total multiplier effect	\$3,159	\$233	\$3,392	\$7,493	161
Total impact (initial + multiplier)	\$3,159	\$233	\$3,392	\$7,493	161

Source: Lightcast impact model.

Student volunteers contribute millions of dollars in value to local community

Since 2014, App State students participating in service programs offered by the Office of Community-Engaged Leadership, as well as those enrolled in academic service-learning courses, have contributed millions of dollars in value to the local community.

App State's offices of Community-Engaged Leadership and Academic Civic Engagement partner with approximately 100 local organizations, engaging students in academic, experiential and community-oriented programs that enhance their capacity to serve and lead in socially responsible ways for the benefit of their local and global communities.



¹⁷ See the Important note on page 7 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 App State *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 in pursuit of achieving a degree are considered alumni.

While App State creates an economic impact through its operations, construction, visitor, and student spending, as well as volunteerism, the economic impact of App State unique to higher education stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni. While attending App State, 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 App State alumni enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits).

The economic impact of App State unique to higher education stems from the added human capital—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni.





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 regional 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 App State'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 App State.

We begin by estimating the portion of alumni who are employed in the workforce. To estimate the historical employment patterns of alumni in the region, 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;¹⁸ 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) regional migration data from the Internal Revenue Service.¹⁹ The result is the estimated portion of alumni from each previous year who were still actively employed in the region 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 credits as a proxy for accumulated human capital. The average number of credits completed per student in FY 2021-22 was 28.0. To estimate the number of credits present in the workforce during the analysis year, we use the university's historical student headcount over the past 45 years, from FY 1977-78 to FY 2021-22. We apply a 45-year time horizon to include all alumni active in the regional 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 App State's student oldest cohort average age (22 years per Lightcast's study for FY 2012-13) 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 inform this average age by the historical student average age from App State's economic impact study conducted by Lightcast for FY 2012-13.

We multiply the 28.0 average credits per student by the headcounts that we estimate are still actively employed from each of the previous years.²⁰ Students who enroll at the university more than one year are counted at least twice in the historical enrollment data. However, credits remain distinct regardless of when and by whom they were earned, so there is no duplication in the credit counts. We estimate there are approximately 1.3 million credits from alumni active in the workforce.

18 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.

19 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.

20 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 App State for a previous study to estimate students' credit load in prior years.





Next, we estimate the value of the credits, or the skills and human capital acquired by App State 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 App State alumni and the alternative wage they would have earned had they not attended App State. Using the regional incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average value per credit to equal \$141. This value represents the regional average incremental increase in wages that alumni of App State received during the analysis year for every credit they completed.

Because workforce experience leads to increased productivity and higher wages, the value per credit varies depending on the students' workforce experience, with the highest value applied to the credits of students who had been employed the longest by FY 2021-22, and the lowest value per credit applied to students who were just entering the workforce. More information on the theory and calculations behind the value per credit appears in Appendix 6. In determining the amount of added labor income attributable to alumni, we multiply the credits of former students in each year of the historical time horizon by the corresponding average value per credit for that year, and then sum the products together. This calculation yields approximately \$177.9 million in gross labor income from increased wages received by former students in FY 2021-22 (as shown in Table 2.9).

Table 2.9: Number of credits in workforce and initial labor income created in the Five-County Region, FY 2021-22

Number of credits in workforce	1,258,167
Average value per credit	\$141
Initial labor income, gross	\$177,886,468
Adjustments for counterfactual scenarios	
Percent reduction for alternative education opportunities	15%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	\$75,601,749

Source: Lightcast impact model.

The next two rows in Table 2.9 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 App State and subsequent influx of skilled labor into the regional economy. The first counterfactual scenario that we address is the adjustment for alternative education opportunities. In the counterfactual scenario where App State does not exist, we assume a portion of App State alumni would have received a comparable education elsewhere in the region or would have left the region and received a comparable education and then returned to the region. The incremental added labor income that accrues to those students cannot be counted towards the added labor income from App State alumni. The adjustment for alternative education opportunities amounts to a 15% reduction of the \$177.9 million in added



labor income. This means that 15% of the added labor income from App State alumni would have been generated in the region anyway, even if the university did not exist. For more information on the alternative education adjustment, see Appendix 7.

The other adjustment in Table 2.9 accounts for the importation of labor. Suppose App State did not exist and in consequence there were fewer skilled workers in the region. Businesses could still satisfy some of their need for skilled labor by recruiting from outside the Five-County Region. 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 regional businesses could have been filled by workers recruited from outside the region if the university did not exist.²¹ 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 \$75.6 million, as shown in Table 2.9.

The \$75.6 million in added labor income appears under the initial effect in the labor income column of Table 2.10. To this we add an estimate for initial non-labor income. As discussed earlier in this section,

businesses that employ former students of App State 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 (\$75.6 million) to the six-digit NAICS industry sectors where students are most likely to be employed. This allocation entails a process that maps completers in the region 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.²² 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 the MR-SAM model to map the occupational distribution of the \$75.6 million in initial labor income effects to the detailed industry sectors in the MR-SAM model.²³

"Employers tell us that our graduates have a competitive edge in the job market because they bring solid, discipline-specific knowledge, combined with a strong work ethic, problem-solving skills and a penchant for innovation."

— App State Chancellor Sheri Everts

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

22 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).

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





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 \$22.3 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 Five-County Region economy, equal to approximately \$97.9 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix.

Table 2.10: Alumni impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	\$75,602	\$22,327	\$97,929	\$196,115	1,639
Multiplier effect					
Direct effect	\$8,408	\$2,662	\$11,070	\$21,848	211
Indirect effect	\$1,969	\$646	\$2,615	\$5,225	51
Induced effect	\$22,228	\$6,841	\$29,069	\$59,077	454
Total multiplier effect	\$32,606	\$10,149	\$42,755	\$86,150	716
Total impact (initial + multiplier)	\$108,207	\$32,476	\$140,684	\$282,265	2,356

Source: Lightcast impact model.

Table 2.10 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 \$32.6 million in added labor income and \$10.1 million in added non-labor income, for an overall total of \$42.8 million in multiplier effects. The grand total of the alumni impact is \$140.7 million in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 2,356 jobs.



Total App State impact



The total economic impact of App State on the Five-County Region can be generalized into two broad types of impacts. First, on an annual basis, App State generates a flow of spending that has a significant impact on the regional economy. The impacts of this spending are captured by the operations, construction, visitor, and student spending impacts, along with the volunteerism impact. While not insignificant, these impacts do not capture the true purpose of App State. The fundamental mission of App State is to foster human capital. Every year, a new cohort of former App State students adds to the stock of human capital in the region, and a portion of alumni continues to add to the regional economy.

Table 2.11: Total App State impact, FY 2021-22

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	\$278,167	\$30,018	\$308,184	\$505,434	3,905
Construction spending	\$28,155	\$3,436	\$31,591	\$152,550	611
Visitor spending	\$4,961	\$4,512	\$9,472	\$38,012	179
Student spending	\$47,760	\$31,755	\$79,515	\$330,113	1,690
Volunteerism	\$3,159	\$233	\$3,392	\$7,493	161
Alumni	\$108,207	\$32,476	\$140,684	\$282,265	2,356
Total impact	\$470,409	\$102,430	\$572,838	\$1,315,867	8,902
% of the Five-County Region economy	7.9%	2.7%	5.9%	6.8%	7.2%

Source: Lightcast impact model.

Table 2.11 displays the grand total impacts of App State on the Five-County Region economy in FY 2021-22. For context, the percentages of App State compared to the total labor income, total non-labor income, combined total income, sales, and jobs in the Five-County Region, as presented in Table 1.3 and Figure 1.3, are included. The total added value of App State is **\$572.8 million**, equivalent to **5.9%** of the GRP of the Five-County Region. By comparison, this contribution that the university provides on





its own is larger than the entire Real Estate & Rental & Leasing industry in the region. App State's total impact supported **8,902 jobs** in FY 2021-22. For perspective, this means that **one out of every 14 jobs** in the Five-County Region is supported by the activities of App State and its students.

These impacts from the university and its students stem from different industry sectors and spread throughout the regional economy. Table 2.12 displays the total impact of App State by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations, construction, visitors, students, volunteerism, and alumni, as shown in Table 2.11, broken down by each industry sector's individual impact on the regional 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 regional economy from the university's activities and from where App State alumni are employed. For example, the activities of App State and its alumni in the Construction industry sector generated an impact of \$49.3 million in FY 2021-22.

Table 2.12: Total App State impact by industry, FY 2021-22

Industry sector	Total income (thousands)	Jobs supported
Government, Education	\$276,736	3,705
Accommodation & Food Services	\$56,286	1,398
Construction	\$49,311	923
Health Care & Social Assistance	\$36,298	538
Other Services (except Public Administration)	\$30,618	643
Retail Trade	\$22,008	406
Information	\$14,353	87
Government, Non-Education	\$14,338	181
Manufacturing	\$13,170	131
Professional & Technical Services	\$11,063	165
Wholesale Trade	\$7,582	54
Finance & Insurance	\$7,502	67
Real Estate & Rental & Leasing	\$7,108	38
Arts, Entertainment, & Recreation	\$6,308	217
Utilities	\$5,832	14
Management of Companies & Enterprises	\$4,729	60
Administrative & Waste Services	\$3,282	71
Educational Services	\$3,022	145
Agriculture, Forestry, Fishing, & Hunting	\$1,440	28
Transportation & Warehousing	\$1,422	27
Mining, Quarrying, & Oil and Gas Extraction	\$432	3
Total impact	\$572,838	8,902

Source: Lightcast impact model.





Investment analysis

The benefits generated by App State 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 North Carolina 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 App State as a worthwhile investment from the perspectives of students, taxpayers, and society.



Student perspective



To enroll in postsecondary education, students pay for tuition and forgo 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 forgone time and money. The benefits are the higher earnings that students receive as a result of their education.

Calculating student costs

Student costs consist of three main items: direct outlays, opportunity costs, and future principal and interest costs incurred from student loans. Direct outlays include tuition and fees, equal to \$140.3 million from Figure 1.1. Direct outlays also include the cost of books and supplies. On average, full-time students spent \$800 each on books and supplies during the reporting year.²⁴ Multiplying this figure by the number of full-time equivalents (FTEs) produced by App State in FY 2021-22²⁵ generates a total cost of \$13.6 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 \$43.6 million in federal loans to attend App State.²⁶ 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 \$43.6 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

Student costs



Out-of-pocket expenses



Opportunity costs

Student benefits



Higher earnings from education

²⁴ Based on the data provided by App State.

²⁵ A single FTE is equal to 30 credits for undergraduate students and 24 credits for graduate students, so there were 18,729 FTEs produced by students in FY 2021-22, equal to 559,249 credits divided by the weighted average number of credits per student.

²⁶ Due to data limitations, only federal loans are considered in this analysis.



and earnings forgone by students who go to university rather than work. To calculate it, we need to know the difference between the students' full earning potential and what they actually earn while attending the 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.²⁷ 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 (21) to better reflect their wages at their current age.²⁸ This calculation yields an average full earning potential of \$17,246 per student.

App State digital textbook rentals boast 99% participation rate, save students \$5M annually

App State's digital textbook rental system—one of the first of its kind in the nation—has been utilized by 99% of the student population and has saved students over \$5 million, which is a 34% savings compared with purchasing new books. The e-book program allows students to download and read textbooks and class materials on their computers, tablets and phones.

Approximately 80% of course materials are available through the digital textbook rental system, with the remaining titles available in physical copies.

App State's previous hard copy textbook rental model also charged a flat fee per semester but supported only one book per class. Any additional books had to be purchased separately. A single extra book under the old model could cost more than the flat rate for the digital textbook system.



In determining how much students earn while enrolled in postsecondary education, an important factor to consider is the time that they actually spend on postsecondary education, since this is the only time that they are required to give up a portion of their earnings. We use the students' credit production as a proxy for time, under the assumption that the more credits students earn, the less time they have to work, and, consequently, the greater their forgone earnings. Overall, students attending App State in FY 2021-22 earned an average of 28.0 credits per student, which is approximately equal to 96% of a full academic year.²⁹ We thus include no more than \$16,492 (or 96%) 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 45% of students are employed.³⁰ For the remainder of students, we assume that they are either seeking work or planning to

²⁷ This is based on students who reported their prior level of education to App State.

²⁸ Further discussion on this adjustment appears in Appendix 6.

²⁹ Equal to 28.0 credits divided by 30 for the proportion of undergraduate students and 24 for the proportion of graduate students, the assumed number of credits in a full-time academic year.

³⁰ Based on data provided by App State.

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 \$16,492). The total value of their forgone earnings thus comes to \$181 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 77% of what they would have earned had they chosen to work full-time rather than go to college.³¹ The remaining 23% comprises the percentage of their full earning potential that they forgo. Obviously, this assumption varies by person; some students forgo more and others less. Since we do not know the actual jobs that students hold while attending, the 23% in forgone earnings serves as a reasonable average.

"Graduating with low—or no—student debt is critical for all students, especially underrepresented student populations and their families. App State students graduate with debt loads that are well below the national average, and the loan default rates of our students are some of the lowest in the entire country. These are important factors for our prospective students and their families as they consider App State."

— App State Chancellor Sheri Everts

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 forgo up to 0.1 hours of leisure time per day.³² 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 forgone during the academic year by the average hourly pay of the students' full earning potential. For working students, therefore, their total opportunity cost is \$37.4 million, equal to the sum of their forgone earnings (\$34.6 million) and forgone leisure time (\$2.7 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

31 The 77% assumption is based on the average hourly wage of jobs commonly held by working students divided by the regional average hourly wage. Occupational wage estimates are published by the Bureau of Labor Statistics (see http://www.bls.gov/oes/current/oes_nat.htm).

32 American Time Use Survey. 2018, 2019, and 2021. Last modified July 2022. <https://www.bls.gov/tus/data.htm>.





in interest. The first step in calculating students' loan interest cost is to determine the payback time for the loans. The \$43.6 million in loans was awarded to 7,224 students, averaging \$6,031 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 App State is a four-year university, students will be indebted four times that amount, or \$24,122 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.³³

This indebtedness calculation is used solely to estimate the loan payback period. Students will be paying back the principal amount of \$43.6 million over time. After taking into consideration the time value of money, this means that students will pay off a discounted present value of \$26.8 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 4.4%³⁴ as our interest rate, we calculate that students will pay a total discounted present value of \$16.2 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.

App State students, employers benefit from enhanced Career Development Center services

The Career Development Center works to facilitate App State's goal of economic development for the region. The center's staff facilitates unions between students and employers that benefit the state as a whole through career fairs, employer workshops, information sessions, networking events and on-campus interviewing opportunities.

Students who participate in the center's services are able to identify core values, beliefs and skills and use them to articulate relatable career goals; acquire transferable skills and relevant experiences for future professional endeavors; and utilize resources that are available to gain experiential learning opportunities and cultivate professional networks.

To better support students and employers, App State's Career Development Center moved to the heart of campus and enhanced its slate

of services by adding more targeted career programming.



³³ Repayment period based on total education loan indebtedness, U.S. Department of Education, 2022. <https://studentaid.gov/manage-loans/repayment/plans/standard>.

³⁴ The student discount rate is derived from the three-year average of 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>.





The steps leading up to the calculation of student costs appear in Table 3.1. Direct outlays amount to \$110.3 million, the sum of tuition and fees (\$140.3 million) and books and supplies (\$13.6 million), less federal loans received (\$43.6 million). Opportunity costs for working and non-working students amount to \$178 million, excluding \$40.4 million in offsetting residual aid that is paid directly to students.³⁵ Finally, we have the present value of future student loan costs, amounting to \$43 million between principal and interest. Summing direct outlays, opportunity costs, and future student loan costs together yields a total of \$331.3 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	\$140,323
Less federal loans received	-\$43,565
Books and supplies	\$13,565
Total direct outlays	\$110,323
Opportunity costs in FY 2021-22	
Earnings forgone by non-working students	\$181,007
Earnings forgone by working students	\$34,637
Value of leisure time forgone by working students	\$2,748
Less residual aid	-\$40,407
Total opportunity costs	\$177,986
Future student loan costs (present value)	
Student loan principal	\$26,789
Student loan interest	\$16,238
Total present value student loan costs	\$43,026
Total present value student costs	\$331,336

Source: Based on data provided by App State 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.

³⁵ Residual aid is the remaining portion of scholarship or grant aid distributed directly to a student after the university applies tuition and fees.



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 \$132.9 million. This value represents the higher wages that accrue to students at the midpoint of their careers and is calculated based on the marginal wage increases of the credits that students complete while attending the university. Using the state of North Carolina earnings, the marginal wage increase per credit is \$238. For a full description of the methodology used to derive the \$132.9 million, see Appendix 6.

App State announces new master's degree in occupational therapy

Beginning in fall 2024, App State's new Master of Science in occupational therapy (OT) program will help address a critical lack of occupational therapists in Western North Carolina.

"This program will not only help meet critical rural health care needs," said App State Chancellor Sheri Everts, "but it will also help ensure that students who live in North Carolina and wish to be occupational therapists are able to receive a cost-effective master's degree that will allow them to live, work and practice in our state."

Occupational therapists offer specialized care to restore physical and cognitive function and enhance quality of life for children and adults with autism, dementia, developmental disabilities or those who may be recovering from surgery, a stroke or an injury. As part of an interprofessional health care team, occupational therapists work in a variety of settings, including hospitals, rehabilitation centers, skilled nursing facilities, home health, schools and private practices.

The new program, to be offered through the Beaver College of Health Sciences' Department of Rehabilitation Sciences, aims to prepare students to become certified occupational therapists in North Carolina. At the time of the program approval, only three public universities in the state offered a comprehensive, entry-level clinical degree in OT, producing approximately 70–80 graduates per year, combined.



The second step is to project the \$132.9 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.³⁶ 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

³⁶ Appendix 6 provides more information on the Mincer function and how it is used to predict future earnings growth.



upward bias, we incorporate a 10% reduction in our projected earnings, otherwise known as the ability bias. With the \$132.9 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 \$132.9 million in gross higher earnings occurs around Year 19, 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 \$132.9 million and the gross higher earnings in the years after the midpoint are greater than \$132.9 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

Alumna Ericka Heath returns to alma mater to lead Hickory campus police division

Lt. Ericka Heath, an App State alumna and a 20-year policing veteran, returned to her alma mater to lead App State's police division at the university's Hickory campus. The appointment makes Heath the university's highest ranking female police officer.

The campus has a dedicated police team managed by App State Police Captain of Operations Johnny Brown and supervised by Heath, who brings a diverse range of experiences and education to the position.

A North Carolina native who grew up with many family members in policing, Heath's first job in policing was with the Hickory Police Department, where she would climb the ranks over 20 years. During that time, she earned her master's degree in strategic leadership from Mountain State University, her Advanced Law Enforcement Certification and gained experience as a local school resource officer. She views each of these accomplishments as a direct means to improve police and public relations within her community.

Heath attended Western Piedmont Community College, where she earned her associate degree in liberal arts. While completing her studies, her talent and affinity for music caught the attention of Dr. Harold McKinney, professor emeritus in App State's Hayes School of Music.

McKinney approached Heath, encouraging her to apply to the Hayes School of Music, and Heath earned a bachelor's degree in music industry studies with a minor in business administration from App State in 1998.



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	\$41.9	11%	\$4.5	\$288.3	-\$283.8
1	\$45.5	19%	\$8.5	\$3.3	\$5.2
2	\$49.4	29%	\$14.1	\$3.3	\$10.8
3	\$53.4	46%	\$24.4	\$3.3	\$21.1
4	\$57.6	70%	\$40.1	\$3.3	\$36.8
5	\$62.0	97%	\$60.4	\$3.3	\$57.1
6	\$66.5	97%	\$64.8	\$3.3	\$61.5
7	\$71.2	97%	\$69.2	\$3.3	\$65.9
8	\$76.0	97%	\$73.8	\$3.3	\$70.5
9	\$80.9	97%	\$78.5	\$3.3	\$75.2
10	\$86.0	97%	\$83.3	\$3.3	\$80.0
11	\$91.1	97%	\$88.1	\$3.3	\$84.8
12	\$96.3	97%	\$93.0	\$3.3	\$89.7
13	\$101.5	96%	\$97.9	\$3.3	\$94.6
14	\$106.8	96%	\$102.8	\$3.3	\$99.5
15	\$112.1	96%	\$107.7	\$3.3	\$104.4
16	\$117.4	96%	\$112.5	\$3.3	\$109.2
17	\$122.6	96%	\$117.3	\$3.3	\$114.0
18	\$127.8	95%	\$122.0	\$3.3	\$118.7
19	\$132.9	95%	\$126.5	\$3.3	\$123.3
20	\$137.9	95%	\$131.0	\$3.3	\$127.7
21	\$142.7	95%	\$135.2	\$0.0	\$135.2
22	\$147.4	94%	\$139.3	\$0.0	\$139.3
23	\$151.9	94%	\$143.1	\$0.0	\$143.1
24	\$156.2	94%	\$146.6	\$0.0	\$146.6
25	\$160.2	94%	\$149.9	\$0.0	\$149.9
26	\$164.0	93%	\$152.9	\$0.0	\$152.9
27	\$167.5	93%	\$155.6	\$0.0	\$155.6
28	\$170.7	92%	\$157.9	\$0.0	\$157.9
29	\$173.6	92%	\$159.8	\$0.0	\$159.8
30	\$176.2	92%	\$161.4	\$0.0	\$161.4
31	\$178.4	91%	\$162.5	\$0.0	\$162.5
32	\$180.2	91%	\$163.2	\$0.0	\$163.2
33	\$181.7	90%	\$163.5	\$0.0	\$163.5
34	\$182.8	89%	\$163.3	\$0.0	\$163.3
35	\$183.5	89%	\$162.7	\$0.0	\$162.7
36	\$183.9	88%	\$161.7	\$0.0	\$161.7
37	\$183.8	87%	\$160.2	\$0.0	\$160.2
38	\$183.3	86%	\$158.2	\$0.0	\$158.2
39	\$182.5	85%	\$155.8	\$0.0	\$155.8
40	\$181.3	84%	\$153.0	\$0.0	\$153.0
41	\$179.7	83%	\$149.8	\$0.0	\$149.8
42	\$177.8	82%	\$146.3	\$0.0	\$146.3
43	\$175.5	81%	\$142.4	\$0.0	\$142.4
44	\$172.9	80%	\$138.2	\$0.0	\$138.2
45	\$170.0	79%	\$133.7	\$0.0	\$133.7
Present value			\$1,906.3	\$331.3	\$1,575.0

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

Source: Lightcast impact model.



Benefit-cost ratio

5.8



Internal rate of return

17.8%



Payback period (years)

7.4





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.

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

Return on investment for students

Having estimated the students’ costs and their future benefits stream, the next step is to discount the results to the present to reflect the time value of money. For the student perspective we assume a discount rate of 4.4% (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.³⁸ In Appendix 1, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to student costs to derive the investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1.0, a rate of return that exceeds the discount rate, and a reasonably short payback period.

Discount rate

The discount rate is a rate of interest that converts future costs and benefits to present values. For example, \$1,000 in higher earnings realized 30 years in the future is worth much less than \$1,000 in the present. All future values must therefore be expressed in present value terms in order to compare them with investments (i.e., costs) made today. The selection of an appropriate discount rate, however, can become an arbitrary and controversial undertaking. As suggested in economic theory, the discount rate should reflect the investor’s opportunity cost of capital, i.e., the rate of return one could reasonably expect to obtain from alternative investment schemes. In this study we assume a 4.4% discount rate from the student perspective and a 0.2% discount rate from the perspectives of taxpayers and society.



³⁷ 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.

³⁸ The student discount rate is derived from the most recent three-year average 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>.





In Table 3.2, the net higher earnings of students yield a cumulative discounted sum of approximately \$1.9 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 App State with a capital asset valued at \$1.9 billion.

The students' cost of attending the university is shown in Column 5 of Table 3.2, equal to a present value of \$331.3 million. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 5.8 (equal to \$1.9 billion in benefits divided by \$331.3 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.³⁹ Table 3.2 shows students of App State earning average returns of 17.8% on their investment of time and money. This is a favorable return compared, for example, to approximately 1% on a standard bank savings account, or 9.6% on stocks and bonds (30-year average return).

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 17.8% student rate of return is a real rate. With an inflation rate of 2.5% (the average rate reported over the past 20 years as per the U.S. Department of Commerce, Consumer Price Index), the corresponding nominal rate of return is 20.3%, higher than what is reported in Table 3.2.

App State students see an average rate of return of **17.8%** for their investment of time and money.

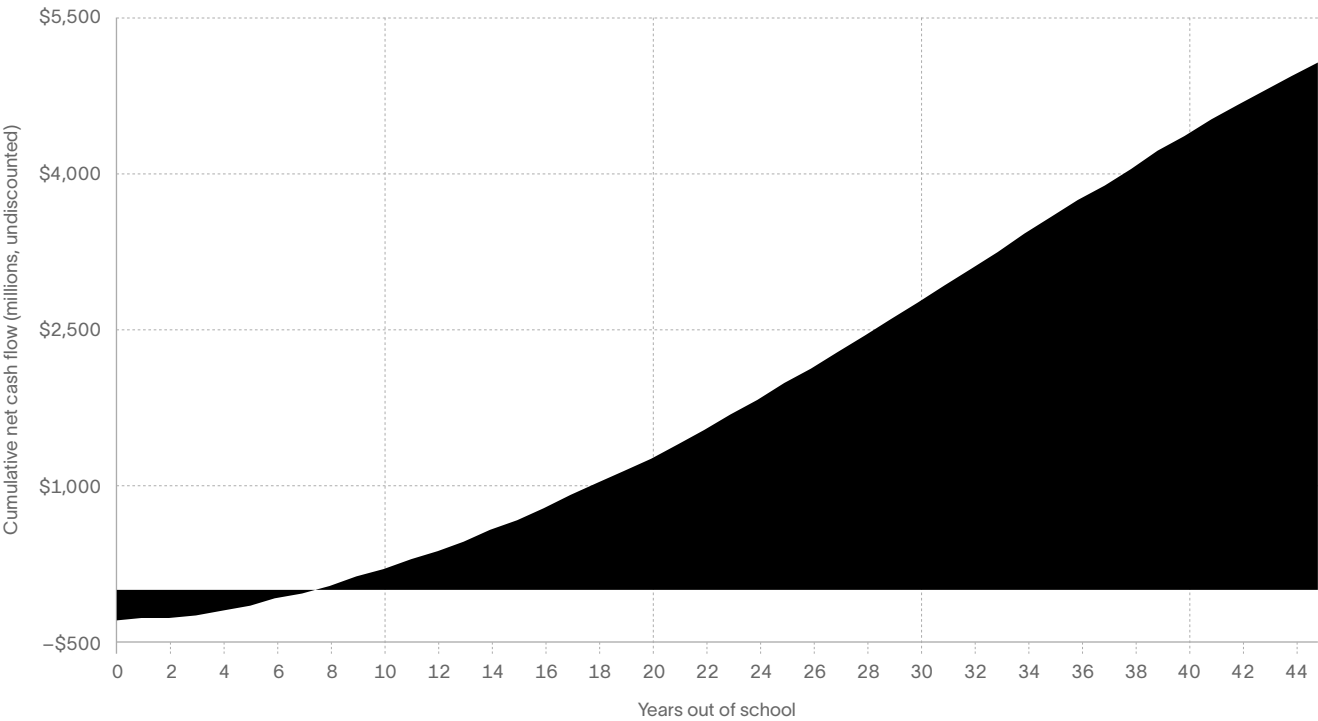
The payback period is defined as the length of time it takes to entirely recoup the initial investment.⁴⁰ Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at App State see, on average, a payback period of 7.4 years, meaning 7.4 years after their initial investment of forgone earnings and out-of-pocket costs, they will have received enough higher future earnings to fully recover those costs (Figure 3.1).

39 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.

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



Figure 3.1: Student payback period



Source: Lightcast impact model.





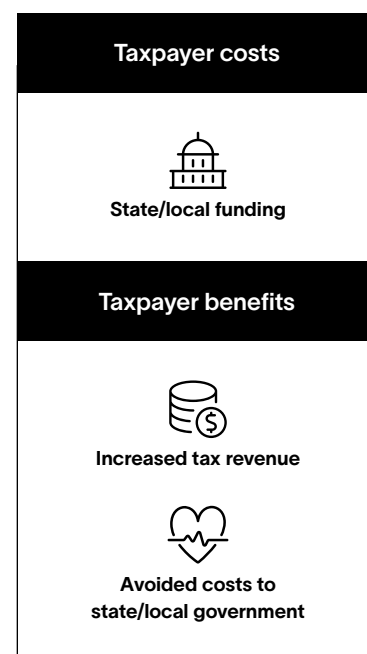
From the taxpayer perspective, the pivotal step is to determine the public benefits that specifically accrue to state and local government. For example, benefits resulting from earnings growth are limited to increased state and local tax payments. Similarly, savings related to improved health, reduced 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.

Growth in state tax revenues

As a result of their time at App State, 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 App State 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.⁴¹ 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 North Carolina 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, visitor, and student spending, measured at the state level. To each of these, we apply the prevailing tax rates so we capture only the tax revenues attributable to state and local government from this additional revenue.

⁴¹ For a full description of the Lightcast MR-SAM model, see Appendix 5.



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 leave 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 App State 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 and local 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 and local government funding for App State did not exist and App State had to derive the revenue elsewhere. To estimate this shutdown point, we apply a sub-model that simulates the students' demand curve for education by reducing state and local support to zero and progressively increasing student tuition and fees. As student tuition and fees increase, enrollment declines. For App State, the shutdown point adjustment is 3%, meaning that the added tax revenue results are discounted by 3% to account for the benefits that the university could still potentially generate even without taxpayer support. The shutdown point adjustment may vary from year to year and is dependent on the proportion of revenues from state and local government appropriations to the total amount of government funding. For more information on the theory and methodology behind the estimation of the shutdown point, see Appendix 9.

"App State Hickory comes at a crucial juncture, when our city is on the cusp of remarkable growth. This extension aligns perfectly with our aspirations to attract new businesses and opportunities to our community. By equipping our workforce with the skills and knowledge necessary to meet the challenges of tomorrow, App State is playing a pivotal role in shaping the future of our workforce."

— Hickory Mayor Hank Guess



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 \$528.4 million. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of 0.2%. This is the three-year average of 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.⁴²

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 App State. 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.

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

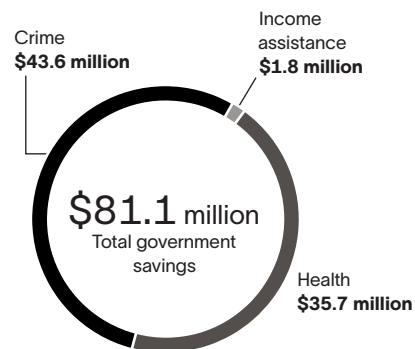
In addition to the creation of **higher tax revenues** to the state and local government, education is statistically associated with a variety of lifestyle changes that generate **social savings**.

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

Added tax revenue	\$528,436
Government savings	
Health-related savings	\$35,715
Crime-related savings	\$43,597
Income assistance savings	\$1,784
Total government savings	\$81,096
Total taxpayer benefits	\$609,532

Source: Lightcast impact model.

Figure 3.2: Present value of government savings



Source: Lightcast impact model.

42 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>.

"The university is the county's largest economic engine. It makes sense to find ways to partner together, allowing the university to grow in a sustainable manner and allowing the county to enrich the lives of our citizens."

— Former Watauga County Commissioner Billy Kennedy



health, crime, and income assistance at the national and state level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved credits at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the 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.⁴³ Finally, we apply the same adjustments for attrition, alternative education, and the shutdown point to derive the net savings to the government. Total government savings appear in Figure 3.2 and sum to \$81.1 million.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to \$528.4 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 \$609.5 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 App State remains in the workforce.

Return on investment for taxpayers

Taxpayer costs are reported in Table 3.4 and come to \$189.5 million, equal to the contribution of state and local government to App State. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 3.2 ($= \$609.5 \text{ million} \div \189.5 million), indicating a profitable investment.

At 7.1%, the rate of return to state and local taxpayers is favorable. Given that the stakeholder in this case is the public sector, we use the mentioned earlier discount rate of 0.2%, the three-year average of the real Treasury interest rate reported by the Office of Management and Budget for 30-year investments. This is the return governments are assumed to be able to earn on generally safe investments of unused funds, or alternatively, the interest rate for which governments, as relatively safe borrowers, can obtain funds. A rate of return of 0.2% would mean that the university just pays its own

⁴³ 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.



way. In principle, governments could borrow monies used to support App State and repay the loans out of the resulting added taxes and reduced government expenditures. A rate of return of 7.1%, on the other hand, means that App State not only pays its own way, but also generates a surplus that the state and local government can use to fund other programs.

Additionally, a benefit-cost ratio greater than 1.0 also indicates a good public investment since the taxes from App State student higher earnings and reduced government expenditures not only recover taxpayer costs but grow North Carolina's tax base.



A benefit-cost ratio of **3.2** means App State is a good public investment since the taxes from App State student higher earnings and reduced government expenditures not only recover taxpayer costs but grow North Carolina's tax base.



Table 3.4: Projected benefits and costs, taxpayer perspective

1	2	3	4
Year	Benefits to taxpayers (millions)	State & local government costs (millions)	Net cash flow (millions)
0	\$31.2	\$189.5	-\$158.4
1	\$2.1	\$0.0	\$2.1
2	\$3.3	\$0.0	\$3.3
3	\$5.5	\$0.0	\$5.5
4	\$8.6	\$0.0	\$8.6
5	\$12.4	\$0.0	\$12.4
6	\$12.6	\$0.0	\$12.6
7	\$12.7	\$0.0	\$12.7
8	\$12.9	\$0.0	\$12.9
9	\$13.2	\$0.0	\$13.2
10	\$13.4	\$0.0	\$13.4
11	\$13.6	\$0.0	\$13.6
12	\$13.9	\$0.0	\$13.9
13	\$14.1	\$0.0	\$14.1
14	\$14.3	\$0.0	\$14.3
15	\$14.5	\$0.0	\$14.5
16	\$14.7	\$0.0	\$14.7
17	\$14.9	\$0.0	\$14.9
18	\$15.1	\$0.0	\$15.1
19	\$15.3	\$0.0	\$15.3
20	\$15.4	\$0.0	\$15.4
21	\$15.6	\$0.0	\$15.6
22	\$15.7	\$0.0	\$15.7
23	\$15.8	\$0.0	\$15.8
24	\$15.9	\$0.0	\$15.9
25	\$15.9	\$0.0	\$15.9
26	\$15.9	\$0.0	\$15.9
27	\$15.9	\$0.0	\$15.9
28	\$15.9	\$0.0	\$15.9
29	\$15.8	\$0.0	\$15.8
30	\$15.8	\$0.0	\$15.8
31	\$15.6	\$0.0	\$15.6
32	\$15.5	\$0.0	\$15.5
33	\$15.3	\$0.0	\$15.3
34	\$15.1	\$0.0	\$15.1
35	\$14.9	\$0.0	\$14.9
36	\$14.6	\$0.0	\$14.6
37	\$14.3	\$0.0	\$14.3
38	\$14.0	\$0.0	\$14.0
39	\$13.6	\$0.0	\$13.6
40	\$13.2	\$0.0	\$13.2
41	\$12.8	\$0.0	\$12.8
42	\$12.4	\$0.0	\$12.4
43	\$12.0	\$0.0	\$12.0
44	\$11.6	\$0.0	\$11.6
45	\$11.1	\$0.0	\$11.1
Present value	\$609.5	\$189.5	\$420.0

Source: Lightcast impact model.



Benefit-cost ratio

3.2



Internal rate of return

7.1%



Payback period (years)

14.4



Real-world research engages students, advances scientific discoveries

As the premier public undergraduate institution in the Southeast, App State prepares students to become globally minded, responsible members of society who engage with and actively contribute to their communities. Students have numerous opportunities to engage in research and creative endeavors alongside faculty mentors—applying knowledge from the classroom to real-world experiences and learning how to problem-solve, effectively communicate and analyze complex issues. Research being conducted at App State includes:

- Dr. Rahman Tashakkori, the Lowe's Distinguished Professor of Computer Science and chair of App State's Department of Computer Science, is leading a research team studying the honeybee—provider of one-third of American food—to help address the population's decline. He and his team members received a grant from the University of North Carolina System's Research Opportunities Initiative that has allowed them to create a new beekeeping information system called AppMAIS (App State Multipurpose Apiary Informatics System). This system helps investigate the health, development and genomic diversity of honeybee hives in North Carolina. The data from their research provides information to scientists, researchers, educators, beekeepers and the public.
- The National Institutes of Health provided a grant to support enzyme research that could aid in the development of new and safer therapies, including those for cancer. Dr. Michael Reddish is an assistant professor in App State's Department of Chemistry and Fermentation Sciences who leads the research study, titled "Structure-Function Studies of the Human Cytochrome P450 27 Family." The study focuses on human cytochrome P450 enzymes—proteins that are involved in the body's metabolism of steroid hormones, pharmaceuticals, carcinogens and fat-soluble vitamins. The study of P450 enzymes has led to several important advances in medicine, including new therapies and the safer use of existing therapies. The P450 27 enzymes catalyze the oxidations of several important hormones, including vitamin D derivatives, cholesterol derivatives and retinoids. The products of these reactions can have either positive or negative effects on human health, depending on their concentrations in the body, and therefore, it could be valuable to either increase or decrease these enzymes' activities for clinical therapies.
- App State students investigated the impacts of climate change in the Andes during a summer 2022 study abroad program in Peru—and accompanied a National Geographic Society team during acclimatization and preparation for installation of the highest weather station in the tropical Andes, near the peak of Nevado Ausangate. Dr. Baker Perry, National Geographic Explorer and professor in App State's Department of Geography and Planning, led the study abroad program, titled "Peru: Climate Change in the Andes." Then, he led the National Geographic expedition team to install the weather station, sample microplastics and water isotopes in the summit snowpack and make other atmospheric and glaciological observations. The weather station installation was a significant milestone in the National Geographic and Rolex Perpetual Planet Amazon Expedition—an exploration of the Amazon River Basin spanning the Andes to the Atlantic. The new weather station, installed just below the summit at 20,830 feet (6,349 meters), collects meteorological data such as temperature, precipitation, humidity, radiation and snow depth, all of which will aid local governments and the international scientific community in observing the impacts of climate change on critical water resources that affect local communities.



Social perspective



North Carolina benefits from the education that App State 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 forgo services that they otherwise would have enjoyed if App State did not exist. Society's investment in App State stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by App State to these investor groups against the total social costs of generating those benefits. The total social costs include all App State expenditures, all student expenditures (including interest on student loans) less tuition and fees, and all student opportunity costs, totaling a present value of \$741.1 million.

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

Growth in state economic base

In the process of absorbing the newly acquired skills of students who attend App State, not only does the productivity of the North Carolina 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 App State on the state's economic base follows a similar process used when calculating increased tax revenues in the taxpayer perspective. However, instead of looking at just the tax revenue portion, we include all of the added earnings

Social costs



App State expenditures



Student out-of-pocket expenses



Student opportunity costs

Social benefits



Increased economic base



Avoided social costs





Beekeeper analogy

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

But from society’s standpoint, there is more. Flowers provide the nectar that bees need for honey production, and smart beekeepers locate near

flowering sources such as orchards. Nearby orchard owners, in turn, benefit as the bees spread the pollen necessary for orchard growth and fruit production. This is an uncompensated external benefit of beekeeping, and economists have long recognized that society might actually do well to subsidize activities that produce positive externalities, such as beekeeping.

Educational institutions are like beekeepers. While their principal aim is to

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



and 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, visitor, and student spending impacts, as well as the volunteerism impact, discussed in Chapter 2 that were created in FY 2021-22, measured at the state level (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 and local 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 \$6.4 billion. Recall from the discussion of the student and taxpayer return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 0.2%.

Social savings

Similar to the government savings discussed above, society as a whole sees savings due to external or incidental benefits of education. These represent the avoided costs that otherwise would have been drawn from private and public resources absent the education provided by App State. 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



App State's Police Officer Development Program jump-starts careers in policing

Mountaineer alumni say App State Police's Appalachian Police Officer Development Program provided a jump-start to their policing careers, and grads of the program are in high demand across North Carolina. As of 2023, the program's Appalachian Police Academy had trained 120 sworn police officers over six years.

The Appalachian Police Officer Development Program equips students with the knowledge, skills and training to become police officers—while simultaneously completing their undergraduate or graduate degrees. The two-year program is the only one of its kind in the state and the second of its kind in the nation.

Unlike traditional basic law enforcement training, the Appalachian Police Officer Development Program provides prospective police officers with an enhanced curriculum, exceeding the state's minimum training standards. Program participants undergo approximately two years of on-the-job training and education.

Any full-time App State student may apply for the program, regardless of their major or program of study. Once accepted, students become cadets in their first year of the program,

assisting with security assignments on campus. In their second year, cadets may attend the Appalachian Police Academy as new recruits and earn the Basic Law Enforcement Training certification needed to become sworn police officers in North Carolina, after which they may continue to work part time on campus in their

new roles—as sworn officers—as they earn their degrees.

At every stage in the program, participants are paid for all part-time work and training, and there is no cost outside of their regular tuition to attend App State.



Appalachian Energy Summit aids \$1.75 billion in statewide avoided energy costs; NC on track to reach \$2 billion goal of avoided energy costs by 2025

As of 2022, the University of North Carolina System and its partners had collectively avoided \$1.75 billion in energy costs since the 2002–03 academic year—an effort spearheaded and guided by the annual Appalachian Energy Summit, which App State has hosted annually since 2012.

The event gathers faculty, staff and students from colleges and universities, as well as energy managers and visionaries and government and industry leaders, to share ideas and put into action ecological, financial and social processes designed to improve energy efficiency across the UNC System, the state

and beyond. Driven by the summit, the UNC System, North Carolina community colleges and other state agencies are on track to save \$2 billion in avoided energy costs by 2025.

"For more than a decade, this annual summit has served as a beacon for government officials, industry leaders, educators and students from across the state and the University of North Carolina System," said App State Chancellor Sheri Everts. "These leaders and innovators convene each summer to share accomplishments, current research and best practices. They return to their home communities and campuses inspired and motivated to effect

change and continue their collaborations year-round. The influence of this summit extends nationwide, and it has also had real and powerful impacts on the North Carolina economy."

App State has achieved nearly \$56 million in avoided energy costs and over \$15 million in avoided water use costs since 2002–03, for a combined total of more than \$71 million in utility savings.

The university has also experienced a 44% reduction in energy use per square foot since 2002–03—exceeding the state-mandated energy use reduction goal of at least 40%.

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 \$6.4 billion, from students' higher earnings and their multiplier effects, increases in non-labor income, and spending impacts. Social savings appear next, beginning with a breakdown of savings related to health. These include savings due to a reduced demand for medical treatment and social services, improved worker productivity and reduced absenteeism, and a reduced number of vehicle crashes and fires induced by alcohol or smoking-related incidents. These savings amount to \$211.2 million. Crime savings amount to \$50 million, including savings associated with a reduced number of crime victims, added worker productivity, and reduced expenditures for police and law enforcement, courts and administration of justice, and corrective services. Finally, the present value of the savings related to income assistance amounts to \$1.9 million, stemming from a reduced number of persons in need of welfare or unemployment benefits. All told, social savings amounted to \$263.1 million in benefits to communities and citizens in North Carolina.

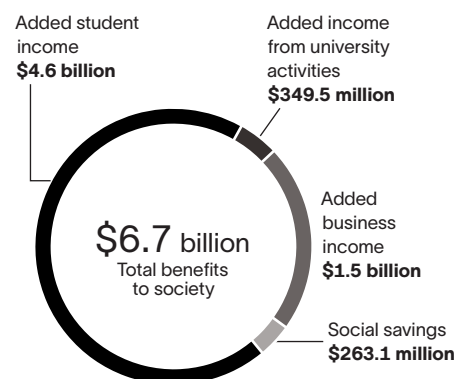
Table 3.5: Present value of the future increased economic base and social savings in the state (thousands)

Increased economic base	\$6,412,335
Social savings	
Health	
Smoking	\$72,662
Alcohol dependence	\$26,907
Obesity	\$59,587
Depression	\$44,545
Drug abuse	\$7,532
Total health savings	\$211,234
Crime	
Criminal justice system savings	\$44,907
Crime victim savings	\$1,086
Added productivity	\$4,034
Total crime savings	\$50,027
Income assistance	
Welfare savings	\$1,546
Unemployment savings	\$311
Total income assistance savings	\$1,857
Total social savings	\$263,118
Total, increased economic base + social savings	\$6,675,453

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

Source: Lightcast impact model.

Figure 3.3: Present value of benefits to society



Source: Lightcast impact model.

The sum of the social savings and the increased state economic base is \$6.7 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 App State remains in the workforce.

Return on investment for society

Table 3.6 presents the stream of benefits accruing to the North Carolina 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 9.0. This means that for every dollar invested in an education from App State, whether it is the money spent on operations of the university or money spent by students on tuition and fees, an average of \$9.00 in benefits will accrue to society in North Carolina.⁴⁴



10 years of running on 'shine—App State's solar vehicle team races to podium finishes and advances App State's sustainability mission

What began as a class project to build a solar-powered golf cart in 2013 has developed into an award-winning solar vehicle racing team with multiple podium finishes and a national championship. Team Sunergy, which represents the university's commitment to sustainability and ingenuity, is composed of dedicated, multidisciplinary students from across App State's campus who compete in the annual Formula Sun Grand Prix and the American Solar Cup races (held every other year)—all while balancing standard course requirements and traditional collegiate commitments.

The team began with a single-occupant race car, Apperion, for its first competitions but quickly designed and built a two-passenger car, ROSE—which stands for Racing on Solar Energy. Since they started, the team has found success in the Formula Sun Grand Prix, a road-track course raced in the Midwest, during its yearly competition. Every two years, the team races in the American Solar Cup race, a 2,000-mile multistate race—winning the competition in 2021. These races pit the team against traditional engineering schools—such as MIT, the University of Minnesota, Georgia Tech and North Carolina State University—as well as competitors from Canada.

"Team Sunergy is the embodiment of true Mountaineer spirit. I am extraordinarily proud of their ingenuity, perseverance and teamwork," said App State Chancellor Sheri Everts.

⁴⁴ 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	\$361.0	\$676.8	-\$315.8
1	\$19.8	\$3.3	\$16.5
2	\$31.3	\$3.3	\$28.0
3	\$52.9	\$3.3	\$49.6
4	\$84.7	\$3.3	\$81.4
5	\$123.2	\$3.3	\$119.9
6	\$126.2	\$3.3	\$122.9
7	\$129.4	\$3.3	\$126.1
8	\$132.7	\$3.3	\$129.4
9	\$136.1	\$3.3	\$132.8
10	\$139.6	\$3.3	\$136.4
11	\$143.2	\$3.3	\$139.9
12	\$146.8	\$3.3	\$143.5
13	\$150.2	\$3.3	\$146.9
14	\$153.5	\$3.3	\$150.2
15	\$156.6	\$3.3	\$153.3
16	\$159.6	\$3.3	\$156.3
17	\$162.5	\$3.3	\$159.2
18	\$165.2	\$3.3	\$161.9
19	\$167.7	\$3.3	\$164.4
20	\$169.9	\$3.3	\$166.6
21	\$172.0	\$0.0	\$172.0
22	\$173.7	\$0.0	\$173.7
23	\$175.2	\$0.0	\$175.2
24	\$176.5	\$0.0	\$176.5
25	\$177.4	\$0.0	\$177.4
26	\$178.0	\$0.0	\$178.0
27	\$178.2	\$0.0	\$178.2
28	\$178.1	\$0.0	\$178.1
29	\$177.7	\$0.0	\$177.7
30	\$176.9	\$0.0	\$176.9
31	\$175.7	\$0.0	\$175.7
32	\$174.1	\$0.0	\$174.1
33	\$172.2	\$0.0	\$172.2
34	\$169.9	\$0.0	\$169.9
35	\$167.2	\$0.0	\$167.2
36	\$164.2	\$0.0	\$164.2
37	\$160.9	\$0.0	\$160.9
38	\$157.2	\$0.0	\$157.2
39	\$153.2	\$0.0	\$153.2
40	\$149.0	\$0.0	\$149.0
41	\$144.4	\$0.0	\$144.4
42	\$139.7	\$0.0	\$139.7
43	\$134.7	\$0.0	\$134.7
44	\$129.6	\$0.0	\$129.6
45	\$124.3	\$0.0	\$124.3
Present value	\$6,675.5	\$741.1	\$5,934.4

Source: Lightcast impact model.



Benefit-cost ratio

9.0



Payback period (years)

5.2





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 App State. 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 App State. 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 (a 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 App State.

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

	Including social savings	Excluding social savings
Taxpayer perspective		
Net present value (millions)	\$420.0	\$338.9
Benefit-cost ratio	3.2	2.8
Internal rate of return	7.1%	5.8%
Payback period (no. of years)	14.4	18.1
Social perspective		
Net present value (millions)	\$5,934.4	\$5,671.2
Benefit-cost ratio	9.0	8.7

Source: Lightcast impact model.

"App State allowing a local food truck onto campus was really, really important for us in being able to make it through the pandemic. Also, partnering with Athletics to have our food truck in the stadium for football games, and for a lot of different events as well—it's just been really great. It makes us feel like they value us as a member of the community, and it's cool to see such a large organization supporting locally owned small businesses."

— Seth Sullivan, co-owner of *The Cardinal*

App State degree programs recognized by U.S. Department of Energy

Two App State degree programs in the Department of Sustainable Technology and the Built Environment have earned the Zero Energy Design Designation from the U.S. Department of Energy—demonstrating the value of App State's programs that train students to excel and lead in a growing economic sector in North Carolina and beyond.

The programs earning the designation are the Master of Science in technology with a sustainable building design and construction concentration and the Bachelor of Science in building sciences with a sustainable building

systems concentration. These programs earned the Zero Energy Design Designation seal of recognition by teaching best practices of zero energy design and requiring students to apply those concepts in zero energy design projects—demonstrating that they are preparing tomorrow's architectural and engineering leaders to design and build the most sustainable buildings possible.

The Zero Energy Design Designation program supports the federal goal of a net-zero emissions economy by 2050 by training building professionals to design and construct high-efficiency,

low-carbon buildings powered by renewable energy technologies.

To be recognized by the U.S. Department of Energy, the Department of Sustainable Technology and the Built Environment faculty and staff demonstrated a commitment to preparing students for a zero carbon future by offering a building science education curriculum within their programs of study that showcases best practices in zero energy design and by requiring a zero energy design practicum.



Conclusion



WHILE APP STATE'S VALUE to the Five-County Region 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 App State's value to the regional 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 App State generates a total economic impact of **\$572.8 million** in total added income for the regional economy. This represents the sum of several different impacts, including the university's:

- Operations spending impact (**\$308.2 million**);
- Construction spending impact (**\$31.6 million**);
- Visitor spending impact (**\$9.5 million**);
- Student spending impact (**\$79.5 million**);
- Volunteerism impact (**\$3.4 million**); and
- Alumni impact (**\$140.7 million**).

One out of every 14 jobs in the Five-County Region is supported by the activities of App State and its students.

University-county property agreement creates opportunity for economic growth through new recreation center

In April 2021, Watauga County cut the ribbon on a new, 100,000-square-foot recreation center located along State Farm Road in Boone, at the site of Appalachian State University's former Business Affairs Annex property. The center is an economic driver for the community, as it hosts tournaments, swim meets and other community events; it also served as a vaccination clinics site for community members during the COVID-19 pandemic.

The university and county reached an agreement in April 2017 for the university to purchase the old Watauga High School property located at 400 High School Drive in Boone. In exchange for the property, the university turned over ownership of its Business Affairs Annex property to the county and is paying \$15.5 million over 20 years.

App State Chancellor Sheri Everts said, "The purchase of the old Watauga High School property and the transfer of the property on State Farm Road will meet a number of needs for the citizens of Watauga County. The properties will once again become vibrant spaces that enhance the county and the university, benefitting our county, region and state."

According to a 2016 study conducted by faculty and students in App State's Walker College of Business, the center will have positive impacts on the economy and health of North Carolina's High Country and its citizens. The researchers concluded, with 90% certainty, that the facility could generate \$10.125 million in benefits above cost over a 30-year period. They also estimated that the facility could save Watauga County residents millions in health care spending—from \$1.3 million to \$10.9 million, calculated based on members' age ranges (65 and older and 65 and younger).



The total impact of \$572.8 million is equivalent to approximately **5.9%** of the total GRP of the Five-County Region and is equivalent to supporting **8,902 jobs**. For perspective, this means that **one out of every 14 jobs** in the Five-County Region is supported by the activities of App State and its students.

Since App State'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, App State offers a benefit of **\$5.80**, **\$3.20**, and **\$9.00**, respectively. These results indicate that App State 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 North Carolina.

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 App State.

App State awarded National Science Foundation funding to recruit, support underrepresented students in STEM fields

App State has received grant funding from the National Science Foundation to support the recruitment and success of underrepresented students in science, technology, engineering and mathematics (STEM) fields.

Through the Louis Stokes Alliance for Minority Participation program at App State, close to 100 participating scholars will each receive a \$2,000 scholarship per year of the program, as well as \$3,000 to conduct summer research under the direction of an App State faculty mentor.

The program aims to help increase the number of underrepresented students studying STEM disciplines at App State—preparing these



students for employment in STEM occupations, which are projected to increase by 10.8% over

the next decade, according to the U.S. Bureau of Labor Statistics.

Grant to facilitate collaboration between Cherokee and Māori communities

A grant—titled “Similarities of Struggle: A Collaboration between the Cherokee in North Carolina and Māori in New Zealand”—awarded by the U.S. Department of State's U.S. Embassy and Consulates in New Zealand allows App State to support visits by Cherokee high school students and community leaders to New Zealand and Māori high school students

and community leaders to North Carolina. Students and educators from the two communities exchange best practices for preserving each nation's language and culture. The project builds upon a decadeslong educational partnership between App State and the Ara Institute of Canterbury Ltd.—New Zealand Institute of Skills and Technology.

The partnership between App State and Cherokee Central Schools, founded in 2013, strives to prepare, support and sustain the future leaders of the Eastern Band of Cherokee Indians through coursework, service and cultural immersion.



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

Alternative education variable

The alternative education variable (15%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the publicly-funded university in the region. 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 7.1% to 6.9%. Likewise, a decrease of 10% (from 15% to 14%) in the assumption increases the rate of return from 7.1% to 7.2%.

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

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Alternative education variable	8%	11%	14%	15%	17%	19%	23%
Taxpayer perspective							
Net present value (millions)	\$476	\$448	\$431	\$420	\$409	\$392	\$364
Rate of return	7.8%	7.4%	7.2%	7.1%	6.9%	6.7%	6.3%
Benefit-cost ratio	3.5	3.4	3.3	3.2	3.2	3.1	2.9
Social perspective							
Net present value (millions)	\$6,523	\$6,229	\$6,052	\$5,934	\$5,817	\$5,640	\$5,345
Benefit-cost ratio	9.8	9.4	9.2	9.0	8.8	8.6	8.2

Based on this sensitivity analysis, the conclusion can be drawn that App State 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 (a 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 2.10. In the model we assume a labor import effect variable of 50%, which means that 50% of the region's labor demands would have been satisfied without the presence of App State. In other words, businesses that hired App State students could have substituted some of these workers with equally-qualified people from outside the region had there been no App State students to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the university.

Table A1.2 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 App State, for example, range from a high of \$211 million at a -50% variation to a low of \$70.3 million at a +50% variation from the base case assumption. This means that if the labor import effect variable increases, the impact that we claim as attributable to alumni decreases. Even under the most conservative assumptions, the alumni impact on the Five-County Region economy still remains sizeable.

Table A1.2: Sensitivity analysis of labor import effect variable

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Labor import effect variable	25%	38%	45%	50%	55%	63%	75%
Alumni impact (millions)	\$211	\$176	\$155	\$141	\$127	\$106	\$70

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 App State 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 45% of students are employed.⁴⁵ This variable is tested in the sensitivity analysis by changing it first to 100% and then to 0%.

⁴⁵ Based on data provided by App State.



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 77%, on average, of the earnings that they statistically would have received if not attending App State. This suggests that many students hold part-time jobs that accommodate their App State attendance, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 77% variable is an estimation based on the average hourly wages of the most common jobs held by students while attending college relative to the average hourly wages of all occupations in the Five-County Region. The model captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 77% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table A1.3, with *A* defined as the percent of students employed and *B* defined as the percent that students earn relative to their full earning potential. Base case results appear in the shaded row; here the assumptions remain unchanged, with *A* equal to 45% and *B* equal to 77%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases *A* to 100% while holding *B* constant, Scenario 2 increases *B* to 100% while holding *A* constant, Scenario 3 increases both *A* and *B* to 100%, and Scenario 4 decreases both *A* and *B* to 0%.

Table A1.3: Sensitivity analysis of student employment variables

Variations in assumptions	Net present value (millions)	Internal rate of return	Benefit-cost ratio
Base case: <i>A</i> = 45%, <i>B</i> = 77%	\$1,575.0	17.8%	5.8
Scenario 1: <i>A</i> = 100%, <i>B</i> = 77%	\$1,710.3	26.2%	9.7
Scenario 2: <i>A</i> = 45%, <i>B</i> = 100%	\$1,609.6	19.3%	6.4
Scenario 3: <i>A</i> = 100%, <i>B</i> = 100%	\$1,787.2	39.9%	16.0
Scenario 4: <i>A</i> = 0%, <i>B</i> = 0%	\$1,464.3	14.6%	4.3

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

- **Scenario 1:** Increasing the percentage of students employed (*A*) from 45% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to \$1.7 billion, 26.2%, and 9.7, respectively, relative to base case results. Improved results are attributable to a lower opportunity cost of time; all students are employed in this case.
- **Scenario 2:** Increasing earnings relative to statistical averages (*B*) from 77% to 100%, the net present value, internal rate of return, and benefit-cost ratio results improve to \$1.6 billion, 19.3%, and 6.4, respectively, relative to base case results; this strong improvement, again, is attributable to a lower opportunity cost of time.
- **Scenario 3:** Increasing both assumptions *A* and *B* to 100% simultaneously, the net present value, internal rate of return, and benefit-cost ratio improve yet further to \$1.8 billion, 39.9%, and 16.0, respectively, relative to base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to statistical averages) while attending classes.

- **Scenario 4:** Finally, decreasing both *A* and *B* to 0% reduces the net present value, internal rate of return, and benefit-cost ratio to \$1.5 billion, 14.6%, and 4.3, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.⁴⁶

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 App State 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 forgo the use of money in the present to receive compensation for it in the future. The discount rate also addresses the investors' risk preferences by serving as a proxy for the minimum rate of return that the proposed risky asset must be expected to yield before the investors will be persuaded to invest in it. Typically, this minimum rate of return is determined by the known returns of less risky assets where the investors might alternatively consider placing their money.

Table A1.4: Sensitivity analysis of discount rate

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Student perspective							
Discount rate	2.2%	3.3%	4.0%	4.4%	4.9%	5.5%	6.6%
Net present value (millions)	\$2,764	\$2,076	\$1,757	\$1,575	\$1,414	\$1,205	\$927
Benefit-cost ratio	9.3	7.3	6.3	5.8	5.3	4.6	3.8
Taxpayer perspective							
Discount rate	0.10%	0.15%	0.18%	0.20%	0.22%	0.25%	0.30%
Net present value (millions)	\$434	\$427	\$423	\$420	\$417	\$413	\$406
Benefit-cost ratio	3.29	3.25	3.23	3.22	3.20	3.18	3.14
Social perspective							
Discount rate	0.10%	0.15%	0.18%	0.20%	0.22%	0.25%	0.30%
Net present value (millions)	\$6,089	\$6,011	\$5,965	\$5,934	\$5,904	\$5,859	\$5,784
Benefit-cost ratio	9.2	9.1	9.0	9.0	9.0	8.9	8.8

⁴⁶ 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.

In this study, we assume a 4.4% discount rate for students and a 0.2% discount rate for society and taxpayers.⁴⁷ 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 payback period is based on the undiscounted cash flow, it is unaffected by changes in the discount rate.

As demonstrated in Table A1.4, an increase in the discount rate leads to a corresponding decrease in the expected returns, and vice versa. For example, increasing the student discount rate by 50% (from 4.4% to 6.6%) reduces the students' benefit-cost ratio from 5.8 to 3.8. Conversely, reducing the discount rate for students by 50% (from 4.4% to 2.2%) increases the benefit-cost ratio from 5.8 to 9.3. The sensitivity analysis results for taxpayers and society show the same inverse relationship between the discount rate and the benefit-cost ratio.

Retained student variable

The retained student variable only affects the student spending impact calculation in Table 2.7. For this analysis, we assume a retained student variable of 10%, which means that 10% of App State's students who originated from the Five-County Region would have left the region for other opportunities, whether that be education or employment, if App State did not exist. The money these retained students spent in the region for accommodation and other personal and household expenses is attributable to App State.

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 App State range from a high of \$80.6 million when the retained student variable is 15% to a low of \$78.4 million when the retained student variable is 5%. This means as the retained student variable decreases, the student spending attributable to App State decreases. Even under the most conservative assumptions, the student spending impact on the Five-County Region economy remains substantial.

Table A1.5: Sensitivity analysis of retained student variable

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Retained student variable	5%	8%	9%	10%	11%	13%	15%
Student spending impact (thousands)	\$78,437	\$78,976	\$79,300	\$79,515	\$79,731	\$80,054	\$80,593

⁴⁷ These values are based on the three-year average of 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."



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.

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 regional product: Measure of the final value of all goods and services produced in a region after netting out the cost of goods used in production. Alternatively, gross regional product (GRP) 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 regional 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 region, 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 region. 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 establishments 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 forgone from alternative B once a decision is made to allocate resources to alternative A. Or, if individuals choose to attend college, they forgo earnings that they would have received had they chosen instead to work full-time. Forgone 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:

$$\text{Payback period} = \text{cost of investment} / \text{net return per period}$$

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

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

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 3,000 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 GRP" as your university (Table 1.3). This percentage represents its portion of the total gross regional product in the region (similar to the nationally recognized gross domestic product but at a regional level). This allows the university to say that their single brick and mortar campus does just as much for the Five-County Region 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 regional product (GRP). Sales include all the intermediary costs associated with producing goods and services. Income is a net measure that excludes these intermediary costs:

$$\text{Income} = \text{Sales} - \text{Intermediary Costs}$$

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 GRP reflects a region 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:

$$\text{Income} = \$5.00 - \$3.00 = \$2.00$$

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.

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

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

Data sources for the model

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

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

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

BEA Gross Domestic Product 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 and the Mincer function

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

Value per credit

Typically, the educational achievements of students are marked by the credentials they earn. However, not all students who attended App State in FY 2021-22 obtained a degree or certificate. Some returned the following year to complete their education goals, while others took a few courses and entered the workforce without graduating. As such, the only way to measure the value of the students' achievement is through their credits. This approach allows us to see the benefits to all students who attended the university, not just those who earned a credential.

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

The second step is to assign a unique value to the credits in the education ladder based on the wage differentials presented in Table 1.4.⁴⁸ For example, the difference in regional earnings between a high school diploma and a bachelor's degree is \$23,000. We spread this \$23,000 wage differential across the 120 credits that occur between a high school diploma and a bachelor's degree, applying a ceremonial "boost" to the last credit in the stage to mark the achievement of the degree.⁴⁹ We repeat this process for each education level in the ladder.

48 The value per credit is calculated differently between the economic impact analysis and the investment analysis. The economic impact analysis uses the region as its background and, therefore, uses regional earnings to calculate value per credit, while the investment analysis uses the state as its backdrop and, therefore, uses state earnings. The methodology outlined in this appendix will use regional earnings; however, the same methodology is followed for the investment analysis when state earnings are used.

49 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).



Next, we map the credit production of the FY 2021-22 student population to the education ladder. Table 1.2 provides information on the credit production of students attending App State, broken out by educational achievement. In total, students completed 559,249 credits during the analysis year. We map each of these credits to the education ladder depending on the students' education level and the average number of credits they completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate degree and the bachelor's degree, and the average number of credits they completed informs the shape of the distribution curve used to spread out their total credit production within that stage of the progression.

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

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

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

Table A6.1 displays the result for the students' aggregate annual increase in income (ΔE), a total of \$98.4 million. By dividing this value by the students' total production of 559,249 credits during the analysis year, we derive an overall value of \$176 per credit.

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

Aggregate annual increase in income	\$98,431,818
Total credits in FY 2021-22	559,249
Value per credit	\$176

Source: Lightcast impact model.

Mincer function

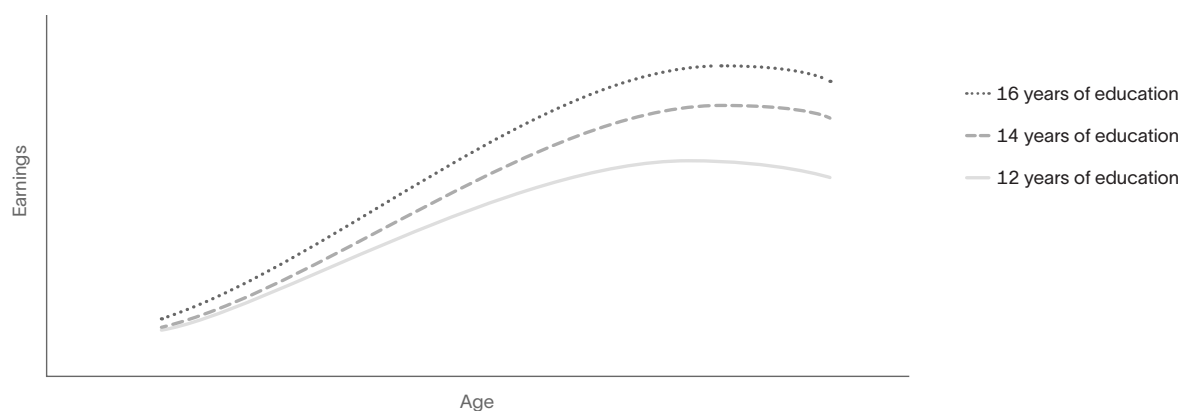
The \$176 value per credit in Table A6.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.⁵⁰ 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

⁵⁰ See Mincer (1958 and 1974).

what is known as an “ability bias.” Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer’s function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use state-specific and education level-specific Mincer coefficients.

Figure A6.1 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 \$176 value per credit to the students’ age and work experience. To the students just starting their career during the analysis year, we apply a lower value per credit; to the students in the latter half or approaching the end of their careers we apply a higher value per credit. The original \$176 value per credit applies only to the credit production of students precisely at the midpoint of their careers during the analysis year.

In Chapter 3 we again apply the Mincer function, this time to project the benefits stream of the FY 2021-22 student population into the future. Here too the value per credit is lower for students at the start of their career and higher near the end of it, in accordance with the scalars derived from the slope of the Mincer curve illustrated in Figure A6.1.

Appendix 7: Alternative education variable

In a scenario where the 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 region 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 region. For example, some students may participate in online programs while remaining in the region. Others may attend an out-of-region institution and return to the region upon completing their studies. For these students—who would have found an alternative education and produced benefits in the region 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 region and not return to the region are *not* discounted. Because these benefits would not occur in the region 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 region. We account for this by discounting the alumni impact, the benefits to taxpayers, and the benefits to society in the region 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.⁵¹

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

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

	Benefit-cost ratio 1.7		Internal rate of return 18.0%		Payback period (years) 4.2
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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 forgone while attending the university for one year (opportunity cost) come to \$20,000 (Column 3).

⁵¹ Note that this is a hypothetical example. The numbers used are not based on data collected from an existing university.



- Together, tuition and earnings forgone 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 forgo 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 forgone) 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. 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.⁵²

52 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 forgone). As indicated in Table A8.1 the cumulative present value of \$5,000 worth of higher earnings between years 2 and 10 is \$35,753 given the 4% interest rate, far lower than the undiscounted \$45,000 discussed above.

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

Internal rate of return

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

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

Benefit-cost ratio

The benefit-cost ratio is simply the present value of benefits divided by present value of costs, or $\$35,753 \div \$21,500 = 1.7$ (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 forgone) 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 forgone 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.

The investment analysis in Chapter 3 weighs the benefits generated by the university against the state and local 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 and local taxpayer support. This adjustment is used to establish a direct link between what taxpayers pay and what they receive in return. If the university is able to generate benefits without taxpayer support, then it would not be a true investment.⁵³

The overall approach includes a sub-model that simulates the effect on student enrollment if the university loses its state and local funding and has to raise student tuition and fees in order to stay open. If the university can still operate without state and local 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 and local government support versus student demand for education

Figure A9.1 presents a simple model of student demand and state and local government support. The right side of the graph is a standard demand curve (D) showing student enrollment as a function of student tuition and fees. Enrollment is measured in terms of total credits and expressed as a percentage of the university's current credit production. Current student tuition and fees are represented by p' , and state and local government support covers $C\%$ of all costs. At this point in the analysis, it is assumed that the university has only two sources of revenues: 1) student tuition and fees and 2) state and local government support.

Figure A9.2 shows another important reference point in the model—where state and local government support is 0%, student tuition and fees are increased to p'' , and credit production is at $Z\%$ (less than 100%). The reduction in credits 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

⁵³ 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.

must be adjusted to net out the benefits that the university can provide absent state and local government support, represented as Z% of the university's current credit production in Figure A9.2.

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

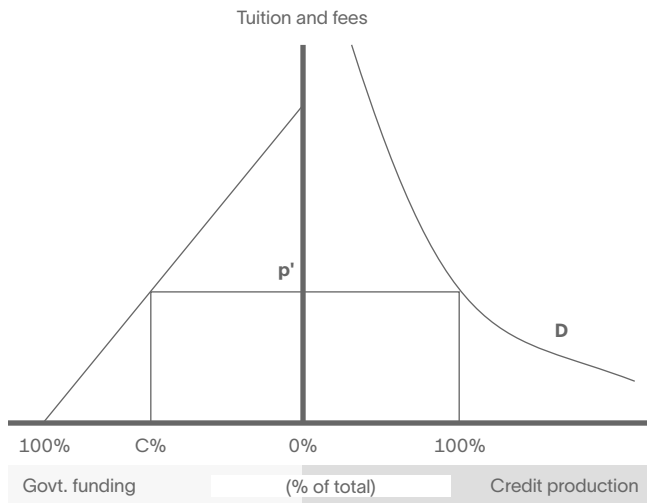
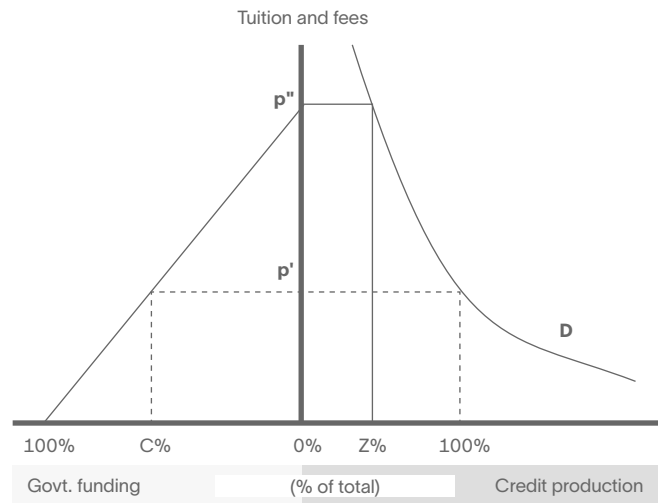


Figure A9.2:
Credit production and government funding by tuition and fees



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 and local government support. The analysis derives all benefits as a function of student enrollment, measured in terms of credits produced. For consistency with the graphs in this appendix, B is expressed as a function of the percent of the university's current credit 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 and local government support is zero nonetheless provides for Z% (less than 100%) of the current enrollment, and benefits are symbolically indicated by the following equation:

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

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

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

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.⁵⁴ 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 and local government funding). State and local government support at point $S\%$ is still zero, and student tuition and fees have been raised to p''' . State and local government support is thus credited with the benefits given by equation 3, or $B = B(100\%) - B(Z\%)$. With student tuition and fees still higher than p'' , the 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 credit production greater than $Z\%$ (the level of zero state and local government support), meaning some minimum level of state and local government support is needed for the 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 and local government support is appropriately credited with all the benefits generated by the university's credit production, or $B = B(100\%)$.

Figure A9.3: Shutdown point after zero government funding

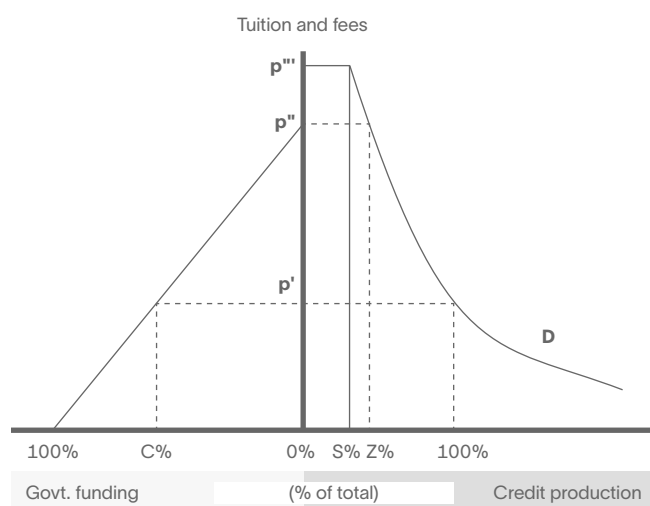
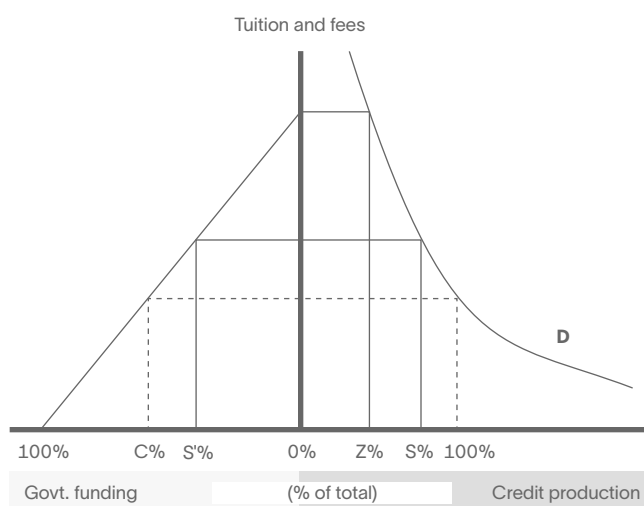


Figure A9.4: Shutdown point before zero government funding



⁵⁴ 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.

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 region, 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.

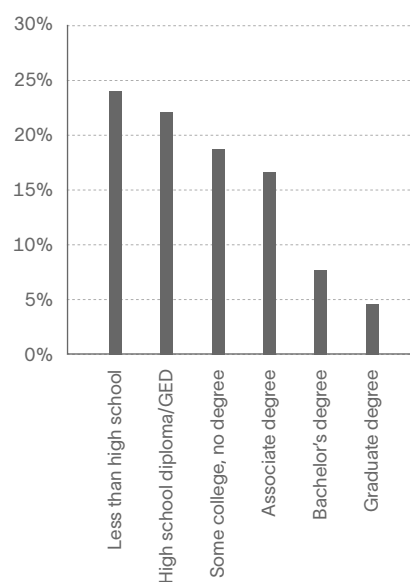
Smoking

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.⁵⁵ 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.⁵⁶ 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.

⁵⁵ Centers for Disease Control and Prevention. "Table. Characteristics of current adult cigarette smokers," National Health Interview Survey, United States, 2016.

⁵⁶ 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, 17.4% of North Carolina adults were smokers in 2018, relative to 15.9% for the nation. We thus apply a scalar of 1.09 to the national probabilities of smoking in order to adjust them to the state of North Carolina.

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.

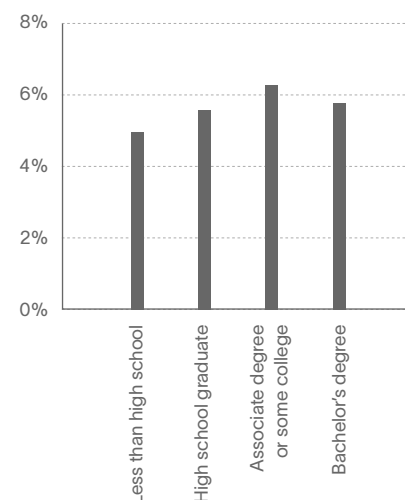
Figure A10.2 compares the percentage of adults, 18 and older, that abuse or depend on alcohol by education level, based on data from the Substance Abuse and Mental Health Services Administration (SAMHSA).⁵⁷ These statistics give an indication of the correlation between education and the reduced probability of alcohol dependence. Adults with an associate degree or some college have higher rates of alcohol dependence than adults with a high school diploma or lower. Prevalence rates are lower for adults with a bachelor's degree or higher than those with an associate degree or some college. Although the data do not maintain a pattern of decreased alcohol dependence at every level of increased education, we include these rates in our model to ensure we provide a comprehensive view of the social benefits and costs correlated with education.

Obesity

The rise in obesity and diet-related chronic diseases has led to increased attention on how expenditures relating to obesity have increased in recent years. The average cost of obesity-related medical conditions is calculated using information from the *Journal of Occupational and Environmental Medicine*, which reports incremental medical expenditures and productivity losses due to excess weight.⁵⁸

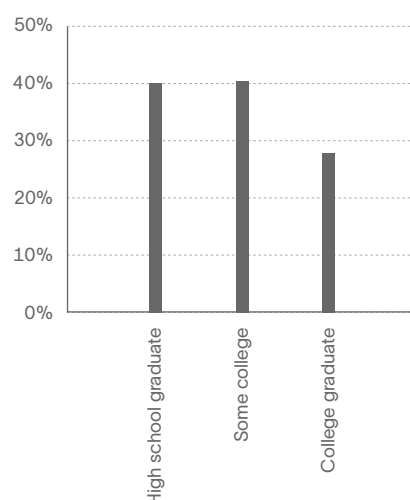
Data for Figure A10.3 is derived from the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over by education, gender, and ethnicity.⁵⁹ As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, 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 A10.2: Prevalence of alcohol dependence or abuse by education level



Source: Centers for Disease Control and Prevention.

Figure A10.3: Prevalence of obesity by education level



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

57 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.

58 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.

59 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.⁶⁰

Figure A10.4 summarizes the prevalence of MDD among adults by education level, based on data provided by the CDC.⁶¹ 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.

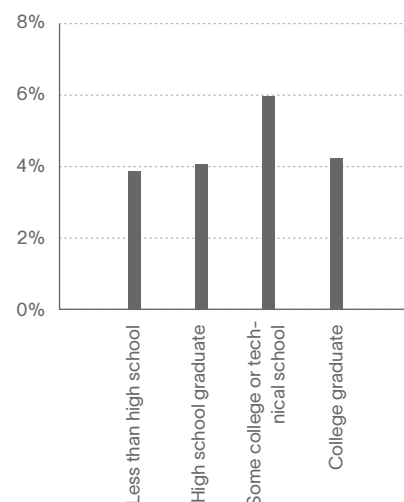
Drug abuse

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.⁶² 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.⁶³

Crime

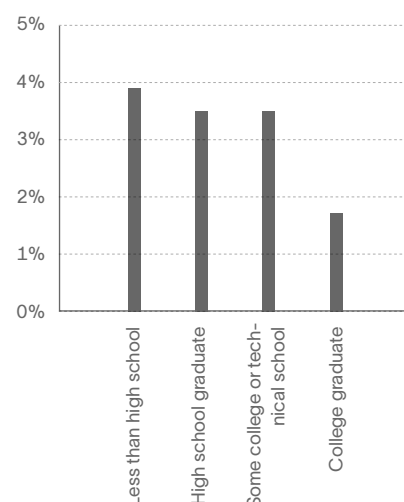
As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial and legal, and corrections, 2) victim costs, and 3) productivity 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.

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

61 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."

62 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.

63 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.⁶⁴

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.⁶⁵

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.

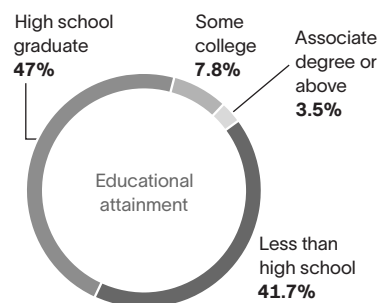
Income assistance

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.⁶⁶

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.⁶⁷ 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.

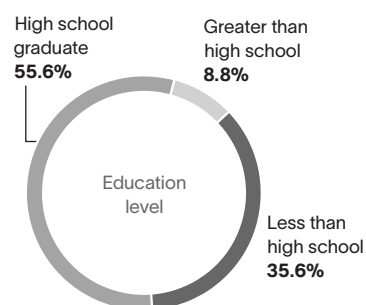
Unemployment rates also decline with increasing levels of education, as illustrated in Figure A10.8. These data are provided by the Bureau of Labor Statistics.⁶⁸ As shown, unemployment rates range from 5.4% for those with less than a high school diploma to 1.9% for those at the graduate degree level or higher.

Figure A10.6:
Educational attainment of the incarcerated population



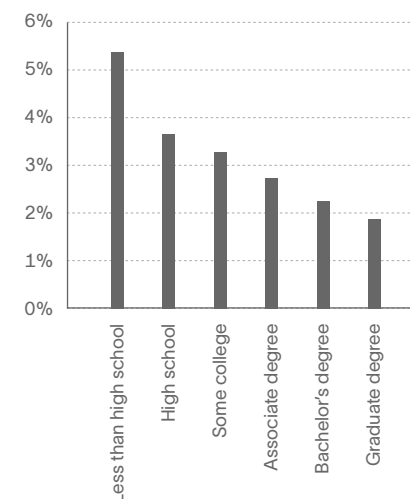
Source: Derived from data provided by the U.S. Census Bureau.

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



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

Figure A10.8: Unemployment by education level



Source: Bureau of Labor Statistics.

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

65 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.

66 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.

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

68 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.