



Executive Summary

The Economic Contribution of

UNIVERSITY OF CENTRAL ARKANSAS

Analysis of Investment Effectiveness and Economic Growth



University of
Central Arkansas™

emsi

December 2011





Socioeconomic Impact Study

STUDY HIGHLIGHTS

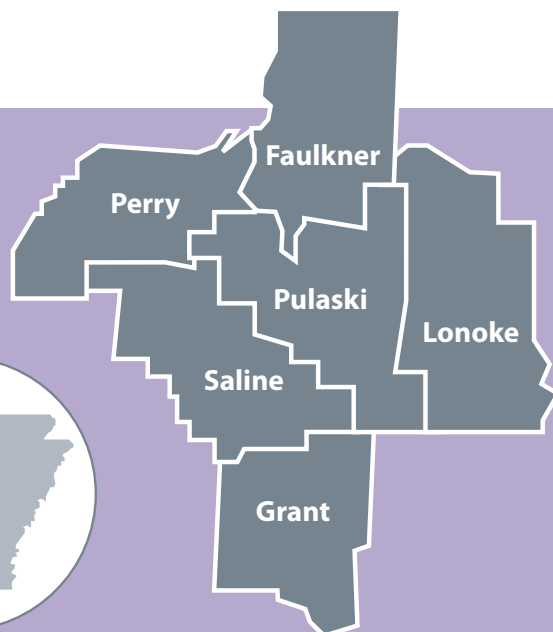
INVESTMENT ANALYSIS

- For every dollar students invest in UCA, they receive a cumulative **\$5.30** in higher future income (discounted) over the course of their working careers.
- Arkansas benefits from improved health and reduced welfare, unemployment, and crime, saving the public some **\$18.5 million** per year.
- Taxpayers see a rate of return of **7.9%** on their investment in UCA.

ECONOMIC GROWTH ANALYSIS

- The net added income generated by UCA operations (**\$78.6 million**) and the spending of visitors (**\$378,300**) and non-local students (**\$17.6 million**) contributes a total of **\$96.6 million** in income to the UCA Service Area economy each year.
- The accumulated credit hours achieved by former UCA students over the past 30 years translate to **\$329.5 million** in added regional income each year due to the higher earnings of students and increased output of businesses.

UCA SERVICE AREA MAP



University
of Central
Arkansas
Service Area

INTRODUCTION

How do the UCA Service Area economy and the state of Arkansas benefit from the presence of University of Central Arkansas (UCA)?

In this study, EMSI applies a comprehensive model designed to quantify the economic benefits of the University of Central Arkansas and translate these into common sense benefit/cost and investment terms. The study includes two major analyses:

Investment Analysis: Treats education funding as an investment, calculating all measurable returns and

comparing them to costs, from the perspectives of students, taxpayers, and society as a whole.

Economic Growth Analysis: Measures added income in the region due to university operations, student and visitor spending, and the accumulated skills of past and present students still in the workforce.

For an in-depth discussion of the methodology and results, the reader is encouraged to consult the Main Report, “The Economic Contribution of University of Central Arkansas.”

THE RESULTS

Investment Analysis

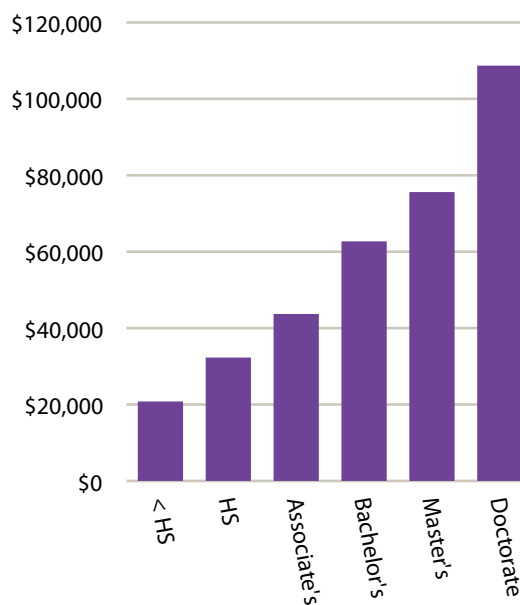
Student Perspective

Benefits of higher education are most obvious from the student perspective: students sacrifice current earnings (as well as money to pay for tuition) in return for a lifetime of higher income. Compared to someone with a high school diploma, bachelor’s degree graduates earn \$30,400 more per year, on average, over the course of a working lifetime (undiscounted).

From an investment standpoint, UCA students enjoy a 14.4% rate of return on their investments of time and money. This compares favorably with returns on other investments, *e.g.*, long-term return on stocks and bonds.

The corresponding benefit/cost ratio is 5.3, *i.e.*, for every dollar students invest in UCA education, they receive a cumulative of \$5.30 in higher future income over their working careers. This is a real return that accounts for any discounting that occurs during the entire period. The payback period is 10.7 years.

Average Earnings by Education Level in UCA Service Area



UCA INVESTMENT ANALYSIS AT A GLANCE

Stakeholder	Rate of Return	Benefit/Cost	Payback (Years)
Student perspective	14.4%	5.3	10.7
Social perspective	NA	27.3	NA
Taxpayer perspective	7.9%	2.4	15.9

Social Perspective

From the perspective of society as a whole, the benefits of education accrue to different publics. For example, UCA students expand the state’s economic base through their higher incomes, while the businesses that employ them also become more productive through the students’ added skills. These benefits, together with the associated ripple effects, contribute an estimated \$87.7 million in taxable income to the Arkansas economy each year.

As they achieve higher levels of education, UCA students are also less likely to smoke or abuse alcohol, draw welfare or unemployment benefits, or commit crimes. This translates into associated dollar savings (*i.e.*, avoided costs) to the public equal to approximately \$18.5 million annually. These are benefits that are incidental to the operations of UCA and accrue for years into the future, for as long as students remain active in the workforce.

To compare benefits to costs, we project benefits into the future, discount them back to the present, and weigh them against the \$58.9 million that state taxpayers spent in FY 2009-10 to support the university. Following this procedure, it is estimated that UCA provides a benefit/cost ratio of 27.3, *i.e.*, every dollar of state tax money invested in the university today yields a cumulative of \$27.30 in benefits that accrue to all Arkansas residents, in terms of added taxable income and avoided social costs.

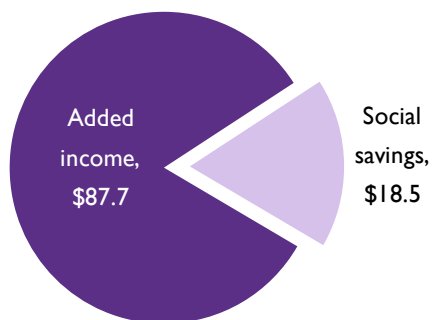
Taxpayer Perspective

Under the taxpayer perspective, only benefits that accrue to state and local governments are counted, namely, increased tax collections and reduced government expenditures. For example, in place of increased income, the taxpayer perspective includes only the increased state and local tax receipts from those higher incomes. Similarly, in place of overall crime, welfare, unemployment and health savings, the taxpayer perspective includes only those that translate to actual reductions in state and local government expenditures.

Note here that government often undertakes activities wanted by the public, but which may be unprofitable in the marketplace. This means that positive economic returns are generally not expected from government investments. From the taxpayer perspective, therefore, even a small positive return (a benefit/cost ratio equal to or greater than 1, or a rate of return equal to or greater than the 3% discount rate used in the taxpayer investment analysis) would be a favorable outcome.

For UCA, the results indicate positive returns: a rate of return of 7.9% and a benefit/cost ratio of 2.4 (every dollar of state tax money invested in UCA today returns \$2.40).

Annual Benefits to Arkansas Public Due To UCA Students (\$ Millions)



Economic Growth Analysis

UCA affects the regional economy in four ways: 1) through its payroll and purchases for supplies and services, 2) through the off-campus spending of out-of-region students, 3) through the spending of visitors from outside the region, and 4) through an increase in the skill base of the regional workforce. These effects break down as follows.

University Operations Effect

UCA creates income through the earnings of its faculty and staff, as well as through its own operating and capital expenditures. Adjusting for taxes and other monies withdrawn from the local economy in support of UCA, it is estimated that the UCA Service Area economy receives a net of \$78.6 million in added labor and non-labor income due to UCA operations each year.

Student Spending Effect

Students from outside the region spend money for room and board, transportation, entertainment, and other miscellaneous personal expenses. These expenditures create jobs and incomes for local businesses. The spending of UCA's non-local students generates approximately \$17.6 million in added income in the UCA Service Area economy each year.

Visitor Spending Effect

Each year UCA draws more than 125,400 visitors to the region. Non-local visitors bring monies that would not have otherwise entered the economy, including expenditures for lodging, eating and drinking, transportation, and other personal expenses. Adjusting for monies paid to the university (*e.g.*, for ticket sales, gifts, food, etc.), the net impact of non-local visitor spending in the region is an estimated \$378,300 in added income annually.

Student Productivity Effect

Every year students leave UCA and join or rejoin the regional workforce. Their added skills translate to higher income and a more robust UCA Service Area economy. Based on UCA's historical enrollment and credit hour production over the past 30-year period, it is estimated that the accumulated contribution of UCA instruction received by former students (both completers and non-completers) annually adds some \$329.5 million in income to the UCA Service Area.

Total Effect

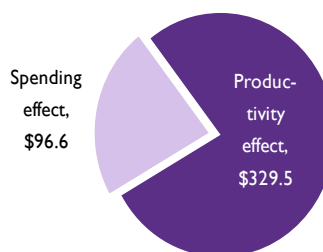
Altogether, the average annual added income due to the activities of UCA and its former students equals \$426.1 million. This is approximately equal to 1.4% of the total UCA Service Area economy.

UCA ECONOMIC IMPACT ANALYSIS AT A GLANCE

Added Income

<i>University operations effect</i>	\$78,569,400
<i>Student spending effect</i>	\$17,627,600
<i>Visitor spending effect</i>	\$378,300
Total spending effect	\$96,575,300
<i>Student productivity effect</i>	\$329,507,100
GRAND TOTAL	\$426,082,400

Total Added Income in UCA Service Area Due to UCA (\$ Millions)





CONCLUSION

The results of this study demonstrate that UCA is a sound investment from multiple perspectives. The university enriches the lives of students and increases their lifetime incomes. It benefits taxpayers by generating increased tax revenues from an enlarged economy and reducing the demand for taxpayer-supported social services. Finally, it contributes to the vitality of both the local and state economies.

ABOUT THE STUDY

This report summarizes the results from “The Economic Contribution of University of Central Arkansas” detailing the role that the university plays in promoting economic development, enhancing students’ careers, and improving quality of life. Data sources include, but are not limited to, 2009-10 academic and financial reports from the university, industry and employment data from the U.S. Bureau of Labor Statistics, earnings and demographic data from the U.S. Census Bureau, and a variety of studies and surveys relating education to social behavior.

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Main Report

The Economic Contribution of

UNIVERSITY OF CENTRAL ARKANSAS

Analysis of Investment Effectiveness and Economic Growth



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ACKNOWLEDGMENTS

Economic Modeling Specialists Inc. (EMSI) gratefully acknowledges the excellent support of the staff at University of Central Arkansas (UCA) in making this study possible. Special thanks go to Lance Grahn, Ph.D., Provost and Vice President for Academic Affairs, Diane Newton, Vice President for Finance and Administration, Shelley Mehl, Vice President for Advancement, Jeff Pitchford, Vice President of University and Government Relations, Laura Young, Assistant Provost, Melissa Goff, Director of Institutional Research, Amber

Hall, Assistant Director of Institutional Research, Cassandra McCuien, Director of Purchasing, Terri Canino, Director of Budget, and Venita Jenkins, Associate Director of Media Relations, who collected and organized much of the data and information requested. Any errors in the report are the responsibility of the authors and not of any of the above-mentioned institutions or individuals.

EMSI formally recognizes and thanks Tom Courtway, Interim President of the University of Central Arkansas.

INTRODUCTION

Study overview

University of Central Arkansas (UCA) generates a wide array of benefits. Students benefit from higher personal income, and society benefits from cost savings associated with reduced welfare and unemployment, improved health, and reduced crime. Education, however, requires a substantial investment on the part of students and taxpayers. All of the education stakeholders, therefore, want to know if they are getting their money's worth. In this study, UCA investigates the attractiveness of its returns as a public training provider relative to alternative public investments. The following two analyses are presented: 1) investment analysis, and 2) economic growth analysis.

The investment analysis captures private and public benefits that accrue to students and taxpayers in return for their educational support. Private benefits include higher income of students, and public benefits include growth in income plus an assortment of positive externalities such as improved health and lifestyle habits, reduced crime, and fewer claims for social assistance. All of these annual benefits continue and accrue into the future for as long as students are in the workforce. To determine the feasibility of the investment, the model projects benefits into the future, discounts them back to the present, and compares them to present costs. Results are displayed in the four following ways: 1) net present value, 2) rate of return, 3) benefit/cost ratio, and 4) payback period.

The economic growth analysis focuses on the role UCA plays in promoting economic development by increasing consumer spending and raising the skill level of the labor force. This in turn leads to more jobs, increased business efficiency, greater availability of public investment funds, and eased tax burdens. In general, university-linked income falls under the fol-

lowing four categories: 1) income generated by annual UCA operating expenditures, 2) income generated by the spending of UCA students; 3) income generated by the spending of UCA visitors; and, 4) income generated by UCA skills embodied in the workforce.

A note of importance: although the reports generated for UCA are similar to those prepared for other educational institutions, the results differ widely. **These differences, however, do not necessarily indicate that some institutions are doing a better job than others.** Results are a reflection of location, student body profile, and other factors that have little or nothing to do with the relative efficiency of the institutions. For this reason, comparing results between institutions or using the data to rank institutions is strongly discouraged.

Organization of the report

This report has four chapters and seven appendices. Chapter 1 provides an overview of UCA and the regional economy. Chapter 2 presents the investment analysis results from the students' and taxpayers' perspectives. Chapter 3 considers the impact of UCA on economic growth in the UCA Service Area. Finally, Chapter 4 provides sensitivity analyses of some of the softer variables.

The appendices include a list of resources and references in Appendix 1, a glossary of terms in Appendix 2, a discussion of the EMSI input-output model in Appendix 3, a detailed explanation of the shutdown point (an adjustment factor) in Appendix 4, an overview of the data and assumptions used in calculating the non-economic (*i.e.*, social) benefits of education in Appendix 5, a short primer on the investment analysis results in Appendix 6, and an explanation of the alternative education variable in Appendix 7.

CHAPTER 1: PROFILE OF UCA AND THE REGIONAL ECONOMY

Introduction

Founded in 1907, UCA is one of the best and most affordable options for higher education in the South. The university is centrally located in Conway, “The City of Colleges,” just 30 miles north of Little Rock and a manageable drive to all corners of the state. UCA’s Georgian-style campus and vibrant cultural presence in Conway are strong draws to its more than 11,000 students and 1,500 faculty and staff. The insti-

tution’s diverse population is comprised of students from 66 different countries and 39 states.

UCA’s breadth of academic offerings includes the highly regarded Honors College, College of Business, and College of Health and Behavioral Sciences. Originally a teachers college, UCA also puts a strong emphasis on honing the skills of future educators through its College of Education. Further, the university has many residential colleges, in which students closely interact with professors and fellow students in unique learning environments. UCA has four first-year residential colleges, one first-year commuter college, one sophomore residential college, and a new sophomore through senior residential college scheduled to open in fall 2012.

Estimating the benefits and costs of UCA requires the following three types of information: (1) the profile of the university and its student body, (2) the economic profile of the region and the state, and (3) statistics relating education to improved social behavior. For the purposes of this study, information on the university and its students was obtained from UCA; data on the regional and state economy were drawn from public databases; and statistics on social behavior were provided by national studies and surveys.

UCA’s National Distinctions

- Kaplan/*Newsweek* ranked the University of Central Arkansas in the top 25 of the “Most Desirable Large Schools” and “Most Desirable Rural Schools” in the United States. UCA and the University of Arkansas in Fayetteville are the only two schools in the state to be listed by Kaplan/*Newsweek*.
- UCA was listed in the 2011 Best Colleges ranking by *U.S. News & World Report*, landing 17th out of 69 public university in the category of “Top Public Schools” among regional universities in the South. Overall, UCA ranks 47th out of 121 private and public institutions in the South—the highest-ranked Arkansas public university among regional universities, according to the report.
- UCA’s College of Business was listed in *The Princeton Review’s* 2011 edition of the best 300 business schools in the U.S. UCA was one of 66 institutions that appeared in one or more of *The Princeton Review’s* rankings. It is ranked 63rd overall in academic experience category, 64th in interesting professors, and 61st in accessible professors.

University profile

Revenues

Table 1.1 shows UCA’s annual revenues by funding source—a total of \$176.9 million in FY 2009-10. These data are critical in identifying annual costs of educating the student body from the perspectives of students and taxpayers alike. As indicated, tuition and fee revenue comprised 32% of the total, state government revenue 33%, federal government revenue 8%, and all

other revenue (*i.e.*, auxiliary revenue, sales and services, interest, and donations) the remaining 26%.

Expenditures

UCA employed more than 1,500 faculty and staff in the 2009-10 reporting year. The combined payroll at UCA amounted to \$88.1 million (including monies paid to student workers). Other expenditures, including capital and purchases of supplies and services, made up \$74.4 million. These budget data appear in Table 1.2.

Student profile

Demographics

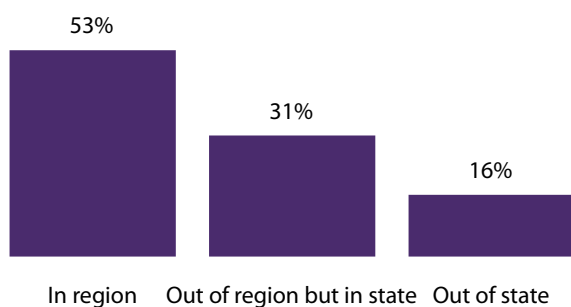
UCA served more than 11,000 students in Fall 2009.¹ The breakdown of the student body by gender was 41% male and 59% female. The breakdown of the student body by ethnicity was 70% whites, 26% minorities,² and 4% unknown. The students' overall average age was 23.³

Figure 1.1 presents the settlement patterns of UCA students. As indicated, 53% of students remain in the UCA Service Area. Another 31% of students settle outside the service area but in the state, and the remaining 16% settle outside the state.

Achievements

UCA offers more than 80 undergraduate degree programs, 39 master's degrees, and five doctoral degrees.

Figure 1.1: Student settlement patterns



- 1 The unduplicated headcount for the entire 2009-10 reporting year was 15,501.
- 2 Including American Indian, Asian, Black, Hispanic, Pacific Islander, non-resident alien, and two or more races.
- 3 Demographic data based on the number of students who reported their age, gender, and ethnicity to UCA.

UCA Noted for Its Financial Stability

While many higher education institutions have struggled with waning state and federal support, the University of Central Arkansas—along with other Arkansas institutions—has done well financially through the recent recession.

Diane Newton, Vice President of Finance and Administration, credits the financial restraint of UCA and the state of Arkansas, among other reasons, for maintaining stability.

“Over the last few years, UCA has steadfastly built reserves to cushion against recession and unpredictable enrollment,” noted Newton, who began at the school in 2010.

“...UCA has fared well, first and foremost due to the commitment and vision of its faculty, staff, and students,” she added. “The second most important factor is that Arkansas is one of only a few states that operates with a balanced budget, resulting in stable funding compared to our sister states. Third, UCA utilized its stimulus funding wisely by only using it for non-recurring expenditures.”

Table 1.1: UCA revenue by source, FY 2009-10 (\$ thousands)

Source	Total	%
Tuition and fees	\$57,282	32%
State government revenue	\$58,936	33%
Federal government revenue	\$14,380	8%
All other revenue	\$46,337	26%
Total revenues	\$176,935	100%

Source: Data supplied by UCA.

Table 1.2: UCA expenses by function, FY 2009-10 (\$ thousands)

Source	Total	%
Salaries, wages, and benefits	\$88,102	54%
Capital expenditures (amortized)	\$8,671	5%
All other non-pay expenditures	\$65,732	40%
Total expenses	\$162,505	100%

Source: Data supplied by UCA.

UCA Puts Focus on Training Teachers

Looking back to its roots as a teachers college, UCA has put an emphasis on strengthening its position as the leading institution in Arkansas for educating future teachers in the state and elsewhere.

One example of what separates UCA's College of Education is the Master of Arts in Teaching graduate program, which recently won the 2010 Association of Teacher Educators' Distinguished Program in Teacher Education Award. The national award honors outstanding teacher education programs that exemplify teacher preparation courses aligned with strong collaboration between local school districts and higher education institutions in program development.

More than 5,000 UCA graduates currently work as educators in Arkansas K-12 schools. The institution is one of the state's top two producers of licensed school educa-

tors in Arkansas.

"We are working hard to reestablish the University of Central Arkansas as the premier institution for teaching education in the state," said Dr. Lance Grahn, Provost and Vice President for Academic Affairs.

UCA is the top university in the state, Grahn noted, for teacher preparation in science and math. In the fall of 2010, the university started the first residential college in Arkansas with an emphasis on science, technology, engineering, and mathematics.

In addition to helping prepare future workers in STEM fields, the STEM residential college also seeks to train more math and science teachers and improve science and math education in the state.

"UCA is on the front line of training the next generation of high school science and math teachers," Grahn said.

UCA's programs of study are broken into six different colleges—the College of Business, the College of Education, the College of Fine Arts and Communications, the College of Health and Behavioral Sciences, the College of Liberal Arts, and the College of Natural Sciences and Mathematics. UCA is the only public school in Arkansas to offer programs such as Digital Filmmaking, Occupational Therapy, Addiction Studies, African-American Studies, and Religious Studies programs. UCA also has the largest Psychology, Speech-Language Pathology, and Dietetics programs in the state.

Table 1.3 summarizes the breakdown of student achievements by degree level for the entire 2009-10 reporting year. As indicated, UCA awarded 54 PhDs, 553 master's degrees, 1,611 bachelor's degrees, and 32 associate's degrees in the 2009-10 reporting year. Enrollment for all other credit-bearing students for the reporting year equaled 11,516 students.

UCA also served 770 students who took non-credit courses for personal enrichment rather than degree attainment. In the analysis, we exclude the credit hour production of personal enrichment students under the

Table 1.3: UCA student achievements by education level, 2009-10

Category	Headcount	Total CHes	Average CHes
Credit			
PhD graduates	54	10	0.2
Master's degree graduates	553	4,421	8.0
Bachelor's degree graduates	1,611	32,141	20.0
Associate's degree graduates	32	468	14.6
All other credit-bearing students	11,516	219,246	19.0
Non-credit			
Personal enrichment students	770	665	0.9
Career training students	965	4,108	4.3
Total/average*	15,501	261,059	17.7

* Headcount figures reflect the entire academic year, not just Fall 2009. The overall average number of CHes per student excludes personal enrichment students.

Source: Data supplied by UCA.

assumption that they do not attain workforce skills that will increase their earnings. Non-credit career training students comprised the remaining 965 students.

Altogether, UCA students completed 261,059 credit hour equivalents (or CHEs) during the 2009-10 reporting year. The average number of CHEs per student (excluding personal enrichment students) was 17.7.

Regional profile

Since UCA first opened its doors to students in 1907, the university has been serving the local community by creating jobs and income, providing area residents with easy access to higher education opportunities, and preparing students for highly-skilled, technical professions. The availability of quality education and training in the UCA Service Area also attracts new industry to the region, thereby generating new businesses and expanding the availability of public investment funds.

Table 1.4, on the following page, summarizes the breakdown of the UCA Service Area economy by major industrial sector, with detail on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income; while non-labor income refers to profits, rents, and other income. Together, labor and non-labor income comprise a region's total gross regional product, or GRP.⁴

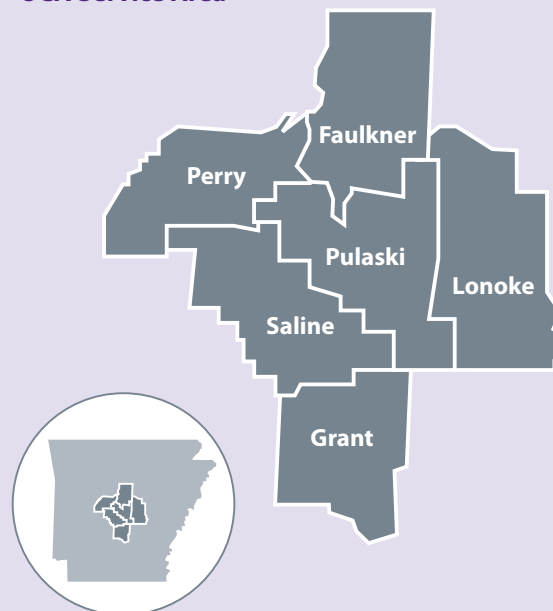
As shown in Table 1.4, the UCA Service Area's GRP is approximately \$29.6 billion, equal to the sum of labor income (\$20 billion) and non-labor income (\$9.6 billion). In Chapter 3, we use the UCA Service Area's gross regional product as the backdrop against which we measure the relative impacts of the university on economic growth in the region.

Conclusion

This chapter presents the broader elements of the database used to determine the results. Additional detail on data sources, assumptions, and general methods underlying the analyses are conveyed in the remaining chapters and appendices. The core of the findings is

⁴ See the glossary of terms in Appendix 2 for a full definition of GRP.

UCA Service Area



UCA Becoming Center for Creative Writing in South

Housed in the College of Fine Arts & Communications, the University of Central Arkansas' writing department is quickly becoming a destination for creative writing—and creative writing journals.

UCA is home to the editorial offices of *The Oxford American*, an award-winning national literary magazine, as well as two national creative writing journals. The school will also soon start a Master of Fine Arts in Creative Writing program, according to Dr. Lance Grahn, Provost and Vice President for Academic Affairs.

"We are moving forward in cementing Conway as a center for creative writing," Grahn said.

presented in the next two chapters—Chapter 2 looks at UCA as an investment, and Chapter 3 considers UCA's role in economic growth. The appendices detail a collection of miscellaneous theory and data issues.

Table 1.4: Labor and non-labor income by major industrial sector in UCA Service Area, 2010 (\$ millions)*

Industry Sector	Labor income	Non-labor income	Total income	% of total
Agriculture, forestry, fishing and hunting	\$144	\$75	\$218	<1%
Mining	\$161	\$273	\$434	1%
Utilities	\$168	\$493	\$661	2%
Construction	\$1,049	\$89	\$1,138	4%
Manufacturing	\$1,193	\$895	\$2,089	7%
Wholesale trade	\$1,187	\$897	\$2,084	7%
Retail trade	\$1,323	\$695	\$2,019	7%
Transportation and warehousing	\$876	\$271	\$1,147	4%
Information	\$602	\$1,118	\$1,720	6%
Finance and insurance	\$1,358	\$1,238	\$2,597	9%
Real estate and rental and leasing	\$475	\$1,507	\$1,982	7%
Professional and technical services	\$1,583	\$406	\$1,990	7%
Management of companies and enterprises	\$367	\$58	\$425	1%
Administrative and waste services	\$798	\$146	\$944	3%
Educational services	\$247	\$29	\$276	<1%
Health care and social assistance	\$2,409	\$245	\$2,654	9%
Arts, entertainment, and recreation	\$90	\$26	\$116	<1%
Accommodation and food services	\$497	\$237	\$734	2%
Other services, except public administration	\$607	\$70	\$676	2%
Federal government	\$1,330	\$406	\$1,736	6%
State and local government	\$3,568	\$438	\$4,007	14%
Total	\$20,033	\$9,615	\$29,648	100%

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

† Numbers may not add due to rounding.

Source: EMSI.

UCA, City of Conway Have Strong Bond

Interim President Tom Courtway has lived in Conway almost his entire life and has strong family ties to the Conway community. He has seen the growth of not only UCA but the community as well. "The University and the community are tied together and we all recognize that fact. Because of that, we have had a great relationship between the community and UCA, and we know that is not always the case in other communities. We know what is good for UCA is good for the local community and vice versa. We are fortunate to have such great support from our community."

When it comes to the harmony between UCA and Conway (pop. 58,908), other UCA administrators point to two examples:

Shelley Mehl, UCA's Vice President for Advancement and President of the UCA Foundation, Inc., has been an elected member of the Conway City Council for the past five years. "There's mutual respect and both appreciate the fact of what the others are trying to do to benefit the citizens here," she said.

Conway Chamber of Commerce President and CEO Brad Lacy, an UCA alumnus, is the chair of the UCA Foundation Board for 2011.

"This community has been committed to higher education almost since birth," said Lacy, noting that Conway is also home to Hendrix College and Central Baptist College—which helped the town become known as "The City of Colleges."

CHAPTER 2: INVESTMENT ANALYSIS

Introduction

Investment analysis is the process of evaluating total costs and measuring these against total benefits to determine whether or not a proposed venture will be profitable. If benefits outweigh costs, then the investment is worthwhile. If costs outweigh benefits, then the investment will lose money and is thus considered infeasible.

In this chapter, we consider UCA as an investment from the perspectives of students and taxpayers, the major stakeholders. The backdrop for the analysis is the entire state of Arkansas.

Student perspective

Analyzing the benefits and costs of education from the perspective of students is the most obvious—they give up time and money to go to the university for the opportunity to pursue a field of their choosing and the potential for a lifetime of higher income. The benefit component of the analysis thus focuses on the extent to which student incomes increase as a result of their education, while costs comprise the monies they put up.

Linking education to earnings

The correlation between education and earnings is well documented and forms the basis for determining the benefits of education. As shown in Table 2.1, mean income levels at the midpoint of the average-aged worker’s career increase for individuals who have attained higher levels of education. These numbers are derived from EMSI’s industry data on average income per worker in the UCA Service Area,⁵ broken out by

⁵ It is important to note that wage rates in the EMSI model combine state and federal sources to provide earnings that reflect proprietors, self-employed workers, and others not typically included in state data, as well as benefits and all forms of employer contributions. As such, EMSI industry earnings-

Figure 2.1: Average income at career midpoint

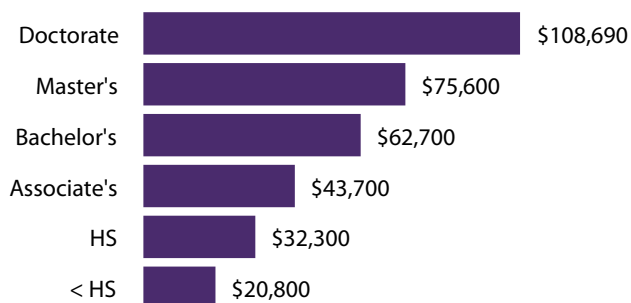


Table 2.1: Expected income in UCA Service Area at midpoint of individual’s working career by education level

Education level	Income	Difference
Less than high school	\$20,800	n/a
High school or equivalent	\$32,300	\$11,500
Associate’s degree	\$43,700	\$11,400
Bachelor’s degree	\$62,700	\$19,000
Master’s degree	\$75,600	\$12,900
Professional/doctoral degree	\$108,690	\$33,090

Source: Derived from data supplied by EMSI industry data and the U.S. Census Bureau. Figures are adjusted to reflect average earnings per worker in the UCA Service Area.

gender, ethnicity, and education level using data supplied by the U.S. Census Bureau.

The differences between income levels define the marginal value of moving from one education level to the next. For example, students who move from a high school diploma to a bachelor’s degree may expect approximately \$30,400 in higher annual income. The difference between a high school diploma and the attainment of a master’s degree is even greater—up to \$43,300 in higher income.

Of course, several other factors such as ability, socio-economic status, and family background also positively

per-worker numbers are generally higher than those reported by other sources.

correlate with higher earnings. Failure to account for these factors results in what is known as an “ability bias.” A literature review by Chris Molitor and Duane Leigh indicates that the upper limit benefits defined by correlation should be discounted by 10%.⁶ As such, we adjust the gross increase in income downward by 10%.

Determining the value per CHE

Not all students who attended UCA in the 2009-10 reporting year obtained a degree or certificate in the course of the year. Some may have returned the following year to complete their education goals, while others may have taken a few courses and entered the workforce without achieving a credential. As such, the only way to measure the value of the students’ achievement is through their credit hour equivalents, or CHEs. This allows us to see the benefits to all students, not just to those who earn an award.

In the model, we calculate the value of the students’ CHE production through a complex process that involves dividing the education ladder into a series of individual steps, each equal to one credit hour. We then spread the income differentials from Table 2.1 over the steps required to complete each education level, assigning a unique value to every step in the ladder.⁷ Next, we apply a continuous probability distribution to map the students’ CHE production to the ladder, depending on their level of achievement and the average number of CHEs they achieve. Finally, we sum the number of CHEs earned at each step and multiply them by their corresponding value to arrive at the students’ average annual increase in income.

Table 2.2 displays the aggregate annual higher income for the UCA student population. Also shown are the total CHEs generated by students and the average value per CHE. Note that, although each step in the education ladder has a unique value, for the sake of simplicity, only the total and average values are displayed.

6 Chris Molitor and Duane Leigh, “Estimating the Returns to Schooling: Calculating the Difference Between Correlation and Causation” (Pullman, WA: March 2001). Report available upon request.

7 Students who obtain a certificate or degree during the reporting year are granted a “ceremonial boost” in the calculations in recognition of the fact that an award has greater value than the individual steps required to achieve it.

Table 2.2: Aggregate higher income of UCA students at career midpoint and average value per CHE

	Total/Avg
Higher annual income, aggregate (thousands)	\$57,758
Total CHEs, excluding personal enrichment students	260,394
Average value per CHE	\$222

Source: EMSI impact model.

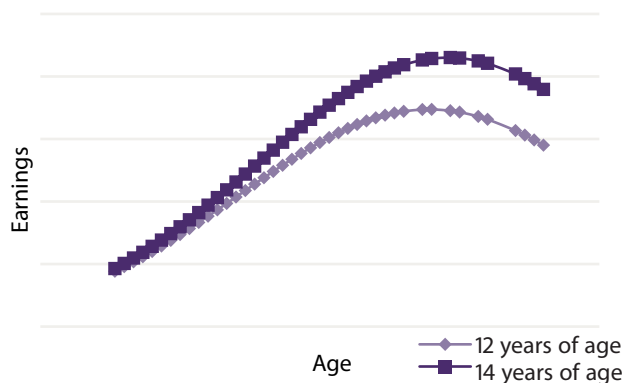
Here a qualification must be made. Research shows that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also indicates that the earnings increment between educated and non-educated workers grows through time. This means that the aggregate annual higher income presented in Table 2.2 will actually be lower at the start of the students’ career and higher near the end of it, gradually increasing at differing rates as the students grow older and advance further in their careers. To model this change in earnings, we use the well-known and well-tested Mincer function, which we discuss more fully in the next section.

Generating a benefits stream

The two names most often associated with human capital theory and its applications are Gary Becker and Jacob Mincer.⁸ The standard human capital earnings function developed by Mincer appears as a three-dimensional surface with the key elements being earnings, years of education, and experience. Figure 2.2 shows the relationship between earnings and age, with age serving as a proxy for experience. Note that, since we are using the graph strictly for illustrative purposes, the numbers on the axes are not shown.

Figure 2.2 illustrates several important features of the Mincer function. First, earnings initially increase at an increasing rate, later increase at a decreasing rate, reach a maximum somewhere after the midpoint of the working career, and then decline in later years.

8 See Gary S. Becker, *Human Capital: a Theoretical Analysis with Specific Reference to Education* (New York: Columbia College Press for NBER, 1964); Jacob Mincer, “Schooling, Experience and Earnings” (New York: National Bureau of Economic Research, 1974); and Mincer, “Investment in Human Capital and Personal Income Distribution,” *Journal of Political Economy*, vol. 66 issue 4, August 1958: 281–302.

Figure 2.2: Earnings for 12 vs. 14 years of education

Second, at higher levels of education, the maximum level of earnings is reached at an older age. And third, the benefits of education, as measured by the difference in earnings for two levels, increase with age.

In the model, we employ the Mincer function as a smooth predictor of earnings over time,⁹ for as long as students remain active in the workforce. Using earnings at the career midpoint as our base (Table 2.1), we derive a set of scalars from the slope of the Mincer curve to model the students' increase in earnings at each age within their working careers. The result is a stream of projected future benefits that follows the same basic shape as the Mincer curve, where earnings gradually increase from the time students enter the workforce, come to a peak shortly after the career midpoint, and then dampen slightly as students approach retirement at age 65.

The benefits stream generated by the Mincer curve is a key component in deriving the students' rate of return. However, not all students enter the workforce at the end of the reporting year, nor do all of them remain in the workforce until age 65. To account for this, we discount the students' benefit stream in the first few years of the time horizon to allow time for those who are still studying at the university to com-

9 The Mincer equation is computed based on estimated coefficients presented in Robert J. Willis, "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Function" in *Handbook of Labor Economics*, Vol. 1 (Amsterdam: Elsevier Science Publishers, 1986): 525–602. These are adjusted to current year dollars in the usual fashion by applying the GDP implicit price deflator. The function does not factor in temporary economic volatility, such as high growth periods or recessions. In the long run, however, the Mincer function is a reasonable predictor.

plete their educational goals and find employment. Next, we discount the entire stream of benefits by the estimated number of students who will die, retire, or become unemployed over the course of their working careers.¹⁰ The likelihood that students will leave the workforce increases as they age, so the older the student population is, the greater the attrition rate applied by the model will be.

Having calculated the students' benefits stream and adjusted for attrition, we next turn to student costs. These are discussed more fully in the next section.

Calculating student costs

Student costs comprise tuition and fees, books and supplies, and the opportunity cost of time. Tuition and fees amount to \$57.3 million (see Table 1.1). Full-time students also spend an average of \$1,000 per year on books, supplies, and equipment.¹¹ Multiplying this figure by the number of full-time equivalents (FTEs) achieved by the student population yields approximately \$9.1 million spent on books and supplies in the 2009-10 reporting year.

Opportunity cost is the most difficult component of student costs to calculate. It refers to the value of time and earnings forgone by students who choose to attend college rather than work full-time. We derive opportunity costs by establishing the full earning potential of students at their current age (23) and education level, and then comparing this to what they are actually earning while attending the university.

We begin with the average annual incomes by education level from Table 2.1 and weight these according to the students' education level at the start of the reporting year.¹² However, recall that Table 2.1 displays earnings at the midpoint of the individual's working career, not immediately upon exiting the university. To arrive at the full earning potential of students while enrolled, we must condition the earnings levels to the students' age, which we accomplish simply by applying a scalar derived from the Mincer curve described above.

10 These data are provided by a variety of sources, including the Center for Disease Control and Prevention (CDC), the Social Security Administration (SSA), and the Bureau of Labor Statistics (BLS).

11 Based on the College Board's Annual Survey of Colleges, 2008.

12 Based on the number of students who reported their entry level of education to UCA.

Another important factor to consider is the time that students actually spend at the university, as this is the only part of the year that they would potentially be required to give up earnings as a result of their education. We use the students' CHE production as a proxy for time, under the assumption that the more CHEs students earn, the less time they have to work, and, consequently, the more earnings they potentially have to give up.

Note that the opportunity cost calculations only apply to students who are economically active, *i.e.*, those who work or are seeking work. UCA estimates that 50% of its students are employed while attending.¹³ For those who are not working, we assume that they are either seeking work or will seek work once they complete their educational goals (with the exception of personal enrichment students, who are not being considered in this calculation).

The differentiation between working and non-working students is important because they are treated differently in the model. Non-working students are assumed to give up their entire earning potential while enrolled. Working students, on the other hand, are able to maintain all or part of their income, so their opportunity cost is not as high. However, many of them give up a significant portion of their leisure time,¹⁴ while others hold jobs that pay less than statistical averages (usually because they can only find work that fits their course schedule). To account for both of these factors, we assume that working students give up 65% of their full earning potential while attending the university, depending on their age and education level.¹⁵

Total opportunity cost for working and non-working students appears in Table 2.3. Also shown are the cost of tuition and fees and the cost of books and supplies,

less monies paid by personal enrichment students. Finally, we net out grants and scholarships refunded to students, as these represent a gain and not a cost

Table 2.3: UCA student costs, 2009-10 (\$ thousands)

	Total
Education cost	
Tuition and fees	\$57,282
Books and supplies	\$9,133
Opportunity cost	
Working students	\$46,975
Non-working students	\$74,286
Adjustments	
Less monies paid by personal enrichment students	-\$168
Less grants and scholarships refunded to students	-\$13,900
Total student costs	\$173,608

Source: Based on data supplied by UCA and outputs of the EMSI impact model.

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% discount rate from the student perspective and a 3% discount rate from the taxpayer perspective. The discount rate from the taxpayer perspective is lower because governments are large and can therefore spread their risks over a larger and more diverse investment portfolio than the private sector can.

13 Based on the number of students who reported their employment status to UCA.

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

15 This assumption is based on the following: (1) the value of leisure time, assumed to have a value equal to 20% of students' full earning potential, and (2) the percent of earnings forgone by students who work at jobs that pay less than statistical averages while enrolled. This latter assumption, equal to 45%, is derived from data supplied by approximately 200 institutions previously analyzed by EMSI. For more information on the value of leisure time, see Becker, 1964.

to students. Total student costs thus come to \$173.6 million, as shown in the bottom row of Table 2.3.

Return on investment

Having calculated the students' future benefits stream and the associated costs, the next step is to discount the results to the present to reflect the so-called time value of money. For the student perspective, we assume a discount rate of 4% (see the "Discount Rate" box). Present values of benefits are then collapsed down to one number and compared to student costs to derive the investment analysis results, expressed in terms of benefit/cost ratios, rates of return, and payback periods. The investment is feasible if returns match or exceed the minimum threshold values, *i.e.*, a benefit/cost ratio greater than 1, a rate of return that exceeds the discount rate, and a reasonably low payback period.

As shown in Table 2.4, higher student income is projected across the working life of students, discounted to the present, and added together to yield a cumulative sum of \$918.2 million, the present value of all of the future income increments. This may also be interpreted as the gross capital asset value of the students' higher income stream. Accordingly, the aggregate 2009-10 student body is rewarded with a capital asset valued at \$918.2 million as a result of their attendance at UCA.

Next, we compare the benefits to the associated costs to judge whether attending the university is a good investment. Costs are provided in the second row of Table 2.4, equal to \$173.6 million. Note that costs only occur in the single reporting year and are thus already in current year dollars, so their present value equals what is reported in Table 2.3. Comparing costs with the present value of benefits yields a student benefit/cost ratio of 5.3 (equal to \$918.2 million in benefits divided by \$173.6 million in costs).

The rate of return is perhaps the most recognized indicator of investment effectiveness. Given the cost of education and the stream of associated future benefits, the rate of return indicates how much a bank would have to pay a depositor of like amount to yield an equally rewarding stream of future payments.¹⁶ Table

¹⁶ 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

Table 2.4: Present value of benefits and costs, UCA student perspective (\$ thousands)

	Total
Present value of future benefit stream	\$918,162
Present value of costs	\$173,608
Net present value	\$744,554
Benefit/cost ratio	5.3
Internal rate of return	14.4%
Payback period (no. of years)	10.7

Source: EMSI impact model.

2.4 shows UCA students earning average returns of 14.4% on their investment of time and money. This is indeed an impressive return compared, for example, to 1% on a standard bank savings account, or approximately 7% on stocks and bonds (thirty-year average return).

The payback period is defined as the length of time it takes to entirely recoup the initial investment.¹⁷ Beyond that point, returns are what economists would call "pure costless rent." As indicated in Table 2.4, students at UCA see, on average, a payback period of 10.7 years on their forgone earnings and out-of-pocket costs.¹⁸

Social perspective

Any benefits that impact the state as a whole—whether students, employers, taxpayers, or whoever else stands to benefit from the activities of UCA—are counted as benefits under the social perspective. We subdivide these benefits into the following two main components: (1) increased income in the state, and (2) social

in return a stream of periodic payments, and then recovers the principal at the end. An education investor, 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.

¹⁷ Payback analysis is generally used by the business community to rank alternative investments when safety of investments is an issue. Its greatest drawback is that it takes no account of the time value of money.

¹⁸ The payback period is calculated by dividing the cost of the investment by the net return per period. In this study, the cost of the investment includes tuition and fees plus the opportunity cost of time—it does not take into account student living expenses or interest on loans.

externalities stemming from the improved lifestyles of students, such as better health, reduced crime, and fewer incidences of unemployment (see the “Beekeeper Analogy” box).

Increased income

Income growth occurs as the higher earnings and added skills of UCA students stimulate the production of income in the 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 (*i.e.*, buildings, machinery and everything else). This in turn raises profits and other business property income. Together, increases in labor and capital income are considered the effect of a skilled workforce.

Estimating the effect of UCA on income growth in the state begins with the projected higher student income from Table 2.4. Not all of these benefits may be counted as benefits to the public, however. Some students leave the state during the course of their careers, and any benefits they generate leave the state with them. To account for this dynamic, we combine student origin data from UCA with data on migration patterns from the U.S. Census Bureau to estimate the number of students who leave the state workforce over time.

Once we have adjusted for regional attrition, we derive a stream of earnings benefits that accrue to the public. These comprise the direct effect of UCA on state income growth. Indirect effects occur when students spend more money on consumer goods, and the increased output of businesses that employ them also creates a demand for inputs and, consequently, input spending. The effect of these two spending items (consumer and business spending) leads to still more spending and more income creation, and so on. To quantify the impact of these several rounds of spending, we apply a multiplier¹⁹ derived from EMSI’s specialized input-output (IO) model, described more fully in Appendix 3.

With an increase in labor income (both direct and indirect) comes an increase in capital investment,²⁰

19 Multipliers are common to economic impact analysis and are used to measure how money cycles through the economy.

20 In the production process, skilled labor and capital complement

Beekeeper Analogy

A classic example of positive externalities (sometimes called “neighborhood effects”) in economics is the private beekeeper. The beekeeper’s intention is to make money by selling honey. Like any other business, the beekeeper’s receipts must at least cover his operating costs. If they don’t, his business will shut down.

But from society’s standpoint, there is more. Flower blossoms provide the raw input 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 positive externalities such as beekeeping.

Educational institutions are in some ways like beekeepers. Strictly speaking, their business is in providing education and raising people’s incomes. Along the way, however, external benefits are created. Students’ health and lifestyles are improved, and society indirectly enjoys these benefits just as orchard owners indirectly enjoy benefits generated by beekeepers. Aiming at an optimal expenditure of public funds, the impact model tracks and accounts for many of these external benefits and compares them to public costs (what taxpayers agree to pay) of education.

thereby generating even more growth in the non-labor (or “non-earnings”) share of the economy. Non-labor income consists of monies gained through investments, including dividends, interests, and rent. To derive the growth in non-labor income, we multiply the direct and indirect labor income figures by a ratio of Arkansas’ gross state product (equal to labor income plus non-labor income) to total labor income in the state.

Table 2.5 summarizes the average annual increase in

each other (*i.e.*, they have a relatively low elasticity of substitution). Accordingly, an increase in skilled labor increases the productivity and income of existing capital while encouraging additional capital investment.

Table 2.5: Aggregate added state income at the career midpoint of UCA students (\$ thousands)

	Total
Labor income	\$54,689
Non-labor income	\$32,972
Total added state income	\$87,661

Source: EMSI impact model.

state income due to the higher earnings of UCA's 2009-10 student population. Note that, for the sake of consistency with the annual student benefits discussed earlier in this chapter, the table only shows the aggregate increase in state income at the midpoint of the students' careers. As before, these figures must be projected out into the future and discounted to the present before weighing them against the costs. Before doing so, however, we must first turn to the social externalities, as these comprise another key component of the benefits that accrue to the public.

Social externalities

In addition to higher income, education is statistically correlated with a variety of lifestyle changes that generate social savings, also known as external or incidental benefits of education. These social savings represent avoided costs that would have otherwise been drawn from private and public resources absent the education provided by UCA.

It is important to note that calculating social externalities is not a straightforward task of counting actual monies saved. The process is difficult because of the uncertainties about what data to include, what methodologies to employ, and what assumptions to make. Because of this, results should not be viewed as exact, but rather as indicative of the impacts of education on health and well-being.

Data relating education to improved social behavior are available from a variety of sources, including the U.S. Census Bureau, the U.S. Department of Labor, and national studies and surveys analyzing the impacts of substance abuse, crime, and unemployment on society. Data on social costs are also relatively abundant. By combining these data sets, we are able to quantify how education contributes to the lowering of social costs and, ultimately, improves quality of life.

Social benefits break down into three main categories: 1) health savings, 2) crime savings, and 3) welfare and unemployment savings. Health savings include avoided medical costs associated with tobacco and alcohol abuse. Crime savings consist of avoided police, incarceration, prosecution, and victim costs, as well as benefits stemming from the added productivity of individuals who would have otherwise been incarcerated. Welfare and unemployment benefits comprise avoided costs due to the reduced number of social assistance and unemployment insurance claims.

In the model, we quantify the effect of social externalities first 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 at the national level, breaking them out by gender and ethnicity and adjusting them from national to state levels. We then spread the probabilities across the education ladder and multiply the marginal differences by the corresponding CHE production at each step. The sum of these effects counts as the upper bound measure of the number of individuals who, due to the education they received at UCA, will not have poor health, commit crimes, or claim welfare and unemployment benefits.

Of course, there are other influences that impact an individual's behavior, and separating these out from the non-economic benefits of education is a challenging task. For the purpose of this analysis, we dampen the results by the "ability bias" adjustment discussed earlier in this chapter to account for other influences besides education that correlate with an individual's quality of life, such as socioeconomic status and family background.

The final step is to express the results in dollar terms by multiplying them by the associated costs per individual, based on data supplied by national studies and surveys.²¹ These comprise the overall savings to society. Results of the analysis are displayed in Table 2.6. As before (and again for the sake of consistency), only

²¹ For more information on the data and assumptions used in estimating the social externalities, please see Appendix 5 and the resources and references list in Appendix 1.

the estimated savings that occur at the students' career midpoint are shown.

Smoking- and alcohol-related savings amount to \$17.5 million, including avoided social costs 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 alcohol or smoking-induced fires. Since the probability that individuals will manifest poor health habits is greater than the probability that they will be incarcerated or become unemployed, the savings associated with health are also considerably greater.

Crime savings sum to \$683,700. These reflect avoided social costs 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, welfare and unemployment savings amount to \$321,600, stemming from a reduced number of persons in need of income assistance.

All told, avoided social costs for the aggregate 2009-10 student body equal approximately \$18.5 million. These savings accrue for years out into the future, for as long as students remain in the workforce.

Total benefits to the public

By combining our income growth calculations with the social externalities, we are able to estimate the total benefits to the public. To this we apply a reduction factor to account for the students' alternative education opportunities. The assumption is that any benefits generated by students who could have received an education elsewhere, even if UCA and the other publicly funded institutions in the state did not exist, cannot be counted as new benefits to the public.²² For this analysis, we assume an alternative education variable of 25%, meaning that 25% of the student population at UCA would have generated benefits anyway even without the university. For more information on the calculation of the alternative education variable, please see Appendix 7.

²² A situation in which there are no public institutions in the state is virtually impossible. The adjustment is entirely hypothetical and is used merely to examine UCA in standard investment analysis terms by accounting for benefits that would have occurred anyway, even if the university did not exist.

Table 2.6: Aggregate avoided social costs at the career midpoint of UCA students (\$ thousands)

	Total
Health	
Smoking-related savings	\$13,548
Alcohol-related savings	\$3,951
Total health savings	\$17,500
Crime	
Incarceration savings	\$95
Crime victim savings	\$167
Added productivity	\$421
Total crime savings	\$684
Welfare/unemployment	
Welfare savings	\$100
Unemployment savings	\$222
Total welfare/unemployment savings	\$322
Total avoided social costs	\$18,505

Source: EMSI impact model.

We also apply an adjustment called the "shutdown point," which is designed to net out benefits that are not directly linked to the state government costs of supporting the university. As with the alternative education variable, the purpose of this adjustment is to account for benefits that would accrue to the public anyway. To estimate the shutdown point, we apply a sub-model that simulates the students' demand curve for education by reducing state support to zero and progressively increasing student tuition and fees. As student tuition and fees increase, enrollment declines. For UCA, the analysis shows that the university could not operate without state government support, and thus no discount applies. For more information on the theory and methodology behind the estimation of the shutdown point, please see Appendix 4.

Having accounted for the adjustments just described, we discount all benefits to the present using a discount rate of 3%. This yields a present value of \$1.3 billion due to income growth, as indicated in Table 2.7. Also shown is a present value of \$286.2 million due to future savings to the public. Altogether, the present value of all public benefits equals roughly \$1.6 billion.

State government support of UCA also appears in Table 2.7, listed as the present value of total costs. While this is technically correct, it is important to note that, unlike streams of benefits that go on into

Table 2.7: Present value of benefits and costs, social perspective (\$ thousands)

	Total
Present value of future added income	\$1,324,167
Present value of future avoided social costs	\$286,171
Total benefits, present value	\$1,610,338
Total state and local gov't costs, present value	\$58,936
Net present value	\$1,551,403
Benefit/cost ratio	27.3

Source: EMSI impact model.

the future, the state government contribution of \$58.9 million was made in the single reporting year. Its present value and nominal dollar value are thus the same.

Having now defined present values of costs and benefits, the model forms a benefit/cost ratio of roughly 27.3 (= \$1.6 billion worth of benefits ÷ \$58.9 million worth of state government support). Recall that this ratio reflects the measure of all benefits generated regardless of those to whom they may accrue. Students are the beneficiaries of higher income, employers are beneficiaries of lower absenteeism and increased worker productivity, still others are beneficiaries of improved health, and so on. These are widely dispersed benefits that do not necessarily return to taxpayers, who pay costs at full measure. Inasmuch as investors and beneficiaries are not the same individuals, measures common to standard investment analyses such as rate of return, payback period, and net present value no longer apply. From the social perspective, therefore, the benefit/cost ratio should be viewed strictly as a comparison between public benefits and taxpayer costs.

Taxpayer perspective

From the taxpayer perspective, the situation is different, since investors and beneficiaries are one and the same. The pivotal step here is to limit overall public benefits shown in Tables 2.5 and 2.6 to those that specifically accrue to state and local governments. For example, benefits resulting from income growth are limited to increased state and local tax payments. Similarly, savings related to improved health, reduced crime, and fewer welfare and unemployment claims

Table 2.8: Aggregate taxpayer benefits at the career midpoint of UCA students (\$ thousands)

	Total
Added tax revenue	\$8,285
Reduced government expenditures	
Health savings	\$1,050
Crime savings	\$140
Unemployment savings	\$16
Total reduced government expenditures	\$1,206
Total taxpayer benefits	\$9,491

Source: EMSI impact model.

are limited to those received strictly by state and local governments. In all instances, benefits to private residents, local businesses, or the federal government are excluded.

Table 2.8 presents taxpayer benefits at the students' career midpoint. Added tax revenue appears in the first row. These figures are derived by multiplying the income growth figures from Table 2.5 by the prevailing state and local government tax rates in the state. For the social externalities, we claim only those benefits where the demand for government-supported social services is reduced, or where the government benefits from improved productivity among government employees. The total undiscounted value of future tax revenues and avoided social costs at the career midpoint thus comes to approximately \$9.5 million.

Projecting the benefits in Table 2.8 out to the future and then discounting them back to the present gives the time value of all future benefit increments that accrue strictly to state and local governments. Results appear in Table 2.9. As indicated, the future stream of benefits provides an overall asset value of \$143.8 million stemming from a year's support of UCA. Costs, on the other hand, come to only \$58.9 million, equal to the annual contribution of state government to UCA (note that this number is repeated from Table 2.7). In return for their public support, therefore, taxpayers are rewarded with an investment benefit/cost ratio of 2.4 (= \$143.8 million ÷ \$58.9 million), indicating a most profitable investment.

At 7.9%, the rate of return to state and local taxpayers is also favorable. Economists typically assume a 3% rate of return when dealing with government invest-

ments and public finance issues. 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 3% would mean that the university just pays its own way. In principle, governments could borrow monies used to support UCA and repay the loans out of the resulting added taxes and reduced government expenditures. A rate of return of 7.9% on the other hand, means that UCA not only pays its own way, but it also generates a surplus that state and local governments can use to fund other programs. It is unlikely that other government programs could make such a claim.

Note that returns reported in Table 2.9 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 2.9, the 7.9% taxpayer rate of return is a real rate. With an inflation rate of 3.1% (the average rate reported over the past 20 years as per the U.S. Department of Commerce, Consumer Price Index), the corresponding nominal rate of return is 11.1%, substantially higher than what is reported in this analysis.

With and without social benefits

Earlier in this chapter, social benefits attributable to education (reduced crime, lower welfare, lower unemployment, and improved health) are defined as externalities that are incidental to the operations of the university. Some would question the legitimacy of including these benefits in the calculation of rates of return to education, arguing that only direct benefits, *i.e.*, higher income, should be counted. Tables 2.7 and 2.9 are inclusive of social benefits reported here as attributable to UCA. Recognizing the other point of view, Table 2.10 shows rates of return for both the social and taxpayer perspectives exclusive of social benefits. As indicated, returns are still above threshold values (a benefit/cost ratio greater than 1 and a rate of return greater than 3%), confirming that taxpayers receive value from investing in UCA.

Table 2.9: Present value of benefits and costs, taxpayer perspective (\$ thousands)

	Total
Present value of future added tax revenue	\$125,153
Present value of future reduced government expenditures	\$18,648
Total benefits, present value	\$143,801
Total state and local gov't costs, present value	\$58,936
Net present value	\$84,865
Benefit/cost ratio	2.4
Internal rate of return	7.9%
Payback period (no. of years)	15.9

Source: EMSI impact model.

Conclusion

This chapter has shown that UCA is an attractive investment to its major stakeholders—students as well as taxpayers. Rates of return to students invariably exceed alternative investment opportunities. At the same time, taxpayers can take comfort in knowing that

Table 2.10: Social and taxpayer perspectives with and without social externalities (\$ thousands)

	Social perspective with social savings...		Taxpayer perspective with social savings...	
	included	excluded	included	excluded
Net present value	\$1,551,403	\$1,265,231	\$84,865	\$66,217
Internal rate of return	n/a	n/a	7.9%	6.9%
Benefit/cost ratio	27.3	22.5	2.4	2.1
Payback period (no. of years)	n/a	n/a	15.9	18.0

Source: EMSI impact model.

their expenditure of government funds creates a wide range of positive social benefits and, perhaps more importantly, actually returns more to government budgets than it costs. Without these increased tax receipts

and avoided costs provided by UCA education, state and local governments would have to raise taxes to make up for lost revenues and added costs.

CHAPTER 3: ECONOMIC GROWTH ANALYSIS

Introduction

UCA promotes economic growth in the UCA Service Area in a variety of ways. The university is an employer and a buyer of goods and services. In addition, UCA is a primary source of education to area residents and a supplier of trained workers to local industry.

The economic impact of education may be calculated in different ways. The approach we use in this study is to express results in terms of income rather than sales, the more common measurement. The reason for this is that measuring impacts in sales terms does not account for monies that leave the economy, which makes results appear larger than they really are. Income, on the other hand, presents a more accurate picture of the university's actual impacts.

Results of the economic growth analysis are broken down according to the following four effects: (1) the university operations effect, stemming from UCA's payroll and purchases; (2) the student spending effect, due to the spending of students for room and board and other personal expenses; (3) the visitor spending effect, resulting from the expenditures of visitors for lodging, food, transportation, etc.; and, finally, (4) the productivity effect, comprising the income growth that occurs as UCA's former students deepen the economy's stock of human capital.

University operations effect

Nearly all employees of UCA (91%) live in the UCA Service Area. Faculty and staff earnings become part of the region's overall income, while their spending for groceries, apparel, and other household expenditures help support local businesses.

In addition to being an employer, UCA is also a pur-

chaser of supplies and services. Many of UCA's vendors are located in the UCA Service Area, creating a ripple effect that generates additional jobs and income throughout the economy.

Calculating the impacts

The impact of UCA operations is subdivided into the following two main effects: the direct effect and the indirect effect. The direct effect, equal to \$88.1 million, comprises the university's payroll and employee benefits (see Table 3.1). The indirect effect refers to the additional income created in the economy as UCA employees and the university's vendors and contractors spend money in the region to purchase even more supplies and services.

Estimating the indirect effect requires use of a specialized input-output (IO) model that shows the interconnection of industries, government, and households in the area. The factor of change that occurs in a region's industries as a result of economic activity in another industry is most commonly known as the multiplier. In this study, the IO model uses common "data-reduction" techniques to generate multipliers that are similar in magnitude to those of other popular regional IO modeling products, such as the IMPLAN and RIO models. For more information on the EMSI IO model, please see Appendix 3.

To calculate the multiplier effects, we take UCA's payroll and purchases, map them to the 21 top-level industry sectors of the IO model, and adjust them to account for spending that occurs locally.²³ We then run the data through the model's multiplier matrix to estimate how the university's spending affects the output of other industries in the area. Finally, we convert the

²³ We blended data from UCA with information on the local spending patterns of some 200 sample colleges to estimate the percent of university expenditures that occur locally.

Table 3.1: UCA operations effect, 2009-10 (\$ thousands)

	Labor income	Non-labor income	Total	% of Total
Total income in service region	\$20,033,074	\$9,615,308	\$29,648,382	
Direct effect of payroll	\$88,102	\$0	\$88,102	0.3%
Indirect effect	\$13,461	\$6,557	\$20,018	<0.1%
Gross total	\$101,563	\$6,557	\$108,120	0.4%
Adjust for alternative fund uses	-\$19,887	-\$9,663	-\$29,551	<0.1%
Net total	\$81,675	-\$3,106	\$78,569	0.3%

Source: EMSI impact model.

sales figures to income by means of earnings-to-sales and value added-to-sales ratios, also provided by the IO model.

Here a qualification must be made. It has been argued that multiplier effects, such as those just described, overstate net effects. The reason is that while the economy is stimulated and incomes increase, factors of production receiving these increased incomes abandon lower paying next-best opportunities. At some level, low-level jobs may be left undone and unused capital may go to waste; or jobs may be outsourced and capital will be used overseas or elsewhere. The result is that gross multiplier effects need to be reduced to reflect this opportunity cost of taking a newly created job. Accordingly, the model applies a downward adjustment suggested by the literature and discards all but 33% of the indicated indirect impact.

The direct and indirect effects of UCA operations are displayed in Table 3.1. The gross total impact amounts to \$108.1 million, equal to the direct effect of the university's payroll plus the indirect effect of off-campus spending. These monies make up a part of the UCA Service Area's overall gross regional product. The lower section of the table shows the adjustment for alternative use of funds, which we discuss more fully in the following section.

Adjusting for alternative uses of funds

UCA received an estimated 43% of its funding from sources in the UCA Service Area. This funding may have come from students living in the region or from local sales and services. A portion of the state funding received by UCA also originated from local taxpayers.²⁴

²⁴ Local taxpayers must pay state taxes as well, so it is fair to assume that a certain portion of state appropriations received by UCA comes from local sources. The portion of state revenue

Devoting local funds to UCA means that they are not available for other uses, *e.g.*, consumer spending on the part of students or public projects on the part of government. Monies that are injected into the economy on the one hand are thus withdrawn on the other. Because of this, a portion of UCA's impact on the economy cannot be considered as new monies brought to the region.

To determine the "net" impact of UCA operations, we take the estimated portion of UCA funding that originated from local sources and convert it to spending. We then bridge the spending figures to the individual sectors of the IO model, calculate the multiplier effect, and convert the amounts to income. The result, \$29.6 million, allows us to see what impacts would have occurred in the UCA Service Area anyway, even if UCA did not exist. This value is subtracted from the gross effect of UCA to arrive at the true or "net" impact of university operations in the 2009-10 reporting year—a total of \$78.6 million.

Student spending effect

An estimated 41% of UCA's students came from outside the UCA Service Area in the 2009-10 reporting year. Of these students, approximately 37% lived in traditional residential halls and university-owned apartments, and 53% lived in the region but off-campus. The remaining 10% lived outside the region. Average living expenses for students attending UCA appear in Table 3.2.

Based on the figures in Table 3.2, we estimate that the

paid by local taxpayers is derived by applying a ratio of state taxes paid by local workers to total taxes in the state. Tax information is supplied by the U.S. Department of Commerce, Regional Economic Information System (REIS).

Table 3.2: Average annual student living expenses, 2009-10

Spending item	Total
Room and board	\$4,880
Personal expenses	\$2,360
Transportation	\$3,100
Total expenses per student (actual value)	\$10,340

Source: Data supplied by UCA.

Table 3.3: Off-campus spending of non-local students, FY 2009-10

	Total
Number of out-of-region students	6,422
Number of students who live in region but off-campus	3,396
Average living expenses per student	\$10,340
Total gross spending	\$35,114,600
Less wages paid to out-of-region students	\$975,700
Less leakage	\$11,334,500
Total net spending	\$22,804,400

Source: Derived from data supplied by UCA and outputs of the EMSI impact model.

UCA's Residential Colleges Help Freshmen Transition to University Life

Residential Colleges encompass both the social and academic aspects of a student's first year in college. These programs—targeted at freshmen—make additional resources available to students to help them make the often difficult transition to university life. Students take classes together and participate in social and civic activities. Full-time UCA faculty members live in each Residential College to help serve as mentors as well as assist with homework. The new STEM Residential College, the first in the state, provides a living/learning environment that fosters the academic success of students pursuing studies in science, technology, computer science, pre-engineering, and mathematics. Residential College students have a 10% higher graduation rate when compared to students who did not live in a Residential College their freshmen year.

gross (*i.e.*, unadjusted) off-campus spending generated by out-of-region students in FY 2009-10 was \$35.1 million. This appears in the fourth row of Table 3.3. Note that the \$35.1 million does not include room and board expenses for students living on campus, nor does it include expenses for books, supplies, and equipment. Many of these monies are paid to the university and are thus already reflected in the operations effect discussed in the previous section. We also exclude the expenses of online students and in-commuters, as these students spend very little in the region compared to students who live in the UCA Service Area.

The bottom section of Table 3.3 displays the net spending of off-campus students, a total of \$22.8 million. We arrive at this figure by discounting the students' gross spending to account for wages paid to out-of-region students who work on campus. This is because student wages and their associated impacts are captured in the operations effect, so they must be excluded to avoid double-counting. We further adjust the off-campus spending to account for monies that leak from the trade sector.²⁵

Estimating the impacts generated by the \$22.8 million in net off-campus student spending follows a procedure similar to that of the operations effect described above. We begin with the direct effect, which we calculate by mapping the \$22.8 million in sales to the industry sectors in the IO model, and then converting them to income through the application of earnings-to-sales and value added-to-sales ratios.

The indirect effect comprises the additional income that is created as the businesses patronized by UCA students also spend money in the region. We derive this effect by running the net sales figure through the multiplier matrix, and again applying earnings-to-sales and value added-to-sales ratios from the IO model to convert the results to income.

²⁵ In arranging data for inclusion in the impact model, only the trade margin is allocated to the trade sector. Modelers customarily assume a 25% mark-up. Accordingly, an item with a retail selling price of \$100 but costing the retailer \$80 will enter the economic model as \$20 (= \$80 × 25%) to the retail trade sector, and \$80 to the manufacturer of the item. If the manufacturer is located outside the region, only the \$20 trade margin is added: in this case the \$80 is spending that is said to “leak” from the regional economy.

Table 3.4: UCA student spending effect, 2009-10 (\$ thousands)

	Labor income	Non-labor income	Total	% of Total
Total income in service region	\$20,033,074	\$9,615,308	\$29,648,382	
Direct effect	\$6,427	\$8,467	\$14,894	<0.1%
Indirect effect	\$1,764	\$969	\$2,733	<0.1%
Total	\$8,191	\$9,436	\$17,628	<0.1%

Source: EMSI impact model.

Summing together the direct and indirect effect yields a total of \$17.6 million in added income generated in the UCA Service Area due to the spending of out-of-region students. This result is presented in Table 3.4.

Visitor spending effect

Each year, UCA draws thousands of visitors who attend the events and activities hosted by the university. Visitors come to tour the campus, participate in conferences and seminars, listen to lectures and presentations, and attend commencement. Based on information provided by UCA, approximately 125,400 visitors came to the university in FY 2009-10. While the majority of these visitors were local residents, an estimated 6,300 of them were from outside the UCA Service Area.

Table 3.5 presents the average daily expenditures of out-of-region visitors for lodging, eating and drinking, transportation, retail, and other personal expenses. These data are estimates based on information supplied by UCA, broken out into two types of visitors—those who stay overnight and those who come for a day trip. The assumption is that visitors who travel longer distances are likely to stay for longer durations and spend more on travel, food, and other personal expenses, while those within driving distance are more likely to come to the region and leave on the same day.

Based on these figures, we estimate that the total sales generated by visitor spending in FY 2009-10 was \$700,500, net of monies paid to the university for ticket sales, gifts and souvenirs, and food.

Calculating the net increase in regional income as a result of visitor spending requires use of the IO model. As before, we begin by discounting the gross sales figures to account for leakage in the trade sector

Table 3.5: Average daily expenditures of non-local visitors, FY 2009-10

Spending item	Over-night	Day trippers
Lodging	\$87	\$0
Eating and drinking	\$43	\$43
Retail	\$40	\$10
Other personal expenses	\$50	\$50
Daily rate	\$220	\$103

Source: Derived from data supplied by UCA.

UCA Athletics Carry "Bear Pride" for Local Community

The UCA Bears participate in 17 NCAA Division I varsity sports. As a member of the Southland Conference, UCA competes against schools from Texas and Louisiana. The various teams have a winning tradition that carries Bear pride for the entire community. The football team has won more national football championships than any other college in Arkansas. The women's volleyball team is a four-time Academic Achievement Award winner and was the 2009 Southland Conference Champion. Also in 2009, on the basketball court, the Sugar Bears accomplished the biggest turnaround in Southland Conference history, finishing 21-8.

and bridging the net figures to the sectors of the IO model. We then convert the sales figures to income to arrive at the direct effect, and run the net sales figures through the multiplier matrix to arrive at the indirect effect. With this methodology, we estimate that the net impact of visitor spending on regional income amounted to \$378,300 in FY 2009-10 (see Table 3.6).

Table 3.6: Visitor spending effect, FY 2009-10 (\$ thousands)

	Labor income	Non-labor income	Total	% of Total
Total income in service region	\$20,033,074	\$9,615,308	\$29,648,382	
Direct effect	\$219	\$86	\$306	<0.1%
Indirect effect	\$47	\$26	\$73	<0.1%
Total	\$266	\$112	\$378	<0.1%

Source: EMSI impact model.

Productivity effect

UCA's impact on the economy is most prevalent in its capacity to provide education, skills training, and career enhancement opportunities to area residents. Since UCA was established, students have studied at the university and entered the workforce, bringing with them the skills they acquired while in attendance. Over time, the skills of former UCA students have accumulated, steadily increasing the training level and experience of the UCA Service Area workforce.

As the skills embodied by former UCA students stockpile, a chain reaction occurs in which higher student incomes generate additional rounds of consumer spending, while new skills and training translate to increased business output and higher property income, causing still more consumer purchases and regional multiplier effects. The sum of all these direct and indirect effects comprises the total impact of student productivity on regional income.

Should UCA cease to exist, former students who remain actively engaged in the workforce would continue to contribute to the economic growth of the region through their added skills. This is what sets the productivity effect apart from the effect of university operations, which would disappear immediately, should UCA hypothetically need to shut down. Without replenishment, however, the supply of UCA skills in the workforce would gradually dissipate over time, and the student productivity effects would disappear along with it.

Calculating the direct effect

Assigning a dollar value to the direct effect of student productivity requires an estimation of the number of UCA skills still active in the workforce, with CHEs serving as a proxy for skills. To calculate this, we begin with the historical student headcount at the university

UCA Helps Conway Become Cultural Hotspot

For a considerable number of University of Central Arkansas alumni, Conway is more than a place to visit every once in a while after graduating. It's become, over the last 20 years, a burgeoning community where many graduates have settled.

Conway's population has more than doubled since 1990, from 26,481 to 58,908. Fueling the growth has been an influx of jobs for UCA graduates at the local Hewlett-Packard site, Acxiom Corp., and other businesses. But that's not all; a revitalized cultural scene has also played a part in Conway's boom.

"The university offers so many entertainment and intellectual and athletic opportunities for people to stay here," said Shelley Mehl, UCA's Vice President for Advancement and President of the UCA Foundation, Inc.

She mentioned just a few of the recent events—a Broadway series and talks by writer/producer Spike Lee and renowned author Nicholas Sparks—to highlight the opportunities available to Conway residents. "That's a part of what's so appealing to living here in Conway," Mehl said. "All those things are open to general citizens. You really get to see and meet these people."

Dr. Lance Grahn came to UCA to become Provost and Vice President for Academic Affairs three years ago after spending nearly 20 years at two Wisconsin institutions. Since he arrived, Grahn said he has been blown away by the thriving culture.

"In terms of cultural events, we have more going on than I've ever seen, for a population of this size," Grahn said.

(both completers and non-completers) over the past 30-year period, from the 1980-81 reporting year to the 2009-10 reporting year.²⁶

Of course, not all students remain in the workforce until retirement age, nor do all students enter the workforce immediately upon exiting the university. Other students leave the UCA Service Area and find employment outside the region. In the model, we adjust for these factors by applying yearly attrition rates derived from the probability that individuals will die, retire, or become unemployed over the course of their working careers. To these we combine migration data supplied by the university and the U.S. Census Bureau to estimate the number of students who leave the UCA Service Area over time. This allows us to estimate the net number of UCA completers and non-completers who were still active in the UCA Service Area workforce in the 2009-10 reporting year.

The next step is to multiply the net number of former students who are still working in the UCA Service Area by the average number of CHEs achieved per student per year (see Table 1.3). Using this methodology, the estimated number of UCA CHEs in the regional workforce comes to 2 million (see the top row of Table 3.7). These are the CHEs that accumulated in the workforce over the past 30-year period and that were still active in the 2009-10 reporting year.

Recall from Chapter 2 that we reduce the benefits to taxpayers by the estimated amount of benefits that would have occurred anyway even if the publicly funded training providers in the state did not exist. We apply the same adjustment here, reducing the gross number of active CHEs by 25%. This yields a net of 1.5 million CHEs that are currently embodied by former UCA students in the regional workforce.

The second half of Table 3.7 demonstrates how we arrive at the direct labor income added to the regional economy due to UCA's historical CHE production. This is a simple calculation that begins by taking the average value per CHE from Table 2.2 (\$222) and multiplying it by the 1.5 million CHEs in the workforce. This yields a gross value of \$330.1 mil-

²⁶ Where historical enrollment data were not available, we projected the numbers backward based on the average annual change in headcount.

Table 3.7: Number of UCA CHEs still active in regional workforce and direct added labor income (thousands)

	Total
Number of CHEs in workforce, gross	1,978
Number of CHEs in workforce, net of 25% adjustment for alternative education opportunities	1,488
Direct labor income†	\$330,139
Adjust for substitution effects	50%
Direct labor income, net	\$165,069
Direct non-labor income	\$88,385
Total direct income	\$253,454

* Numbers may not add due to rounding.

† Equal to 1,488 CHEs × \$222 value per CHE from Table 2.2.

Source: EMSI impact model.

lion in added labor income. We then adjust this figure downward by 50% to account for substitution effects, *i.e.*, the substitution of out-of-area workers for in-area workers.²⁷ The reason for this is that if UCA did not exist and there were fewer skilled workers in the region, businesses could still recruit and hire some of their employees from outside the UCA Service Area. With the 50% adjustment, the net labor income added to the economy thus comes to \$165.1 million, as shown in Table 3.7.

But there is more. Added to the direct effect on labor income is another \$88.4 million in non-labor income, representing the higher property values and increased investment income stemming from the direct income of students and enhanced productivity of the businesses that employ them. Non-labor income attributable to past student skills is obtained by disaggregating higher student income to the industrial sectors of the IO model and multiplying it by the associated value added-to-earnings ratios.²⁸ Summing labor and non-labor income together gives a direct effect of past student productivity equal to approximately \$253.5 million in 2009-10.

²⁷ The 50% adjustment is an assumption—there is no way to determine precisely how many workers could have been recruited from outside the region if UCA did not exist. For a sensitivity analysis of the substitution variable, please see Chapter 4.

²⁸ There are twenty-one top-level industry sectors in the EMSI IO model. Disaggregating direct student earnings in this fashion avoids aggregation error. See chapter 5 in Ron Miller and Peter Blair, *Input-Output Analysis: Foundations and Extensions* (Englewood Cliffs, NJ: Prentice Hall, 1985).

UCA Makes Mark with Health and Allied Sciences

In Little Rock, Conway, and the other cities that comprise central Arkansas, there is a flourishing health care community in the fast-growing region that is supported by the University of Central Arkansas.

Many graduates from UCA's College of Health and Behavioral Sciences—and also the College of Natural Sciences and Mathematics—move into health fields in the Conway area or move to the University of Arkansas for Medical Sciences (UAMS) in Little Rock, which supports 12 regional hospitals.

"UCA has the ability to feed a lot of the professionals [for those hospitals]," said Conway Chamber of Commerce President and CEO Brad Lacy, adding that the university has done "an exceptional job in the past 20 years in health sciences."

Dr. Lance Grahn, Provost and Vice President for Academic Affairs, said students in the state who want to pursue physical therapy, occupational therapy, and other similar fields have two options: UCA or UAMS. "In terms of particular things that characterize UCA," Grahn said, "we certainly are one of the premier universities in terms of health and allied sciences."

Approximately 50% of first-year pharmacy students at the state medical school come from UCA, and many of these postgraduate students come from UCA's chemistry department (or other departments in the College of Natural Sciences and Mathematics).

In February 2011, UCA and Conway Regional Health System announced plans for a healthcare education center that will address healthcare education needs of the hospital staff, academic programs at UCA, and the citizens of Conway and the region.

Calculating the indirect effect

Economic growth stemming from a skilled workforce does not stop with the direct effect. To calculate the indirect effect, the model allocates increases in regional income to specific industrial sectors and augments these to account for both demand-side and supply-side multiplier effects. Demand-side effects refer to the increased demand for consumer goods and services

as the higher incomes of skilled workers and their employers are spent in the local economy. For example, the increased output of businesses is associated with an increased demand for inputs, which in turn produces a set of regional economic multiplier effects that are all captured as part of demand-side indirect effects. In the model, these are estimated by converting higher student income into direct increased industry sales, running these through an indirect multiplier matrix, and converting them to regional income by applying earnings-to-sales and value added-to-sales ratios supplied by the regional IO model.

Supply-side effects occur through a process of "cumulative causation," or "agglomeration," whereby growth becomes in some degree self-perpetuating. The presence of one industry, for example, attracts other industries that use the first industry's outputs as inputs, which produces subsequent rounds of industry growth, and so on.²⁹ To estimate agglomeration effects, the model converts the direct income of past students to industry value added and applies this to a set of supply-driven multipliers provided by the regional IO model. To increase the plausibility of this assumption, the model applies only direct effects associated with industries in the highest stages of development.³⁰

The sum of demand-side and supply-side effects constitutes the indirect effect of UCA education, equal to \$50.7 million of all labor income and approximately \$25.3 million of all non-labor income (Table 3.8). Adding these to the direct effects of student productivity yields a grand total of \$329.5 million in added income attributable to the accumulation of UCA skills in the regional workforce. This figure appears in the bottom row of Table 3.8.

29 For a more complete discussion of agglomeration and cumulative causation, see Masahisa Fujita, Paul Krugman, and Anthony Venables, *The Spatial Economy: Cities, Regions, and International Trade* (Cambridge: Massachusetts Institute of Technology, 1999).

30 Parr (1999) describes the following four stages of economic development: primary production, process manufacturing, fabricative manufacturing, and producer services and capital export. The model applies "development scores" to Parr's stages, *i.e.*, low scores for lower stage sectors and higher scores for higher development sectors. Only those industries with the highest scores are applied to the supply-driven multipliers of the IO model. For additional detail on the use of this approach for classifying industries by industrial stage, see Rutgers *et al.*, 2002.

Table 3.8: UCA student productivity effect, 2009-10 (\$ thousands)

	Labor income	Non-labor income	Total	% of Total
Total income in service region	\$20,033,074	\$9,615,308	\$29,648,382	
Direct effect	\$165,069	\$88,385	\$253,454	0.9%
Indirect effect	\$50,725	\$25,327	\$76,053	0.3%
Total	\$215,795	\$113,712	\$329,507	1.1%

Source: EMSI impact model.

Table 3.9: UCA total effect, 2009-10 (\$ thousands)

	Total	% of Total
Total income in service region	\$29,648,382	
University operations effect	\$78,569	0.3%
Student spending effect	\$17,628	<0.1%
Visitor spending effect	\$378	<0.1%
Student productivity effect	\$329,507	1.1%
Total	\$426,082	1.4%

Source: EMSI impact model.

Note that the \$329.5 million omits the effect of educated workers on innovation and technical progress. This effect is generally labeled as “external” because it is uncertain in nature and spills beyond businesses employing skilled workers. For this reason it is excluded from the analysis. To the extent there are such effects, and theory suggests that there are, the overall results can be considered conservative.

Conclusion

Table 3.9 displays the grand total of UCA’s impact on the UCA Service Area in 2009-10, including the university operations effect, the student spending effect, the visitor spending effect, and the student productivity effect.

These results demonstrate several important points. First, UCA promotes regional economic growth through its own operations spending and through the increase in productivity as former UCA students remain active in the regional workforce. Second, the student productivity effect is by far the largest and most important impact of UCA, stemming from higher incomes of students and their employers. And third, regional income in the UCA Service Area would be substantially lower without the educational activities of UCA.

UCA Helps Spur Local Economic Development

UCA has played a key role in the expansion of the town 30 miles north of Little Rock. Prominent companies have either relocated to Conway or blossomed there, and city officials insist that wouldn’t have been possible without the presence of UCA and the steady flow of skilled workers it produces.

One shining example is Hewlett-Packard, which settled on Conway two years ago for a shared services center that employs nearly 1,400. When HP visited the city during the site selection process, the firm was enamored by the region’s educated labor pool and Technology Park, where it eventually settled.

“Obviously something that was attractive to [HP] was the young, well-educated workforce,” said Brad Lacy, President and CEO of the Conway Chamber of Commerce and Conway Development Corporation. HP is now part of a large tech sector in Conway that includes Acxiom Corp., an IT and business intelligence firm that has built its local workforce to roughly 2,000 workers. In Acxiom’s case, Lacy again credits UCA for supplying a “pipeline of educated students they could hire.”

“UCA is a huge economic engine by itself,” said Tab Townsell, who has been Conway’s mayor since 1998. “Just its presence here—its budget, its community. The students and faculty who come here to live or come here to teach and earn a living [make a big impact].”

CHAPTER 4: SENSITIVITY ANALYSIS

Introduction

This study concludes with a sensitivity analysis of some key variables on both the student and taxpayer investment sides. The purpose of the sensitivity analysis is to set the approach apart from “advocacy” education impact analyses that promote education. These studies often use assumptions that do not stand up to rigorous peer scrutiny and generate results that overstate benefits. The approach here is to account for relevant variables in calculating benefits and costs as reflected in the conservatively estimated base case assumptions laid out in Chapters 2 and 3.

The sensitivity tests include the following: a) the impacts associated with changes in the student employment variables for the investment analysis, b) the sensitivity of results associated with the alternative education variable, and c) the sensitivity of results associated with the substitution variable.

Student employment variables

Student employment variables are difficult to estimate either 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 employed, and 2) of those employed, what percentage they earn relative to earnings they would

have received if they were not attending UCA. Both employment variables relate to earnings forgone by students, *i.e.*, the opportunity cost of time; and they affect the investment analysis results (net present value, rate of return, benefit/cost ratio, and payback period).

Percent of students employed

Students incur substantial expense by attending UCA 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 50% of students who reported their employment status are employed, based on data provided by UCA. This variable is tested in the sensitivity analysis by changing it first to 100% and then to 0%.

Percent of earnings relative to full earnings

The second opportunity cost variable is more difficult to estimate. For UCA, it is estimated that students working while attending classes earn only 55%, on average, of the earnings they would have statistically received if not attending UCA. This suggests that many students hold part-time jobs that accommodate their UCA attendance, though it is at an additional cost in terms of receiving a wage that is less than what they might otherwise make. The model captures these differences and counts them as part of the opportunity cost of time. As above, this variable is tested in the sensitivity analysis by changing the assumption to 100% and then to 0%.

Table 4.1: Sensitivity analysis of UCA student perspective

Variables	Rate of Return	Benefit/Cost	Payback
Base case: A = 50%, B = 55%	14.4%	5.3	10.7
Scenario 1: A = 100%, B = 55%	15.8%	6.2	9.9
Scenario 2: A = 50%, B = 100%	16.2%	6.5	9.7
Scenario 3: A = 100%, B = 100%	21.9%	11.2	7.6
Scenario 4: A = 0%, B = 0%	13.2%	4.6	11.5

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

Results

The changed assumptions generate results summarized in Table 4.1 on the previous page, 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 50% and B equal to 55%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases A to 100% while holding B constant, Scenario 2 increases B to 100% while holding A constant, Scenario 3 increases both A and B to 100%, and Scenario 4 decreases both A and B to 0%.

Scenario 1: Increasing the percent of students employed (A) from 50% to 100%, the rate of return, benefit/cost ratio, and payback period results improve to 15.8%, 6.2, and 9.9 years, 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 55% to 100%, the rate of return, benefit/cost ratio, and payback period results improve to 16.2%, 6.5, and 9.7 years, respectively, relative to base case results—a strong improvement, again attributable to a lower opportunity cost of time.

Scenario 3: Increasing both assumptions A and B to 100% simultaneously, the rate of return, benefit/cost ratio, and payback period results improve yet further to 21.9%, 11.2, and 7.6 years, 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 rate of return, benefit/cost ratio, and payback period results to 13.2%, 4.6, and 11.5 years, respectively, relative to base case results. These results

are reflective of an increased opportunity cost—none of the students are employed in this case.³¹

It is strongly emphasized in this section that base case results are very attractive in that results are all above their threshold levels, and payback periods are short. As is clearly demonstrated here, results of the first three alternative scenarios appear much more attractive, although they overstate benefits. Results presented in Chapter 2 are realistic, indicating that investments in UCA generate excellent returns, well above the long-term average percent rates of return in stock and bond markets.

Alternative education variable

The alternative education variable (25%) is characterized as a “negative benefit” used to account for students who can obtain a similar education elsewhere absent the publicly funded training providers in the state. Given the difficulty in accurately specifying the alternative education variable, the obvious question is the following: how great a role does it play in the magnitude of the results?

Variations in the alternative education assumption are calculated around base case results listed in the middle column of Table 4.2. Next, the model brackets the base case assumption on either side with a plus or minus 17%, 33%, and 50% variation in assumptions. Analyses are then redone introducing one change at a time, holding all other variables constant. For example, an increase of 17% in the alternative education assumption (from 25% to 29%) reduces the taxpayer perspective rate of return from 7.9% to 7.6%. Likewise, a decrease of 17% (from 25% to 21%) in the assumption increases the rate of return from 7.9% to 8.3%.

Based on this sensitivity analysis, the conclusion can be drawn that UCA investment analysis results from the

Table 4.2: Sensitivity analysis of alternative education variable, taxpayer perspective (\$ millions)

	-50%	-33%	-17%	Base Case	17%	33%	50%
Alternative education variable	12%	17%	21%	25%	29%	33%	37%
Net present value	\$108.5	\$100.6	\$92.8	\$84.9	\$77.0	\$69.1	\$61.2
Rate of return	8.9%	8.6%	8.3%	7.9%	7.6%	7.2%	6.8%
Benefit/cost ratio	2.8	2.7	2.6	2.4	2.3	2.2	2.0
Payback period (years)	14.6	15.0	15.4	15.9	16.4	17.0	17.6

Table 4.3: Sensitivity analysis of substitution variable on student productivity (\$ millions)

	-50%	-33%	-17%	Base Case	17%	33%	50%
Substitution variable	25%	33%	42%	50%	58%	67%	75%
Student productivity effect	\$164.8	\$219.7	\$274.6	\$329.5	\$384.4	\$439.3	\$494.3
Total effect	\$261.3	\$316.2	\$371.2	\$426.1	\$481.0	\$535.9	\$590.8
Percent of regional income	0.9%	1.1%	1.3%	1.4%	1.6%	1.8%	2.0%

taxpayer perspective are not very sensitive to relatively large variations in the alternative education variable. As indicated, results are still above their threshold levels (net present value greater than 0, benefit/cost ratio greater than 1, and rate of return greater than the discount rate of 3%) even when the alternative education assumption is increased by as much as 50% (from 25% to 37%). The conclusion is that although the assumption is difficult to specify, its impact on overall investment analysis results for the taxpayer perspective is not very sensitive.

Substitution variable

The substitution variable only affects the student productivity calculation in Table 3.8. In the model we assume a substitution variable of 50%, which means that we claim only 50% of the direct labor income generated by increased worker productivity. The other 50% we assume would have occurred even if UCA did not exist. This is because, if there were no UCA students to hire, some businesses could have recruited similarly qualified individuals from outside the region.

Table 4.3 presents the results of the sensitivity analysis for the substitution variable. As above, the assumption increases and decreases relative to the base case of 50% by the increments indicated in the table. Impacts on the results are more pronounced. Student productivity effects attributable to UCA, for example, range from a

high of \$494.3 million at 50% to a low of \$164.8 million at a -50% variation from the base case assumption for this variable. This means that if the substitution variable were to decrease, the number of benefits that we claim also decreases; hence, the income attributable to UCA decreases accordingly.

It is important to note that, even under the most conservative assumptions, the total effect of UCA—including the effects of university operations, student spending, visitor spending, and student productivity—still remains a sizeable factor in the UCA Service Area economy. The university operations effect, student spending effect, and visitor spending effect are kept constant for this sensitivity analysis, so the variations in the total effect are caused solely by the changes to student productivity in the second row. The last row of the table shows the percent of total regional income that is attributable to UCA and its students.

Conclusion

The results of this study demonstrate that UCA is a sound investment from multiple perspectives. The university enriches the lives of students and increases their lifetime incomes. It benefits taxpayers by generating increased tax revenues from an enlarged economy and reducing the demand for taxpayer-supported social services. Finally, it contributes to the vitality of both the local and state economies.

APPENDIX 1: RESOURCES AND REFERENCES

- Becker, Gary S. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York: Columbia College Press for NBER, 1964.
- Bils, M. and P.J. Klenow. "Does Schooling Cause Growth?" *American Economic Review* 90, no. 5 (2000): 1160–1183.
- The College Board. "Trends in College Pricing, 2008." The College Board, *Trends in Higher Education*, 2008.
- Borts, G.H. and J.L. Stein. *Economic Growth in a Free Market*. New York: Columbia College Press, 1964.
- Drake, R.L. "A Shortcut to Estimates of Regional Input-Output Multipliers: Methodology and Evaluation." *International Regional Science Review* 1, no. 2 (Fall 1976).
- Economic Modeling Specialists, Inc. Labor market data and software.
- Fujita, Masahisa, Paul Krugman, and Anthony Venables. *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge: Massachusetts Institute of Technology, 1999.
- Governor's Office of Planning and Budget, Demographic and Economic Analysis Section, and Consulting Economists. "The Base Period 1992 Utah Multiregional Input-Output (UMRIO-92) Model: Overview, Data Sources, and Methods." Utah State and Local Government Fiscal Impact Model, Working Paper Series 94-1. Salt Lake City, UT: Demographic and Economic Analysis (DEA), June 1994.
- Hamilton, J.R., N.K. Whittlesey, M.H. Robison, and J. Ellis. "Economic Impacts, Value Added and Benefits in Regional Project Analysis." *American Journal of Agricultural Economics* 31, no. 2 (1991): 334–344.
- Harlow, Caroline Wolf. *Education and Correctional Populations*, NCJ 195670. Washington, DC: US Department of Justice, Bureau of Justice Statistics, January 2003.
- Henderson, James M. and Richard E. Quandt. *Microeconomic Theory: A Mathematical Approach*. New York: McGraw-Hill Book Company, 1971.
- Internal Revenue Service. SOI Tax Stats—County-to-County Migration Data, annual.
- Kirsanova, Tatiana and James Sefton. *A Comparison of National Savings Rates in the UK, US and Italy*. London: National Institute of Economics and Social Research, July 2006.
- Lee, Valerie *et al.* "Persistence to the Baccalaureate Degree for Students Who Transfer from Community College." *American Journal of Education*, 102, no. 1 (November 1993): 80-114.
- Leoniso, Michael. "The Economics of Retirement: A Nontechnical Guide." Division of Economic Research, Office of Research, Statistics and Evaluation, Social Security Administration. *Social Security Bulletin*, 59, no. 4 (Winter 1996).
- Losch, August. *The Economics of Location*. Translated by W.H. Woglom and W.F. Stolper. New Haven: Yale College Press, 1954.
- Miller, Ron and Peter Blair. *Input-Output Analysis: Foundations and Extensions*. Englewood Cliffs, NJ: Prentice Hall, 1985.

- Miller, Ted R., Mark A. Cohen, and Brian Wiersema. *Victim Costs and Consequences: A New Look*, Research Report series, NCJ 155282. Washington, DC: U.S. Department of Justice, National Institute of Justice, January 1996.
- Mincer, Jacob. "Investment in Human Capital and Personal Income Distribution." *Journal of Political Economy* 66, no. 4 (August 1958): 281–302.
- Mincer, Jacob. *Schooling, Experience and Earnings*. New York: National Bureau of Economic Research, 1974.
- Molitor, Chris and Duane Leigh. "Estimating the Returns to Schooling: Calculating the Difference Between Correlation and Causation." Pullman, WA: by the authors, March 2001.
- Morgan, James and Edward Robb. "The Impact of Age upon Interregional Migration." *The Annals of Regional Science*, 15, no. 3 (November 1981).
- National Center for Education Statistics. "Adult Education Participation in 2004-5." Table 9, "Number and percentage of adults who took English as a Second Language classes, by type of provider, 2004-05." http://nces.ed.gov/pubs2006/adulted/tables/table_9.asp (accessed August 2009).
- . Digest of Education Statistics. Table 356, "Participants in adult basic and secondary education programs, by type of program and state or jurisdiction. Selected fiscal years, 1990 through 2005." http://nces.ed.gov/programs/digest/d07/tables/dt07_356.asp (accessed August 2009).
- National Institutes of Health. National Institute on Alcohol Abuse and Alcoholism. "Drinking status (in percents) of men and women by selected demographics: NHIS, 1990." <http://www.niaaa.nih.gov/Resources/DatabaseResources/QuickFacts/AlcoholConsumption/dkpat11.htm> (accessed June 2009).
- . "Estimated economic costs of alcohol abuse in the United States, 1992 and 1998." <http://www.niaaa.nih.gov/Resources/DatabaseResources/QuickFacts/EconomicData/cost8.htm> (accessed June 2009).
- Parr, J.B. "Regional Economic Development: An Export-Stages Framework," *Land Economics* 77, no. 1 (1999): 94–114.
- Robison, M.H. "Community Input-Output Models for Rural Area Analysis: With an Example from Central Idaho." *Annals of Regional Science* 31, no. 3 (1997): 325–351.
- , R. Coupal, N. Meyer, and C.C. Harris. *The Role of Natural-Resource-Based Industries in Idaho's Economy*. College of Idaho, College of Agriculture Bulletin 731. Moscow, ID: College of Idaho, College of Agriculture, 1991.
- . "The Oregon Economic Modeling System (OREMS): A Tool for Analyzing Changes in Jobs, Incomes, and the Spatial Structure of the Oregon Economy." Missoula, MT: 29th Annual Pacific Northwest Economic Conference, May 1995.
- Rutgers, State College of New Jersey, *et al.* "The Impact of EDA RLF Loans on Economic Restructuring." Paper prepared for U.S. Department of Commerce, Economic Development Administration. New Brunswick: Rutgers State College of New Jersey, 2002.
- Stephan, James J. *State Prison Expenditures, 2001*, NCJ 202949. Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, June 2004.
- Stevens, B.H., G.I. Treyz, D.J. Ehrlich, and J.R. Bower. "A New Technique for the Construction of Non-Survey Regional Input-Output Models." *International Regional Science Review* 8, no. 3 (1983): 271–186.

- U.S. Census Bureau. "Census 2000, County-To-County Worker Flow Files." <http://www.census.gov/population/www/cen2000/commuting/index.html>.
- . "Educational Attainment in the United States: 2008." Table 1, "Educational Attainment of the Population 18 Years and Over, by Age, Sex, Race, and Hispanic Origin: 2008." <http://www.census.gov/population/www/socdemo/education/cps2008.html> (accessed June 2009).
- . "Educational Attainment in the United States: 2008." Table 2, "Educational Attainment of the Population 25 Years and Over, by Selected Characteristics: 2008." <http://www.census.gov/population/www/socdemo/education/cps2008.html> (accessed June 2009).
- . Federal, State, and Local Governments. State and Local Government Finances. <http://www.census.gov/govs/estimate/>
- . Housing and Household Economic Statistics Division. Historical Income Tables.
- . The 2009 Statistical Abstract. "Social Insurance & Human Services: Employee Benefits, Government Transfer Payments, Social Assistance." http://www.census.gov/compendia/statab/cats/social_insurance_human_services/employee_benefits_government_transfer_payments_social_assistance.html (accessed June 2009).
- . The 2009 Statistical Abstract. "Social Insurance & Human Services: Food Programs." http://www.census.gov/compendia/statab/cats/social_insurance_human_services/food_programs.html (accessed June 2009).
- . The 2009 Statistical Abstract. "Social Insurance & Human Services: Supplemental Security Income, Temporary Assistance to Needy Families." http://www.census.gov/compendia/statab/cats/social_insurance_human_services/supplemental_security_income_temporary_assistance_to_needy_families.html (accessed June 2009).
- U.S. Department of Health and Human Services, Administration for Children & Families. Table 17, "Percent distribution of TANF adult recipients by education level, October 1997 - September 1998." http://www.acf.hhs.gov/programs/ofa/character/FY98/tab17_98.htm (accessed June 2009).
- . Table 19. "Percent distribution of TANF adult recipients by work exemption status, October 1997 - September 1998." http://www.acf.hhs.gov/programs/ofa/character/FY98/tab19_98.htm (accessed June 2009).
- . Table 20, "Percent distribution of TANF adult recipients by employment status, October 1997–September 1998." http://www.acf.hhs.gov/programs/ofa/character/FY98/tab20_98.htm (accessed June 2009).
- . Table 21, "TANF adult recipients by type of non-TANF income, October 1997 - September 1998." http://www.acf.hhs.gov/programs/ofa/character/FY98/tab21_98.htm (accessed June 2009).
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention & Health Promotion, Behavioral Risk Factor Surveillance System. Prevalence and Trends Data. Alcohol Consumption-2007. "Heavy drinkers (adult men having more than two drinks per day and adult women having more than one drink per day)." <http://www.cdc.gov/brfss/> (accessed November 2008).
- . National Center for Chronic Disease Prevention & Health Promotion, Behavioral Risk Factor Surveillance System. Prevalence and Trends Data. Tobacco Use - 2008. "Adults who are current smokers." <http://apps.nccd.cdc.gov/brfss/list.asp?cat=TU&yr=2008&qkey=4396&state=All> (accessed June 2009).

- . National Center for Health Statistics. United State Life Tables, 2004. *National Vital Statistics Reports*, 56, no. 9 (December 28, 1007).
- . National Health Interview Survey. Health, United States 2007. Table 64, “Age-adjusted prevalence of current cigarette smoking among adults 25 years of age and over, by sex, race, and education level: United States, selected years 1974-2006.” www.cdc.gov/nchs/hus.htm. (accessed November 2008).
- . “Tobacco Use Among Adults --- United States, 2005.” *Morbidity and Mortality Weekly Report*, 55, no. 42 (October 27, 2006): 1145-1148.
- U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics. “Correctional Populations in the United States - Statistical Tables.” <http://www.ojp.usdoj.gov/bjs/abstract/cpusst.htm> (accessed June 2009).
- . Criminal Sentencing Statistics. <http://www.ojp.usdoj.gov/bjs/sent.htm> (accessed June 2009).
- U.S. Department of Labor, Bureau of Labor Statistics. Consumer Price Index.
- . “Unemployment and age, January 2008.” <http://www.bls.gov/opub/ted/2008/feb/wk1/art02.htm> (accessed August 2009).
- U.S. Department of the Treasury. “The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation.” *Report-3113*, March 1998.
- Willis, Robert J. “Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions.” In *Handbook of Labor Economics*, Vol. 1. Edited by Kenneth J. Arrow and Michael D. Intriligator. Amsterdam: Elsevier Science Publishers, 1986: 525-602.

APPENDIX 2: GLOSSARY OF TERMS

- Alternative education** A “with” and “without” measure of the percent of students who would still be able to avail themselves of education absent the publicly funded educational institutions in the state. 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 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** Rate at which students leave the local region due to out-migration, 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.
- Credit hour equivalent** Credit hour equivalent, or CHE, is defined as 15 contact hours of education if on a semester system, and 10 contact hours if on a quarter system. In general, it requires 450 contact hours to complete one full time equivalent, or FTE.
- Demand** Relationship between the market price of education and the volume of education demanded (expressed in terms of enrollment). The law of the downward-sloping demand curve is related to the fact that enrollment increases only if the price (student tuition and fees) is lowered, or conversely, enrollment decreases if price increases.
- Direct effect** Jobs and income directly generated by the university and its students.
- Discounting** Expressing future revenues and costs in present value terms.
- 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 (student tuition and fees). If a decrease in fees increases total revenues, demand is elastic. If it decreases total revenues, demand is inelastic. If total revenues remain the same, elasticity of demand is unitary.
- Externalities** Impacts (positive and negative) for which there is no compensation. Positive externalities of education include improved social behaviors such as lower crime, reduced unemployment, and improved health. 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. Alternatively, 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.
- Indirect effect** Jobs and income that result from the direct spending of the university and 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. In an educational setting, when universities pay wages and salaries and spend money for supplies in the local 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 which, 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.

Labor income Income which is received as a result of labor, *i.e.*, wages.

Multiplier The number of times a dollar cycles through the economy, generating additional income and jobs, before leaving the economy. Therefore, a multiplier of 1.7 estimates that a

dollar will generate an additional \$0.70 in the economy before leaving.

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 which is received from investments (such as rent, interest, and dividends) and transfer payments (payments from governments to individuals).

Opportunity cost Benefits forgone from alternative B once a decision is made to allocate resources to alternative A. Or, if an individual chooses not to attend the university, he or she forgoes higher future earnings associated with education. The benefit of education, therefore, is the “price tag” of choosing not to attend the university.

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:

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

APPENDIX 3: EMSI INPUT-OUTPUT MODEL

Introduction and data sources

EMSI’s input-output model represents the economic relationships among a region’s industries, with particular reference to how much each industry purchases from each other industry. Using a complex, automated process, we can create regionalized models for geographic areas comprised by counties or ZIP codes in the United States.

Our primary data sources are the following:

- The Industry Economic Accounts from the Bureau of Economic Analysis (BEA); specifically the “make” and “use” tables from the annual and benchmark input-output accounts.
- Regional and national jobs-by-industry totals, and national sales-to-jobs ratios (from EMSI’s industry employment and earnings data process).
- Proprietor earnings from State and Local Personal Income Reports (BEA).

Creation of the national Z matrix

The BEA “make” and “use” tables (MUTs) show which industries make or use which commodity types. These two tables are combined to replace the industry-commodity-industry relationships with simple industry-industry relationships in dollar terms. This is called

the national “Z” matrix, which shows the total amount (\$) each industry purchases from others. Industry purchases run down the columns, while industry sales run across the rows.

The value 1,532.5 in this table means that Industry 2 purchases \$1,532,500,000 worth of commodities and/or services from Industry 1.

The whole table is basically an economic double-entry accounting system, configured so that all money inflows have corresponding outflows elsewhere.

In addition to regular industries (such as “oil and gas extraction,” “machinery manufacturing,” “food and beverage stores,” “hospitals,” and so on), there are three additional rows representing labor earnings, profits, and business taxes, which together represent industry “value added” and account for the fact that industries do not spend all of their income on inputs from other industries. There are also three rows and columns representing federal, state, and local government (we later separate federal government into civilian and military sectors).

We create two separate Z matrices since there are two sets of MUTs—annual and benchmark. The benchmark data are produced every five years with a five-year lag and specify up to 500 industry sectors; annual data have a one-year lag but specify only 80 industrial sectors.

The basic equation is as follows:

$$Z = VQ^* - 1U$$

where V is the industry “make” table, $Q^* - 1$ is a vector of total gross commodity output, and U is the industry “use” table.

In reality, this equation is more complex because we

Table 1: Sample “Z” matrix (\$ millions)

	Industry 1	Industry 2	...	Industry N
Industry 1	3.3	1,532.5	...	232.1
Industry 2	9.2	23.0	...	1,982.7
...
Industry N	819.3	2,395.6	...	0

also need to “domesticate” the Z matrix by removing all imports. This is needed because we are creating a “closed” type of national model.

In addition, there are a number of modifications that need to be made to the BEA data before the calculations can begin. These are almost all related to the conversion of certain data in BEA categories to new categories that are more compatible with other data sets we use in the process, and describing them in detail is beyond the scope of this document.

Disaggregation of the national Z matrix

The previous step resulted in two national Z matrices—one based on the benchmark BEA data (five years old, approximately 500 industries) and the other based on the annual BEA data (one year old, but only about 80 industries). These initial national Z matrices are then combined and disaggregated to 1,125 industry sectors. Combining them allows us to capitalize on both the recency of the annual data and the detail of the benchmark data. The disaggregation is performed for each initial Z matrix using probability matrices that allow us to estimate industry transactions for the more detailed sectors based on the known transactions of their parent sectors. The probability matrix is created from detailed EMSI industry earnings data, which are available for all 1,125 sectors and are created using a separate process.

Creation of the national A matrix

The national disaggregated Z matrix is then “normalized” to show purchases as percentages of each industry’s output rather than total dollar amounts. This is called the national “A” matrix.

Table 2: Sample “A” matrix

	Indus-try 1	Indus-try 2	...	Industry 1125
Industry 1	.001	.112035
Industry 2	.097	0065
...
Industry 1125	.002	.076	...	0

Each cell value represents the percentage of a row industry’s output that goes toward purchasing inputs from each column industry. Thus, the cell containing .112 above means that Industry 1 spends 11.2% of its total output to obtain inputs from Industry 2.

At this point, our additional rows representing earnings, profits, and business taxes are removed. However, we will use them in a different form later.

Regionalization of the A matrix

To create a regional input-output model, we regionalize the national A matrix using that region’s industry mix.

The major step in the process is the calculation of per-industry out-of-region exports. This is performed using a combination of the following standard techniques that are present in the academic literature:

- Stevens regional purchase coefficients (RPCs)
- Simple location quotient of value added sales
- Supply/demand pools derived from the national A matrix

We try to maximize exports in order to account as fully as possible for “cross-hauling,” which is the simultaneous export and import of the same good or service to/from a region, since it is quite common in most industries.

Another major part of the process is the regionalization of consumption, investment, and local government “row industries” (rows referring to the rows of the A matrix). These represent the percentage of each industry’s sales that end up going toward consumption, capital purchases, and taxes to local government, respectively. They are created from the “value added” rows that we removed earlier. Consumption is calculated using each industry’s earnings and profits, as well as a constant called “the average propensity to consume,” which describes the approximate percentage of earnings and profits that are spent on consumption. Investment and local government rows are calculated by distributing the known total investment and endogenous local government for the entire region to individual industries proportionally to their value added.

The A-matrix regionalization process is automated for any given region for which industry data are available. Although partially derived from national figures, the regional A matrix offers a best possible estimate of regional values without resorting to costly and time-consuming survey techniques, which in most cases are completely infeasible.

Creating multipliers and using the A matrix

Finally, we convert the regional “A” matrix to a “B” matrix using the standard Leontief inverse

$B = (I - A)^{-1}$. The “B” matrix consists of inter-industry sales multipliers, which can be converted to jobs or earnings multipliers using per-industry jobs-to-sales or earnings-to-sales ratios.

The resulting tables and vectors from this process are then used in the actual end-user software to calculate regional requirements, calculate the regional economic base, estimate sales multipliers, and run impact scenarios.

APPENDIX 4: SHUTDOWN POINT

Introduction

The investment analysis weighs benefits of enrollment (measured in terms of CHEs) against the support provided by state government. This adjustment factor is used to establish a direct link between the costs of supporting the university and the benefits it generates in return. If benefits accrued without taxpayer support, then it would not be a true investment.³²

The overall approach includes a sub-model that simulates the effect on student enrollment should the university lose its state funding and have to raise student tuition and fees in order to stay open. If the university can still operate without state support, then any benefits it generates at that level are discounted from total benefit estimates. If the simulation indicates that the university cannot stay open, however, then benefits are directly linked to costs, and no discounting applies. This appendix documents the procedure for making these adjustments.

State government support versus student demand

Figure 1 presents a simple model of student demand and state government support. The right side of the graph is a standard demand curve (D) showing student enrollment as a function of student tuition and fees. Enrollment is measured in terms of total CHEs generated and expressed as a percentage of current CHE production. Current student tuition and fees are represented by p' , and state government support covers $C\%$ of all costs. At this point in the analysis, it

is assumed that the university has only two sources of revenues: (1) student tuition and fees, and; (2) state government support.

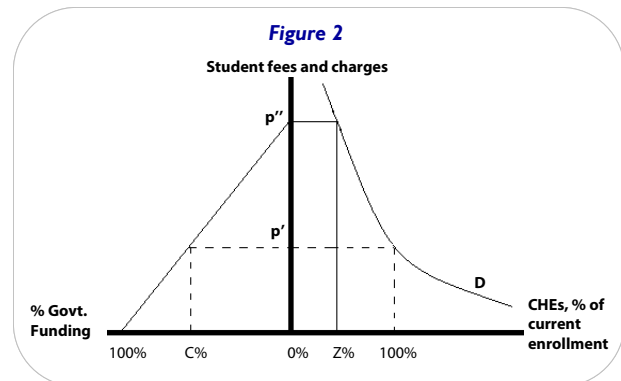
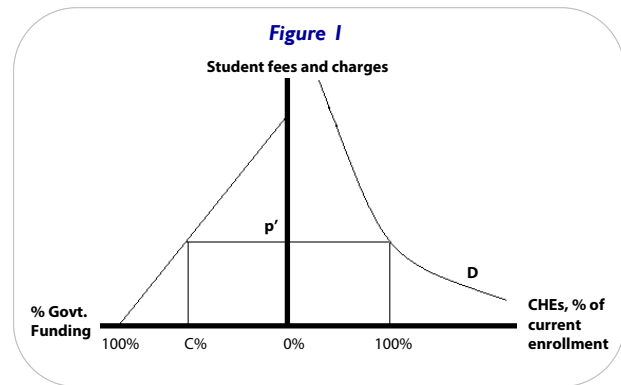


Figure 2 shows another important reference point in the model—where state government support is 0%, student tuition and fees are increased to p'' , and enrollment is $Z\%$ (less than 100%). The reduction in enrollment reflects price elasticity in the students' education vs. no-education decision. Neglecting for the moment those issues concerning the university's minimum operating scale (considered below in the section called "Shutdown Point"), the implication for the investment analysis is that benefits of state government support must be adjusted to net out benefits associated with a level of enrollment at $Z\%$ (*i.e.*, the

³² Of course, as a public training provider, UCA 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 UCA 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.

university can provide these benefits absent state government support).

From enrollment to benefits

This appendix focuses mainly on the size of enrollment (*i.e.*, CHE production) and its relationship to student versus state government funding. However, to clarify the argument it is useful to briefly consider the role of enrollment in the larger benefit/cost model.

Let B equal the benefits attributable to state government support. The analysis derives all benefits as a function of student enrollment (*i.e.*, CHE production). For consistency with the graphical exposition elsewhere in this appendix, B is expressed as a function of the percent of current enrollment (*i.e.*, percent of current CHE production). Accordingly, the equation

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

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

Consider benefits now with reference to Figure 2. The point at which state government support is zero nonetheless provides for Z% (less than 100%) of the current enrollment, and benefits are symbolically indicated by the following equation:

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

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

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

Shutdown point

University operations cease when fixed costs can no longer be covered. The shutdown point is introduced graphically in Figure 3 as S%. The location of point S% indicates that the university can operate at an even lower enrollment level than Z% (the point of zero state funding). At point S%, state government support is still zero, and student tuition and fees have been raised to p^{'''}. With student tuition and fees still

higher than p^{'''}, the university would not be able to attract enough students to keep the doors open, and it would shut down. In Figure 3, point S% illustrates the shutdown point but otherwise plays no role in the estimation of taxpayer benefits. These remain as shown in equation (3).

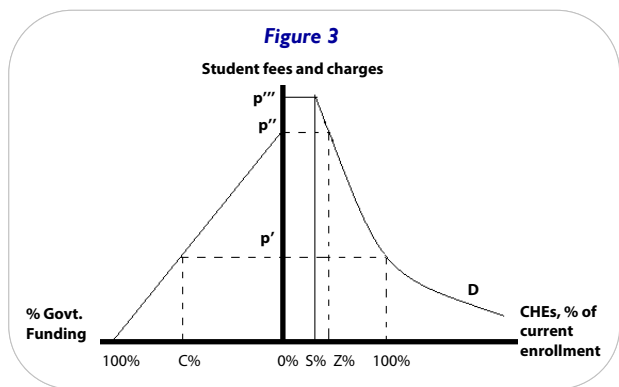
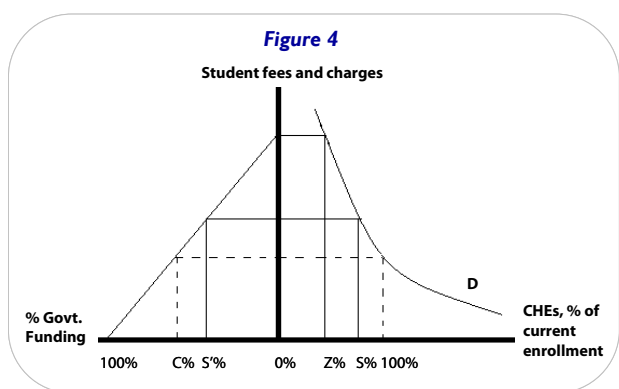


Figure 4 illustrates yet another scenario. Here the shutdown point occurs at an enrollment level greater than Z% (the level of zero state government support), meaning some minimum level of state government support is needed for the university to operate at all. This minimum portion of overall funding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



Adjusting for alternative education opportunities

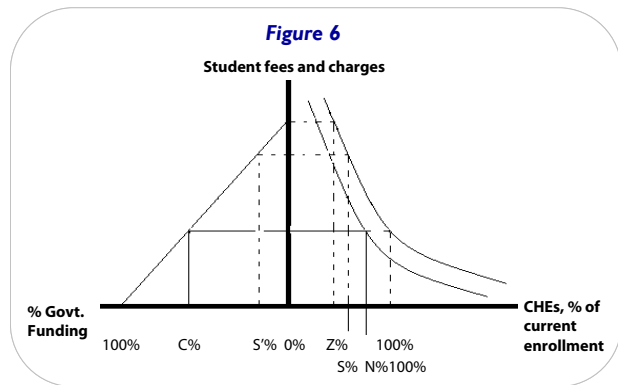
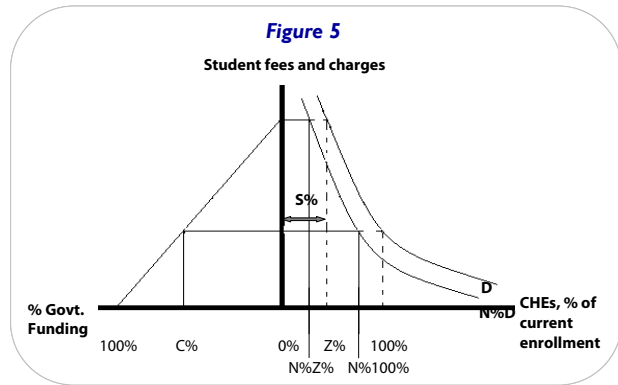
Because some students may be able to avail themselves of an education even without the publicly funded training providers in the state, the benefits associated

with these students must be deducted from the overall benefit estimates. The adjustment for alternative education is easily incorporated into the simple graphic model. For simplicity, let A% equal the percent of students with alternative education opportunities, and let N% equal the percent of students without an alternative. Note that $N\% + A\% = 100\%$.

Figure 5 presents the case where the university could operate absent state government support (*i.e.*, Z% occurs at an enrollment level greater than the shut-down level S%). In this case, the benefits generated by enrollments absent state government support must be subtracted from total benefits. This case is parallel to that indicated in equation (3), and the net benefits attributable to state government support are given by the following equation:

$$4) \quad B = B (N\% \times 100\%) - B (N\% \times Z\%)$$

Finally, Figure 6 presents the case where the university cannot remain open absent some minimum S' % level of state government support. In this case, taxpayers are credited with all benefits generated by current enrollment, less only the percent of students with alternative education opportunities. These benefits are represented symbolically as $B (N\% \times 100\%)$.



APPENDIX 5: SOCIAL EXTERNALITIES

Introduction

Education has a predictable and positive effect on a diverse array of social benefits. These, when quantified in dollar terms, represent significant avoided social costs that directly benefit the public as whole, including taxpayers. In this appendix we discuss the following three main benefit categories: 1) improved health, 2) reductions in crime, and 3) reductions in unemployment and welfare.

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 clearly show the correlation between increases in education and improved health. The manifestations of this are found in two health-related variables, smoking and alcohol. There are probably several 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.

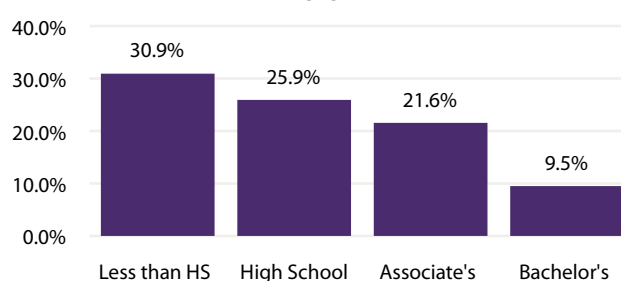
Smoking

Despite declines over the last several decades in the percentage of the U.S. population who smoke, a sizeable percentage of the U.S. population still use tobacco. 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 United States.

Figure 1 reports the prevalence of cigarette smoking

among adults aged 25 years and over, based on data provided by the National Health Interview Survey. As indicated, the percent of persons who smoke cigarettes begins to decline beyond the level of high school education.

Figure 1: Prevalence of smoking by education level



The CDC reports the percent of adults who are current smokers by state.³³ We use this information to create an index value by which we adjust the national prevalence data on smoking to each state. For example, 22.3% of Arkansas' adults were smokers in 2008, relative to 18.3% for the nation. We thus apply a scalar of 1.2 to the national probabilities of smoking in order to adjust them to the state of Arkansas.

Alcohol

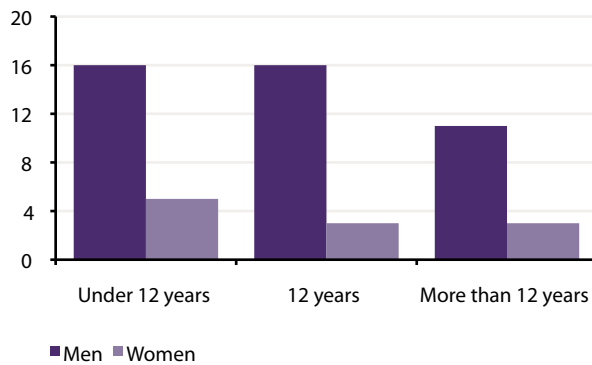
Alcoholism is difficult to measure and define. There are many patterns of drinking, ranging from abstinence to heavy drinking. Alcohol abuse is riddled with social costs, including health care expenditures for treatment, prevention and support; workplace losses due to reduced worker productivity and premature mortality; and other costs related to vehicle crashes, fire destruction, and social welfare administration.

Figure 2 presents the percent of the adult popula-

³³ Center for Disease Control and Prevention (CDC), Prevalence and Trends Data, Tobacco Use - 2008, Adults who are current smokers (accessed June 2009).

tion that are heavy drinkers, by gender and education level.³⁴ These statistics give an indication of the correlation between education and the reduced probability of alcohol abuse. As indicated, heavy drinking among males falls from a 16% prevalence rate among individuals with fewer than 12 years of education, to an 11% prevalence rate among individuals with more than 12 years of education. The probability of being a heavy drinker also falls on a sliding scale for women, from 5% to 3%. Note that women are less likely to be heavy drinkers than men.

Figure 2: Prevalence of heavy drinking by gender and education level



Crime

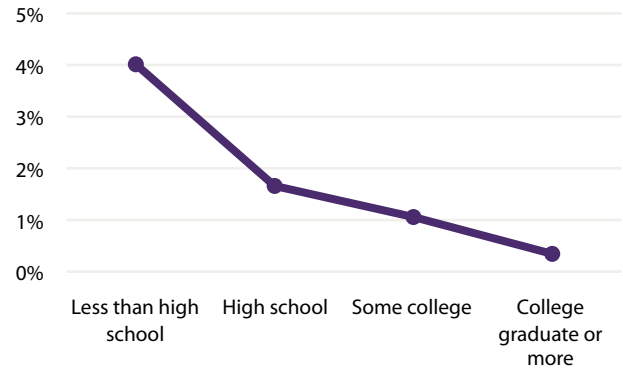
As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) incarceration, including prosecution, imprisonment, and reform, 2) victim costs, and 3) productivity lost as a result of time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

Figure 3 displays the probability that an individual will be incarcerated by education level. Data are derived from the breakdown of the inmate population by education level in state, federal, and local prisons (as provided by the Bureau of Justice Statistics), divided by the total population. As indicated, incarceration drops on a sliding scale as education levels rise.

Victim costs comprise material, medical, physical, and emotional losses suffered by crime victims. Some of

³⁴ Data are supplied by the National Institute of Alcohol Abuse and Alcoholism.

Figure 3: Incarceration rates by education level



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 such as future loss of productivity resulting from traumas, crimes not handled or prosecuted through the judicial system, and money spent on personal security that would otherwise have been spent on other, more productive endeavors.³⁵

Yet another measurable benefit is the added economic productivity of people who are now gainfully employed, all else being equal, and not incarcerated. The measurable productivity benefit here is simply the number of additional people employed multiplied by the average income in their corresponding education levels.

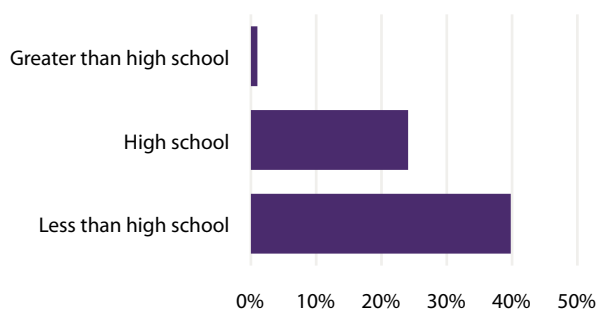
Welfare and Unemployment

Statistics show that as education levels increase, the number of welfare and unemployment applicants declines. Welfare recipients can receive assistance from a variety of different sources, including TANF (Temporary Assistance for Needy Families), food stamps, Medicaid, Supplemental Security Income (SSI), housing subsidies, child care services, weatherization programs, and various educational programs.

³⁵ The model makes use of tangible, lower end costs that can be directly measured without controversy. Thus, 2.0 million inmates (in 1999) divided into \$105 billion costs an average of roughly \$52,000 per inmate. From this we derive an estimate of \$85,000, assuming that the 1999 study was based on at least two- to three-year-old data.

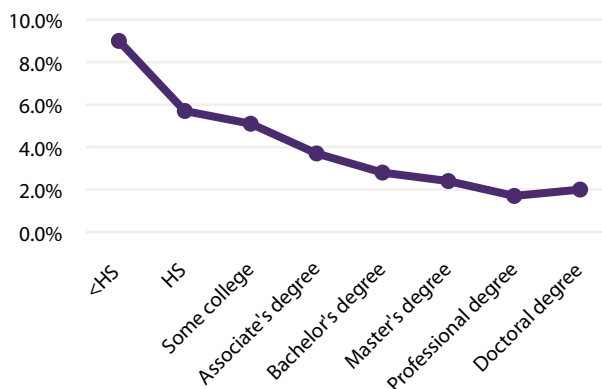
Figure 4 relates the probabilities that an individual will apply for welfare by education level, derived from data supplied by the Department of Health and Human Services. As shown, the probability of claiming welfare drops significantly as individuals move to higher levels of education. Note that these data are based on TANF recipients only, as these constitute the most needy welfare recipients and are the point of departure for the allocation between the other ethnic groups in the model.

Figure 4: Probability of claiming welfare, by education level



Unemployment rates also decline with increasing levels of education, as illustrated in Figure 5. These data are supplied by the Bureau of Labor Statistics. As shown, unemployment rates range from 9% for those with less than a high school diploma to 2% for those at the doctoral degree level.

Figure 5: Unemployment rates by education level



Conclusion

The statistical databases bear out the simple correlation between education and improved health, lower incarceration rates, and reduced welfare and unemployment. These by no means comprise the full range of benefits one possibly can link to education. Other social benefits certainly may be identified in the future as reliable statistical sources are published and data are incorporated into the analytical framework. However, the fact that these incidental benefits occur and can be measured is a bonus that enhances the economic attractiveness of university operations.

APPENDIX 6: INVESTMENT ANALYSIS—A PRIMER

The purpose of this appendix is to provide some context and meaning to the investment analysis results in general, using the simple hypothetical example summarized in Table 1 below. The table shows the projected (assumed) benefits and costs over time for one student and associated investment analysis results.³⁶

Assumptions are as follows:

1. The time horizon is 10 years—*i.e.*, benefits and costs are projected out 10 years into the future (Column 1). Once education has been earned, benefits of higher earnings remain with the student into the future. The objective is to measure these future benefits and compare them to the costs of education.
2. The student attends college for one year, for which he or she pays total fees of \$1,500 (Column 2).
3. The opportunity cost of time (earnings forgone while attending college for one year) for this student is estimated at \$20,000 (Column 3).
4. Together, these two cost elements (\$21,500 total) represent the out-of-pocket investment made by the student (Column 4).
5. In return, it is assumed that the student, having completed the one year of study, will earn \$5,000 more per year than he/she would have without the education (Column 5).
6. Finally, the net cash flow column (NCF) in Column 6 shows higher earnings (Column 5) less the total cost (Column 4).
7. 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 (NPV), the internal rate of return (IRR, or simply RR), the benefit/cost ratio (B/C), and the payback period. Each of these is briefly explained below in the context of the cash flow numbers in Table 1.

Net present value (NPV)

“A bird in hand is worth two in the bush.” This simple folk wisdom lies at the heart of any economic analysis of investments lasting more than one year. The student in Table 1 can choose either to attend the university or to forgo post-secondary education and maintain present employment. If he or she decides to enroll, certain economic implications unfold: student tuition and fees must be paid, and earnings will cease for one year. In exchange, the student calculates that with post-secondary education, his or her income 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/she adds up higher earnings of \$5,000 per year for the remaining nine years in Table 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 (student tuition and fees plus forgone earnings) are felt immediately because they are incurred today—in the present. Benefits (higher earnings), 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.³⁷ Let us take a brief example—at 4%, the

³⁶ Note that this is a hypothetical example. The numbers used are not based on data collected from an existing college.

³⁷ Technically, the interest rate is applied to compounding—the process of looking at deposits today and determining how

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 ten, 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 ten years. An “economically rational” person would, therefore, be equally satisfied receiving \$3,377 today or \$5,000 ten years from today given the going rate of interest of 4%. The process of discounting—finding the present value of future higher earnings—allows the model to express values on an equal basis in future or present value terms.

The goal is to express all future higher earnings in present value terms so that they can be compared to investments incurred today—student tuition and fees and forgone earnings. As indicated in Table 1, the cumulative present value of \$5,000 worth of higher earnings between years 2 and 10 is \$35,747 given the 4% interest rate, far lower than the undiscounted \$45,000 discussed above.

The net present value of the investment is \$14,247. This is simply the present value of the benefits less the present value of the costs, or $\$35,747 - \$21,500 = \$14,247$. In other words, the present value of benefits exceeds the present value of costs by as much as \$14,247. 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 (IRR)

The internal rate of return is another way of measuring the worth of investing in education using the same cash flows shown in Table 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 NPV example above, the model applies the “going rate” of interest of 4% and

computes a positive net present value of \$14,247. 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 1. Or, if a discount rate of 18.0% were applied to the NPV 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 incomes 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 7% 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).

A word of caution—the IRR approach can sometimes generate “wild” or “unbelievable” results—percentages that defy the imagination. Technically, the approach requires at least one negative cash flow (student tuition and fees plus opportunity cost of time) to offset all subsequent positive flows. For example, if the student works full-time while attending the university, the opportunity cost of time would be much lower; the only out-of-pocket cost would be the \$1,500 paid for student tuition and fees. In this case, it is still possible to compute the internal rate of return, but it would be a staggering 333% because only a negative \$1,500 cash flow will be offsetting nine subsequent years of \$5,000 worth of higher earnings. The 333% return is technically correct, but not consistent with conventional understanding of returns expressed as percentages. For purposes of this report, therefore, all results exceeding 100% are expressed simply as: “n/a” or “>100%.”

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.

Benefit/cost ratio (B/C)

The benefit/cost ratio is simply the present value of benefits divided by present value of costs, or $\$35,747 \div \$21,500 = 1.7$ (based on the 4% discount rate). Of course, any change in the discount rate will 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—or 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 student tuition and fees plus earnings forgone) until higher future earnings give a return on the investments made. For the student in Table 1, it will take roughly 4.2 years of \$5,000 worth of higher earnings to recapture his or her investment of \$1,500 in student tuition and fees and the \$20,000 earnings he or she forgoes while attending the university. Higher earnings occurring beyond 4.2 years are the returns that make the investment in education in this example economically worthwhile. The payback period is a fairly rough, albeit common, means of choosing between investments. The shorter the payback period, the stronger the investment.

APPENDIX 7: ALTERNATIVE EDUCATION VARIABLE

Introduction

The alternative education variable is the percent of students who would still be able to avail themselves of education absent the publicly funded colleges and universities in the state. This variable is estimated in the model through a regression analysis based on data supplied by 117 colleges previously analyzed by EMSI. The purpose of this appendix is to lay out the theoretical framework for determining the alternative education opportunity variable and the data used to make this determination.

Alternative education variable in function form

The alternative education variable is the dependent variable, expressed in functional form as follows:

$$1) \quad Y = b_1X_1 + b_2X_2 + b_3X_3 + e$$

Where:

Y = Dependent variable

b_i = partial regression coefficients

e = standard error

Independent variables

The three independent variables reflect the explanatory parameters that form the theoretical backdrop to the internal estimation of the dependent variable based on 117 observations. The three independent variables include the following:

X_1 = Population per square mile in the service region

This variable defines the population density of the ser-

vice region. A positive coefficient (b) is expected; *i.e.*, the more densely populated the area, the more numerous the alternative education opportunities will be.³⁸

X_2 = Number of private school employees per 1,000 population per square mile in the service region

This variable is a proxy for the availability of private educational institutions providing alternative education opportunities in the region. A positive coefficient (b) is expected; *i.e.*, the more private school employees, the more alternative education opportunities there are in the area.³⁹

X_3 = Personal income

The average personal income of residents in the region serves as a measure of the relative economic well-being of the area. A positive coefficient (b) is expected; *i.e.*, the higher the average earnings in the area, the more the students will be able to avail themselves of the alternative education opportunities. This number is expressed in thousands.⁴⁰

Example of analysis and results

The procedure used to estimate the parameters was the ordinary least squares procedure (OLS). Fitting the equation by OLS yielded the following results:

$$2) \quad Y = 3.43E - 05X_1 + 0.023565X_2 + 0.005748X_3 + 0.064722$$

(2.723) (1.4765) (3.1326)

$R_2 = .458$ (coefficient of determination)

F = 31.84 (Fischer test statistic)

38 Available from U.S. Census Bureau, Current Population Survey.

39 Available from U.S. Department of Commerce, County Business Patterns.

40 Available from U.S. Department of Commerce, Bureau of Economic Analysis, REIS Employment and Earnings Reports.

The numbers in parentheses below the coefficients are the “t” values (all statistically significant). The R_2 measures the degree to which the independent variables explain the variation in the dependent variable. The maximum R_2 attainable (1.00) is the case in which all observations fall on the regression line and all variability is explained. The .458 R_2 obtained in equation (2) indicates that nearly 46 percent of the variation in the alternative education opportunity is explained by the variables. The F-ratio indicates that the equation can be considered a good predictor of the alternative education opportunity.

The positive signs of the regression coefficients agree with expected relationships. As population density, the number of private school employees, and personal income increase, so does the provision of alternative education opportunities.

For example, suppose the institution has a service region of five counties. The total population of the five counties is 188,341, while the size of the region is 3754 square miles; the average population per square mile is therefore a little over 50. Within this region, there is one higher education private school employee for every 3,000 residents. Finally, the average income per person within the region is \$21,869 per year. Using these data, the following results are produced:

$$3) \quad Y = (3.43E - 05 \times 50.2) + (0.023565 \times .3318) + (0.005748 \times 21.869)$$

$$4) \quad Y = 13.5\%$$

Thus, according to these calculations, an estimated 13.5% of the student population would have been able to receive an education elsewhere if there were no publicly funded colleges and universities in the state.



University of
Central Arkansas

– Economic Impact –
UNIVERSITY OF
CENTRAL ARKANSAS

Overview Fact Sheet

University of Central Arkansas plays a significant role in the local economy and is a sound investment from multiple perspectives. Students benefit from improved lifestyles and increased earnings. Taxpayers benefit from a larger economy and lower social costs. Finally, the community as a whole benefits from increased job and investment opportunities, higher business revenues, greater availability of public funds, and an eased tax burden.

Investment analysis

Student Perspective

- UCA served more than **11,000** students in Fall 2009.
- Education increases lifetime income. The average income at the career midpoint of someone with a bachelor's degree in the UCA Service Area is **\$62,700**, 94% more than a student with a high school diploma.
- Throughout his or her working career, the average UCA student's discounted lifetime income increases by **\$5.30** for every dollar invested in UCA.
- Students enjoy an attractive **14.4%** average rate of return on their UCA educational investment, recovering all costs (including tuition, fees, and forgone wages) in 10.7 years.

*Students enjoy a **14.4%** rate of return on their investment in UCA.*

Social Perspective

- Higher earnings of UCA students and associated increases in state income expand the tax base in Arkansas by about **\$87.7 million** each year.
- Arkansas will see avoided social costs amounting to **\$18.5 million** per year due to UCA students, including savings associated with improved health, reduced crime, and reduced welfare and unemployment.

Taxpayer Perspective

- State government allocated approximately **\$58.9 million** in support of UCA in FY 2009-10.
- For every dollar of this support, taxpayers see a cumulative return of **\$2.40** over the course of students' working careers (in the form of higher tax receipts and avoided costs).
- State and local governments see a rate of return of **7.9%** on their support for UCA. This return compares very favor-

ably with private sector rates of return on similar long-term investments.

Economic Growth Analysis

University Operations Effect

- The UCA Service Area economy annually receives roughly **\$78.6 million** in income due to UCA operations. This is a conservative figure adjusted to account for monies that leave the economy or are withdrawn from the economy in support of the university.

Student and Visitor Spending Effect

- Non-local students who attend UCA spend money for room and board, transportation, and other personal expenses. The off-campus expenditures of these students generates approximately **\$17.6 million** in added income in the UCA Service Area each year.
- Visitors who come to the university from outside the region also spend money for lodging, food and other personal expenses. This creates an estimated **\$378,300** in added income each year.

Productivity Effect

- The current UCA Service Area economy embodies approximately **1.5 million** credit hours that have accumulated over the past 30-year period as thousands of former UCA students (completers and non-completers) enter the workforce year after year.
- UCA skills translate to higher earnings for students and increased output of businesses. The added income attributable to the accumulation of UCA credit hours in the workforce amounts to around **\$329.5 million** each year.

*Added income attributable to the accumulation of UCA skills amounts to **\$329.5 million** each year.*

Total Effect

- Altogether, the average annual added income due to the activities of UCA and its former students equals **\$426.1 million**. This is approximately equivalent to **1.4%** of the regional economy.

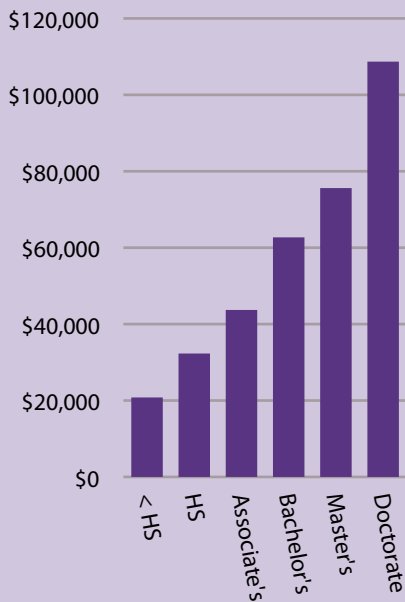
EMSI is a leading provider of socioeconomic impact and strategic planning tools to colleges and universities in the US and Canada. Visit us at www.economicmodeling.com for more information. To see the full documentation of the study, please contact UCA.

EDUCATION WILL PAY YOU BACK—FOR A LIFETIME

- Students enjoy an attractive **14.4%** rate of return on their UCA educational investment.
- Over the course of his or her working career, the average UCA student's lifetime earnings will increase **\$5.30** for every dollar invested in their UCA education (in the form of tuition, fees, and forgone earnings).



Average Earnings in UCA Service Area



EDUCATION IS YOUR TICKET TO A BETTER JOB

- The average annual income of the typical bachelor's degree graduate in the UCA Service Area at the midpoint of his or her career is **\$62,700**, 94% more than someone with a high school diploma.
- Over the course of a working lifetime, bachelor's degree graduates in the UCA Service Area earn **\$1.3 million** more than someone with a high school diploma (undiscounted).

EMSI is a leading provider of socioeconomic impact and strategic planning tools to colleges and universities in the US and Canada. Visit us at www.economicmodeling.com for more information. To see the full documentation of the study, please contact UCA.



State and local taxpayers earn a 7.9% rate of return on their investment in University of Central Arkansas.

University of Central Arkansas adds more money to the state treasury than it takes out. Not only does the university pull its own weight, but it also effectively subsidizes other sectors funded by the taxpayers. Absent UCA, taxes would actually have to be raised in order to maintain services in all other sectors at their current levels. The return on investment is considered from two taxpayer perspectives: social and taxpayer.

Social Perspective

The social perspective adds up all benefits attributable to UCA, regardless of recipient, and compares the total to the original investment made. This is called the “benefit/cost ratio.” If the ratio is less than 1.0, the investment is not worthwhile; if it is greater, the investment is considered sound.

For example, a transportation authority might justify a new road by showing that savings in travel time and vehicle expenses accrued by thousands of drivers exceed the project’s cost. Public parks are justified by showing that recreation, scenic, and other values enjoyed by park users exceed the cost of park infrastructure, operation, and the net value of the park’s land and resources not used for other purposes. So the social perspective counts all benefits, not just those that accrue back to state or local government.

Benefits generated by UCA also accrue to different groups. Students benefit from higher incomes, employers benefit from increased worker productivity, and the public at large benefits from an expanded economic base. The public also enjoys a variety of external social benefits, such as reduced crime, lower welfare and unemployment, improved health, and less absenteeism from work. All of these are tallied up and compared to the investment made by the taxpayers. A social perspective benefit/cost ratio greater than 1.0 is a minimal indicator of a worthwhile public investment.

Counting benefits and costs in this way, UCA’s benefit/cost ratio is 27.3. In other words, the cumulative added value attached to each dollar invested will have a present value of \$27.30 by the end of the students’ working career.

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Taxpayer Perspective

The taxpayer investment perspective counts only benefits that can be entered into the books of state and local governments. For example, educated workers earn more and thus pay more taxes. Furthermore, because state and local governments bear part of the cost of crime, their budgets benefit from education’s crime-reducing effect, and the same is true for other benefits of an educated populace. The bottom line: state and local governments receive returns from their support of UCA in the form of increased tax revenue and savings associated with avoided social costs.

Worthwhile public projects often generate negative taxpayer perspective returns, because the role of government is to provide services that the public wants but that the business sector may find unprofitable. Considerable funds are spent on public parks, for example, yet they yield little or no direct return. From a taxpayer perspective, returns are negative, though the park is justified by the benefits tracked under the social perspective.

But unlike most government endeavors, funding for UCA generates strong results from *both* the social and taxpayer perspectives. Economists generally assume a 3% discount rate in analyzing government investments, assuming that governments can obtain unsecured loans at a rate of 3% or receive a 3% return on any excess funds, if they were invested. *Since UCA’s taxpayer rate of return of 7.9% is greater than 3%, state and local governments actually make money on the investment.* By funding the university, therefore, other recipients of state and local funding are actually subsidized through the revenues generated by the university.

Comparison of UCA’s Rate of Return to Discount Rate and Average Return on Stocks and Bonds



UCA INCREASES STATE INCOME

- The activities of UCA's 2009-10 student body will generate about **\$54.7 million** in labor income in the state economy each year.
- Once UCA's current students become active in the workforce, they will promote business output, raise consumer spending, and increase property income in the state. All of this contributes an additional **\$33 million** in taxable income each year.
- Altogether, higher student income and associated effects on business productivity add **\$87.7 million** in income annually to the state economy.



Annual Benefits to the Arkansas Public Due to UCA (\$ Millions)

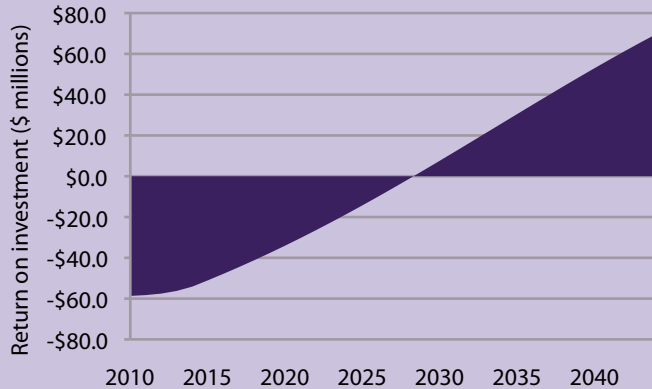


UCA REDUCES SOCIAL COSTS

- Education is statistically correlated with improved lifestyle behaviors, including reduced incidences of absenteeism, alcohol abuse, and smoking, lower probability of committing crime, and fewer welfare and unemployment claims.
- It is estimated that UCA's 2009-10 student population will generate social savings to the Arkansas public equal to **\$18.5 million** a year.
- These savings accrue to all state and local residents—students, homeowners, businesses, and taxpayers.

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Long-term Return to Taxpayers on Their UCA Investment



UCA GENERATES A RETURN ON PUBLIC INVESTMENT

- State government allocated about **\$58.9 million** in support of UCA in FY 2009-10.
- For every dollar appropriated by state government to UCA, taxpayers will see a return with a cumulative added value of **\$2.40** in the form of higher tax revenues and avoided social costs.
- State and local governments will receive a rate of return of **7.9%** on their investments in UCA.

UCA LEVERAGES TAXPAYER DOLLARS

- An estimated **84%** of UCA students remain in Arkansas and contribute to economic growth. Students who enter the workforce expand the tax base by generating higher earnings and reducing social costs.
- Higher student earnings and associated increases in property income generate about **\$8.3 million** in added tax revenue each year.
- State and local governments will save approximately **\$1.2 million** in avoided social costs each year, including savings associated with improved health, lower costs of law enforcement, and fewer welfare claimants.



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University of
Central Arkansas

– Economic Impact –
UNIVERSITY OF
CENTRAL ARKANSAS

Business Perspective

UCA RAISES CONSUMER SPENDING

- UCA employed more than 1,500 faculty and staff in the 2009-10 reporting year, with an annual payroll of \$88.1 million (including monies paid to graduate workers).
- In addition to payroll, UCA spent **\$74.4 million** in FY 2009-10 for supplies and services, of which an estimated 41% was spent in the UCA Service Area.
- UCA estimates that approximately 6,420 of its students came from outside the UCA Service Area in FY 2009-10. Non-local students who settle in the region support local businesses through their off-campus expenditures for room and board, entertainment, transportation, and other personal expenses.
- UCA also drew **125,400** visitors in FY 2009-10. Of these, an estimated 6,300 were from outside the region and spent money at local businesses for food, lodging, and other expenses.

UCA Spurs Economic Development

UCA has played a key role in the expansion of Conway, where the university is located. One shining example is Hewlett-Packard, which settled on Conway two years ago for a shared services center that employs nearly 1,400. When HP visited the city during the site selection process, the firm was enamored by the region's educated labor pool and Technology Park, where it eventually settled. HP is now part of a large tech sector in Conway that includes Acxiom Corp., an IT and business intelligence firm that has built its local workforce to roughly 2,000 workers.

"UCA is a huge economic engine by itself," said Tab Townsell, who has been Conway's mayor since 1998. "Just its presence here – its budget, its community. The students and faculty who come here to live or come here to teach and earn a living [make a big impact]."

Added Income in UCA Service Area
Due to UCA (\$ Millions)



UCA GENERATES NEW INCOME

- The net added income generated by UCA operations (\$78.6 million), student spending (\$17.6 million), and visitor spending (\$378,300) contributes a total of **\$96.6 million** in income to the UCA Service Area economy each year.
- The increased productivity of workers due to the accumulation of past and present UCA skills in the UCA Service Area workforce creates **\$329.5 million** in added income each year.
- Altogether, the average annual added income due to the activities of UCA and its students equals **\$426.1 million**. This is approximately equal to 9,020 average-wage jobs.

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