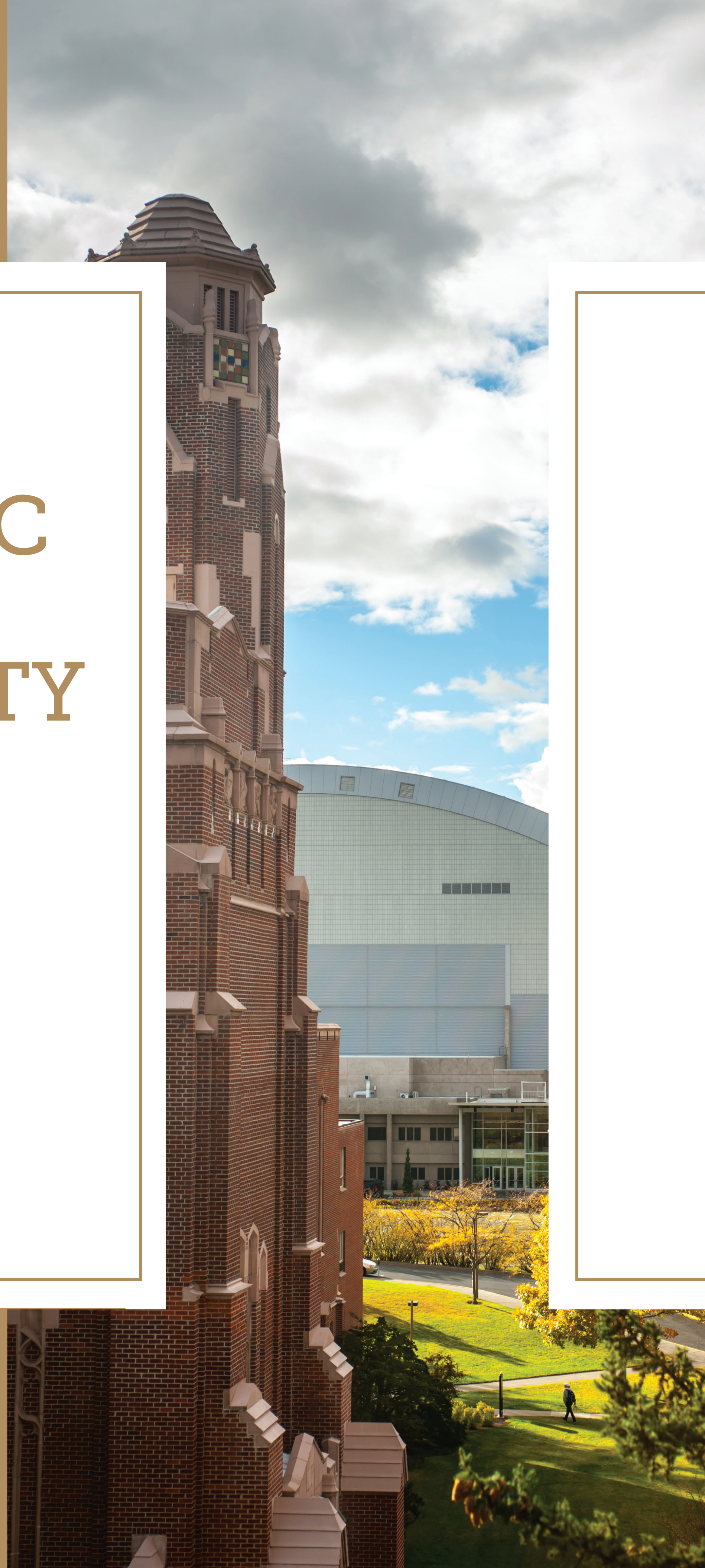
University of Idaho



The

ECONOMIC VALUE *of the* UNIVERSITY OF IDAHO

Main Report

Analysis of the Economic Impact & Return on Investment of Education

OCT 2015

CONTENTS

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

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

ECONOMIC IMPACT ANALYSIS

During the analysis year, UI spent **$213 million** on payroll and benefits for **3,067** full-time and part-time employees, and spent another **$155.2 million** on goods and services to carry out its day-to-day operations. This initial round of spending creates more spending across other businesses throughout the state economy, resulting in the commonly referred to multiplier effects. This analysis estimates the net economic impact of UI that directly takes into account the fact that state and local dollars spent on UI could have been spent elsewhere in the state if not directed towards UI and would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of UI.

This analysis shows that in FY 2013-14, operations and research, spending of UI, together with the spending from its entrepreneurial activities, students, visitors, and alumni, generated **$1.1 billion** in gross state product (GSP) to the Idaho economy. The additional GSP of $1.1 billion created by UI is equal to approximately **1.9%** of the total GSP of Idaho, and is equivalent to creating **22,188** new jobs. For perspective, this impact from the university is slightly larger than the Utilities industry in the state. These economic impacts break down as follows:

Operations spending impact

Payroll and benefits to support day-to-day operations of UI amounted to **$166.5 million** (less research activities). The net impact of operations spending toward the university in Idaho during the analysis year was approximately **$200.5 million** in GSP, which is equivalent to creating **2,835** new jobs.

Research spending impact

Research activities of UI impact the state economy by employing people and making purchases for equipment, supplies, and services. They also facilitate new knowledge creation throughout Idaho. In 2013-14, UI spent **$46.5 million** on payroll to support research activities. Research spending of UI generates **$77.7 million** in GSP for the Idaho economy, which is equivalent to creating **1,188** new jobs.

Start-up and spin-off company impact

UI creates an exceptional environment that fosters innovation and entrepreneurship, evidenced by the number of start-up and spin-off companies related to UI created in the state. In FY 2013-14, start-up and spin-off companies related to UI created **$35.3 million** in GSP for the Idaho economy, which is equivalent to creating **548** jobs.

Student spending impact

Around 30% of students attending UI originated from outside the state. Some of these students relocated to Idaho to attend UI. In addition, some students are residents of Idaho who would have left the state if not for the existence of UI. The money that these students spent toward living expenses in Idaho is attributable to UI.

The expenditures of relocated and retained students in the state during the analysis year added approximately **$31.2 million** in GSP for the Idaho economy, which is equivalent to creating **898** new jobs.

Visitor spending impact

Out-of-state visitors attracted to Idaho for activities at UI brought new dollars to the economy through their spending at hotels, restaurants, gas stations, and other state businesses. The spending from these visitors added approximately **$5.1 million** in GSP for the Idaho economy, which is equivalent to creating **152** new jobs.

Alumni impact

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

The accumulated impact of former students currently employed in the Idaho workforce amounted to **$782 million** in GSP to the Idaho economy, which is equivalent to creating **16,567** new jobs.

INVESTMENT ANALYSIS

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

Student perspective

Students invest their own money and time in their education. Students enrolled at UI paid an estimated total of **$95.5 million** to cover the cost of tuition, fees, books, and supplies at UI in FY 2013-14. While some students were employed while attending the university, overall students forwent an estimated **$167.1 million** in earnings that they would have generated had they been in full employment instead of learning. In return, students will receive a present value of **$871.1 million** in increased earnings over their working lives. This translates to a return of **$3.30** in higher future income for every $1 that students pay for their education at UI. The corresponding annual rate of return is **14.0%**.

Taxpayer perspective

Taxpayers provided **$128.8 million** of state funding to UI in FY 2013-14. In return, taxpayers will receive an estimated present value of **$226.7 million** in added tax revenue stemming from the students' higher life-

Important Note

When reviewing the impacts estimated in this study, it's important to note that it reports impacts in the form of GSP rather than output. Output includes all of the intermediary costs associated with producing goods and services. GSP, on the other hand, is a net measure that excludes these intermediary costs and is synonymous with value added and added income. For this reason, it is a more meaningful measure of new economic activity than output.

time incomes and the increased output of businesses. Savings to the public sector add another estimated **$86.2 million** in benefits due to a reduced demand for government-funded social services in Idaho. For every tax dollar spent on educating students attending UI, taxpayers will receive an average of **$2.40** in return over the course of the students' working lives. In other words, taxpayers enjoy an annual rate of return of **8.2%**.

Social perspective

Idaho as a whole spent an estimated **$547.4 million** on educations at UI in FY 2013-14. This includes **$368.2 million** in expenses by UI, **$12.1 million** in student expenses, and **$167.1 million** in student opportunity costs. In return, the state of Idaho will receive an estimated present value of **$2.1 billion** in added state income over the course of the students' working lives. Idaho will also benefit from an estimated **$459.6 million** in present value social savings related to reduced crime, lower welfare and unemployment, and increased health and well-being across the state. For every dollar society invests in an education from UI, an average of **$4.60** in benefits will accrue to Idaho over the course of the students' careers.

INTRODUCTION

The University of Idaho (UI), established in 1889, has today grown to serve 14,039 credit and 2,197 non-credit students. The university is led by Dr. Chuck Staben. The university's service region, for the purposes of this report, consists of the state of Idaho.

While UI affects its state in a variety of ways, many of them difficult to quantify, this study is concerned with considering its economic benefits. The university naturally helps students achieve their individual potential and develop the knowledge, skills, and abilities they need to have a fulfilling and prosperous career. However, the value of UI consists of more than simply influencing the lives of students. The university's program offerings supply employers with workers to make their businesses more productive. The expenditures of the university and its employees, entrepreneurial activities, students, and visitors support the state economy through the output and employment generated by state vendors. The benefits created by the university extend as far as the state treasury in terms of the increased tax receipts and decreased public sector costs generated by students across the state.

This report assesses the impact of UI as a whole on the state economy and the benefits generated by the university for students, taxpayers, and society. The approach is twofold. We begin with an economic impact analysis of the university on the Idaho economy. To derive results, we rely on a specialized Social Accounting Matrix (SAM) model to calculate the gross state product (GSP) created in the Idaho economy as a result of increased consumer spending and the added knowledge, skills, and abilities of students. Results of the economic impact analysis are broken out according to the following impacts: 1) impact of the university's day-to-day operations, 2) impact of research spending, 3) impact of start-up and spin-off companies, 4) impact of student spending, 5) impact of visitor spending, and 6) impact of alumni who are still employed in the Idaho workforce.

The second component of the study measures the benefits generated by UI for the following stakeholder groups: students, taxpayers, and society. For students, we perform an investment analysis to determine how the money spent by students on their education performs as an investment over time. The students' investment in this case consists of their out-of-pocket expenses and the opportunity cost of attending the university as opposed to working. In return for these investments, students receive a lifetime of higher incomes. For taxpayers, the study measures the benefits to state taxpayers in the form of increased tax revenues and public sector savings stemming from a reduced demand for social services. Finally, for society, the study assesses how the students' higher incomes and improved quality of life create benefits throughout Idaho as a whole.

The study uses a wide array of data that are based on several sources, including the 2013-14 academic and financial reports from UI; industry and employment data from the U.S. Bureau of Labor Statistics and U.S. Census Bureau; outputs of EMSI's impact model and SAM model; and a variety of published materials relating education to social behavior.

PROFILE *of the* UNIVERSITY OF IDAHO *and the* ECONOMY

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

UI EMPLOYEE & FINANCE DATA

Employee data

Data provided by UI include information on faculty and staff by place of work and by place of residence. These data appear in Table 1.1. As shown, UI employed 2,215 full-time and 852 part-time faculty and staff, including student workers, in FY 2013-14. Of these, 99% worked in the state and 90% lived in the state. These data are used to isolate the portion of the employees' payroll and household expenses that remains in the state economy.

Revenues

Table 1.2 shows the university's annual revenues by funding source—a total of $386.1 million in FY 2013-14. As indicated, tuition and fees comprised 22% of total revenue, and revenues from state and

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

Table 1.1: Employee data, FY 2013-14

Full-time faculty and staff	2,215
Part-time faculty and staff	852
Total faculty and staff	**3,067**
% of employees that work in the state	99%
% of employees that live in the state	90%

Source: Data supplied by UI.

Table 1.2: Revenue by source, FY 2013-14

Tuition and fees	$83,361,394	22%
State government*	$128,753,629	33%
Federal government	$87,204,964	23%
All other revenue	$86,829,585	22%
Total revenues	**$386,149,572**	**100%**

** Revenue from state government includes capital appropriations.*
Source: Data supplied by UI.

federal government sources comprised another 56%. All other revenue (i.e., auxiliary revenue, sales and services, interest, and donations) comprised the remaining 22%. These data are critical in identifying the annual costs of educating the student body from the perspectives of students, taxpayers, and society.

Expenditures

The combined payroll at UI, including student salaries and wages, amounted to $213 million. This was equal to 58% of the university's total expenses for FY 2013-14. Other expenditures, including capital and purchases of supplies and services, made up $155.2 million. These budget data appear in Table 1.3.

Students

UI served 14,039 students taking courses for credit and 2,197 non-credit students in the 2013-14 reporting year. These numbers represent unduplicated student headcounts. The breakdown of the student body by gender was 53% male and 47% female. The breakdown by ethnicity was 79% white, 18% minority, and 3% unknown. The students' overall average age was 25 years old.[2] An estimated 73% of students remain in Idaho after finishing their time at UI and the remaining 27% settle outside the state.[3]

Table 1.4 summarizes the breakdown of the student population and their corresponding awards and credits by education level. In the 2013-14 reporting year, UI served 214 PhD or professional graduates, 523 master's degree graduates, 1,784 bachelor's degree graduates, and 37 certificate graduates. Another 10,450 students enrolled in courses for credit but did not complete a degree during the reporting year. The university offered dual credit courses to high schools, serving a total of 1,031 students over the course of the year. Students not allocated to the other categories—including non-degree-seeking workforce students—comprised the remaining 2,197 students.

We use credit hour equivalents (CHEs) to track the educational workload of the students. One CHE is equal to 15 contact hours of classroom instruction per semester. The average number of CHEs per student was 18.2.

2 Unduplicated headcount, gender, ethnicity, and age data provided by UI.

3 Settlement data provided by UI. In the event that the data was unavailable, EMSI used estimates based on student origin.

Table 1.3: Expenses by function, FY 2013-14

EXPENSE ITEM	TOTAL	%
Employee salaries, wages, and benefits	$212,995,733	58%
Capital depreciation	$32,509,286	9%
All other expenditures	$122,659,873	33%
Total expenses	**$368,164,892**	**100%**

Source: Data supplied by UI.

Table 1.4: Breakdown of student headcount and CHE production by education level, FY 2013-14

CATEGORY	HEADCOUNT	TOTAL CHES	AVERAGE CHES
PhD or professional graduates	214	3,834	17.9
Master's degree graduates	523	6,255	12.0
Bachelor's degree graduates	1,784	42,944	24.1
Certificate graduates	37	558	15.1
Continuing students	10,450	231,991	22.2
Dual credit students	1,031	4,578	4.4
Workforce and all other students	2,197	5,417	2.5
Total, all students	**16,236**	**295,577**	**18.2**

Source: Data supplied by UI.

THE IDAHO ECONOMY

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

As shown in Table 1.5, the GSP of Idaho is approximately $58.7 billion, equal to the sum of labor income ($35.7 billion) and non-labor income ($23 billion). In

Table 1.5: Labor and non-labor income by major industry sector in Idaho, 2013*

INDUSTRY SECTOR	LABOR INCOME (MILLIONS)	NON-LABOR INCOME (MILLIONS)	GSP† (MILLIONS)	% OF GSP	SALES (MILLIONS)
Agriculture, Forestry, Fishing, and Hunting	$1,578	$1,220	$2,798	4.8%	$6,886
Mining	$311	$667	$978	1.7%	$1,365
Utilities	$292	$691	$982	1.7%	$1,400
Construction	$2,051	$715	$2,766	4.7%	$5,020
Manufacturing	$4,087	$3,380	$7,466	12.7%	$21,192
Wholesale Trade	$1,787	$1,560	$3,347	5.7%	$5,120
Retail Trade	$2,793	$1,195	$3,988	6.8%	$6,894
Transportation and Warehousing	$1,151	$408	$1,559	2.7%	$3,446
Information	$616	$890	$1,506	2.6%	$2,837
Finance and Insurance	$2,023	$1,233	$3,256	5.6%	$5,779
Real Estate and Rental and Leasing	$1,317	$3,716	$5,032	8.6%	$7,572
Professional and Technical Services	$2,683	$429	$3,112	5.3%	$5,266
Management of Companies and Enterprises	$558	$94	$652	1.1%	$1,133
Administrative and Waste Services	$1,498	$396	$1,893	3.2%	$2,937
Educational Services	$410	$37	$447	0.8%	$760
Health Care and Social Assistance	$4,103	$351	$4,454	7.6%	$7,624
Arts, Entertainment, and Recreation	$313	$115	$428	0.7%	$750
Accommodation and Food Services	$966	$441	$1,407	2.4%	$2,796
Other Services (except Public Administration)	$839	$3,901	$4,739	8.0%	$7,883
Public Administration	$6,343	$1,516	$7,858	13.4%	$32,738
Total	**$35,719**	**$22,951**	**$58,670**	**100.0%**	**$129,398**

** 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.

Section 2, we use GSP as the backdrop against which we measure the relative impacts of the university on the state economy.

Table 1.6 provides the breakdown of jobs by industry in Idaho. Among the state's non-government industry sectors, the Retail Trade sector is the largest employer, supporting 101,453 jobs or 11.3% of total employment in the state. The second largest employer is the Health Care and Social Assistance sector, supporting 94,695 jobs or 10.5% of the state's total employment. Altogether, the state supports 897,726 jobs.[4]

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

Table 1.6: Jobs by major industry sector in Idaho, 2013*

INDUSTRY SECTOR	TOTAL JOBS	% OF TOTAL
Agriculture, Forestry, Fishing, and Hunting	50,799	5.7%
Mining	6,555	0.7%
Utilities	2,979	0.3%
Construction	52,558	5.9%
Manufacturing	65,622	7.3%
Wholesale Trade	31,463	3.5%
Retail Trade	101,453	11.3%
Transportation and Warehousing	26,483	3.0%
Information	12,254	1.4%
Finance and Insurance	39,050	4.3%
Real Estate and Rental and Leasing	42,099	4.7%
Professional and Technical Services	52,016	5.8%
Management of Companies and Enterprises	5,930	0.7%
Administrative and Waste Services	52,421	5.8%
Educational Services	15,855	1.8%
Health Care and Social Assistance	94,695	10.5%
Arts, Entertainment, and Recreation	18,801	2.1%
Accommodation and Food Services	58,523	6.5%
Other Services (except Public Administration)	42,500	4.7%
Public Administration	125,670	14.0%
Total	**897,726**	**100.0%**

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

Table 1.7 presents the mean income by education level in Idaho at the midpoint of the average-aged worker's career. These numbers are derived from EMSI's complete employment data on average income per worker in the state.[5] As shown, students have the potential to earn more as they achieve higher levels of education compared to maintaining a high school diploma. Students who achieve a bachelor's degree can expect $46,300 in income per year, approximately $20,100 more than someone with a high school diploma.

Figure 1.1: Expected income by education level at career midpoint

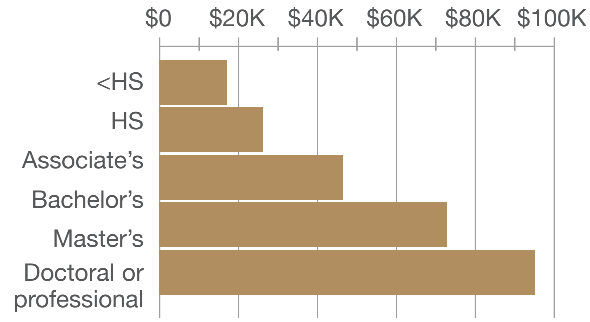

Table 1.7: Expected income in Idaho at the midpoint of an individual's working career by education level

EDUCATION LEVEL	INCOME	DIFFERENCE FROM NEXT LOWEST DEGREE	DIFFERENCE FROM HIGH SCHOOL DIPLOMA
Less than high school	$16,500	n/a	n/a
High school or equivalent	$26,200	$9,700	n/a
Associate's degree	$31,600	$5,400	$5,400
Bachelor's degree	$46,300	$14,700	$20,100
Master's degree	$72,200	$25,900	$46,000
Doctoral degree	$94,100	$21,900	$67,900

Source: EMSI complete employment data.

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

ECONOMIC IMPACTS *on the* IDAHO ECONOMY

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UI impacts the Idaho economy in a variety of ways. The university is an employer and buyer of goods and services. It attracts monies that otherwise would not have entered the state economy through its day-to-day and research operations, the expenditures of its out-of-state students and visitors, and its entrepreneurial activities. Further, it provides students with the knowledge, skills, and abilities they need to become productive citizens and add to the overall output of the state.

In this section we estimate the following economic impacts of UI: 1) the day-to-day operations spending impact; 2) the research spending impact, 3) the start-up and spin-off company impact, 4) the student spending impact; 5) the visitor spending impact, and 6) the alumni impact, measuring the GSP created in the state as former students expand the state economy's stock of human capital.

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

How would economic activity change in Idaho if UI and its alumni did not exist in FY 2013-14?

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

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in gross state product, or GSP. This measure is similar to the commonly used gross domestic product (GDP), with the difference being that GSP reflects the state and GDP the nation. GSP may be further broken out into the **labor income impact**, also known as earnings, which assesses the change in employee compensation; and the **non-labor income impact**, which assesses the change in business profits. Together, labor income and non-labor income sum to GSP.

Another way to state the impact is in terms of **jobs**, a measure of the number of full- and part-time jobs that would be required to support the added GSP to the state from UI. For each type of impact, we hone in on the industries that the respective impact is most likely to affect in Idaho. The effected industries differ depending on the type of impact. The number of jobs the added GSP creates is based on industry-specific jobs-to-earnings ratios, or the average wage per job in each industry. Note that each impact affects individual industries differently, and each industry has a specific jobs-to-earnings ratio. Hence, there is no common divisor for calculating the jobs from total GSP between the different impacts. Total jobs are calculated by summing the initial jobs created in Idaho by UI and the jobs that are created due to the ripple effects in the industries of the particular impact being measured.

Finally, a frequently used measure is the **sales impact**, which comprises the change in business sales revenue in the economy as a result of increased economic activity. It is important to bear in mind, however, that much of this sales revenue leaves the state economy through intermediary transactions and costs.[6] All of these measures—GSP, labor and non-labor income, jobs, and sales—are used to estimate the economic impact results presented in this section. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

- The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses.
- The initial round of spending creates more spending in the economy, resulting in what is commonly known as the **multiplier effect**. The multiplier effect comprises the additional activity that occurs across all industries in the economy and may be further decomposed into the following three types of effects:
  - The **direct effect** refers to the additional economic activity that occurs as the industries affected by the initial effect spend money to purchase goods and services from their supply chain industries.
  - The **indirect effect** occurs as the supply chain of the initial industries creates even more activity in the economy through their own inter-industry spending.
  - The **induced effect** refers to the economic activity created by the household sector as the businesses affected by the initial, direct, and indirect effects raise salaries or hire more people.

6 See Appendix 3 for an example of the intermediary costs included in the sales impact but not in the GSP impact.

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

<table>
<tr><th>EMSI</th><th>IMPLAN</th></tr>
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Multiplier effects in this analysis are derived using EMSI's Social Accounting Matrix (SAM) input-output model that captures the interconnection of industries, government, and households in the state. The EMSI SAM contains approximately 1,100 industry sectors at the highest level of detail available in the North American Industry Classification System (NAICS) and supplies the industry-specific multipliers required to determine the impacts associated with increased activity within a given economy. For more information on the EMSI SAM model and its data sources, see Appendix 4.

OPERATIONS SPENDING IMPACT

Faculty and staff payroll is part of the state's overall income, and the spending of employees for groceries, apparel, and other household expenditures helps support state businesses. The university itself purchases supplies and services, and many of its vendors are located in Idaho. These expenditures create a ripple effect that generates still more jobs and income throughout the economy.

Table 2.1 presents university expenditures for the following three categories: 1) salaries, wages, and benefits, 2) capital depreciation, and 3) all other expenditures (including purchases for supplies and services). The first step in estimating the multiplier effects of the university's operational expenditures is to map these categories of expenditures to the approximately 1,100 industries of the EMSI SAM model. Assuming that the spending patterns of university personnel approximately match those of the average consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure coefficients supplied by EMSI's national SAM. Approximately 90% of the people working at UI live in Idaho (see Table 1.1), and therefore we consider 90% of the salaries, wages, and benefits. For the other two expenditure categories (i.e., capital depreciation and all other expenditures), we assume the university's spending patterns approximately match national averages and apply the national spending coefficients for NAICS 611310 (Colleges, Universities, and Professional Schools). Capital depreciation is mapped to the construction sectors of NAICS 611310 and the university's remaining expenditures to the non-construction sectors of NAICS 611310.

We now have three vectors of expenditures for UI: one for salaries, wages, and benefits; another for capital items; and a third for the university's purchases of supplies and services. The next step is to estimate the portion of these expenditures that occur inside the state. The expenditures occurring outside the state are known as leakages. We estimate in-state expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by state suppliers, for each of the approximately 1,100 industries in the SAM model.[7] For example, if 40% of the demand for NAICS 541211 (Offices of Certified Public Accountants) is satisfied by state suppliers, the RPC for that industry is 40%. The remaining 60% of the demand for NAICS 541211 is provided by suppliers located outside the state. The three vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-state expenditures associated with the university. See Table 2.1 for a break-out of the expenditures that occur in-state. Finally, in-state spending is entered, industry by industry, into the SAM model's multiplier matrix,

7 See Appendix 4 for a description of EMSI's SAM model.

Table 2.1: UI expenses by function (less research), FY 2013-14

EXPENSE CATEGORY	TOTAL EXPENDITURES (THOUSANDS)	OUT-OF-STATE EXPENDITURES (THOUSANDS)	IN-STATE EXPENDITURES (THOUSANDS)
Employee salaries, wages, and benefits	$166,473	$59,065	$107,408
Capital depreciation	$32,509	$22,106	$10,403
All other expenditures	$73,589	$38,876	$34,713
Total	**$272,571**	**$120,047**	**$152,524**

Source: Data supplied by UI and the EMSI impact model.

Table 2.2: Impact of UI operations spending, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$164,808	$0	$164,808	$272,571	2,373
MULTIPLIER EFFECT					
Direct effect	$18,672	$17,538	$36,210	$60,982	526
Indirect effect	$3,249	$2,861	$6,110	$10,713	91
Induced effect	$36,874	$32,230	$69,104	$120,997	1,139
Total multiplier effect	**$58,795**	**$52,630**	**$111,424**	**$192,691**	**1,756**
GROSS IMPACT (initial + multiplier)	$223,603	$52,630	$276,232	$465,262	4,129
Less alternative uses of funds	-$41,025	-$34,728	-$75,753	-$134,998	-1,294
NET IMPACT	$182,577	$17,902	$200,479	$330,265	2,835

Source: EMSI impact model.

which in turn provides an estimate of the associated multiplier effects on state labor income, non-labor income, GSP, sales, and jobs.

Table 2.2 presents the economic impact of university operations spending. The people employed by UI and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, GSP, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled multiplier effect. Summing the initial and multiplier effects, the gross impacts are $223.6 million in labor income and $52.6 million in non-labor income. This comes to a total impact of $276.2 million in GSP associated with the spending of the university and its employees in the state. Weighted by the industries most affected by the spending of UI employees and UI's operations, this is equivalent to 4,129 jobs.

The $276.2 million in gross GSP is often reported by researchers as an impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event—in this case, the expenditure of in-state funds on UI—had not occurred. UI received an estimated 65.2% of its funding from sources within Idaho. These monies came from the tuition and fees paid by resident students, from the auxiliary revenue and donations from private sources located within the state, from state taxes, and from the financial aid issued to students by state government. We must account for the opportunity cost of this in-state funding. Had other industries received these monies rather than UI, income impacts would have still been created in the economy. In economic analysis, impacts that occur under counterfactual conditions are used to offset the impacts that actually occur in order to derive the true impact of the event under analysis.

We estimate this counterfactual by simulating a scenario where in-state monies spent on the university are instead spent on consumer goods and savings. This simulates the in-state monies being returned to the taxpayers and being spent by the household sector. Our approach is to establish the total amount spent by in-state students and taxpayers on UI, map this to the detailed industries of the SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-state spending, and run the in-state spending through the SAM model's multiplier matrix to derive multiplier effects. The results of this exercise are shown as negative values in the row labeled less alternative uses of funds in Table 2.2.

The total net impacts of the university's operations are equal to the gross impacts less the impacts of the alternative use of funds—the opportunity cost of the state money. As shown in the last row of Table 2.2, the total net impact is approximately $182.6 million in labor income and $17.9 million in non-labor income. This totals $200.5 million in GSP and is equivalent to 2,835 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of UI.

RESEARCH SPENDING IMPACT

Similar to the day-to-day operations of UI, research activities impact the economy by employing people and requiring the purchase of equipment and other supplies and services. Table 2.3 shows UI's research expenses by function—payroll, equipment, construction, and other—for the last four fiscal years. In FY 2013-14, UI spent over $95.6 million on research and development activities. These expenses would not have been possible without funding from outside the state—UI received around 53% of its research funding from federal and other sources.

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

Mapping the research expenses by category to the industries of the SAM model—the only difference from our previous methodology—requires some exposition. We asked UI to provide information on expenditures by research and development field as they report to the National Science Foundation's Higher Education Research and Development Survey (HERD).[8] We map these fields of study to their respective industries in the SAM model. The result is a distribution of research expenses to the various 1,100 industries that follows a weighted average of the fields of study reported by UI.

Initial, direct, indirect, and induced effects of UI's research expenses appear in Table 2.4 on the next page. As with the operations spending impact, the initial effect consists of the 663 research jobs and their associated salaries, wages, and benefits. The university's research expenses have a total gross impact of $74.9 million in labor income and $16.2 million in non-labor income. This totals $91.1 million in GSP, equivalent to 1,416 jobs. Taking into account the impact of the alternative uses of funds, net research expenditure impacts of UI are $67.6 million in labor income and $10.1 million in non-labor income. This totals to $77.7 million in GSP. Weighted by the industries most affected by the spending of research employees and UI's research spending, this is equivalent to 1,188 jobs.

Research and innovation plays an important role in driving the Idaho economy. Some indicators of innovation are the number of invention disclosures,

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

Table 2.3: Research expenses by function of UI, FY 2013-14

FISCAL YEAR	PAYROLL (THOUSANDS)	EQUIPMENT (THOUSANDS)	CONSTRUCTION (THOUSANDS)	OTHER (THOUSANDS)	TOTAL (THOUSANDS)
2013-14	$46,523	$4,670	$10,326	$34,075	$95,594
2012-13	$47,201	$4,874	$9,918	$33,898	$95,891
2011-12	$47,698	$3,101	$10,264	$36,163	$97,227
2010-11	$50,932	$3,302	$8,266	$33,729	$96,229

Source: Data supplied by UI.

Table 2.4: Impact of the research activities of UI, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$46,058	$0	$46,058	$95,594	663
MULTIPLIER EFFECT					
Direct effect	$12,580	$5,770	$18,350	$30,453	301
Indirect effect	$2,449	$984	$3,433	$5,872	57
Induced effect	$13,797	$9,462	$23,260	$40,160	395
Total multiplier effect	**$28,826**	**$16,216**	**$45,043**	**$76,484**	**753**
GROSS IMPACT (initial + multiplier)	$74,884	$16,216	$91,100	$172,078	1,416
Less alternative uses of funds	-$7,235	-$6,125	-$13,360	-$23,809	-228
NET IMPACT	**$67,649**	**$10,091**	**$77,740**	**$148,269**	**1,188**

Source: EMSI impact model.

Table 2.5: Invention disclosures, patent applications, licenses, and license income of UI

FISCAL YEAR	INVENTION DISCLOSURES RECEIVED	PATENT APPLICATIONS FILED	LICENSES AND OPTIONS EXECUTED	ADJUSTED GROSS LICENSE INCOME
2012-13	17	15	7	$1,416,451
2011-12	16	16	8	$430,688
2010-11	28	27	6	$651,210
2009-10	28	25	8	$289,990
Total	**89**	**83**	**29**	**$2,788,339**

Source: Data supplied by UI.

patent applications, and licenses and options executed. Over the last four years, UI received 89 invention disclosures, filed 83 new US patent applications, and produced 29 licenses (see Table 2.5). Without the research activities of UI, this level of innovation and sustained economic growth would not have been possible.

IMPACT OF START-UP AND SPIN-OFF COMPANIES

This subsection presents the economic impact of companies that would not have existed in the state but for the presence of UI. To estimate these impacts, we categorize companies according to the following types:

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

We vary our methodology from the previous sections in order to estimate the impacts of start-up and spin-off companies. Ideally, we would use detailed financial information for all start-up and spin-off companies to estimate their impacts. However, collecting that information is not feasible and would raise a number of privacy concerns. As an alternative, we use the number of employees of each start-up and spin-off company that was collected and reported by the university. Table 2.6 presents the number of employees for all start-up and spin-off companies related to UI that were active in Idaho during the analysis year.

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

Table 2.7 presents the impacts of the start-up companies. The initial effect is 62 jobs, equal to the number of employees at all start-up companies in the state (from Table 2.6). The corresponding initial effect on labor income is $3.2 million. The amount of labor income per job created by the start-up companies is much higher than in the previous sections. This is due to the higher average wages within the industries of the start-up companies. The total impacts (the sum of the initial, direct, indirect, and induced effects) are $4.7 million in added labor income and $1.5 million in non-labor income. This totals to $6.3 million in GSP—or the equivalent of 94 jobs.

Note that start-up companies have a strong and clearly defined link to UI. The link between the university and the existence of its spin-off companies, however, is less direct and is thus viewed as more subjective. We include the impacts from spin-off companies in the grand total impact presented later in the report since they represent entrepreneurial activities of the university. But we have included them separately here in case the reader would like to exclude the impacts from spin-off companies from the grand total impact.[9]

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

Table 2.6: Start-up and spin-off companies related to UI that were active in Idaho in FY 2013-14

	NUMBER OF COMPANIES	NUMBER OF EMPLOYEES
Start-up companies	9	62
Spin-off companies	6	273

Source: Data supplied by UI.

Table 2.7: Impact of start-up companies related to UI, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$3,182	$1,030	$4,212	$8,628	62
MULTIPLIER EFFECT					
Direct effect	$338	$143	$481	$1,020	7
Indirect effect	$65	$25	$90	$189	1
Induced effect	$1,160	$335	$1,496	$2,999	24
Total multiplier effect	**$1,563**	**$503**	**$2,067**	**$4,208**	**32**
NET IMPACT	**$4,745**	**$1,534**	**$6,279**	**$12,836**	**94**

Source: EMSI impact model.

Table 2.8: Impact of spin-off companies related to UI, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$16,208	$1,543	$17,751	$31,628	273
MULTIPLIER EFFECT					
Direct effect	$2,571	$269	$2,841	$5,002	45
Indirect effect	$508	$53	$561	$978	9
Induced effect	$7,144	$688	$7,832	$13,452	127
Total multiplier effect	**$10,223**	**$1,010**	**$11,233**	**$19,431**	**180**
NET IMPACT	$26,431	$2,553	$28,984	$51,059	453

Source: EMSI impact model.

As demonstrated in Table 2.8, the university creates an exceptional environment that fosters innovation and entrepreneurship. As a result, the impact of spin-off companies related to UI comes to $26.4 million in added labor income and $2.6 million in non-labor income, totaling $29 million in GSP. Weighted by the industries most affected by the spending of start-up and spin-off company employees and the spending of the companies, this is the equivalent of 453 jobs.

STUDENT SPENDING IMPACT

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

While there were 11,365 students attending UI who originated from Idaho, not all of them would have remained in the state if not for the existence of UI. We apply a conservative assumption that 10% of these students would have left Idaho for other education opportunities if UI did not exist. Therefore, we recognize that the in-state spending of 1,137 students retained in the state is attributable to UI. These students spent money at businesses in the state for groceries, accommodation, transportation, and so on. Of the retained students, we estimate 24 lived on-campus while attending UI. While these students spend money while attending the university, we exclude most of their spending for room and board since these expenditures are already reflected in the impact of the university's operations.

An estimated 3,458 students came from outside the state and lived off campus while attending UI in FY 2013-14. Another estimated 925 out-of-state students lived on-campus while attending the university. We apply the same adjustment as described above to the students that relocated and lived on-campus during their time at UI. Collectively, the off-campus expenditures of out-of-state students supported jobs and created new income in the state economy.[10]

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

The average costs of students appear in the first section of Table 2.9, equal to $11,842 per student. Note that this table excludes expenses for books and supplies, since many of these monies are already reflected in the operations impact discussed in the previous section. We multiply the $11,842 in annual costs by the 4,355 students who either were retained or relocated to the state because of UI and lived in-state but off-campus. This provides us with an estimate of their total spending. For students living on-campus, we multiply the per-student cost of personal expenses, transportation, and off-campus food purchases (assumed to be equal to 25% of room and board) by the number of students who lived in the state but on-campus while attending (949 students). Altogether, off-campus spending of relocator and retained students generated gross sales of $57.1 million. This figure, once net of the monies paid to student workers, yields net off-campus sales of $51.8 million, as shown in the bottom row of Table 2.9.

Estimating the impacts generated by the $51.8 million in student spending follows a procedure similar to that of the operations impact described above. We distribute the $51.8 million in sales to the industry sectors of the SAM model, apply RPCs to reflect in-state spending, and run the net sales figures through the SAM model to derive multiplier effects.

Table 2.10 presents the results. Unlike the previous

Table 2.9: Average student costs and total sales generated by relocator and retained students in Idaho, FY 2013-14

Room and board	$8,034
Personal expenses	$2,366
Transportation	$1,442
Total expenses per student	**$11,842**
Number of students that were retained	1,137
Number of students that relocated	4,384
Gross retained student sales	$10,756,762
Gross relocated student sales	$46,337,604
Total gross off-campus sales	**$57,094,366**
Wages and salaries paid to student workers*	$5,247,700
Net off-campus sales	**$51,846,666**

**This figure reflects only the portion of payroll that was used to cover the living expenses of resident and non-resident student workers who lived in the state.*
Source: Student costs and wages supplied by UI. The number of relocator and retained students who lived in the state and off-campus or on-campus while attending is derived by EMSI from the student origin data and in-term residence data supplied by UI. The data is based on all students.

Table 2.10: Student spending impact, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$3,182	$1,030	$4,212	$8,628	62
MULTIPLIER EFFECT					
Direct effect	$12,242	$7,454	$19,696	$34,393	568
Indirect effect	$2,019	$1,186	$3,205	$5,699	91
Induced effect	$5,219	$3,100	$8,320	$14,397	239
Total multiplier effect	**$19,480**	**$11,741**	**$31,221**	**$54,489**	**898**
TOTAL IMPACT (initial + multiplier)	**$19,480**	**$11,741**	**$31,221**	**$106,335**	**898**

Source: EMSI impact model.

subsections, the initial effect is purely sales-oriented and there is no change in labor or non-labor income. The impact of relocator and retained student spending thus falls entirely under the multiplier effect. The total impact of student spending is $19.5 million in labor income and $11.7 million in non-labor income. This totals $31.2 million in GSP. Weighted by the industries most affected by the spending of UI's students, this is equivalent to 898 jobs. These values represent the direct effects created at the businesses patronized by the students, the indirect effects created by the supply chain of those businesses, and the effects of the increased spending of the household sector throughout the state economy as a result of the direct and indirect effects.

VISITOR SPENDING IMPACT

In addition to out-of-state students, thousands of visitors came to UI to participate in various activities, including commencement, sports events, and orientation. UI estimated that 63,483 out-of-state visitors attended events hosted by UI in FY 2013-14. Table 2.11 presents the average expenditures per person-trip for accommodation, food, transportation, and other personal expenses (including shopping and entertainment). Based on these figures, the gross spending of out-of-state visitors totaled $10.2 million in FY 2013-14. However, some of this spending includes monies paid to the university through non-textbook items (e.g., event tickets, food, etc.). These have already been accounted for in the operations impact and should thus be removed to avoid double-counting. We estimate that on-campus sales generated by out-of-state visitors totaled $780,841. The net sales from out-of-state visitors in FY 2013-14 thus come to $9.4 million.

Calculating the increase in GSP as a result of visitor spending again requires use of the SAM model. The analysis begins by discounting the off-campus

Table 2.11: Average visitor costs and sales generated by out-of-state visitors in Idaho, FY 2013-14

Accommodation	$107
Food	$30
Entertainment and shopping	$12
Transportation	$12
Total expenses per visitor	**$161**
Number of out-of-state visitors	63,483
Gross sales	**$10,220,763**
On-campus sales (excluding text books)	$780,841
Net off-campus sales	**$9,439,922**

Source: Sales calculations by EMSI estimated based on data provided by UI.

Table 2.12: Impact of the spending of out-of-state visitors of UI, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$0	$0	$0	$9,440	0
MULTIPLIER EFFECT					
Direct effect	$1,930	$1,276	$3,206	$5,667	95
Indirect effect	$340	$217	$557	$1,001	17
Induced effect	$804	$532	$1,336	$2,347	40
Total multiplier effect	**$3,074**	**$2,024**	**$5,099**	**$9,015**	**152**
TOTAL IMPACT (initial + multiplier)	**$3,074**	**$2,024**	**$5,099**	**$18,455**	**152**

Source: EMSI impact model.

sales generated by out-of-state visitors to account for leakage in the trade sector, and then bridging the net figures to the detailed sectors of the SAM model. The model runs the net sales figures through the multiplier matrix to arrive at the multiplier effects. As shown in Table 2.12, the net impact of visitor spending in FY 2013-14 comes to $3.1 million in labor income and $2 million in non-labor income. This totals to $5.1 million in GSP. Weighted by the industries most affected by the spending of out-of-state visitors, this is equivalent to 152 jobs.

ALUMNI IMPACT

In this section we estimate the economic impacts stemming from the higher labor income of alumni in combination with their employers' higher non-labor income. This impact is based on the number of students who have attended UI throughout its history. We then use this total number to consider the impact of those students in the single FY 2013-14. Former students who achieved a degree as well as those who may not have finished their degree or did not take courses for credit are considered alumni.

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

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

We begin by estimating the portion of alumni who are employed in the workforce. To estimate the historical employment patterns of alumni in the state, we use the following sets of data or assumptions: 1) settling-in factors to determine how long it takes the average student to settle into a career;[11] 2) death, retirement, and unemployment rates from the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics; and 3) state migration data from the U.S. Census Bureau. The result is the estimated portion of alumni from each previous year who were still actively employed in the state as of FY 2013-14.

The next step is to quantify the skills and human capital that alumni acquired from the university. We use the students' production of credit hour equivalents (CHEs) as a proxy for accumulated human capital. The average number of CHEs completed per student in 2013-14 was 18.2. To estimate the number of CHEs present in the workforce during the analysis year, we use the university's historical student headcount over the past 30 years, from 1984-85 to 2013-14.[12] We multiply the 18.2 average CHEs per student by the headcounts that we estimate are still actively employed from each of the previous years.[13] Students who enroll at the university more than one year are counted at least twice in the historical enrollment data. However, CHEs remain distinct regardless of

11 Settling-in factors are used to delay the onset of the benefits to students in order to allow time for them to find employment and settle into their careers. In the absence of hard data, we assume a range between one and three years for students who graduate with a certificate or a degree, and between one and five years for returning students.

12 We apply a 30-year time horizon because the data on students who attended UI prior to 1984-85 is less reliable, and because most of the students served more than 30 years ago had left the state workforce by 2013-14.

13 This assumes the average credit load and level of study from past years is equal to the credit load and level of study of students today.

when and by whom they were earned, so there is no duplication in the CHE counts. We estimate there are approximately 4.9 million CHEs from alumni active in the workforce.

Next, we estimate the value of the CHEs, or the skills and human capital acquired by UI alumni. This is done using the incremental added labor income stemming from the students' higher wages. The incremental labor income is the difference between the wage earned by UI alumni and the alternative wage they would have earned had they not attended UI. Using the incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average value per CHE to equal $191. This value represents the average incremental increase in wages that alumni of UI received during the analysis year for every CHE they completed.

Because workforce experience leads to increased productivity and higher wages, the value per CHE varies depending on the students' workforce experience, with the highest value applied to the CHEs of students who had been employed the longest by FY 2013-14, and the lowest value per CHE applied to students who were just entering the workforce. More information on the theory and calculations behind the value per CHE appears in Appendix 5. In determining the amount of added labor income attributable to alumni, we multiply the CHEs of former students in each year of the historical time horizon by the corresponding average value per CHE for that year, and then sum the products together. This calculation yields approximately $929.4 million in gross labor income from increased wages received by former students in FY 2013-14 (as shown in Table 2.13).

The next two rows in Table 2.13 show two adjustments used to account for counterfactual outcomes. As discussed above, counterfactual outcomes in economic analysis represent what would have happened if a given event had not occurred. The event in question is the education and training provided by UI and subsequent influx of skilled labor into the state economy. The first counterfactual scenario that we address is the adjustment for alternative education opportunities. In the counterfactual scenario where UI does not exist, we assume a portion of UI alumni would have received a comparable education

Table 2.13: Number of CHEs in workforce and initial labor income created in Idaho, FY 2013-14

Number of CHEs in workforce	4,862,969
Average value per CHE	$191
Initial labor income, gross	**$929,377,184**
COUNTERFACTUALS	
Percent reduction for alternative education opportunities	15%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$394,781,765**

Source: EMSI impact model.

elsewhere in the state or would have left the state and received a comparable education and then returned to the state. The incremental labor income that accrues to those students cannot be counted towards the added labor income from UI alumni. The adjustment for alternative education opportunities amounts to a 15% reduction of the $929.4 million in added labor income.[14] This means that 15% of the added labor income from UI alumni would have been generated in the state anyway, even if the university did not exist. For more information on the alternative education adjustment, see Appendix 6.

The other adjustment in Table 2.13 accounts for the importation of labor. Suppose UI did not exist and in consequence there were fewer skilled workers in the state. Businesses could still satisfy some of their need for skilled labor by recruiting from outside Idaho. We refer to this as the labor import effect. Lacking information on its possible magnitude, we assume 50% of the jobs that students fill at state businesses could have been filled by workers recruited from outside the state if the university did not exist[15]. We conduct a sensitivity analysis for this assumption in Section 4. With the 50% adjustment, the net labor income added to the economy comes to $394.8 million, as shown in Table 2.13.

14 For a sensitivity analysis of the alternative education opportunities variable, see Section 4.

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

The $394.8 million in added labor income appears under the initial effect in the labor income column of Table 2.14. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of UI see higher profits as a result of the increased productivity of their capital assets. To estimate this additional income, we allocate the initial increase in labor income ($394.8 million) to the six-digit NAICS industry sectors where students are most likely to be employed. This allocation entails a process that maps completers in the state to the detailed occupations for which those completers have been trained, and then maps the detailed occupations to the six-digit industry sectors in the SAM model.[16] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics (BLS), we map the breakdown of the state's completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from the SAM model to map the occupational distribution of the $394.8 million in initial labor income effects to the detailed industry sectors in the SAM model.[17]

Once these allocations are complete, we apply the ratio of non-labor to labor income provided by the SAM model for each sector to our estimate of initial labor income. This computation yields an estimated $86.1 million in non-labor income attributable to the university's alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the Idaho economy, equal to approximately $480.8 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the SAM model. We then run the values through the SAM's multiplier matrix.

Table 2.14 shows the multiplier effects of alumni. Multiplier effects occur as alumni generate an increased demand for consumer goods and services through the expenditure of their higher wages. Further, as the industries where alumni are employed increase their output, there is a corresponding increase in the demand for input from the indus-

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

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

Table 2.14: Alumni impact, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
INITIAL EFFECT	$394,782	$86,055	$480,837	$900,888	10,030
MULTIPLIER EFFECT					
Direct effect	$45,020	$10,847	$55,868	$103,829	1,230
Indirect effect	$8,370	$2,156	$10,526	$20,020	228
Induced effect	$199,162	$35,585	$234,747	$378,672	5,079
Total multiplier effect	**$252,552**	**$48,588**	**$301,141**	**$502,521**	**6,537**
TOTAL IMPACT (initial + multiplier)	**$647,334**	**$134,643**	**$781,977**	**$1,403,410**	**16,567**

Source: EMSI impact model.

UI Alumni
Making a Difference

ONE BONE AT A TIME

The research that occurs at UI provides many opportunities for scientific advancement and economic success stories every year. One of those success stories is currently growing at MJ3 Industries, a bio-nanotechnology firm led by UI alumnus Jamie L. Hass.

MJ3 Industries is part of the developing field of osseointegration—the optimization of bone implants for orthopedic and dental purposes. Such implants are part of a multi-billion dollar industry that is expected to continue growing rapidly in coming years. But as a young technology, such implants are frequently plagued by failure. According to MJ3, implants fail at a rate of 8-20%, which severely undercuts their otherwise promising potential to improve patients' lives.

MJ3 Industries is working to overcome that problem. Using a sophisticated nanomaterial coating based on a patented silicon dioxide nanospring, Dr. Hass and her team have developed a method of treating implants that greatly improves their likelihood of succeeding. Because the structure of the microsprings in the coating is very similar to the structure of collagen (the main protein out of which bone is composed), its presence on the implant encourages the patient's bones to treat the implant as natural bone. This increases the speed with which new bone material is deposited on the implant, and thus the speed with which the bone heals.

MJ3's nanotechnology holds significant promise for use in both medical and veterinary fields; in fact, it was as a result of Dr. Hass's extensive background in veterinary science that the company came into being. Dr. Hass has over 26 years of experience in veterinary fields; she brought that background to UI when she did her doctoral work there between 2008 and 2012. It was at UI that she did the fundamental research on the use of nanosprings to encourage osseointegration, which was the subject of her doctoral dissertation.

The result of that research at MJ3 Industries has been the issuance of a patent for her methods. In addition, Dr. Hass was the recipient of the 2010 Idaho IDeA Network of Biomedical Excellence (INBRE) fellowship and a 2011 Idaho Early-Stage Innovation Award finalist. Her work has also received recognition in many other ways, including 3rd Place in the University of Idaho Innovation and Enterprise Works Business Competition 2012.

tries in the employers' supply chain. Together, the incomes generated by the expansions in business input purchases and household spending constitute the multiplier effect of the increased productivity of the university's alumni. The final results are $252.6 million in labor income and $48.6 million in non-labor income, for an overall total of $301.1 million in multiplier effects. The grand total of the alumni impact thus comes to $782 million in GSP, the sum of all initial and multiplier labor and non-labor income effects. Weighted by the industries most affected by the spending of UI's alumni, this is equivalent to 16,567 jobs.

TOTAL IMPACT OF UI

The total economic impact of UI on Idaho can be generalized into two broad types of impacts. First, on an annual basis, UI generates a flow of spending that has a significant impact on the Idaho economy. The impacts of this spending are captured by the operations, research, start-up and spin-off companies, student, and visitor spending impacts. While not insignificant, these impacts do not capture the true purpose of UI. The basic mission of UI is to foster human capital. Every year, a new cohort of UI former students adds to the stock of human capital in Idaho, and a portion of alumni continues to add to the Idaho economy. Table 2.15 displays the grand total impacts of UI on the Idaho economy in FY 2013-14. For context, the percentages of UI compared to the total labor income, non-labor income, GSP, sales, and jobs in Idaho, as presented in Table 1.5 and Table 1.6, are included. The total added value of UI is equivalent to 1.9% of the GSP of Idaho. By comparison, this contribution that the university provides on its own is slightly larger than the entire Utilities industry in Idaho.

These impacts, stemming from spending related to the university and from human capital, spread throughout the state economy and affect individual industry sectors. Table 2.16 on the next page displays the total impact of UI on industry sectors based on their two–digit NAICS code. The table shows the total impact of operations, research, start-up and spin-off companies, students, visitors, and alumni as shown in Table 2.15, broken down by industry sector using processes outlined earlier in this chapter. By showing the impact on individual industry sectors, it is possible to see in finer detail where UI has the greatest impact. For example, UI's impact for the Educational Services industry sector was 5,486 jobs in FY 2013-14.

Table 2.15: Total impact of UI, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
Operations spending	$182,577	$17,902	$200,479	$330,265	2,835
Research spending	$67,649	$10,091	$77,740	$148,269	1,188
Start-up and spin-off companies	$31,176	$4,087	$35,263	$63,895	548
Student spending	$19,480	$11,741	$31,221	$106,335	898
Visitor spending	$3,074	$2,024	$5,099	$18,455	152
Alumni	$647,334	$134,643	$781,977	$1,403,410	16,567
Total impact	**$951,291**	**$180,489**	**$1,131,779**	**$2,070,629**	**22,188**
% of the Idaho economy	2.7%	0.8%	1.9%	1.6%	2.5%

Table 2.16: Total impact of UI by industry, FY 2013-14

	LABOR INCOME (THOUSANDS)	NON-LABOR INCOME (THOUSANDS)	GSP (THOUSANDS)	SALES (THOUSANDS)	JOBS
Agriculture, Forestry, Fishing and Hunting	$17,522	$13,672	$31,193	$77,401	565
Mining	$3,601	$8,202	$11,803	$16,253	108
Utilities	$2,586	$5,932	$8,518	$12,574	31
Construction	$23,856	$8,318	$32,175	$58,509	617
Manufacturing	$29,725	$25,920	$55,646	$131,073	479
Wholesale Trade	$5,650	$4,936	$10,586	$16,187	95
Retail Trade	$6,647	$3,018	$9,664	$22,956	215
Transportation and Warehousing	$4,459	$1,874	$6,333	$14,727	112
Information	$10,895	$13,112	$24,007	$45,606	211
Finance and Insurance	$13,342	$7,648	$20,990	$39,367	272
Real Estate and Rental and Leasing	$9,353	$27,933	$37,286	$58,925	295
Professional and Technical Services	$121,447	$10,879	$132,326	$242,000	2,106
Management of Companies and Enterprises	$7,042	$1,188	$8,230	$14,298	75
Administrative and Waste Services	$9,989	$2,337	$12,326	$19,442	338
Educational Services	$87,595	$8,406	$96,001	$167,912	3,113
Health Care and Social Assistance	$26,212	$2,246	$28,457	$52,768	705
Arts, Entertainment, and Recreation	$6,592	$1,942	$8,534	$14,998	483
Accommodation and Food Services	$16,200	$10,939	$27,139	$86,675	899
Other Services (except Public Administration)	$8,271	-$3,620	$4,651	$16,939	454
Government, Non-Education	$37,632	$8,380	$46,012	$36,950	599
Government, Education	$502,675	$17,228	$519,903	$929,162	10,418
Total Impact	**$951,290**	**$180,489**	**$1,131,779**	**$2,074,723**	**22,187**

Source: EMSI impact model.

INVESTMENT ANALYSIS

3

The benefits generated by UI affect the lives of many people. The most obvious beneficiaries are the university's students; they give up time and money to go to the university in return for a lifetime of higher income and improved quality of life. But the benefits do not stop there. As students earn more, communities and citizens throughout Idaho benefit from an enlarged economy and a reduced demand for social services. In the form of increased tax revenues and public sector savings, the benefits of education extend as far as the state government.

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

STUDENT PERSPECTIVE

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

Calculating student costs

Student costs consist of two main items: direct outlays and opportunity costs. Direct outlays include tuition and fees, equal to $83.4 million from Table 1.2. Direct outlays also include the cost of books and supplies. On average, full-time students spent $1,232 each on books and supplies during the reporting year.[18] Multiplying this figure times the number of full-time equivalents (FTEs) produced by UI in 2013-

18 Based on the data supplied by UI.

14[19] generates a total cost of $12.1 million for books and supplies.

Opportunity cost is the most difficult component of student costs to estimate. It measures the value of time and earnings forgone by students who go to the university rather than work. To calculate it, we need to know the difference between the students' full earning potential and what they actually earn while attending the university.

We derive the students' full earning potential by weighting the average annual income levels in Table 1.7 according to the education level breakdown of the student population when they first enrolled.[20] However, the income levels in Table 1.7 reflect what average workers earn at the midpoint of their careers, not while attending the university. Because of this, we adjust the income levels to the average age of the student population (25) to better reflect their wages at their current age.[21] This calculation yields an average full earning potential of $25,794 per student.

In determining how much students earn while enrolled in postsecondary education, an important factor to consider is the time that they actually spend on postsecondary education, since this is the only time that they are required to give up a portion of their earnings. We use the students' CHE production as a proxy for time, under the assumption that the more CHEs students earn, the less time they have to work, and, consequently, the greater their forgone earnings. Overall, students attending UI earned an average of 18.2 CHEs per student, which is approximately equal to 61% of a full academic year.[22] We thus include no more than $15,652 (or 61%) of the students' full earning potential in the opportunity cost calculations.

Another factor to consider is the students' employment status while enrolled in postsecondary education. Based on data supplied by the university, approximately 64% of students are employed.[23] For the 36% that are not working, we assume that they are either seeking work or planning to seek work once they complete their educational goals. By choosing to enroll, therefore, non-working students give up everything that they can potentially earn during the academic year (i.e., the $15,652). The total value of their forgone income thus comes to $91.5 million.

Working students are able to maintain all or part of their income while enrolled. However, many of them hold jobs that pay less than statistical averages, usually because those are the only jobs they can find that accommodate their course schedule. These jobs tend to be at entry level, such as restaurant servers or cashiers. To account for this, we assume that working students hold jobs that pay 58% of what they would have earned had they chosen to work full-time rather than go to college.[24] The remaining 42% comprises the percent of their full earning potential that they forgo. Obviously this assumption varies by person; some students forego more and others less. Since we do not know the actual jobs that students hold while attending, the 42% in forgone earnings serves as a reasonable average.

Working students also give up a portion of their leisure time in order to attend higher education institutions. According to the Bureau of Labor Statistics American Time Use Survey, students forgo up to 1.4 hours of leisure time per day.[25] Assuming that an hour of leisure is equal in value to an hour of work, we derive the total cost of leisure by multiplying the number of leisure hours foregone during the academic year by the average hourly pay of the students' full earning potential. For working students, therefore, their total opportunity cost comes to $96.9 million, equal to the sum of their foregone income ($69 million) and forgone leisure time ($28 million).

19 A single FTE is equal to 30 CHEs, so there were 9,853 FTEs produced by students in 2013-14, equal to 295,577 CHEs divided by 30.

20 This is based on the number of students who reported their entry level of education to UI. EMSI provided estimates in the event that the data was not available from the university.

21 Further discussion on this adjustment appears in Appendix 5.

22 Equal to 18.2 CHEs divided by 30, the assumed number of CHEs in a full-time academic year.

23 EMSI provided an estimate of the percentage of students employed in the case the university was unable to collect the data.

24 The 58% assumption is based on the average hourly wage of the jobs most commonly held by working students divided by the national average hourly wage. Occupational wage estimates are published by the Bureau of Labor Statistics (see http://www.bls.gov/oes/current/oes_nat.htm).

25 "Charts by Topic: Leisure and sports activities," Bureau of Labor Statistics American Time Use Survey, last modified November 2012, accessed July 2013, http://www.bls.gov/TUS/CHARTS/LEISURE.HTM.

Table 3.1: Student costs, FY 2013-14 (thousands)

DIRECT OUTLAYS	
Tuition and fees	$83,361
Books and supplies	$12,138
Total direct outlays	**$95,500**
OPPORTUNITY COSTS	
Earnings forgone by non-working students	$91,488
Earnings forgone by working students	$68,962
Value of leisure time forgone by working students	$27,955
Less residual aid	-$21,352
Total opportunity costs	**$167,053**
Total student costs	**$262,553**

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

The steps leading up to the calculation of student costs appear in Table 3.1. Direct outlays amount to $95.5 million, the sum of tuition and fees ($83.4 million) and books and supplies ($12.1 million). Opportunity costs for working and non-working students amount to $167.1 million, excluding $21.4 million in offsetting residual aid that is paid directly to students.[26] Summing direct outlays and opportunity costs together yields a total of $262.6 million in student costs.

Linking education to earnings

Having estimated the costs of education to students, we weigh these costs against the benefits that students receive in return. The relationship between education and earnings is well documented and forms the basis for determining student benefits. As shown in Table 1.7, mean income levels at the midpoint of the average-aged worker's career increase as people achieve higher levels of education. The differences between income levels define the incremental benefits of moving from one education level to the next.

A key component in determining the students' return on investment is the value of their future benefits stream; i.e., what they can expect to earn in return for the investment they make in education. We calculate the future benefits stream to the university's 2013-14 students first by determining their average annual increase in income, equal to $59.5 million. This value represents the higher income that accrues to students at the midpoint of their careers and is calculated based on the marginal wage increases of the CHEs that students complete while attending the university. For a full description of the methodology used to derive the $59.5 million, see Appendix 5.

The second step is to project the $59.5 million annual increase in income into the future, for as long as students remain in the workforce. We do this using the Mincer function to predict the change in earnings at each point in an individual's working career.[27] The Mincer function originated from Mincer's seminal work on human capital (1958). The function estimates earnings using an individual's years of education and post-schooling experience. While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Card (1999 and 2001) addresses a number of these criticisms using US based research over the last three decades and concludes that any upward bias in the Mincer parameters is on the order of 10% or less. We use United States based Mincer coefficients estimated by Polachek (2003). To account for any upward bias, we incorporate a 10% reduction in our projected earnings, otherwise known as the ability bias. With the $59.5 million representing the students' higher earnings at the midpoint of their careers, we apply scalars from the Mincer function to yield a stream of projected future benefits that gradually increase from the time students enter the workforce, peak shortly after the career midpoint, and then dampen slightly as students approach retirement at age 67. This earnings stream appears in Column 2 of Table 3.2.

As shown in Table 3.2, the $59.5 million in gross added income occurs around Year 16, which is the approximate midpoint of the students' future working careers given the average age of the student

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

27 Appendix 5 provides more information on the Mincer function and how it is used to predict future earnings growth.

Table 3.2: Projected benefits and costs, student perspective

1	2	3	4	5	6
YEAR	GROSS ADDED INCOME TO STUDENTS (MILLIONS)	% ACTIVE IN WORKFORCE*	NET ADDED INCOME TO STUDENTS (MILLIONS)	STUDENT COSTS (MILLIONS)	NET CASH FLOW (MILLIONS)
0	$35.9	11%	$3.8	$262.6	-$258.7
1	$37.4	26%	$9.7	$0	$9.7
2	$39.0	34%	$13.2	$0	$13.2
3	$40.6	47%	$19.2	$0	$19.2
4	$42.1	67%	$28.1	$0	$28.1
5	$43.7	96%	$41.7	$0	$41.7
6	$45.2	96%	$43.2	$0	$43.2
7	$46.8	96%	$44.7	$0	$44.7
8	$48.3	96%	$46.2	$0	$46.2
9	$49.8	96%	$47.7	$0	$47.7
10	$51.3	96%	$49.1	$0	$49.1
11	$52.8	96%	$50.5	$0	$50.5
12	$54.2	96%	$51.8	$0	$51.8
13	$55.6	96%	$53.1	$0	$53.1
14	$57.0	95%	$54.4	$0	$54.4
15	$58.3	95%	$55.6	$0	$55.6
16	$59.5	95%	$56.7	$0	$56.7
17	$60.7	95%	$57.7	$0	$57.7
18	$61.8	95%	$58.7	$0	$58.7
19	$62.9	95%	$59.6	$0	$59.6
20	$63.8	95%	$60.4	$0	$60.4
21	$64.8	94%	$61.1	$0	$61.1
22	$65.6	94%	$61.7	$0	$61.7
23	$66.3	94%	$62.2	$0	$62.2
24	$67.0	94%	$62.6	$0	$62.6
25	$67.6	93%	$62.9	$0	$62.9
26	$68.0	93%	$63.1	$0	$63.1
27	$68.4	92%	$63.2	$0	$63.2
28	$68.7	92%	$63.2	$0	$63.2
29	$68.9	91%	$63.0	$0	$63.0
30	$69.0	91%	$62.7	$0	$62.7
31	$69.0	90%	$62.3	$0	$62.3
32	$68.9	90%	$61.8	$0	$61.8
33	$68.8	89%	$61.2	$0	$61.2
34	$68.5	88%	$60.5	$0	$60.5
35	$68.1	88%	$59.6	$0	$59.6
36	$67.6	87%	$58.6	$0	$58.6
37	$67.1	86%	$57.6	$0	$57.6
38	$66.4	85%	$56.4	$0	$56.4
39	$65.7	84%	$55.1	$0	$55.1
40	$64.9	26%	$16.9	$0	$16.9
41	$64.0	7%	$4.6	$0	$4.6
Present value			**$871.1**	**$262.6**	**$608.6**
Internal rate of return					14.0%
Benefit-cost ratio					3.3
Payback period (no. of years)					9.3

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

population and an assumed retirement age of 67. In accordance with the Mincer function, the gross added income that accrues to students in the years leading up to the midpoint is less than $59.5 million and the gross added income in the years after the midpoint is greater than $59.5 million.

The final step in calculating the students' future benefits stream is to net out the potential benefits generated by students who are either not yet active in the workforce or who leave the workforce over time. This adjustment appears in Column 3 of Table 3.2 and represents the percentage of the 2013-14 student population that will be employed in the workforce in a given year. Note that the percentages in the first five years of the time horizon are relatively lower than those in subsequent years. This is because many students delay their entry into the workforce, either because they are still enrolled at the university or because they are unable to find a job immediately upon graduation. Accordingly, we apply a set of "settling-in" factors to account for the time needed by students to find employment and settle into their careers. As discussed in Section 2, settling-in factors delay the onset of the benefits by one to three years for students who graduate with a certificate or a degree and by one to five years for degree-seeking students who do not complete during the analysis year.

Beyond the first five years of the time horizon, students will leave the workforce for any number of reasons, whether death, retirement, or unemployment. We estimate the rate of attrition using the same data and assumptions applied in the calculation of the attrition rate in the economic impact analysis of Section 2.[28] The likelihood of leaving the workforce increases as students age, so the attrition rate is more aggressive near the end of the time horizon than in the beginning. Column 4 of Table 3.2 shows the net added income to students after accounting for both the settling-in patterns and attrition.

Return on investment to students

Having estimated the students' costs and their future benefits stream, the next step is to discount the results to the present to reflect the time value of money. For the student perspective we assume a discount rate of 4.5% (see below). Because students tend to rely upon debt to pay for their educations—i.e. they are negative savers—their discount rate is based upon student loan interest rates.[29] In Section 4, we conduct a sensitivity analysis of this discount rate. The present value of the benefits is then compared to student costs

Discount Rate

The discount rate is a rate of interest that converts future costs and benefits to present values. For example, $1,000 in higher earnings realized 30 years in the future is worth much less than $1,000 in the present. All future values must therefore be expressed in present value terms in order to compare them with investments (i.e., costs) made today. The selection of an appropriate discount rate, however, can become an arbitrary and controversial undertaking. As suggested in economic theory, the discount rate should reflect the investor's opportunity cost of capital, i.e., the rate of return one could reasonably expect to obtain from alternative investment schemes. In this study we assume a 4.5% discount rate from the student perspective and a 1.4% discount rate from the perspective of taxpayers and society.

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

29 The student discount rate is derived from the baseline forecasts for the 10-year zero coupon bond discount rate published by the Congressional Budget Office. See the Congressional Budget Office, Student Loan and Pell Grant Programs - March 2012 Baseline, Congressional Budget Office Publications, last modified March 13, 2012, accessed July 2013, http://www.cbo.gov/sites/default/files/cbofiles/attachments/43054_StudentLoanPellGrantPrograms.pdf.

to derive the investment analysis results, expressed in terms of a benefit-cost ratio, rate of return, and payback period. The investment is feasible if returns match or exceed the minimum threshold values; i.e., a benefit-cost ratio greater than 1, a rate of return that exceeds the discount rate, and a reasonably short payback period.

In Table 3.2, the net added income of students yields a cumulative discounted sum of approximately $871.1 million, the present value of all of the future income increments (see the bottom section of Column 4). This may also be interpreted as the gross capital asset value of the students' higher income stream. In effect, the aggregate 2013-14 student body is rewarded for its investment in UI with a capital asset valued at $871.1 million.

The students' cost of attending the university is shown in Column 5 of Table 3.2, equal to a present value of $262.6 million. Note that costs occur only in the single analysis year and are thus already in current year dollars. Comparing the cost with the present value of benefits yields a student benefit-cost ratio of 3.3 (equal to $871.1 million in benefits divided by $262.6 million in costs).

Another way to compare the same benefits stream and associated cost is to compute the rate of return. The rate of return indicates the interest rate that a bank would have to pay a depositor to yield an equally attractive stream of future payments.[30] Table 3.2 shows students of UI earning average returns of 14.0% on their investment of time and money. This is a favorable return compared, for example, to approximately 1% on a standard bank savings account, or 7% on stocks and bonds (30-year average return).

Note that returns reported in this study are real returns, not nominal. When a bank promises to pay a certain rate of interest on a savings account, it employs an implicitly nominal rate. Bonds operate in a similar manner. If it turns out that the inflation rate is higher than the stated rate of return, then money is lost in real terms. In contrast, a real rate of return is on top of inflation. For example, if inflation is running at 3% and a nominal percentage of 5% is paid, then the real rate of return on the investment is only 2%. In Table 3.2, the 14.0% student rate of return is a real rate. With an inflation rate of 2.5% (the average rate reported over the past 20 years as per the U.S. Department of Commerce, Consumer Price Index), the corresponding nominal rate of return is 16.5%, higher than what is reported in Table 3.2.

The payback period is defined as the length of time it takes to entirely recoup the initial investment.[31] Beyond that point, returns are what economists would call pure costless rent. As indicated in Table 3.2, students at UI see, on average, a payback period of 9.3 years on their forgone earnings and out-of-pocket costs.

TAXPAYER PERSPECTIVE

From the taxpayer perspective, the pivotal step here is to hone in on the public benefits that specifically accrue to state government. For example, benefits resulting from income growth are limited to increased state tax payments. Similarly, savings related to improved health, reduced crime, and fewer welfare and unemployment claims, discussed below, are limited to those received strictly by state government. In all instances, benefits to private residents, local businesses, or the federal government are excluded.

Growth in state tax revenues

As a result of their time at UI, students earn more because of the skills they learned while attending the university, and businesses earn more because stu-

30 Rates of return are computed using the familiar internal rate-of-return calculation. Note that, with a bank deposit or stock market investment, the depositor puts up a principal, receives in return a stream of periodic payments, and then recovers the principal at the end. Someone who invests in education, on the other hand, receives a stream of periodic payments that include the recovery of the principal as part of the periodic payments, but there is no principal recovery at the end. These differences notwithstanding comparable cash flows for both bank and education investors yield the same internal rate of return.

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

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

Estimating the effect of UI on increased tax revenues begins with the present value of the students' future income stream, which is displayed in Column 4 of Table 3.2. To this we apply a multiplier derived from EMSI's SAM model to estimate the added labor income created in the state as students and businesses spend their higher incomes.[32] As labor income increases, so does non-labor income, which consists of monies gained through investments. To calculate the growth in non-labor income, we multiply the increase in labor income by a ratio of the Idaho gross state product to total labor income in the state. We also include the spending impacts discussed in Section 2 that were created in 2013-14 by the operations of the university, research spending, student spending, and visitor spending. To each of these, we apply the prevailing tax rates so we capture only the tax revenues attributable to state government from this additional income.

Not all of these tax revenues may be counted as benefits to the state, however. Some students leave the state during the course of their careers, and the higher income they receive as a result of their education leaves the state with them. To account for this dynamic, we combine student settlement data from the university with data on migration patterns from the U.S. Census Bureau to estimate the number of students who will leave the state workforce over time.

We apply another reduction factor to account for the students' alternative education opportunities. This is the same adjustment that we use in the calculation of the alumni impact in Section 2 and is designed to account for the counterfactual scenario where UI does not exist. The assumption in this case is that any benefits generated by students who could have received an education even without the university cannot be counted as new benefits to society. For this analysis, we assume an alternative education variable of 15%, meaning that 15% of the student population at the university would have generated benefits anyway even without the university. For more information on the alternative education variable, see Appendix 6.

We apply a final adjustment factor to account for the "shutdown point" that nets out benefits that are not directly linked to the state government costs of supporting the university. As with the alternative education variable discussed under the alumni impact, the purpose of this adjustment is to account for counterfactual scenarios. In this case, the counterfactual scenario is where state government funding for UI did not exist and UI had to derive the revenue elsewhere. To estimate this shutdown point, we apply a sub-model that simulates the students' demand curve for education by reducing state support to zero and progressively increasing student tuition and fees. As student tuition and fees increase, enrollment declines. For UI, the shutdown point adjustment is 0%, meaning that the university could not operate without taxpayer support. As such, no reduction applies. For more information on the theory and methodology behind the estimation of the shutdown point, see Appendix 8.

After adjusting for attrition, alternative education opportunities, and the shutdown point, we calculate the present value of the future added tax revenues that occur in the state, equal to $226.7 million. Recall from the discussion of the student return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. Given that the stakeholder in this case is the public sector, we use the discount rate of 1.4%. This is the real treasury interest rate recommended by the Office for Management and Budget (OMB) for 30-year investments, and in Section 4, we conduct a sensitivity analysis of this discount rate. [33]

32 For a full description of the EMSI SAM model, see Appendix 4.

33 See the Office of Management and Budget, Real Treasury Interest Rates in "Table of Past Years Discount Rates" from Appendix C of OMB Circular No. A-94 (revised December 2012).

Government savings

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

The model quantifies government savings by calculating the probability at each education level that individuals will have poor health, commit crimes, or claim welfare and unemployment benefits. Deriving the probabilities involves assembling data from a variety of studies and surveys analyzing the correlation between education and health, crime, welfare, and unemployment at the national and state level. We spread the probabilities across the education ladder and multiply the marginal differences by the number of students who achieved CHEs at each step. The sum of these marginal differences counts as the upper bound measure of the number of students who, due to the education they received at the university, will not have poor health, commit crimes, or claim welfare and unemployment benefits. We dampen these results by the ability bias adjustment discussed earlier in the student perspective section and in Appendix 5 to account for factors (besides education) that influence individual behavior. We then multiply the marginal effects of education times the associated costs of health, crime, welfare, and unemployment.[34] Finally, we apply the same adjustments for attrition and alternative education to derive the net savings to the government.

34 For a full list of the data sources used to calculate the social externalities, see the References and Resource section. See also Appendix 4 for a more in-depth description of the methodology.

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

ADDED TAX REVENUE	$226,748
GOVERNMENT SAVINGS	
Health-related savings	$78,819
Crime-related savings	$6,953
Welfare/unemployment-related savings	$401
Total government savings	**$86,173**
TOTAL TAXPAYER BENEFITS	$312,920

Source: EMSI impact model.

Table 3.3 displays all benefits to taxpayers. The first row shows the added tax revenues created in the state, equal to $226.7 million, from students' higher incomes, increases in non-labor income, and spending impacts. A breakdown in government savings by health, crime, and welfare/unemployment-related savings appears next. These total to $86.2 million. The sum of the social savings and the added income in the state is $312.9 million, as shown in the bottom row of Table 3.3. These savings accrue in the future as long as the 2013-14 student population of UI remains in the workforce.

Return on investment to taxpayers

Taxpayer costs are reported in Table 3.4 on the following page and come to $128.8 million, equal to the contribution of state government to UI. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 2.4 (= $312.9 million ÷ $128.8 million), indicating a profitable investment.

At 8.2%, the rate of return to state taxpayers is favorable. Given that the stakeholder in this case is the public sector, we use the discount rate of 1.4%, the real treasury interest rate recommended by the Office for Management and Budget (OMB) for 30-year investments.[35] This is the return governments are

35 See the Office of Management and Budget, Real Treasury

Table 3.4: Projected benefits and costs, taxpayer perspective

1	2	3	4
YEAR	BENEFITS TO TAXPAYERS (MILLIONS)	STATE GOV'T COSTS (MILLIONS)	NET CASH FLOW (MILLIONS)
0	$34.8	$128.80	-$94.0
1	$2.2	$0	$2.2
2	$2.9	$0	$2.9
3	$4.2	$0	$4.2
4	$6.0	$0	$6.0
5	$8.7	$0	$8.7
6	$8.9	$0	$8.9
7	$9.1	$0	$9.1
8	$9.2	$0	$9.2
9	$9.4	$0	$9.4
10	$9.5	$0	$9.5
11	$9.6	$0	$9.6
12	$9.8	$0	$9.8
13	$9.9	$0	$9.9
14	$10.0	$0	$10.0
15	$10.1	$0	$10.1
16	$10.2	$0	$10.2
17	$10.3	$0	$10.3
18	$10.4	$0	$10.4
19	$10.5	$0	$10.5
20	$10.6	$0	$10.6
21	$10.6	$0	$10.6
22	$10.7	$0	$10.7
23	$10.7	$0	$10.7
24	$10.7	$0	$10.7
25	$10.7	$0	$10.7
26	$10.7	$0	$10.7
27	$10.7	$0	$10.7
28	$10.7	$0	$10.7
29	$10.6	$0	$10.6
30	$10.6	$0	$10.6
31	$10.5	$0	$10.5
32	$10.4	$0	$10.4
33	$10.3	$0	$10.3
34	$10.2	$0	$10.2
35	$10.1	$0	$10.1
36	$9.9	$0	$9.9
37	$9.8	$0	$9.8
38	$9.6	$0	$9.6
39	$9.4	$0	$9.4
40	$2.9	$0	$2.9
41	$0.8	$0	$0.8
Present value	**$312.9**	**$128.80**	**$184.2**
Internal rate of return			8.2%
Benefit-cost ratio			2.4
Payback period (no. of years)			13.5

Source: EMSI impact model.

assumed to be able to earn on generally safe investments of unused funds, or alternatively, the interest rate for which governments, as relatively safe borrowers, can obtain funds. A rate of return of 1.4% would mean that the university just pays its own way. In principle, governments could borrow monies used to support UI and repay the loans out of the resulting added taxes and reduced government expenditures. A rate of return of 8.2%, on the other hand, means that UI not only pays its own way, but also generates a surplus that the state government can use to fund other programs. It is unlikely that other government programs could make such a claim.

SOCIAL PERSPECTIVE

Idaho benefits from the education that UI provides through the income that students create in the state and through the savings that they generate through their improved lifestyles. To receive these benefits, however, members of society must pay money and forgo services that they otherwise would have enjoyed if UI did not exist. Society's investment in UI stretches across a number of investor groups, from students to employers to taxpayers. We weigh the benefits generated by UI to these investor groups against the total social costs of generating those benefits. The total social costs include all UI expenditures, all student expenditures less tuition and fees, and all student opportunity costs, totaling $547.4 million ($368.2 million in UI expenditures, $12.1 million in student expenditures, and $167.1 million in student opportunity costs).

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

Income growth in the state

In the process of absorbing the newly-acquired skills of students that attend UI, not only does the productivity of Idaho's workforce increase, but so does

Beekeeper Analogy

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

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

Educational institutions are like beekeepers. While their principal aim is to provide education and raise people's incomes, in the process an array of external benefits are created. Students' health and lifestyles are improved, and society indirectly benefits just as orchard owners indirectly benefit from beekeepers. Aiming at a more complete accounting of the benefits generated by education, the model tracks and accounts for many of these external social benefits.

Interest Rates in "Table of Past Years Discount Rates" from Appendix C of OMB Circular No. A-94 (revised December 2012).

the productivity of its physical capital and assorted infrastructure. Students earn more because of the skills they learned while attending the university, and businesses earn more because student skills make capital more productive (buildings, machinery, and everything else). This in turn raises profits and other business property income. Together, increases in labor and non-labor (i.e., capital) income are considered the effect of a skilled workforce.

Estimating the effect of UI on income growth in the state follows the same process as used when calculating increased tax revenues in the taxpayer perspective. However, instead of looking at just the tax revenue portion, we include all of the added income. We again factor in student attrition and alternative education opportunities. The shutdown point does not apply to income growth to society because the social perspective captures not only the state taxpayer support to the university, but also the support from the students and other non-governmental sources.

After adjusting for attrition and alternative education opportunities, we calculate the present value of the future added income that occurs in the state, equal to $2.1 billion. Recall from the discussion of the student and taxpayer return on investment that the present value represents the sum of the future benefits that accrue each year over the course of the time horizon, discounted to current year dollars to account for the time value of money. As stated in the taxpayer perspective, given that the stakeholder in this case is the public sector, we use the discount rate of 1.4%.

Table 3.5: Present value of the future added income and social savings in the state (thousands)

ADDED INCOME	$2,076,563
SOCIAL SAVINGS	
Health	
Smoking	$207,860
Alcoholism	$9,480
Obesity	$165,927
Mental illness	$46,631
Drug abuse	$19,940
Total health savings	**$449,838**
CRIME	
Criminal Justice System savings	$6,677
Crime victim savings	$604
Added productivity	$2,041
Total crime savings	**$9,322**
WELFARE/UNEMPLOYMENT	
Welfare savings	$46
Unemployment savings	$355
Total welfare/unemployment savings	**$401**
Total social savings	**$459,560**
TOTAL, added income + social savings	$2,536,123

Source: EMSI impact model.

Social savings

Similar to the government savings discussed above, society as a whole sees savings due to external or incidental benefits of education. These represent the avoided costs that otherwise would have been drawn from private and public resources absent the education provided by UI. Social benefits appear in Table 3.5 and break down into three main categories: 1) health savings, 2) crime savings, and 3) welfare and unemployment savings. These are similar to the categories from the taxpayer perspective above, although health savings now also include lost productivity and other effects associated with smoking, alcoholism, obesity, mental illness, and drug abuse. In addition to avoided costs to the justice system, crime savings also consist of avoided victim costs and benefits stemming from the added productivity of individuals who otherwise would have been incarcerated. Welfare and unemployment benefits comprise avoided costs due to the reduced number of social assistance and unemployment insurance claims.

Table 3.5 above displays the results of the analysis. The first row shows the added income created in the state, equal to $2.1 billion, from students' higher incomes and their multiplier effects, increases in non-labor income, and spending impacts. Social savings appear next, beginning with a breakdown

Table 3.6: Projected benefits and costs, social perspective

1	2	3	4
YEAR	BENEFITS TO SOCIETY (MILLIONS)	SOCIAL COSTS (MILLIONS)	NET CASH FLOW (MILLIONS)
0	$323.8	$547.4	-$223.6
1	$16.7	$0	$16.7
2	$22.3	$0	$22.3
3	$32.1	$0	$32.1
4	$46.4	$0	$46.4
5	$68.0	$0	$68.0
6	$69.4	$0	$69.4
7	$70.8	$0	$70.8
8	$72.1	$0	$72.1
9	$73.5	$0	$73.5
10	$74.8	$0	$74.8
11	$76.0	$0	$76.0
12	$77.2	$0	$77.2
13	$78.3	$0	$78.3
14	$79.4	$0	$79.4
15	$80.5	$0	$80.5
16	$81.4	$0	$81.4
17	$82.3	$0	$82.3
18	$83.1	$0	$83.1
19	$83.8	$0	$83.8
20	$84.4	$0	$84.4
21	$85.0	$0	$85.0
22	$85.4	$0	$85.4
23	$85.7	$0	$85.7
24	$85.9	$0	$85.9
25	$86.1	$0	$86.1
26	$86.1	$0	$86.1
27	$86.0	$0	$86.0
28	$85.7	$0	$85.7
29	$85.4	$0	$85.4
30	$85.0	$0	$85.0
31	$84.4	$0	$84.4
32	$83.7	$0	$83.7
33	$82.9	$0	$82.9
34	$81.9	$0	$81.9
35	$80.9	$0	$80.9
36	$79.6	$0	$79.6
37	$78.3	$0	$78.3
38	$76.8	$0	$76.8
39	$75.2	$0	$75.2
40	$23.1	$0	$23.1
41	$6.3	$0	$6.3
Present value	**$2,536.1**	**$547.40**	**$1,988.8**
Benefit-cost ratio			4.6
Payback period (no. of years)			6.5

Source: EMSI impact model.

of savings related to health. These savings amount to a present value of $449.8 million, including savings due to a reduced demand for medical treatment and social services, improved worker productivity and reduced absenteeism, and a reduced number of vehicle crashes and fires induced by alcohol or smoking-related incidents. Crime savings amount to $9.3 million, including savings associated with a reduced number of crime victims, added worker productivity, and reduced expenditures for police and law enforcement, courts and administration of justice, and corrective services. Finally, the present value of the savings related to welfare and unemployment amount to $401,103, stemming from a reduced number of persons in need of income assistance. All told, social savings amounted to $459.6 million in benefits to communities and citizens in Idaho.

The sum of the social savings and the added income in the state is $2.5 billion, as shown in the bottom row of Table 3.5. These savings accrue in the future as long as the 2013-14 student population of UI remains in the workforce.

Return on investment to society

Table 3.6 on the previous page presents the stream of benefits accruing to the Idaho society and the total social costs of generating those benefits. Comparing the present value of the benefits and the social costs, we have a benefit-cost ratio of 4.6. This means that for every dollar invested in an education from UI, whether it is the money spent on day-to-day operations of the university or money spent by students on tuition and fees, an average of $4.60 in benefits will accrue to society in Idaho.[36]

With and without social savings

Earlier in this chapter, social benefits attributable to education (reduced crime, lower welfare, lower unemployment, and improved health) were defined as externalities that are incidental to the operations of UI. Some would question the legitimacy of including these benefits in the calculation of rates of return to education, arguing that only the tangible benefits (higher income) should be counted. Table 3.4 and Table 3.6 are inclusive of social benefits reported as attributable to UI. Recognizing the other point of view, Table 3.7 shows rates of return for both the taxpayer and social perspectives exclusive of social benefits. As indicated, returns are still above threshold values (a benefit-cost ratio greater than 1.0 and a rate of return greater than 1.4%), confirming that taxpayers receive value from investing in UI.

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

	INCLUDING SOCIAL SAVINGS	EXCLUDING SOCIAL SAVINGS
TAXPAYER PERSPECTIVE		
Net present value	$184,167	$97,994
Benefit-cost ratio	2.4	1.8
Internal rate of return	8.2%	5.4%
Payback period (no. of years)	13.5	18.3
SOCIAL PERSPECTIVE		
Net present value	$1,988,767	$1,214,668
Benefit-cost ratio	4.6	3.2

Source: EMSI impact model.

CONCLUSION

This section has shown that the education provided by UI is an attractive investment to students with rates of return that exceed alternative investment opportunities. At the same time, the presence of the university expands the state economy and creates a wide range of positive social benefits that accrue to taxpayers and society in general within Idaho.

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

SENSITIVITY ANALYSIS

4

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

ALTERNATIVE EDUCATION VARIABLE

The alternative education variable (15%) accounts for the counterfactual scenario where students would have to seek a similar education elsewhere absent the publicly-funded university in the state. Given the difficulty in accurately specifying the alternative education variable, we test the sensitivity of the taxpayer and social investment analysis results to its magnitude. Variations in the alternative education assumption are calculated around base case results listed in the middle column of Table 4.1 on the next page. Next, the model brackets the base case assumption on either side with a plus or minus 10%, 25%, and 50% variation in assumptions. Analyses are then redone introducing one change at a time, holding all other variables constant. For example, an increase of 10% in the alternative education assumption (from 15% to 17%) reduces the taxpayer perspective rate of return from 8.2% to 8.0%. Likewise, a decrease of 10% (from 15% to 14%) in the assumption increases the rate of return from 8.2% to 8.4%.

Based on this sensitivity analysis, the conclusion can be drawn that UI investment analysis results from the taxpayer and social perspectives are not very sensitive to relatively large variations in the alternative education variable. As indicated, results are still above their threshold levels (net present value greater than 0, benefit-cost ratio greater than 1, and rate of return greater than the discount rate of 1.4%), even when the alternative education assumption is increased by as much as 50% (from 15% to 23%). The conclusion is that although the assumption is difficult

Table 4.1: Sensitivity analysis of alternative education variable, taxpayer and social perspective

% VARIATION IN ASSUMPTION	-50%	-25%	-10%	BASE CASE	10%	25%	50%
Alternative education variable	8%	11%	14%	15%	17%	19%	23%
TAXPAYER PERSPECTIVE							
Net present value (millions)	$212	$198	$190	$184	$179	$170	$157
Rate of return	9.1%	8.7%	8.4%	8.2%	8.0%	7.7%	7.2%
Benefit-cost ratio	2.6	2.5	2.5	2.4	2.4	2.3	2.2
SOCIAL PERSPECTIVE							
Net present value (millions)	$2,213	$2,101	$2,034	$1,989	$1,944	$1,877	$1,765
Benefit-cost ratio	5.0	4.8	4.7	4.6	4.6	4.4	4.2

to specify, its impact on overall investment analysis results for the taxpayer and social perspective is not very sensitive.

LABOR IMPORT EFFECT VARIABLE

The labor import effect variable only affects the alumni impact calculation in Table 2.14. In the model we assume a labor import effect variable of 50%, which means that we claim only 50% of the initial labor income generated by increased alumni productivity. The other 50% we assume would have been created in the state anyway—even without UI—since the businesses that hired UI students could have substituted some of these workers with equally-qualified people from outside the state had there been no UI students to hire.

Table 4.2 presents the results of the sensitivity analysis for the labor import effect variable. As above, the assumption increases and decreases relative to the base case of 50% by the increments indicated in the table. Alumni productivity impacts attributable to UI, for example, range from a low of $391 million at a -50% variation to a high of $1.2 billion at a +50% variation from the base case assumption. This means that if the labor import effect variable increases, the impact that we claim as attributable to alumni increases as well. The impact stemming from the alumni still remains a sizeable factor in the Idaho economy, even under the most conservative assumptions.

STUDENT EMPLOYMENT VARIABLES

Student employment variables are difficult to estimate because many students do not report their employment status or because universities generally do not collect this kind of information. Employment variables include the following: 1) the percentage of students that are employed while attending the university and 2) the percentage of earnings that working students receive relative to the income they

Table 4.2: Sensitivity analysis of labor import effect variable

% VARIATION IN ASSUMPTION	-50%	-25%	-10%	BASE CASE	10%	25%	50%
Labor import effect variable	75%	63%	55%	50%	45%	38%	25%
Alumni impact (millions)	$391	$586	$704	$782	$860	$977	$1,173

Table 4.3: Sensitivity analysis of student employment variables

VARIATIONS IN ASSUMPTIONS	NET PRESENT VALUE (MILLIONS)	INTERNAL RATE OF RETURN	BENEFIT-COST RATIO
Base case: A = 64%, B = 58%	$608.6	14.0%	3.3
Scenario 1: A = 100%, B = 58%	$645.5	15.7%	3.9
Scenario 2: A = 64%, B = 100%	$677.5	17.6%	4.5
Scenario 3: A = 100%, B = 100%	$753.3	25.1%	7.4
Scenario 4: A = 0%, B = 0%	$542.8	11.7%	2.7

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

would have received had they not chosen to attend the university. Both employment variables affect the investment analysis results from the student perspective.

Students incur substantial expense by attending UI because of the time they spend not gainfully employed. Some of that cost is recaptured if students remain partially (or fully) employed while attending. It is estimated that 64% of students who reported their employment status are employed, based on data provided by UI.[37] This variable is tested in the sensitivity analysis by changing it first to 100% and then to 0%.

The second student employment variable is more difficult to estimate. In this study we estimate that students that are working while attending the university earn only 58%, on average, of the income that they statistically would have received if not attending UI. This suggests that many students hold part-time jobs that accommodate their UI attendance, though it is at an additional cost in terms of receiving a wage that is less than what they otherwise might make. The 58% variable is an estimation based on the average hourly wages of the most common jobs held by students while attending college relative to the average hourly wages of all occupations in the U.S. The model captures this difference in wages and counts it as part of the opportunity cost of time. As above, the 58% estimate is tested in the sensitivity analysis by changing it to 100% and then to 0%.

The changes generate results summarized in Table 4.3, with A defined as the percent of students employed and B defined as the percent that students earn relative to their full earning potential. Base case results appear in the shaded row; here the assumptions remain unchanged, with A equal to 64% and B equal to 58%. Sensitivity analysis results are shown in non-shaded rows. Scenario 1 increases A to 100% while holding B constant, Scenario 2 increases B to 100% while holding A constant, Scenario 3 increases both A and B to 100%, and Scenario 4 decreases both A and B to 0%.

- **Scenario 1:** Increasing the percentage of students employed (A) from 64% to 100%, the net present value, internal rate of return, and benefit-cost ratio improve to $645.5 million, 15.7%, and 3.9, respectively, relative to base case results. Improved results are attributable to a lower opportunity cost of time; all students are employed in this case.
- **Scenario 2:** Increasing earnings relative to statistical averages (B) from 58% to 100%, the net present value, internal rate of return, and benefit-cost ratio results improve to $677.5 million, 17.6%, and 4.5, respectively, relative to base case results; a strong improvement, again attributable to a lower opportunity cost of time.
- **Scenario 3:** Increasing both assumptions A and B to 100% simultaneously, the net present value,

37 EMSI provided an estimate of the percentage of students employed in the event that the university was unable to collect the data.

internal rate of return, and benefit-cost ratio improve yet further to $753.3 million, 25.1%, and 7.4, respectively, relative to base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to statistical averages) while attending classes.

- **Scenario 4:** Finally, decreasing both A and B to 0% reduces the net present value, internal rate of return, and benefit-cost ratio to $542.8 million, 11.7%, and 2.7, respectively, relative to base case results. These results are reflective of an increased opportunity cost; none of the students are employed in this case.[38]

It is strongly emphasized in this section that base case results are very attractive in that results are all above their threshold levels. As is clearly demonstrated here, results of the first three alternative scenarios appear much more attractive, although they overstate benefits. Results presented in Chapter 3 are realistic, indicating that investments in UI generate excellent returns, well above the long-term average percent rates of return in stock and bond markets.

38 Note that reducing the percent of students employed to 0% automatically negates the percent they earn relative to full earning potential, since none of the students receive any earnings in this case.

DISCOUNT RATE

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

In this study, we assume a 4.5% discount rate for

Table 4.4: Sensitivity analysis of discount rate

% VARIATION IN ASSUMPTION	-50%	-25%	-10%	BASE CASE	10%	25%	50%
STUDENT PERSPECTIVE							
Discount rate	2.2%	3.4%	4.0%	4.5%	4.9%	5.6%	6.7%
Net present value (millions)	$1,045	$797	$678	$609	$546	$464	$431
Benefit-cost ratio	5.0	4.0	3.6	3.3	3.1	2.8	2.6
TAXPAYER PERSPECTIVE							
Discount rate	0.7%	1.1%	1.3%	1.4%	1.5%	1.8%	2.1%
Net present value (millions)	$227	$204	$192	$184	$177	$166	$149
Benefit-cost ratio	2.8	2.6	2.5	2.4	2.4	2.3	2.2
SOCIAL PERSPECTIVE							
Discount rate	0.7%	1.1%	1.3%	1.4%	1.5%	1.8%	2.1%
Net present value (millions)	$2,328	$2,151	$2,052	$1,989	$1,928	$1,841	$1,706
Benefit-cost ratio	5.3	4.9	4.7	4.6	4.5	4.4	4.1

students and a 1.4% discount rate for taxpayers and society.[39] Similar to the sensitivity analysis of the alternative education variable, we vary the base case discount rates for students, taxpayers, and society on either side by increasing the discount rate by 10%, 25%, and 50%, and then reducing it by 10%, 25%, and 50%. Note that, because the rate of return and the payback period are both based on the undiscounted cash flows, they are unaffected by changes in the discount rate. As such, only variations in the net present value and the benefit-cost ratio are shown for students, taxpayers, and society in Table 4.4.

As demonstrated in the table, an increase in the discount rate leads to a corresponding decrease in the expected returns, and vice versa. For example, increasing the student discount rate by 50% (from 4.5% to 6.7%) reduces the students' benefit-cost ratio from 3.3 to 2.6. Conversely, reducing the discount rate for students by 50% (from 4.5% to 2.2%) increases the benefit-cost ratio from 3.3 to 5.0. The sensitivity analysis results for taxpayers and society show the same inverse relationship between the discount rate and the benefit-cost ratio, with the variance in results being the greatest under the social perspective (from a 5.3 benefit-cost ratio at a -50% variation from the base case, to a 4.1 benefit-cost ratio at a 50% variation from the base case).

39 These values are based on the baseline forecasts for the 10-year zero coupon bond discount rate published by the Congressional Budget Office, and the real treasury interest rates recommended by the Office for Management and Budget (OMB) for 30-year investments. See the Congressional Budget Office, Student Loan and Pell Grant Programs - March 2012 Baseline, and the Office of Management and Budget, Circular A-94 Appendix C, last modified December 2012.

CONCLUSION

5

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

From an economic impact perspective, we calculated that UI generates a total economic impact of $1.1 billion in GSP on the state economy. This represents the sum of several different impacts, including the university's operations spending impact ($200.5 million), research spending impact ($77.7 million), impact from start-up and spin-off companies ($6.3 million), student spending impact ($31.2 million), visitor spending impact ($5.1 million), and alumni impact ($782 million). This impact means that UI is responsible for 22,188 jobs in Idaho.

Since UI's activity represents an investment by various parties, including students, taxpayers, and society as a whole, we also considered the university as an investment to see the value it provides to these investors. For each dollar invested by students, taxpayers, and society, UI offers a benefit of $3.30, $2.40, and $4.60, respectively.

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

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APPENDIX 1: GLOSSARY OF TERMS

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

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

Asset value Capitalized value of a stream of future returns. Asset value measures what someone would have to pay today for an instrument that provides the same stream of future revenues.

Attrition rate Rate at which students leave the workforce due to out-migration, unemployment, retirement, or death.

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

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

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

Discounting Expressing future revenues and costs in present value terms.

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

Elasticity of demand Degree of responsiveness of the quantity of education demanded (enrollment) to changes in market prices (tuition and fees). If a decrease in fees increases 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 welfare and 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 state product Measure of the final value of all goods and services produced in a state after netting out the cost of goods used in production. Alternatively, gross state product (GSP) equals the combined incomes of all factors of production; i.e., labor, land and capital. These include wages, salaries, proprietors' incomes, profits, rents, and other. Gross state product is also sometimes called value added or added income.

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

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

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

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

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

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

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

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

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

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

Payback period =
cost of investment/net return per period

APPENDIX 2: FREQUENTLY ASKED QUESTIONS (FAQS)

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

What is economic impact analysis?

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

What is investment analysis?

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

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

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

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

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

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

In general EMSI discourages comparisons between institutions since many factors, such as regional economic conditions, institutional differences, and student demographics are outside of the university's control. It is best to compare the rate of return to the discount rates of 4.5% (for students) and 1.1% (for society and taxpayers), which can also be seen as the opportunity cost of the investment (since these stakeholder groups could be spending their time and money in other investment schemes besides education). If the rate of return is higher than the discount rate, the stakeholder groups can expect to receive a positive return on their educational investment.

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

How are jobs, as a measure of impact, calculated for the different impacts?

Jobs are one metric used to measure the impact of an institution. The jobs associated with each impact is not simply the GSP divided by the average salaries for the region; we instead go a step further. For each impact we measure the jobs in the industries that the impact is most likely to affect in that region. For example, the operations spending impact includes the jobs of the institution's employees who work in the region and the jobs that are directly linked to the spending patterns of the employees and of the institution. For the visitor spending impact, jobs would result from the spending patterns of out-of-state visitors. The different spending patterns result in different impacts on each industry. The number of jobs the added GSP creates is based on industry-specific jobs-to-earnings ratios, or the average wage per job in each industry. Note that each impact affects individual industries differently, and each industry has a specific jobs-to-earnings ratio. Hence, there is no common divisor between the different impacts to calculate the number of jobs from the total GSP. Jobs are calculated by summing the initial jobs created in the region by the institution and the jobs that are created due to the ripple effects of the particular impact being measured.

Net Present Value (NPV): How do I communicate this in laymen's terms?

Which would you rather have: a dollar right now or a dollar 30 years from now? That most people will choose a dollar now is the crux of net present value. The preference for a dollar today means today's dollar is therefore worth more than it would be in the future (in most people's opinion). Because the dollar today is worth more than a dollar in 30 years, the dollar 30 years from now needs to be adjusted to express its worth today. Adjusting the values for "this time value of money" is called discounting and the result of adding them all up after discounting each value is called net present value.

Internal Rate of Return (IRR): How do I communicate this in laymen's terms?

Using the bank as an example, an individual needs to decide between spending all of their paycheck today and putting it into savings. If they spend it today, they know what it is worth: $1 = $1. If they put it into savings, they need to know that there will be some sort of return to them for spending those dollars in the future rather than now. This is why banks offer interest rates and deposit interest earnings. This makes it so an individual can expect, for example, a 3% return in the future for money that they put into savings now.

Total Economic Impact: How do I communicate this in laymen's terms?

Big numbers are great, but putting it into perspective can be a challenge. To add perspective, find an industry with roughly the same "% of GSP" as your university (Table 1.5). This percentage represents its portion of the total gross state product in the region (similar to the nationally recognized gross domestic product but at a regional level). This allows the university to say that their single brick and mortar campus does just as much for Idaho as the entire utility industry, for example. This powerful statement can help put the large total impact number into perspective.

APPENDIX 3: EXAMPLE OF SALES VERSUS GSP

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

GSP = Sales – Intermediary Costs

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

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

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

GSP = $5.00 – $3.00 = $2.00

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

APPENDIX 4: EMSI MR-SAM

EMSI's Multi-Regional Social Accounting Matrix (MR-SAM) represents the flow of all economic transactions in a given region. It replaces EMSI's previous input-output (IO) model, which operated with some 1,100 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (i.e., multipliers) in the state economy as a result of industries entering or exiting the region. The SAM model performs the same tasks as the old IO model, but it also does much more. Along with the same 1,100 industries, government, household and investment sectors embedded in the old IO tool, the SAM exhibits much more functionality, a greater amount of data, and a higher level of detail on the demographic and occupational components of jobs (16 demographic cohorts and about 750 occupations are characterized).

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

DATA SOURCES FOR THE MODEL

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

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

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

BEA Gross Domestic Product by State (GSP) describes gross domestic product from the value added (also known as added income) perspective. Value added is equal to employee compensation, gross operating surplus, and taxes on production and imports, less subsidies. Each of these components is reported for each state and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The EMSI SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

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

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

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

Census of Government's (CoG) state and local government finance dataset is used specifically to aid breaking out state and local data that is reported in the MUTs. This allows EMSI to have unique production functions for each of its state and local government sectors.

Census' OnTheMap (OTM) is a collection of three datasets for the census block level for multiple years. Origin-Destination (OD) offers job totals associated with both home census blocks and a work census block. Residence Area Characteristics (RAC) offers jobs totaled by home census block. Workplace Area Characteristics (WAC) offers jobs totaled by work census block. All three of these are used in the commuting submodel to gain better estimates of earnings by industry that may be counted as commuting. This dataset has holes for specific years and regions. These holes are filled with Census' Journey-to-Work described later.

Census' Current Population Survey (CPS) is used as the basis for the demographic breakout data of the MR-SAM model. This set is used to estimate the ratios of demographic cohorts and their income for the three different income categories (i.e., wages, property income, and transfers).

Census' Journey-to-Work (JtW) is part of the 2000 Census and describes the amount of commuting jobs between counties. This set is used to fill in the areas where OTM does not have data.

Census' American Community Survey (ACS) Public Use Microdata Sample (PUMS) is the replacement for Census' long form and is used by EMSI to fill the holes in the CPS data.

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

OVERVIEW OF THE MR-SAM MODEL

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

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

National SAM

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

The SAM may be broken into three different aggregation layers: broad accounts, sub-accounts, and detailed accounts. The broad layer is the most aggregate and will be covered first. Broad accounts cover between one and four sub-accounts, which in turn cover many detailed accounts. This appendix will not discuss detailed accounts directly because of their number. For example, in the industry broad account, there are two sub-accounts and over 1,100 detailed accounts.

Multi-regional aspect of the SAM

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

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

COMPONENTS OF THE EMSI MR-SAM MODEL

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

County earnings distribution matrix

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

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

Commuting model

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

National SAM

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

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

Gravitational flows model

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

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

APPENDIX 5: VALUE PER CREDIT HOUR EQUIVALENT AND THE MINCER FUNCTION

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

VALUE PER CHE

Typically the educational achievements of students are marked by the credentials they earn. However, not all students who attended UI in the 2013-14 analysis year obtained a degree or certificate. Some returned the following year to complete their education goals, while others took a few courses and entered the workforce without graduating. As such, the only way to measure the value of the students' achievement is through their credit hour equivalents, or CHEs. This approach allows us to see the benefits to all students who attended the university, not just those who earned a credential.

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

The second step is to assign a unique value to the CHEs in the education ladder based on the wage differentials presented in Table 1.7. For example, the difference in earnings between a high school diploma and a bachelor's degree is $20,100. We spread this $20,100 wage differential across the 60 CHEs that occur between a high school diploma and a bachelor's degree, applying a ceremonial "boost" to the last CHE in the stage to mark the achievement of the degree.[40] We repeat this process for each education level in the ladder.

Next we map the CHE production of the 2013-14 student population to the education ladder. Table 1.4 provides information on the CHE production of students attending UI, broken out by educational achievement. In total, students completed 295,577 CHEs during the analysis year. We map each of these CHEs to the education ladder depending on the students' education level and the average number of CHEs they completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate's degree and the bachelor's degree, and the average number of CHEs they completed informs the shape of the distribution curve used to spread out their total CHE production within that stage of the progression.

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

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

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

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

Table A5.1 displays the result for the students' aggregate annual increase in income (ΔE), a total of $59.5 million. By dividing this value by the students' total production of 295,577 CHEs during the analysis year, we derive an overall value of $201 per CHE.

Table A5.1: Aggregate annual increase in income of students and value per CHE

Aggregate annual increase in income	$59,504,607
Total credit hour equivalents (CHEs) in FY 2013-14	**295,577**
Value per CHE	$201

Source: EMSI Impact model.

MINCER FUNCTION

The $201 value per CHE in Table A5.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.[41] While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use United States based Mincer coefficients estimated by Polachek (2003).

41 See Mincer (1958 and 1974).

Figure A5.1: Lifecycle change in earnings, 12 years versus 14 years of education

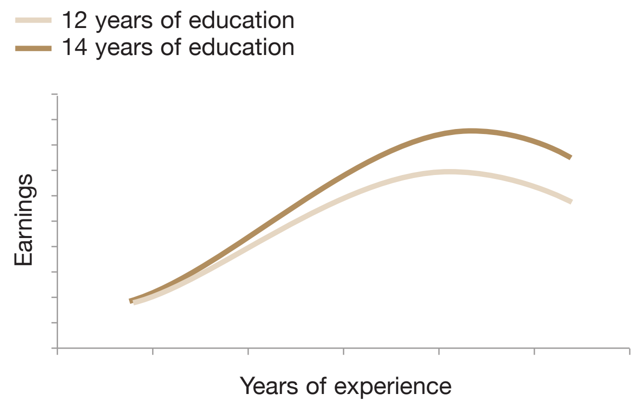


Figure A5.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum somewhere well after the midpoint of the working career, and then decline in later years. Second, individuals with higher levels of education reach their maximum earnings at an older age compared to individuals with lower levels of education (recall that age serves as a proxy for years of experience). And third, the benefits of education, as measured by the difference in earnings between education levels, increase with age.

In calculating the alumni impact in Section 2, we use the slope of the curve in Mincer's earnings function to condition the $201 value per CHE to the students' age and work experience. To the students just starting their career during the analysis year, we apply a lower value per CHE; to the students in the latter half or approaching the end of their careers we apply a higher value per CHE. The original $201 value per CHE applies only to the CHE production of students precisely at the midpoint of their careers during the analysis year.

In Section 3 we again apply the Mincer function, this time to project the benefits stream of the 2013-14 student population into the future. Here too the value per CHE is lower for students at the start of their career and higher near the end of it, in accordance with the scalars derived from the slope of the Mincer curve illustrated in Figure A5.1.

APPENDIX 6: ALTERNATIVE EDUCATION VARIABLE

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

Recall this analysis considers only relevant economic information regarding the university. Considering the existence of various other academic institutions surrounding the university, we have to assume that a portion of the students could find alternative educations and either remain in or return to the state. For example, some students may participate in online programs while remaining in the state. Others may attend an out-of-state institution and return to the state upon completing their studies. For these students—who would have found an alternative education and produced benefits in the state regardless of the presence of the university—we discount the benefits attributed to the university. An important distinction must be made here: the benefits from students who would find alternative educations outside the state and not return to the state are not discounted. Because these benefits would not occur in the state without the presence of the university, they must be included.

In the absence of the university, we assume 15% of the university's students would find alternative education opportunities and remain in or return to the state. We account for this by discounting the alumni impact, the benefits to taxpayers, and the benefits to society in the state in sections 2 and 3 by 15%. In other words, we assume 15% of the benefits created by the university's students would have occurred anyways in the counterfactual scenario where the university did not exist. A sensitivity analysis of this adjustment is presented in chapter 4.

APPENDIX 7: OVERVIEW OF INVESTMENT ANALYSIS MEASURES

The appendix provides context to the investment analysis results using the simple hypothetical example summarized in Table A7.1 below. The table shows the projected benefits and costs for a single student over time and associated investment analysis results.[42]

Assumptions are as follows:

- Benefits and costs are projected out 10 years into the future (Column 1).
- The student attends the university for one year, and the cost of tuition is $1,500 (Column 2).
- Earnings forgone while attending the university for one year (opportunity cost) come to $20,000 (Column 3).
- Together, tuition and earnings forgone cost sum to $21,500. This represents the out-of-pocket investment made by the student (Column 4).
- In return, the student earns $5,000 more per year than he otherwise would have earned without the education (Column 5).
- The net cash flow (NCF) in Column 6 shows higher earnings (Column 5) less the total cost (Column 4).
- The assumed going rate of interest is 4%, the rate of return from alternative investment schemes for the use of the $21,500.

Results are expressed in standard investment analysis terms, which are as follows: the net present value, the internal rate of return, the benefit-cost ratio, and the

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

Table A7.1: Example of the benefits and costs of education for a single student

YEAR	TUITION	OPPORTUNITY COST	TOTAL COST	HIGHER EARNINGS	NET CASH FLOW
1	2	3	4	5	6
1	$1,500	$20,000	$21,500	$0	-$21,500
2	$0	$0	$0	$5,000	$5,000
3	$0	$0	$0	$5,000	$5,000
4	$0	$0	$0	$5,000	$5,000
5	$0	$0	$0	$5,000	$5,000
6	$0	$0	$0	$5,000	$5,000
7	$0	$0	$0	$5,000	$5,000
8	$0	$0	$0	$5,000	$5,000
9	$0	$0	$0	$5,000	$5,000
10	$0	$0	$0	$5,000	$5,000
Net present value			**$21,500**	**$35,753**	**$14,253**
Internal rate of return					18.0%
Benefit-cost ratio					1.7
Payback period					4.2 years

payback period. Each of these is briefly explained below in the context of the cash flow numbers presented in Table A7.1.

NET PRESENT VALUE

The student in Table A7.1 can choose either to attend college or to forgo post-secondary education and maintain his present employment. If he decides to enroll, certain economic implications unfold. Tuition and fees must be paid, and earnings will cease for one year. In exchange, the student calculates that with post-secondary education, his 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 adds up higher earnings of $5,000 per year for the remaining nine years in Table A7.1, the total will be $45,000. Compared to a total investment of $21,500, this appears to be a very solid investment. The reality, however, is different. Benefits are far lower than $45,000 because future money is worth less than present money. Costs (tuition plus earnings forgone) are felt immediately because they are incurred today, in the present. Benefits, on the other hand, occur in the future. They are not yet available. All future benefits must be discounted by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.[43]

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

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

The goal is to express all future higher earnings in present value terms so that they can be compared to investments incurred today (in this example, tuition plus earnings forgone). As indicated in Table A7.1 the cumulative present value of $5,000 worth of higher earnings between years 2 and 10 is $35,753 given the 4% interest rate, far lower than the undiscounted $45,000 discussed above.

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

INTERNAL RATE OF RETURN

The internal rate of return is another way of measuring the worth of investing in education using the same cash flows shown in Table A7.1. In technical terms, the internal rate of return is a measure of the average earning power of money used over the life of the investment. It is simply the interest rate that makes the net present value equal to zero. In the discussion of the net present value above, the model applies the going rate of interest of 4% and computes a positive net present value of $14,253. The question now is what the interest rate would have to be in order to reduce the net present value to zero. Obviously it would have to be higher—18.0% in fact, as indicated in Table A7.1. Or, if a discount rate of 18.0% were applied to the net present value calculations instead of the 4%, then the net present value would reduce to zero.

What does this mean? The internal rate of return of 18.0% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the net present value equals zero. Or, at 18.0%, higher 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).

BENEFIT-COST RATIO

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

PAYBACK PERIOD

This is the length of time from the beginning of the investment (consisting of tuition and earnings forgone) until higher future earnings give a return on the investment made. For the student in Table A7.1, it will take roughly 4.2 years of $5,000 worth of higher earnings to recapture his investment of $1,500 in tuition and the $20,000 in earnings forgone while attending the university. Higher earnings that occur beyond 4.2 years are the returns that make the investment in education in this example economically worthwhile. The payback period is a fairly rough, albeit common, means of choosing between investments. The shorter the payback period, the stronger the investment.

APPENDIX 8: SHUTDOWN POINT

The investment analysis in Chapter 3 weighs the benefits generated by the university against the state taxpayer funding that the university receives to support its operations. An important part of this analysis is factoring out the benefits that the university would have been able to generate anyway, even without state and local taxpayer support. This adjustment is used to establish a direct link between what taxpayers pay and what they receive in return. If the university is able to generate benefits without taxpayer support, then it would not be a true investment.[44]

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

STATE AND LOCAL GOVERNMENT SUPPORT VERSUS STUDENT DEMAND FOR EDUCATION

Figure A8.1 presents a simple model of student demand and state and local government support. The right side of the graph is a standard demand curve (D) showing student enrollment as a function of student tuition and fees. Enrollment is measured in terms of total credit hour equivalents (CHEs) and expressed as a percentage of the university's current CHE production. Current student tuition and fees are represented by p', and state and local government support covers C% of all costs. At this point in the analysis, it is assumed that the university has only two sources of revenues: 1) student tuition and fees and 2) state and local government support.

Figure A8.1: Student demand and government funding by tuition and fees

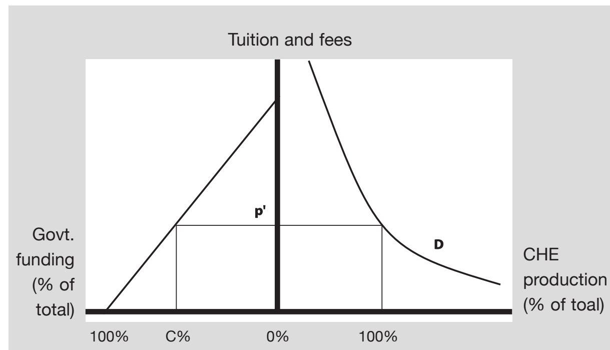


Figure A8.2: CHE production and government funding by tuition and fees

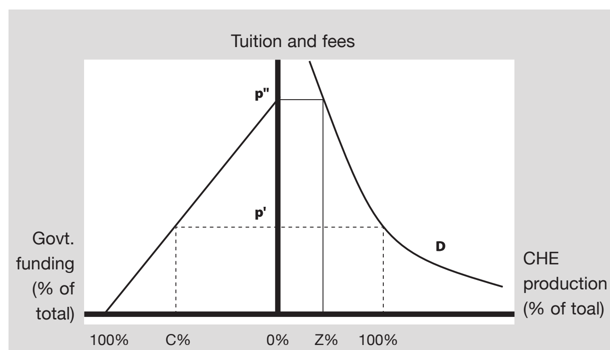


Figure A8.2 shows another important reference point in the model—where state and local govern-

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

ment support is 0%, student tuition and fees are increased to p'', and CHE production is at Z% (less than 100%). The reduction in CHEs reflects the price elasticity of the students' demand for education, i.e., the extent to which the students' decision to attend the university is affected by the change in tuition and fees. Ignoring for the moment those issues concerning the university's minimum operating scale (considered below in the section called "Shutdown Point"), the implication for the investment analysis is that benefits to state and local government must be adjusted to net out the benefits that the university can provide absent state and local government support, represented as Z% of the university's current CHE production in Figure A8.2.

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

1) B = B (100%)

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

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

2) B = B (Z%)

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

3) B = B (100%) – B (Z%)

CALCULATING BENEFITS AT THE SHUTDOWN POINT

Colleges and universities cease to operate when the revenue they receive from the quantity of education demanded is insufficient to justify their continued operations. This is commonly known in economics as the shutdown point.[45] The shutdown point is introduced graphically in Figure A8.3 as S%. The location of point S% indicates that the university can operate at an even lower enrollment level than Z% (the point at which the university receives zero state and local government funding). State and local

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

Figure A8.3: Shutdown Point after Zero Government Funding

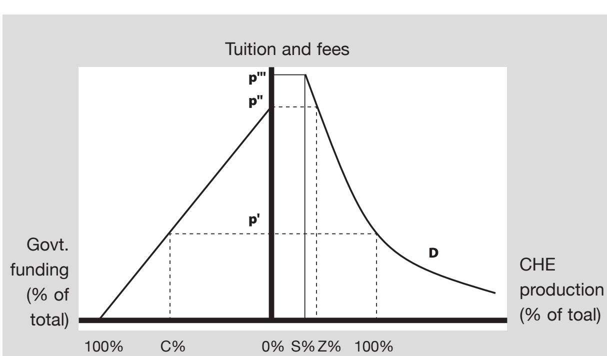
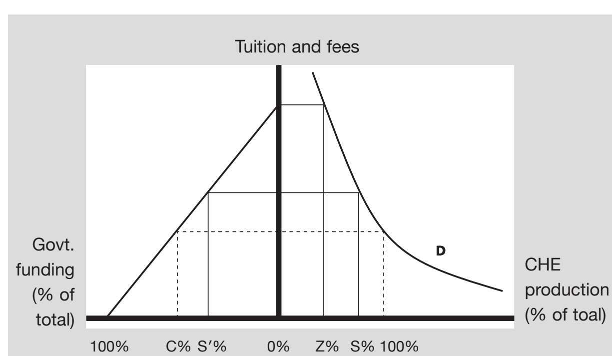


Figure A8.4: Shutdown Point before Zero Government Funding



government support at point S% is still zero, and student tuition and fees have been raised to p‴. State and local government support is thus credited with the benefits given by equation 3, or B = B (100%) B (Z%). With student tuition and fees still higher than p‴, the university would no longer be able to attract enough students to keep the doors open, and it would shut down.

Figure A8.4 illustrates yet another scenario. Here the shutdown point occurs at a level of CHE production greater than Z% (the level of zero state and local government support), meaning some minimum level of state and local government support is needed for the university to operate at all. This minimum portion of overall funding is indicated by S′% on the left side of the chart, and as before, the shutdown point is indicated by S% on the right side of chart. In this case, state and local government support is appropriately credited with all the benefits generated by the university’s CHE production, or B = B (100%).

APPENDIX 9: SOCIAL EXTERNALITIES

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

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 five health-related variables: smoking, alcoholism, obesity, mental illness, and drug abuse. There are other health-related areas that link to educational attainment, but these are omitted from the analysis until we can invoke adequate (and mutually exclusive) databases and are able to fully develop the functional relationships between them.

Smoking

Despite a marked decline over the last several decades in the percentage of U.S. residents that smoke, a sizeable percentage of the U.S. population still uses 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 U.S.

Figure A9.1: Prevalence of smoking among U.S. adults by education level

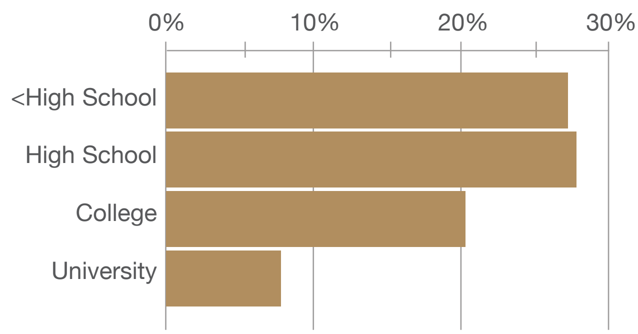


Figure A9.1 shows the prevalence of cigarette smoking among adults aged 25 years and over, based on data provided by the National Health Interview Survey.[46] As indicated, the percent of persons who smoke begins to decline beyond the level of high school education.

The Centers for Disease Control and Prevention (CDC) reports the percentage of adults who are current smokers by state.[47] We use this information to create an index value by which we adjust the national prevalence data on smoking to each state. For example, 17.2% of Idaho' adults were smokers in 2011, relative to 21.2% for the nation. We thus apply a scalar of 0.8 to the national probabilities of smoking in order to adjust them to the state of Idaho.

46 Centers for Disease Control and Prevention, "Table 61. Age-adjusted prevalence of current cigarette smoking among adults aged 25 and over, by sex, race, and education level: United States, selected years 1974-2011," National Health Interview Survey, 2011.

47 Centers for Disease Control and Prevention, "Adults who are current smokers" in "Tobacco Use—2011," Behavioral Risk Factor Surveillance System Prevalence and Trends Data, accessed August 2013, http://apps.nccd.cdc.gov/brfss/list.asp?cat=TU&yr=2011&qkey=8161&state=All.

Alcohol abuse

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 healthcare expenditures for treatment, prevention, and support; workplace losses due to reduced worker productivity; and other effects.

Figure A9.2 compares the percent of males and females aged 26 and older that abuse or depend on alcohol at the less than high school level to the prevalence rate of alcoholism among college graduates, based on data supplied by the Substance Abuse and Mental Health Services Administration (SAMHSA).[48] These statistics give an indication of the correlation between education and the reduced probability of alcoholism. As indicated, alcohol dependence or abuse falls from a 7.7% prevalence rate among males with less than a high school diploma to a 6.9% prevalence rate among males with a college degree. Similarly, alcohol dependence or abuse among females ranges from a 3.7% prevalence rate at the less than high school level to a 3.3% prevalence rate at the college graduate level.

Obesity

The rise in obesity and diet-related chronic diseases has led to increased attention on how expenditures relating to obesity have increased in recent years. The average cost of obesity-related medical conditions is calculated using information from the Journal of Occupational and Environmental Medicine, which reports incremental medical expenditures and productivity losses due to excess weight.[49] The CDC also reports the prevalence of obesity among adults by state.[50]

48 Substance Abuse and Mental Health Services Administration, "Table 5.7B - Substance Dependence or Abuse in the Past Year among Persons Aged 26 or Older, by Demographic Characteristics: Percentages, 2010 and 2011," Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2010 and 2011.

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

50 Centers for Disease Control and Prevention, "Adult Obesity Facts," Overweight and Obesity, accessed August 2013, http://www.cdc.gov/obesity/data/adult.html#Prevalence.

Figure A9.2: Prevalence of alcohol dependence or abuse by sex and education level

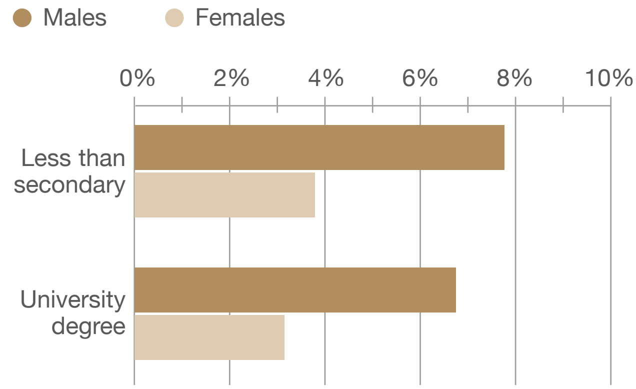
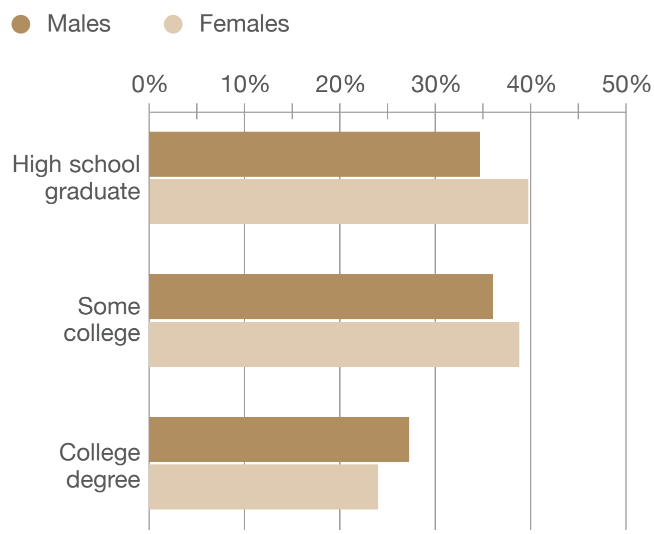


Figure A9.3: Prevalence of obesity by education level



Data for Figure A9.3 was provided by the National Center for Health Statistics which shows the prevalence of obesity among adults aged 20 years and over by education and sex.[51] As indicated, college graduates are less likely to be obese than individuals with a high school diploma. However, the prevalence

51 Cynthia L. Ogden, Molly M. Lamb, Margaret D. Carroll, and Katherine M. Flegal, "Figure 3. Prevalence of obesity among adults aged 20 years and over, by education, sex, and race and ethnicity: United States 2005-2008" in "Obesity and Socioeconomic Status in Adults: United States 2005-2008," NCHS data brief no. 50, Hyattsville, MD: National Center for Health Statistics, 2010.

of obesity among males with some college is actually greater than males with no more than a high school diploma. In general, though, obesity tends to decline with increasing levels of education.

Mental illness

Capturing the full economic cost of mental disorders is problematic because many of the costs are hidden or difficult to detach from others externalities, such as drug abuse or alcoholism. For this reason, this study only examines the costs of absenteeism caused by depression in the workplace. Figure A9.4 summarizes the prevalence of self-reported frequent mental distress among adults by education level, based on data supplied by the CDC.[52] As shown, people with higher levels of education are less likely to suffer from mental illness, with the prevalence of mental illness being the highest among people with less than a high school diploma.

Drug abuse

The burden and cost of illicit drug abuse is enormous in our society, but little is known about potential costs and effects at a population level. What is known is that the rate of people abusing drugs is inversely proportional to their education level. The higher the education level, the less likely a person is to abuse or depend on illicit drugs. The probability that a person with less than a high school diploma will abuse drugs is 2.9%, nearly six times greater than the probability of drug abuse for college graduates (0.5%). This relationship is presented in Figure A9.5 based on data supplied by SAMHSA.[53] Health costs associated with illegal drug use are also available from SAMSHA, with costs to state government representing 48% of the total cost related to illegal drug use.[54]

Figure A9.4: Prevalence of frequent mental distress by education level

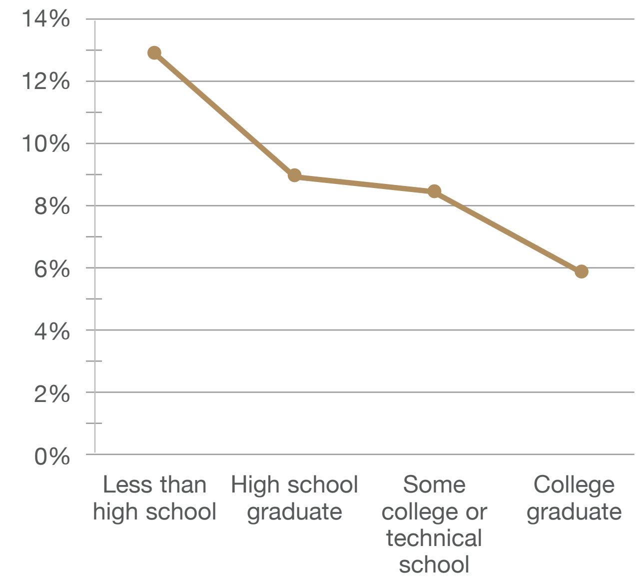
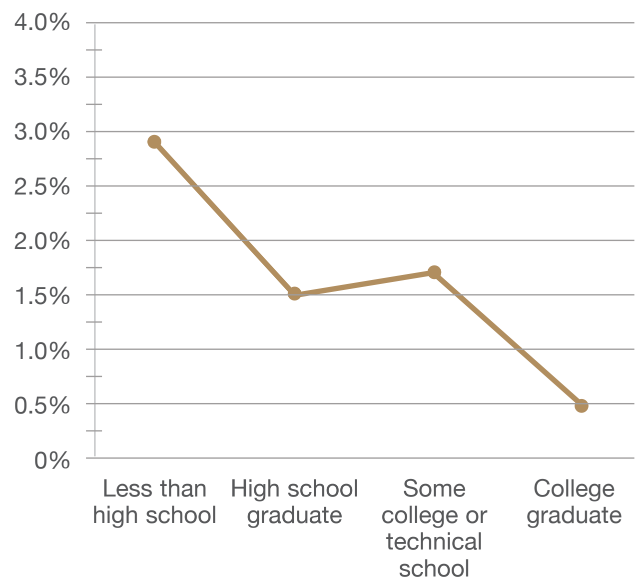


Figure A9.5: Prevalence of illicit drug dependence or abuse by education level



52 Centers for Disease Control and Prevention, "Table 1. Number of respondents to a question about mental health and percentage who self-reported frequent mental distress (FMD), by demographic characteristics -- United States, Behavioral Risk Factor Surveillance System, 1993-1996" in "Self-Reported Frequent Mental Distress Among Adults -- United States, 1993-1996." *Morbidity and Mortality Weekly Report* 47, no. 16 (May 1998): 325-331.

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

54 Substance Abuse and Mental Health Services Administration. "Table A.2. Spending by Payer: Levels and Percent Distribution for Mental Health and Substance Abuse (MHSA), Mental Health (MH), Substance Abuse (SA), Alcohol Abuse (AA), Drug Abuse (DA), and All-Health, 2005" in *National Expenditures for Mental Health Services & Substance Abuse Treatment, 1986 – 2005*. DHHS Publication No. (SMA) 10-4612. Rockville, MD: Center for Mental Health Services and Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration, 2010.

CRIME

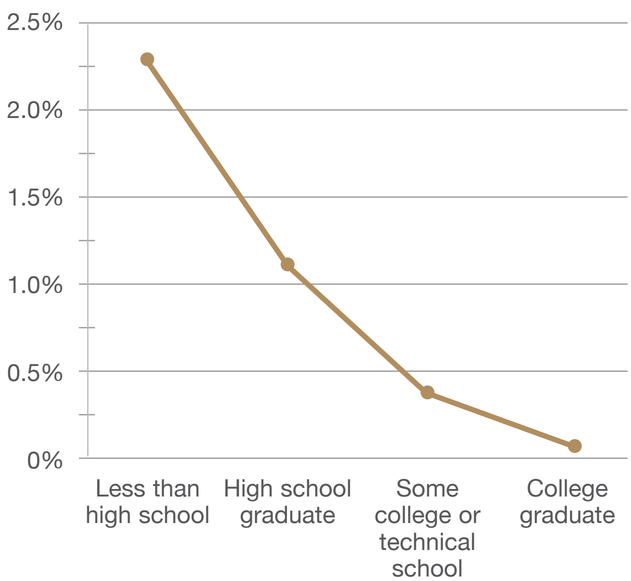
As people achieve higher education levels, they are statistically less likely to commit crimes. The analysis identifies the following three types of crime-related expenses: 1) criminal justice expenditures, including police protection, judicial and legal, and corrections, 2) victim costs, and 3) productivity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

Figure A9.6 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 federal, state, and local prisons as provided by the Bureau of Justice Statistics,[55] divided by the total adult 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 these costs are hidden, while others are available in various databases. Estimates of victim costs vary widely, attributable to differences in how the costs are measured. The lower end of the scale includes only tangible out-of-pocket costs, while the higher end includes intangible costs related to pain and suffering (McCollister et al., 2010).

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

Figure A9.6: Incarceration rates by education level

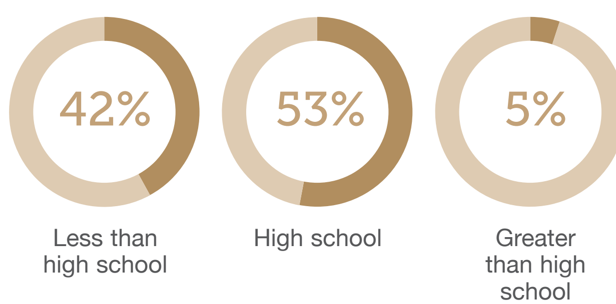


WELFARE AND UNEMPLOYMENT

Statistics show that as education levels increase, the number of welfare and unemployment applicants declines. Welfare and unemployment claimants can receive assistance from a variety of different sources, including Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Medicaid, Supplemental Security Income (SSI), and unemployment insurance.[56]

Figure A9.7 relates the breakdown of TANF recipients by education level, derived from data supplied by the U.S. Department of Health and Human Ser-

Figure A9.7: Breakdown of TANF recipients by education level



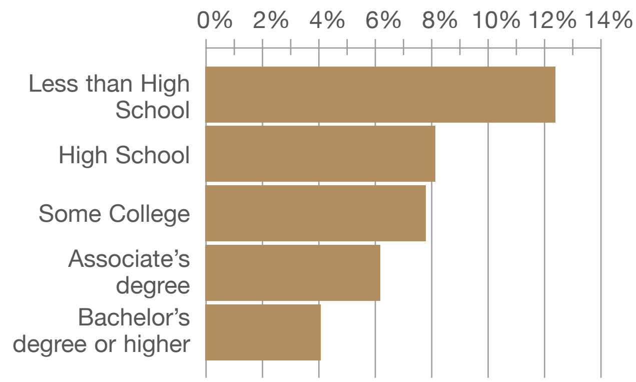
55 Caroline Wolf Harlow. "Table 1. Educational attainment for State and Federal prison inmates, 1997 and 1991, local jail inmates, 1996 and 1989, probationers, 1995, and the general population, 1997" in "Education and Correctional Populations." Bureau of Justice Statistics Special Report, January 2003, NCJ 195670. Accessed August 2013. http://bjs.ojp.usdoj.gov/index.cfm?ty=pbdetail&iid=814.

56 Medicaid is not considered in the analysis for welfare because it overlaps with the medical expenses in the analyses for smoking, alcoholism, obesity, mental illness, and drug abuse. We also exclude any welfare benefits associated with disability and age.

vices.[57] As shown, the demographic characteristics of TANF recipients are weighted heavily towards the less than high school and high school categories, with a much smaller representation of individuals with greater than a high school education.

Unemployment rates also decline with increasing levels of education, as illustrated in Figure A9.8. These data are supplied by the Bureau of Labor Statistics.[58] As shown, unemployment rates range from 12.4% for those with less than a high school diploma to 4.0% for those at the bachelor's degree level or higher.

Figure A9.8: Unemployment by education level



57 U.S. Department of Health and Human Services, Office of Family Assistance, "Table 10:26 - Temporary Assistance for Needy Families - Active Cases: Percent Distribution of TANF Adult Recipients by Educational Level, FY 2009" in Temporary Assistance for Needy Families Program Ninth Report to Congress, 2012.

58 Bureau of Labor Statistics, "Table 7. Employment status of the civilian noninstitutional population 25 years and over by educational attainment, sex, race, and Hispanic or Latino ethnicity." Current Population Survey, Labor Force Statistics. Accessed August 2013. http://www.bls.gov/cps/cpsaat07.pdf.