

The Socioeconomic Benefits Generated by Northeastern Junior College

State of Colorado

Volume 1: Main Report

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Table of Contents

ACKNOWLEDGMENTS	iii
ACRONYMS	iv
Preface	v
Chapter 1 INTRODUCTION	1
Overview	1
Annual Private and Public Benefits	1
Present Values of Future Benefits	2
Regional Economic and Local Business Community Benefits	3
Chapter 2 DATA SOURCES AND ASSUMPTIONS	4
Introduction	4
College Profile	4
Faculty, Staff, and Operating Budget	4 E
The Students Entry-Level Education, Gender, and Ethnicity	
The Achievements	8
Annual Private Benefits	10
Annual Public Benefits	11
Higher Earnings	
Health Savings	
Welfare and Unemployment Reduction Benefits	
Costs	17
Opportunity Cost of Time	
The Budget	
Other Assumptions	
Regional Economic Benefits	
The Impact of NJC Operations	21
Estimating CHEs Embodied in the Present-Day Workforce	
Reducing NJC CHEs to Account for Alternative Education Opportunities	
From Embodied CHEs to Direct Regional Income Effects	
The Industries Where Past Students Work	
The Indirect Economic Development Effects of Students	
Chapter 3 PRIVATE, PUBLIC, AND REGIONAL ECONOMIC BENEFITS	30
Introduction	
Annual Benefits	
Higher Student Earnings	
Social Savings	
Health-Related Savings	
Crime-Related Savings	

Table of Contents

Welfare and Unemployment Savings Total Public Benefits	
Annual Benefits Per CHE and Per Student	
The Investment Analysis: Incorporating Future Benefits	
The Student Perspective	
The Narrow Taxpayer Perspective	
With and Without Social Benefits	
Summary	
Regional Economic Benefits	45
Earnings Linked to NJC Operation and Capital Spending	
Past Student Economic Development Effects: The Direct Effect	
Past Student Economic Development Effects: The Indirect Effect	50
Overall Effect of NJC on the Regional Economy	52
Chapter 4 SENSITIVITY ANALYSIS OF KEY VARIABLES	55
Introduction	55
The Student Employment Variables	55
Percent of Students Employed	
Percent of Earnings Relative to Full Earnings	
Results	56
Regional Economic Development	
The Economic Impact of Student Spending	58
Economic Impacts Reported as Gross Sales	59
Variables Requiring "Judgment"	61
Alternative Education Opportunity	62
Attrition Variable	63
RESOURCES AND REFERENCES	64
Appendix 1: Glossary of Terms	71
Appendix 2: Explaining the Results—a Primer	75
The Net Present Value (NPV)	
The Internal Rate of Return (IRR)	
The Benefit/Cost Ratio (B/C)	79
The Payback Period	79
Appendix 3: Methodology for Creating Income Gains by Levels of Education	80
Appendix 4: Adjusting for the Benefits Available Absent State Government Support	
Introduction	
State Government Support Versus Tuition	
From Enrollment to Benefits	
The College Shutdown Point	
Adjusting for Alternative Education Opportunities	

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CCbenefits, Inc. is a company created in collaboration with the Association of Community College Trustees (ACCT) to provide economic analysis services to two-year technical and community colleges. Questions of a technical nature concerning the approach, assumptions, and/or results should be directed to CCbenefits, Inc., c/o Drs. Kjell Christophersen and Hank Robison, 1150 Alturas Dr., Suite 102, Moscow ID 83843, phone: 208-882-3567, fax: 208-882-3317, e-mail: ccbenefits@moscow.com.

ACRONYMS

AD	Associate Degree
ABE	Adult Basic Education
ACCT	Association of Community College Trustees
B/C	Benefit/Cost Ratio
CHE	Credit Hour Equivalent
ESL	English as a Second Language
GED	General Equivalency Diploma (also Education Development Certificate)
HS	High School
ΙΟ	Input-Output Analysis
NCF	Net Cash Flow
NJC	Northeastern Junior College
NPV	Net Present Value
REIS	Regional Economic Information System
RR	Rate of Return

Preface

The Association of Community College Trustees (ACCT) contracted with the authors in 1999 to create the model used in this study. The original vision was simple – to make available to colleges a generic and low cost yet comprehensive tool that would allow them to estimate the economic benefits accrued by students and taxpayers as a result of the higher education achieved. In short, it only makes economic sense for the students to attend college if their future earnings increase beyond their present investments of time and money. Likewise, taxpayers will only agree to increase funding or to fund colleges at the current levels if it is demonstrated that the economic benefits gained from the education exceed the costs.

This economic impact study consists of several reports:

- The present report is the **Main Volume** for the study. It is largely intended for a limited audience (economists, institutional researchers, financial officers, etc.) interested in the overall transparency of the study, the assumptions used, the data imbedded in the model that generate the results, and the results themselves.
- The **Detailed Tables** are a tabular summary of all results broken out by entry level of education and gender (also intended for a limited audience).
- The **Executive Summary** is a six-page report intended for a wide audience, written in layman's terms.
- The **Fact Sheet**, a one-page "super-executive" summary, is also intended for a wide audience where the main results are presented in bullet form.
- The **Taxpayer Perspective Sheet** is a one-page layman's write-up of the differences between the "broad" and "narrow" taxpayer results.
- Finally, we submit a **PowerPoint** presentation of the main results to each college.

All the reports aim to bring to the attention of education stakeholders the economic roles played by Northeastern Junior College in the local economy. There is something in it for the students – will they be better off attending college or should they just forego additional education and stay employed where they are? There is something in it for the taxpayers – should they continue with their investments at current levels, or is it in their

economic interest to increase or decrease the funding? There is something in it for the local community – to what extent does it benefit from the daily operations of the college, and which sectors of the economy benefit relatively more?

Economic impact studies that provide answers to these kinds of questions are not new. In contrast to other similar studies, however, the ACCT vision was that the model reach beyond the "standard" study – the computation of the simple multiplier effects stemming from the annual operations of the colleges. Although the standard study was part and parcel of the model ultimately developed, it was only a relatively small part. The current model also accounts for the economic impacts generated by past students who are still applying their skills in the local workforce; and it accounts for a number of external social benefits such as reduced crime, improved health, and reduced welfare and unemployment, which translate into avoided costs to the taxpayers. All of these benefits are computed for each college and analyzed. The analysis is based on regional data adjusted to local situations to the greatest extent possible.

One final note of importance: although the written reports generated for Northeastern Junior College are similar in text to the reports prepared for other colleges, the results differ widely. These differences, however, do not necessarily indicate that some colleges are doing a better job than others. Differences among colleges are a reflection of the student profiles, particularly whether or not the students are able to maintain their jobs while attending, and the extent to which state taxpayers fund the colleges. Therefore, if the average student rate of return for College A is 15%, and that of College B is 20%, that does not mean that B is doing a better job than A. Rather, it is attributable to the employment opportunities in the region, or that one college may enroll more women than men, or more minorities, and/or different kinds of students such as transfer or workforce. In turn, the student body profiles are associated with their own distinct earnings functions reflecting these employment, gender and ethnicity differences. The location of the college, therefore, dictates the student body profile, which, to a large extent, translates into the magnitudes of the results. Thus, College A with a 15% student rate of return may actually be a better or more efficiently managed school than College B with a 20% student rate of return. Any difference in management efficiency is not equal to the difference between the two returns.

Chapter 1 INTRODUCTION

OVERVIEW

Community and technical colleges generate a wide array of benefits. Students benefit directly from higher personal earnings, and society at large benefits indirectly from cost savings (avoided costs) associated with reduced welfare and unemployment, improved health, and reduced crime. Higher education, however, requires a substantial investment on the parts of the students and society as a whole. Therefore, all education stakeholders – taxpayers, legislators, employers, and students – want to know if they are getting their money's worth. In this study, Northeastern Junior College (NJC) investigates the attractiveness of its returns relative to alternative public investments. The benefits are presented in three ways: 1) annual benefits, 2) present values of future annual benefits (rates of return and benefit/cost ratios, etc.), and 3) regional economic benefits, including returns to the business community.

The main volume has four chapters and four appendices. **Chapter 1** is an overview of the benefits measured. **Chapter 2** details the major assumptions underlying the analysis. **Chapter 3** presents the main socioeconomic benefits, returns to business, and regional economic results. Finally, **Chapter 4** presents a sensitivity analysis of some key assumptions – tracking the changes in the results as assumptions are changed. **Appendix 1** is a glossary of terms. **Appendix 2** is a short primer on the context and meaning of the investment analysis results – the net present values (NPV), rates of return (RR), benefit/cost ratios (B/C), and the payback period. **Appendix 3** explains how the earnings related to higher education data were derived. **Appendix 4** provides a detailed technical/theoretical explanation of how benefits must be adjusted if the college can still stay open absent state government support.

ANNUAL PRIVATE AND PUBLIC BENEFITS

Private benefits are the higher earnings captured by the students; these are well-known and well-documented in economics literature (see for example Becker, 1964 and Mincer 1958, plus many others listed in the references at the end of this report). Less wellknown and documented are the indirect benefits, or what economists call *positive* *externalities,* which are a collection of public benefits captured by society at large, such as improved health and lifestyle habits, lower crime, and lower incidences of welfare and unemployment. These stem from savings to society as taxpayer-provided services are reduced. The dollar savings (or avoided costs) associated with reduced arrest, prosecution, jail, and reform expenditures are estimated based on published crime statistics arranged by education levels (see **Tables 2.7** and **2.9**, and the references section at the end of this report). Likewise, statistics that relate unemployment, welfare, and health habits to education levels are used to measure other savings. The annual economic impacts are presented in three ways: 1) per credit-hour equivalent (CHE), defined as a combination of credit and non-credit attendance,¹ 2) per student, and 3) in the aggregate (statewide).

PRESENT VALUES OF FUTURE BENEFITS

The annual impacts continue and accrue into the future, and are quantified and counted as part of the economic return of investing in education. This lifetime perspective is summarized as *present values* – a standard approach of projecting benefits into the future and discounting them back to the present. The approach allows us to express the benefits occurring incrementally (every year) in the future in present value terms so that they can be compared with the costs incurred in the present. The present value analysis is required to determine the economic feasibility of investing in college education—i.e., whether the benefits outweigh the costs. The time horizon over which future benefits are measured is the retirement age (65) less the average age of the students weighted by their total achievements (CHEs).²

The values of future benefits are also expressed in four ways: 1) net present value (NPV) total, per CHE, and per student, 2) rate of return (RR) where the results are expressed as a percent return on investment, 3) benefit/cost (B/C) ratio – the returns per dollar expended, and 4) the payback period – the number of years needed to fully recover the

¹ Instruction hours are not the same as credit hours. Community and technical colleges prepare people both for jobs and for degrees. Many attend for short periods and then leave to accept jobs without graduating. Others simply enroll in non-academic programs. Nonetheless, the CHEs earned will positively impact the students' lifetime earnings and social behavior.

² Retirement at age 65 is only our assumption. In some areas people retire earlier, in others later. Whether they retire at 62, 65, or 67, this will not change the magnitudes of the results by much. The assumption only affects the time horizon over which the analysis is conducted.

investments made (see **Appendix 1** and **Appendix 2** for a more detailed explanation of the meaning of these terms).

REGIONAL ECONOMIC AND LOCAL BUSINESS COMMUNITY BENEFITS

The benefits of a robust local economy are many: jobs, increased business revenues, greater availability of public investment funds, and eased tax burdens. The financial and educational activities of NJC benefit local businesses directly by raising the skill level of the local labor force and providing opportunities for direct contract training of employees. Local businesses also benefit as the presence of a trained labor force works to attract new industry and increase the efficiency, competitiveness, and output of existing industry. All these together spell a more effective and robust local economy.

In this study we show the impact of NJC as a creator of earnings in the local economy. Increased earnings are displayed by economic sector (for the purposes of this report, we employ the major divisions of the Standard Industrial Classification system [SIC], which includes all industrial and service sectors). The role of NJC in the local economy is then indicated by the percentage of sector-by-sector earnings explained by the college. The geographic boundaries of the regional economy used in this report are shown in the map below. In general, these college-linked regional earnings fall under two categories: 1) earnings generated by the annual operating expenditures of the college, and 2) earnings attributable to the college skills embodied in the local workforce.



Note: The whole counties included in the economic region comprise the backdrop for the calculation of the economic impacts.

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The Socioeconomic Benefits of Northeastern Junior College
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Chapter 2 DATA SOURCES AND ASSUMPTIONS

INTRODUCTION

To the extent possible, documented statistics obtained from several databases and from the college were used to craft the assumptions on which the results are based. In the few cases where hard data were scarce, however, the college institutional researchers on the scene applied well-informed judgments and estimations on the basis of their intimate knowledge of the college and student body.

This chapter contains six assumption sections, all based on various data imbedded in the analytic model: 1) the NJC profile; 2) annual earnings by education levels; 3) the social benefit assumptions (health, crime, and welfare/unemployment); 4) education costs; 5) other assumptions (the discount rate used, health, crime, and welfare cost statistics, etc.); and 6) assumptions pertaining to regional economic effects.

COLLEGE PROFILE

Faculty, Staff, and Operating Budget

NJC employed 168 full- and 438 part-time faculty and staff in year 2003 amounting to a total annual payroll of some \$9.4 million. **Table 2.1** shows NJC's annual revenues by funding source: a total of \$16.0 million. Two main revenue sources – private and public – are indicated. Private sources include tuition and fees (31.0%) plus 25.8% from other private sources (such as contract revenues, interest payments and the like). Public funding is comprised of state aid (38.5%) and federal grants (4.7%). These budget data are critical in identifying the annual costs of educating the college student body from the perspectives of the students and the taxpayers alike. The same information is displayed in **Figure 2.1** in the form of a pie chart.

Table 2.1. Aggregate Revenues					
Sources	Revenues	Total	% of Total		
Private Funding					
Tuition payments	\$4,958,595		31.0%		
Other sources of revenues	\$4,130,447	\$9,089,042	25.8%		
Public Funding					
Local taxes	\$0		0.0%		
State aid	\$6,160,374		38.5%		
Federal grants	\$745,802	\$6,906,176	4.7%		
Total		\$15,995,218	100%		

Source: Data supplied by NJC.



The Students

Students attend community and technical colleges for different reasons: to prepare for transfer to four-year institutions, to obtain Associate Degrees or Certificates in professional/technical programs, to obtain basic skills, or perhaps to take refresher courses or participate in non-credit programs. Students also leave for various reasons – they may have achieved their educational goals or decided to interrupt their college career to work full-time. **Tables 2.2 – 2.4** summarize the student body profile. The NJC unduplicated student body headcount is 7,368 (fiscal 2003 enrollment). This total consists of both credit and non-credit students.

Some students forego earnings entirely while attending college while others may hold full- or part-time jobs. Information about student employment plays a role in determining the *opportunity cost* of education incurred by the students while attending NJC.³ In **Table 2.2**, the rows labeled "Students employed while attending college (%)"

³ The opportunity cost is the measure of the earnings foregone; i.e., the earnings the individual would have collected had he or she been working instead of attending NJC.

and "Full-time earning potential (%)" provide the percentage estimates of the students who held jobs (85%) while attending NJC, and how much they earned (78%) relative to full-time employment (or what they would statistically be earning if they did not attend NJC). The former is a simple percent estimate of the portion of the student body working full- or part-time. The latter is a more complex estimate of their earnings relative to their earning power if they did not attend college (i.e., recognizing that several students may hold one or more part-time jobs that pay minimum wage).

Table 2.2. Student Body Profile

	Values
Total headcount of unduplicated credit students	7,368
Total headcount of unduplicated non-credit students	-
Total unduplicated enrollment, all campuses	7,368
Enrollment on campus for which analysis is carried out 100%	7,368
Students employed while attending college (%)	85%
Full-time earning potential (%)	78%
Students remaining in local community after leaving college	75%
Thirty-year attrition rate (leaving local community)	25%
"Settling In" factors (years):	
Completing Associate Degree	2.0
Completing Certificate	0.5
Non-completing transfer track	2.5
Non-completing workforce	0.0
ABE/ESL/GED	0.5

Sources: Student profile data supplied by the college. Settling-in factors adapted from Norton Grubb, The Economic Benefits of Sub-Baccalaureate Education, CCRC Brief No. 2, ISSN 1526-2049 (New York, NY: Community College Research Center, June 1999).

As indicated in the table, it is estimated that 75% of the students remain in the local community (as defined in the map) and thereby generate local community benefits. The remaining 25% leave the community and are not counted as contributing to regional economic development. The 75% local retention rate applies only to the first year, however. We assume that 25% of the students, and thus associated benefits, will leave the area over the next thirty years due to attrition (e.g., retirement, out-migration, or death).

The last five items in **Table 2.2** are *settling-in* factors — the time needed by students to settle into the careers that will characterize their working lives. These factors are adapted from Norton Grubb (see the source reference in the table). Settling-in factors have the effect of delaying the onset of the benefits to the students and to society at large. Thus, we assume that for transfer track students, the earnings benefits will be delayed for at least 2.5 years to account for the time spent subsequently at four-year colleges.

Entry-Level Education, Gender, and Ethnicity

Table 2.3 and **Figure 2.2** show the education level, gender, and ethnicity of the NJC student body. This breakdown is used only to add precision to the analysis, not for purposes of comparing between different groups.⁴ Five education entry levels are indicated in approximate one-year increments, ranging from less than HS to post AD. These provide the platform upon which the economic benefits are computed.

The *entry level* characterizes the education level of the students when they first enter the college; this is consistent with the way most colleges keep their records. The analysis in this report, however, is based on the educational achievements of the students during the current year. As not all students reported in the enrollment figures for the fiscal year are in their first year of college, an adjustment was made to account for students who had accumulated credits during their college experience and moved up from the "<HS/GED" category. For this reason, the education levels of the student body must also be estimated for the beginning of the analysis year. Thus, of the 1,178 white males who first entered with a high school diploma or GED, it is estimated that only 206 still remain in that category at the beginning of the analysis year, meaning that 972 students have actually moved up from the "HS/GED equivalent" category to the "One year post HS or less" category or beyond since they first entered NJC.⁵ (Note that the "Entry Level" and "Begin Year" columns always add to the same total.) Differences between the two columns reflect a redistribution of students from entry level to where they are at the beginning of the analysis year. The assumptions underlying the process of redistributing the students from the "Entry Level" to "Begin Year" columns are internal to the economic model – they are designed to capture the dynamics of the educational progress as the students move up the educational ladder beyond their entry level.

⁴ In this volume we present the gender and ethnicity breakdown only in **Table 2.3**. Otherwise, the breakdown is presented as weighted averages for the remainder of the report. Please refer to the separate companion volume, **Volume 2**: **Detailed Results**, to see the breakdown by gender, ethnicity and level of education.

⁵ These calculations are based on parameters (such as the frequency of "stopouts") that characterize how typical college students progress over time in their college career from when they first started up to the analysis year.

Chapter 2: Data Sources and Assumptions

Table 2.3. Student Body Education Level: Entry vs. Beginning of Analysis Year										
	White	Male	Minority	/ Male	White F	emale	Minority	Female	Tot	al
	Entry	Begin	Entry	Begin	Entry	Begin	Entry	Begin	Entry	Begin
Education Level	Level	Year	Level	Year	Level	Year	Level	Year	Level	Year
< HS/GED	237	185	30	23	296	231	37	29	600	468
HS/GED equivalent	1,178	206	148	26	1,785	312	133	23	3,244	567
One year post HS or less	964	1,170	42	124	665	1,474	71	117	1,742	2,885
Two years post HS or less	596	1,363	41	85	653	1,321	48	115	1,337	2,884
> AD	193	242	0	3	222	284	30	35	444	563
Total	3,167	3,167	261	261	3,622	3,622	319	319	7,368	7,368

Source: Computed internally by analytical model based on data supplied by NJC.



The Achievements

Table 2.4, along with **Figures 2.3** and **2.4**, shows the student breakdown in terms of analysis year academic pursuits and/or achievements according to six categories: 1) retirees and/or self-enrichment students, 2) Associate Degree completers, 3) Diploma and Certificate completers, 4) all transfer students, 5) all workforce students, and 6) ABE/ESL/GED students.⁶

As indicated in the table, students achieving their graduation goals would be those completing Associate Degrees or Certificates (2.8% and 1.8%, respectively). The majority of students complete college credits, and either fulfill their educational needs, or return the following year to continue to work toward their goals (11.0% + 80.4% = 91.4% in the transfer track and workforce categories, respectively). The retired and leisure students (4.0%) and ABE/ESL/GED students (0.0%) complete the breakdown of the student body. The retired students are simply backed out of the analysis altogether on the assumption that they do not attend NJC to acquire skills that will increase their earnings.

⁶ ABE/ESL/GED = Adult basic education, English as a second language, and General Equivalency Diploma

ABE/ESL/GED students are assumed to have a lower percentage impact than other students, because the end product of their education is to arrive at the "starting gate" on an equal basis with others. This does not mean that ABE/ESL/GED education has lower value; it simply means that these students must complete an extra step before they can compete effectively in the job market and reap the benefits of higher earnings.

The fourth column shows the average age of the students generating the benefits (excluding retirees). The time horizon for the analysis is 34 years, which is the difference between the average age (31.0 years) and retirement age (65 years).

As indicated in Column 5, the average Associate Degree and Certificate student completed 31.0 and 20.0 CHEs of study, respectively, during the analysis year. The total number of CHEs completed during the year of analysis for the entire student body is 51.0 thousand. Finally, the last column shows the average time the students are actually in attendance during the analysis year. This information is needed to determine the opportunity cost of their education (or the time they would otherwise have been working and earning wages).

. . . .

	Student	Headcount	Average	CHEs This	Total	# Years
Student Body Category	Distribution	Credit and Non-Credit	Age*	Year**	CHEs	Attend.
Retired and court-required students	4.0%	295	82	1.5	442	0.05
Completing AD	2.8%	206	22	31.0	6,395	1.03
Completing Certificate	1.8%	133	43	20.0	2,652	0.67
Transfer track	11.0%	810	23	22.0	17,831	0.73
Workforce and all other non-credit students	80.4%	5,924	38	4.0	23,695	0.13
ABE/ESL/GED	0.0%	0	0	0.0	0	0.00
Total or weighted averages	100.0%	7,368	31.0	7.2	51,016	

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*Note: The weighted averages for student age and CHEs per year do not include the retired students

**Note: A total of 30 CHEs is required for one full-time year equivalent of study.

Source: Computed internally by model based on data supplied by NJC.



The Socioeconomic Benefits of Northeastern Junior College



ANNUAL PRIVATE BENEFITS

The earnings statistics in Table 2.5 and Figure 2.5 reflect all occupations (technical and non-technical). These statistics form the basis for the benefit estimates reported in Chapter 3. The lower the education level, the lower the average earnings, regardless of the subject matters studied. The distinguishing feature among the achievement categories, therefore, is the number of CHEs completed. Statistics indicate that earnings are highly correlated with education, but correlation does not necessarily mean causation. Higher education is not the only factor explaining the private and public benefits reported in the statistics. Other variables such as ability, family background, and socioeconomic status play significant roles. The *simple correlation* between higher earnings and education nonetheless defines the *upper limit* of the effect measured. Our estimates of higher education's impact on earnings are based on a survey of recent econometric studies. A literature review by Chris Molitor and Duane Leigh (March, 2001) indicates that the upper limit benefits defined by correlation should be discounted by 10%. Absent any similar research for the social variables (health, crime, and welfare and unemployment), we assume that the same discounting factor applies as well to the public benefits.

As education milestones are achieved, students move into higher levels of average earnings. **Table 2.5** shows average earnings by one-year education increments, linked to the gender and ethnicity profile of the NJC student body. The differences between the steps are indicated in the last column. We assume that *all* education has value; and thereby attribute value to students completing less than full steps as well. Specific detail on **Table 2.5** data sources and estimating procedures is found in **Appendix 3**.

Chapter 2: Data Sources and Assumptions

	Average				
Entry Level	Earnings	Difference			
One year short of HS/GED	\$13,693	NA			
HS/GED equivalent	\$21,532	\$7,839			
One-year Certificate	\$24,859	\$3,327			
Two-year Associate Degree	\$29,080	\$4,220			
One year post Associate Degree	\$33,177	\$4,097			

Table 2.5. Weighted Average Earnings

Source: Computed from data supplied by the US Census Bureau, regionalized for the State of Colorado, and weighted to reflect the specific gender and ethnicity profile of the NJC student body.



ANNUAL PUBLIC BENEFITS

Both students and society at large benefit from higher earnings. Indeed, the principal motivation for publicly funded higher education is to raise the productivity of the workforce and the incomes that the students will enjoy once they complete their studies. Society benefits in other ways as well. Higher education is associated with a variety of lifestyle changes that generate savings (e.g., reduced welfare and unemployment, improved health, and reduced crime). Note that these are *external* or *incidental* benefits of education (see box). Colleges are created to provide education, not to reduce crime, welfare and unemployment, or improve health. The fact that these incidental benefits occur and can be measured, however, is a bonus that enhances the economic attractiveness of the college operations. It should not be taken to mean that taxpayers should channel more money to colleges on the strength of these external benefits. Our purpose is simply to bring to the attention of education stakeholders that the activities of NJC impact society in many more ways than simply the education it provides. In so doing, we have identified and measured some social benefits obviously related to

educational achievements and included them in the mix of impacts generated by the college.

Assuming state taxpayers represent the public, the public benefits of higher education can be gauged from two perspectives, 1) a *broad* perspective that tallies all benefits, and 2) a *narrow* perspective that considers only changes in the revenues and expenditures of the state government.

Higher Earnings

Broad Perspective: Higher education begets higher earnings. The economy generates more income than it would without the college skills embodied in the labor force. From the broad taxpayer perspective, the total increase in regional earnings is counted as benefits of college education, adjusted down by the alternative education variable in **Table 2.9** (14.3%) – these students would still be able to attend college elsewhere even if the community and technical colleges in the state were not present.

The Beekeeper Analogy

The classic example of a positive externality (sometimes called "neighborhood effect") in economics is that of the private beekeeper. The beekeeper's only intention is to make money by selling honey. Like any other business, the beekeeper's receipts must at least cover his operating costs. If they don't, he will shut down.

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

Colleges are in some ways like the beekeepers. Strictly speaking, their business is in providing education and raising people's incomes. Along the way, however, external benefits are created. Students' health and lifestyles are improved, and society indirectly benefits from these just as orchard owners indirectly benefit from the location of beekeepers. Aiming at an optimal expenditure of public funds, the CCbenefits model tracks and accounts for many of these external benefits, and compares them to the public cost (what the taxpayers agree to pay) of college education.

Narrow Perspective: Higher regional earnings translate into higher state *tax collections*. In the narrow taxpayer perspective we assume that the state authorities will collect 15.0% of the higher earnings in the form of taxes – the estimated composite of all taxes other than the federal income taxes.⁷

⁷ The tax data are obtained from the US Census Bureau. See also **Appendix 3**.

The Socioeconomic Benefits of Northeastern Junior College

Health Savings

The improved health of students generates savings in three measurable ways: 1) lower absenteeism from work, 2) reduced smoking, and 3) reduced alcohol abuse (**Table 2.6**; see also **Figures 2.6-2.8**). These variables are based on softer (i.e., less-documented) data. In general, statistics show a positive correlation between higher education and improved health habits. **Table 2.6** shows the calculated reductions in the incidences of smoking and alcohol abuse as a function of adding higher education, also linked to the gender and ethnicity profile of the NJC student body. Recall from above, the health savings are reduced by 10% in recognition of causation variables not yet identified.

Broad Perspective: The benefits from reduced absenteeism are equal to the average earnings per day multiplied by the number of days saved (less the students covered by the alternative education variable, as above). These are benefits that accrue largely to employers. Smoking and alcohol-related savings accrue mostly to the individuals who will *not* have to incur the health-related costs. In the broad taxpayer perspective, however, these benefits accrued to employers and individuals are also public benefits.

<u>Narrow Perspective</u>: Taxpayers benefit from reduced absenteeism to the extent that the state government is an employer. Accordingly, we assume a taxpayer's portion of absenteeism savings at 10.0%, equal to the estimated public portion of employment in the region.⁸ As for smoking and alcohol-related savings, the taxpayers benefit to the extent that state health subsidies (to hospitals, for example) are reduced. We assume that 6% of the total benefits can be counted as taxpayer savings.

Table 2.6. Reduced Absenteeism, Smoking, and Alcohol Habits						
	Abser	nteeism	Smo	oking	Alcohol Abuse	
Education Level	Days	%/Year	Average	Reduction	Average	Reduction
< HS/GED	10.7	4.1%	31.0%	NA	11.7%	NA
HS/GED equivalent	8.6	3.3%	28.2%	9.0%	11.0%	6.5%
One year post HS or less	7.5	2.9%	25.7%	9.0%	10.3%	6.4%
Two years post HS or less	6.0	2.3%	21.5%	16.5%	9.0%	11.9%
> AD	5.2	2.0%	18.8%	12.3%	8.3%	8.7%

Sources: Computed from data supplied by the Bureau of Labor Statistics, US Department of Labor; National Center for Health Statistics, "Table 61: Age-adjusted prevalence of current cigarette smoking," in *Health, United States, 2001* (Hyattsville, MD, 2001); US Department of Treasury, *The Economic Costs of Smoking in the United States*, Report-3113 (Washington, D.C., 1998); National Center for Health Statistics, "Health Promotion and Disease Questionnaire of the 1990 National Health Interview Survey"; National Institute on Drug Abuse, *The Economic Costs of Alcohol and Drug Abuse in the United States*, (Bethesda, MD: National Institute of Health, 1998).

⁸ The ratio of state earnings over total earnings in the United States (Regional Economic Information System – REIS, Bureau of Economic Analysis, US Department of Commerce, 1998).







The Socioeconomic Benefits of Northeastern Junior College

Crime Reduction Benefits

Table 2.7 and **Figure 2.9** relate the probabilities of incarceration to education levels – incarceration drops on a sliding scale as education levels rise (linked to the gender and ethnicity profile of the NJC student body).⁹ The implication is, as people achieve higher education levels, they are statistically less likely to commit crimes. The difference between before and after the education achievement (multiplied by the average cost per year) comprises the upper limit of the benefits attributable to education.

We identify three types of crime-related expenses: 1) the expense of incarceration, including prosecution, imprisonment, and reform, 2) victim costs, and 3) productivity lost as a result of time spent in jail or prison rather than working. As with our other social statistics, crime-related expenses are reduced by 10% in recognition of other causation factors.

Broad Perspective: From the broad taxpayer perspective, all reductions in crime-related expenses are counted as a benefit (less the students covered by the alternative education variable, as above).

<u>Narrow Perspective</u>: We assume that nearly all (80%) of the incarceration savings accrue to the state taxpayers—federal funding covers the remainder. Crime victim savings are avoided costs to the potential victims, not to the taxpayers. As such, we claim none of these as taxpayer savings. Finally, we apply our "composite" state government average tax rate (15.0%) to the added productivity of persons *not* incarcerated to arrive at the taxpayer benefits.

Table 2.7. Incarceration Rates					
Education Level	Average	Reduction			
< HS/GED	4.9%	NA			
HS/GED equivalent	3.4%	29.0%			
One year post HS or less	2.5%	26.1%			
Two years post HS or less	1.4%	44.2%			
> AD	0.9%	33.6%			

Sources: Computed from data supplied by the National Center for Education Statistics, *Literacy Behind Prison Walls* (Washington, D.C.: US Department of Education, 1994); Thomas P. Bonczar and Alan J. Beck, *Lifetime Likelihood of Going to State or Federal Prison* (Washington D.C.: US Department of Justice, 1997); Bureau of Justice Statistics, "Table 1: State (1) average annual pay for 2000 and 2001 and percent change in pay for all covered workers (2)" (Washington, D.C.: US Department of Labor, Criminal Justice Expenditure and Employment Extracts Program, 2000).

⁹ See also Beck and Harrison: <u>http://www.ojp.usdoj.gov/bjs/abstract/p00.htm</u>.



Welfare and Unemployment Reduction Benefits

Higher education is statistically associated with lower welfare and unemployment. **Table 2.8** and **Figure 2.10** relate the probabilities of individuals applying for welfare and/or unemployment assistance to education levels (linked to the gender and ethnicity profile of the NJC student body). As above, all welfare and unemployment savings are reduced by 10% in recognition of other causation factors.

Broad Perspective: Reduced welfare and unemployment claims multiplied by the average cost per year are counted in full as benefits in the broad taxpayer perspective (less the students covered by the alternative education variable, as above).

<u>Narrow Perspective</u>: Taxpayer benefits from reduced welfare are limited to 16% – the extent to which the state taxpayers subsidize the welfare system. None is claimed for unemployment, because none of these costs are borne by the state taxpayers.

	We	lfare	Unemployment				
Education Level	Average	Reduction	Average	Reduction			
< HS/GED	7.8%	NA	7.7%	NA			
HS/GED equivalent	5.5%	28.7%	4.9%	35.7%			
One year post HS or less	4.1%	26.8%	4.3%	13.4%			
Two years post HS or less	2.2%	46.6%	3.9%	8.7%			
> AD	1.3%	37.7%	3.5%	9.2%			

Table 2.8. Welfare and Unemployment

Sources: Computed from data supplied by the Temporary Assistance for Needy Families (TANF) Program, "Table 12: Percent distribution of TANF adult recipients by race" and "Table 17: Percent distribution of TANF adult recipients by educational level" in *Characterisitics and Financial Circumstances of TANF Recipients* (Washington D.C.: US Department of Health and Human Services, May 1999); Robert Rector, *Means-Tested Welfare Spending: Past and Future Growth* [database on-line] (Heritage Foundation, March 2001).



COSTS

There are two main cost components considered in the analytic framework: 1) the cost incurred by the student, including the expenses for tuition and books, and the opportunity cost of his or her time (represented by the earnings foregone while attending NJC) and, 2) the cost incurred by state government taxpayers, which is part of the college's operating and capital costs (see **Table 2.1**). These are briefly discussed below.

Opportunity Cost of Time

The opportunity cost of time is, by far, the largest cost. While attending NJC, most students forego some earnings, because they are not employed or are employed only part-time. Some may even go into debt. The assumptions are discussed in conjunction with **Table 2.2** above. For the non-working students, the opportunity cost is the full measure of the incomes not earned during their college attendance. For students working part-time, the opportunity cost is the difference between what they could make full-time less what they are making part-time, plus the estimated dollar value of the leisure time given up. For students working full-time, the only opportunity cost of time charged is for the value of the leisure time given up.¹⁰ The opportunity costs are derived

¹⁰ Elementary consumer theory presents a tradeoff between income and leisure (e.g., Henderson and Quandt, 1971). Students able to work full- or part-time while attending college maintain all or part of their incomes, but give up a significant amount of their leisure time. Failing to impute value to the leisure foregone would underestimate the cost of attending the college.

The Socioeconomic Benefits of Northeastern Junior College

from the earnings categories by education entry levels given in **Table 2.5**, although with some important modifications, as briefly described below:

- The earnings in **Table 2.5** are averages based on trajectories of earnings for all ages, from 17 to 65 (roughly defining the time spent engaged in the workforce).
- The average earnings, therefore, define the midpoint of a working life trajectory that begins with low entry-level wages and culminates with a typical worker's highest wages around age 60.¹¹ The earnings data shown in Table 2.5 are specific to the state of Colorado, weighted, however, to reflect the specific gender and ethnicity makeup of the NJC student body. Details on earnings and education sources are found in Appendix 3.
- The opportunity cost of time is then conditioned by the average age of the student (31.0 years in **Table 2.4**). In particular, the average earnings at the midpoint (\$24,696 in **Table 3.5**) are adjusted downward to \$16,831 to reflect the average earnings at age 31.0.

The Budget

Beyond the student perspective, our assessment of NJC considers the benefits and costs from the state government taxpayer perspective. Accordingly, only the state government revenues in **Table 2.1** are included as costs in the investment and benefit/cost assessment. All else being equal, the larger the other revenue sources in **Table 2.1** are (federal grants, student tuition, and contract revenues), relative to state government revenues, the larger the relative economic payback to state taxpayers will be.

OTHER ASSUMPTIONS

Table 2.9 lists several other assumptions imbedded in the analytic model: 1) the discount rate and time horizon;¹² 2) crime-related costs (incarceration costs that are inclusive of the cost per prison year plus all costs associated with arrest, investigation,

¹¹ This profile of lifetime earnings is well documented in labor economics literature. For example, see Willis (1986), which is supported by the well-respected theoretical and empirical work of Becker (1964) and Mincer (1958).

¹² See the "Student Perspective" section in Chapter 3 for a more in-depth discussion of the discount rate.

The Socioeconomic Benefits of Northeastern Junior College

trial and finally incarceration); 3) welfare and unemployment costs per year;¹³ and 4) health-related costs.¹⁴ The alternative education opportunity assumption is discussed later in this chapter in association with the regional economic impacts.

	Variables
Discount rate	4.0%
Time horizon, years to retirement	34.0
Average cost per prison year (arrest, trial, incarceration, rehab. etc.)	\$77,178
Average length of incarceration (total years)	4.0
Average victim cost	\$ 85,000
Average cost per welfare year	\$ 75,138
Average duration on welfare (total years)	4.0
Average cost per unemployment year	\$ 36,249
Average duration on unemployment (total years)	4.0
Smoking-related medical costs per year	\$ 2,962
Alcohol-related medical costs per year	\$7,946
Alternative education opportunities	14.3%

Table	2.9.	Miscellaneous	Variables
1 GDIO	2.0.	1110001101100000	v anabioo

Sources: Bureau of Justice Statistics, "Table 1: State (1) average annual pay for 2000 and 2001 and percent change in pay for all covered workers (2)" (Washington, D.C.: US Department of Labor, Criminal Justice Expenditure and Employment Extracts Program, 2000); Office of International Criminal Justice (OICJ), "The Extent and Costs of Victimization, Crime and Justice," *The Americas* (Dec-Jan 1995); Robert Rector, *Means-Tested Welfare Spending: Past and Future Growth* [database on-line] (Heritage Foundation, March 2001); US Department of Treasury, *The Economic Costs of Smoking in the United States*, Report-3113 (Washington, D.C., 1998); National Center for Health Statistics, "Health Promotion and Disease Questionnaire of the 1990 National Health Interview Survey"; National Institute on Drug Abuse, *The Economic Costs of Alcohol and Drug Abuse in the United States*, (Bethesda, MD: National Institute of Health, 1998).

REGIONAL ECONOMIC BENEFITS

In general, the regional economy is affected by the presence of NJC in two ways: from its day-to-day operations (including capital spending), and from students who enter the workforce with increased skills. Day-to-day operations of the college provide the *direct* jobs and earnings of the faculty and staff, and additional *indirect* jobs and earnings through the action of regional multiplier effects. At the same time, the presence of college-trained past and present NJC students in the local workforce deepens the

¹³ As indicated in the table, we assume that the average duration on welfare and unemployment is 4.0 and 4.0 years, respectively. This means that, over the next thirty years or so, the cumulative incidence of welfare and/or unemployment will be spread evenly over the time horizon—it is not a consecutive period.

¹⁴ The incarceration, health, welfare and unemployment probability, and cost variables are internal to the analytic model.

economy's stock of human capital, which attracts new industry and makes existing industry more productive.

Estimating these regional economic effects requires a number of interrelated models. Multiplier effects are obtained with an input-output (IO) model constructed for the Northeastern Junior College economic region.¹⁵ Estimating college operations effects requires an additional model that takes college expenditures, deducts spending that leaks from the economy, and bridges what is left to the sectors of the IO model.

Estimating the skill-enhancing effect of past students on the regional economy entails five basic steps:

- 1. Estimate the number of past NJC students still active in the regional workforce.
- 2. Adjust for alternative education opportunities.
- 3. Estimate the increased earnings of the students still active in the regional workforce.
- 4. Adjust the overall earnings estimated in step 3 to account for a collection of substitution effects. This provides an estimate of the direct increase in regional earnings.
- Allocate the direct increase in regional earnings to affected economic sectors, and augment these to account for a collection of demand- and supply-side multiplier effects.

¹⁵ The NJC economic impact model is constructed using data purchased from Economic Modeling Specialists, Inc. and EMSI input-output (IO) modeling software (Moscow, ID: 2002). This software employs a standard regional-purchase-coefficient (RPC) non-survey IO modeling technique, similar to that used in constructing the Utah Multiregional IO (UMRIO) model (Governor's Office of Planning and Budget et al. [Salt Lake City, UT: Demographic and Economic Analysis, 1994]), the Idaho Economic Modeling Project (IDAEMP) (M. H. Robison, R. Coupal, N. Meyer, and eds [Moscow, ID: University of Idaho, College of Agriculture, 1991]), the Oregon Economic Modeling System (OREMS) (M. H. Robison, Proceeding at the 29th Annual Pacific Northwest Economic Conference [Missoula, MT: 1995]), models chronicled for small areas (see M. H. Robison, "Community Input-Output Models," *Annals of Regional Science* 31 no.3 [1997]: 325-351), IMPLAN models constructed using IMPLAN IO modeling software (Stillwater, MN: Minnesota IMPLAN Group, annual) and "Regional IO models" (RIO models) constructed by Rutgers University, Center for Urban Policy Research (New Brunswick, NJ: Rutgers University, 2002).

The end results include estimates of the impact of past student skills and increased productivity on: 1) the size of regional industries, and 2) the size of the overall regional economy.

This section is divided into a number of subsections. The first documents our estimation of day-to-day NJC operations effects, followed by sections that detail the steps necessary to estimate the effect of past student skills on the regional economy.

The Impact of NJC Operations

The first step in estimating the impact of NJC operations is to assemble data on its combined operating and capital expenditures. These data are assembled from college budgets and collected into the categories of **Table 2.10**. Column 1 simply shows the total dollar amount of spending. Columns 2 through 5 apportion that spending to local (i.e. in-region) and non-local but in-state vendors. The net local portion is derived in Column 6.

The information on total spending required for Column 1 is generally readily available, though sorting specific items to the categories of the table can take some time. Information in Columns 2 through 5 is generally more problematic: hard data are scarce on the local/non-local split. In these cases, NJC staff members were asked to use their best judgment.

The first row in **Table 2.10** shows salaries, wages, and benefits. These *direct* earnings are part of the economic region's overall earnings by place-of-work. These appear later as "Direct Earnings of Faculty and Staff" in the table of findings, **Table 3.16**. Dollar values in Column 6 of **Table 2.10** are fed into the economic region IO model.¹⁶ The IO model provides an estimate of indirect effects, and these appear as "Indirect Earnings" in **Table 3.16**.

¹⁶ **Table 2.10**, by itself, might provide useful information to local audiences – Chambers of Commerce, local business establishments, Rotary clubs, and the like. The table indicates that the college is a "good neighbor" in the local community, evidenced by the fact that an estimated 70% of all college expenditures benefit local vendors (\$10,962 / \$15,615 = 70%).

The Socioeconomic Benefits of Northeastern Junior College

Chapter 2: Data Sources and Assumptions

Table 2.10. Profile of NJC Spending In and Out of Regional Economy (\$ Thousands)								
	Total		% Non-	%	% Manu.	Net		
	Dollar	Local	Local, but	Manufact.	Non-Local	Local		
	Amount*	%	In-State	Local	but In-State	Spending		
Spending Categories	(1)	(2)	(3)	(4)	(5)	(6)		
Salaries, Wages, and Benefits	\$9,404	86%	13%			\$8,088		
Telephone	\$72	5%	90%			\$4		
Electricity and Natural Gas	\$376	5%	90%			\$19		
Water Supply and Sewerage Systems	\$36	100%	0%			\$36		
General Merchandise Stores	\$1,455	17%	47%	1%	47%	\$247		
Building Materials and Gardening Supplies	\$168	75%	15%	16%	17%	\$126		
Maintenance and Repair Construction	\$152	74%	24%			\$112		
New Construction	\$597	49%	51%			\$293		
Services to Buildings	\$46	20%	80%			\$9		
Travel	\$130	15%	70%			\$19		
Eating and Drinking	\$31	100%	0%			\$31		
Marketing	\$79	50%	40%			\$40		
U.S. Postal Service	\$67	80%	20%			\$54		
Printing and Publishing	\$191	12%	81%			\$23		
Accounting, Auditing and Bookkeeping	\$6	0%	100%			\$0		
Credit Agencies	\$175	3%	97%			\$5		
Legal Services	\$5	0%	100%			\$0		
Insurance	\$71	5%	95%			\$4		
Other Business Services	\$1,440	55%	40%			\$792		
Rental Property	\$199	100%	0%			\$199		
Unemployment Compensation	\$8	0%	100%			\$0		
Household Income	\$907	95%	5%			\$862		
Total	\$15,615					\$10, <mark>962</mark>		

*Note: This table provides details for the summary of the college role in the regional economy (Table 3.16). The total dollar amount in Column 1 differs from the reported college budget by the amount of the unrestricted portion of Pell and other direct grants.

Source: Computed internally by the model based on data supplied by NJC.

Estimating CHEs Embodied in the Present-Day Workforce

This section describes the submodel for estimating the CHEs of past NJC instruction embodied in the present-day regional workforce. **Table 2.11** indicates variables critical to the model, while **Table 2.12** shows the various steps in the calculation. The values presented in **Table 2.11** also appear in **Tables 2.2** and **2.4**. Considering **Table 2.12** one column at a time reveals the steps involved in estimating embodied CHEs.

Table 2.11. Critical Variables

Assumptions	Values
Current headcount of students	7,368
Students remaining in community after leaving college	75%
Thirty-year attrition	25%
Decay rate	1.0%
Overall average of credits earned per student this year	7.2
Source: Data supplied by NIC. See also Tables 2.2 and 2.4	

Source: Data supplied by NJC. See also Tables 2.2 and 2.4.

Chapter 2: Data Sources and Assumptions

Column 1 provides an estimate of the enrollment history (unduplicated headcount) of NJC students. Column 2 represents the non-retired students, in other words, the students who have the potential to go into the workforce. Column 3 is the same as Column 2, but net of students who leave the region immediately upon leaving NJC. As shown in the table, 75% of the students remain in the area upon leaving the college, and 25% leave the region.

Column 4 goes one step further – a comparison of Columns 3 and 4 indicates that all past students have left NJC except for the last three years (2000-2003) where students are still enrolled (the leaver assumptions are shown in Column 9). Column 5 further reduces leavers to focus only on those who have settled into a somewhat permanent occupation. As shown in Column 10 (the "settling factor"), it is assumed that all students settle into permanent occupations by their fourth year out of school. Settling-in assumptions are specified in **Table 2.2** above.

Column 6 transitions further from leavers who have settled into jobs to leavers still active in the current workforce. Here we net off workers who, subsequent to leaving NJC and settling into the local workforce, have out-migrated, retired, or died. As shown in **Table 2.11**, 25% of the past students will out-migrate, retire or die over the course of the next thirty years. This "thirty-year attrition" follows an assumed logarithmic decay function shown in the column labeled "Active in Workforce."

Column 7 shows the average CHEs generated per year back to 1974. These data were obtained by dividing total year-by-year CHEs by the corresponding headcount.¹⁷ Column 8 shows the product of the year-by-year average CHEs, and the estimate of the number of past students active in the current workforce in Column 6. Looking to the total in Column 8, we estimate that the current workforce of the Northeastern Junior College economic region embodies some 978.4 thousand CHEs of past NJC instruction.

Reducing NJC CHEs to Account for Alternative Education Opportunities

The 978.4 thousand CHEs of past NJC instruction indicated in **Table 2.12** increase the skills embodied in the local workforce and, through them, the overall size of the regional economy in terms of earnings. Before turning to the income calculation, however, it is fair to ask to what degree past NJC students would have been able to obtain schooling

¹⁷ We used the current year estimate of CHEs (see **Table 2.4**), adjusted for the retired students, as a proxy for the average achievement per student in all prior years before FY 2003.

The Socioeconomic Benefits of Northeastern Junior College

(and therefore skills) absent the community and technical college system in Colorado. This is the common "with and without condition" in applied economic analysis.

The NJC institutional research staff provided the estimate of the alternative education opportunity variable (14.3%) by taking into account opportunities such as private trade schools and colleges, public four-year institutions, correspondence schools, and so on.¹⁸ Accordingly, when calculating the net increase in regional income attributable to NJC, the historic CHEs indicated in **Table 2.12** should be reduced by 14.3%.

Table 2.12. Estimating CHEs of Instruction Embodied in the Workforce											
			Subtract	Students	Leavers	# Settled Into		CHEs		Assumptions	
	Student	Subtract	Students	Who Have	Who Have	Jobs - Active		Embodied	% of		
	Enrollment	Retired	Migrating	Left College	Settled	in the	Average	in the	Students in	"Settling-In"	Active in
	Headcount*	Students	Immediately	(Leavers)	Into Jobs	Workforce	CHEs	Workforce	Workforce	Factor	Workforce
Year	1	2	3	4	5	6	7	8	9	10	11
1974	6,059	5,816	4,362	4,362	4,362	3,272	7.15	23,392	100%	100%	75.0%
1975	6,125	5,880	4,410	4,410	4,410	3,339	7.15	23,875	100%	100%	75.7%
1976	6,191	5,943	4,457	4,457	4,457	3,408	7.15	24,365	100%	100%	76.5%
1977	6,257	6,006	4,505	4,505	4,505	3,477	7.15	24,862	100%	100%	77.2%
1978	6,323	6,070	4,552	4,552	4,552	3,548	7.15	25,367	100%	100%	77.9%
1979	6,389	6,133	4,600	4,600	4,600	3,619	7.15	25,879	100%	100%	78.7%
1980	6,455	6,197	4,647	4,647	4,647	3,692	7.15	26,398	100%	100%	79.4%
1981	6,521	6,260	4,695	4,695	4,695	3,766	7.15	26,925	100%	100%	80.2%
1982	6,587	6,323	4,743	4,743	4,743	3,841	7.15	27,460	100%	100%	81.0%
1983	6,653	6,387	4,790	4,790	4,790	3,916	7.15	28,002	100%	100%	81.8%
1984	6,719	6,450	4,838	4,838	4,838	3,993	7.15	28,553	100%	100%	82.5%
1985	7,842	7,528	5,646	5,646	5,646	4,705	7.15	33,644	100%	100%	83.3%
1986	8,964	8,605	6,454	6,454	6,454	5,431	7.15	38,831	100%	100%	84.1%
1987	8,988	8,628	6,471	6,471	6,471	5,498	7.15	39,310	100%	100%	85.0%
1988	8,678	8,331	6,248	6,248	6,248	5,359	7.15	38,320	100%	100%	85.8%
1989	9,820	9,427	7,070	7,070	7,070	6,123	7.15	43,778	100%	100%	86.6%
1990	10,961	10,523	7,892	7,892	7,892	6,900	7.15	49,338	100%	100%	87.4%
1991	9,706	9,317	6,988	6,988	6,988	6,169	7.15	44,108	100%	100%	88.3%
1992	8,450	8,112	6,084	6,084	6,084	5,423	7.15	38,772	100%	100%	89.1%
1993	8,717	8,368	6,276	6,276	6,276	5,648	7.15	40,383	100%	100%	90.0%
1994	7,470	7,171	5,378	5,378	5,378	4,887	7.15	34,939	100%	100%	90.9%
1995	7,753	7,443	5,582	5,582	5,582	5,121	7.15	36,612	100%	100%	91.7%
1996	7,829	7,516	5,637	5,637	5,637	5,221	7.15	37,327	100%	100%	92.6%
1997	7,983	7,664	5,748	5,748	5,748	5,375	7.15	38,428	100%	100%	93.5%
1998	6,648	6,382	4,787	4,787	4,787	4,519	7.15	32,310	100%	100%	94.4%
1999	7,801	7,489	5,617	5,617	5,617	5,354	7.15	38,279	100%	100%	95.3%
2000	7,402	7,106	5,329	5,329	5,329	5,129	7.15	36,672	100%	100%	96.2%
2001	6,827	6,554	4,915	4,913	4,422	4,296	7.15	30,718	100%	90%	97.2%
2002	6,862	6,588	4,941	4,829	3,622	3,553	7.15	25,406	98%	75%	98.1%
2003	7,368	7,073	5,305	4,509	<u>2,2</u> 55	2,255	7.15	<u>16,1</u> 20	<u>8</u> 5%	<u>5</u> 0%	100.0%
Embodie	Embodied Total 978,375										

*Note: Column 1 shows the combined total of credit and non-credit students based on the implicit assumption that the same ratio between credit and non-credit students during the analysis year also applies to the previous years. The enrollment headcount numbers, therefore, are based on a constant ratio for all years, unless there is hard data available on the ratio of credit to non-credit students for the years in the time horizon.

Sources: Computed from data supplied by NJC. For Columns 7 and 11, see Tables 2.4 and 2.11, respectively.

¹⁸ We are not comparing NJC to other community and technical colleges in the Colorado college system. As indicated in the preface to this report, our analysis is not intended as a vehicle for comparing one college with others — it examines NJC as a member of the community and technical college system, and not as a competitor with other two-year colleges in the state.

From Embodied CHEs to Direct Regional Income Effects

In the standard model, regional income is expressed as a function of physical and human capital. Human capital is increased by adding new workers or by enhancing the skills of existing workers - the former adds the productivity of the new workers: the latter increases the productivity of existing workers. Increased human capital has a direct and indirect effect on *regional* income. The direct effect is conveyed in the higher earnings of the newly skilled workers themselves, while the indirect stems from associated multiplier effects. This section describes our process for estimating the direct effect.

A key part of the overall model is the "engine" that estimates the value per CHE of instruction.¹⁹ The product of per-CHE added earnings, and the total of embodied past NJC instruction (978.4

Elasticity of Substitution: Two Polar Cases

Polar Case 1. Two Inelastic Assumptions.

Assumption #1: The rate of technical substitution between local skilled and unskilled workers is infinitely inelastic. Skilled workers are able to perform tasks that unskilled workers cannot. Here, the added skills only increase value; they do not replace or substitute for existing production inputs. The added skills enable product line expansion and increased competitiveness of existing industry, and they attract new industry. Earnings and output expand as a result.

Assumption #2: The rate of technical substitution between local and non-local workers is infinitely inelastic. Skilled workers cannot be attracted from outside the region. Here, the existence of local skilled workers enables industry to do things they could not do otherwise. Locally skilled workers may attract new industry to the region (there is a near stand-alone development theory based on the notion that skilled workers attract new industry – Borts and Stein, 1964).

Polar Case 2. Two Elastic Assumptions.

Assumption #1: *The rate of technical substitution between local skilled and unskilled workers is infinitely elastic.* This implies that skilled workers are substituted for unskilled workers in a manner that creates no net additional regional earnings. Businesses simply replace lower productivity (and lower paid) unskilled workers with some smaller number of higher productivity (and higher paid) skilled workers, with no net change in overall output or earnings.

Assumption #2: The rate of technical substitution between local and non-local workers is infinitely elastic. Here existing or new industry can draw skilled workers from outside the region without extraordinary inducements or wage premiums that would otherwise increase costs and reduce competitiveness. Regional growth is driven by something other than local workforce skills. Hamilton et al., 1991, provides a broad discussion of the issues that work to limit the response of regional income to specified economic changes.

¹⁹ Briefly, the engine that estimates the value per CHE does so by combining earnings/education data from **Table 2.5** with information on aggregate student achievements during the analysis year (from **Table 2.4**). These calculations are discussed more fully in **Chapter 3**.

thousand CHEs, **Table 2.12**) provides the dollar estimate of how much more past students are earning as a result of their NJC coursework. The question is: how much of this added *personal* income can be counted as added *regional* income?

The answer to this question depends on the magnitude of the elasticity assumptions at work in the regional income model. As shown in the text box, the elasticities can vary from perfectly inelastic to perfectly elastic. The text box describes the issue according to two polar cases, one accepting all of the added student income, the other accepting none of it. Obviously the actual value will lie somewhere between.

There is considerable empirical literature on the economic development effects of education, though mainly in the international rather than regional context. In a recent study, Bils and Klenow (2000) survey previous work on the subject and advance a model of their own. Based on their findings, we reduce the full past student income increase (the perfectly inelastic case) by 2/3 to arrive at our estimate of the net increase in regional income. This estimate for NJC appears in **Table 3.16** under the subheading "Direct Earnings," in the section titled "Earnings Attributable to Past Student Economic Development Effects."

The Industries Where Past Students Work

Calculating the indirect impacts of workforce-embodied NJC skills also requires the use of the regional IO model discussed above. The model captures the extent to which a dollar spent turns over in the economy. We estimate indirect income effects by applying the IO multiplier to the direct effects. The use of IO multipliers in this way requires that the direct effects be disaggregated into specific industrial sectors. Disaggregating direct impacts avoids IO aggregation error,²⁰ and it facilitates an analysis of NJC's contribution to the business sector – an analysis that appears in **Chapter 3**.

²⁰ Aggregation error occurs when a model with many industrial sectors is reduced through industry combination to a model with many fewer "aggregated industries" (see Miller and Blair, 1985, Chapter 5). Our initial estimate of past-student direct earnings effects appears with no industry detail, and would thus require aggregating all industries to a single aggregate. By any measure, use of such an aggregated multiplier would court an unacceptable aggregation error. At the same time, the EMSI IO modeling system conveys industry detail at roughly the SIC 4-digit level. An assembly of data on direct past student effects at this fine level of detail is not realistic. Our solution is to disaggregate past student direct effects to the nineteen sectors appearing in **Table 2.13**.

Chapter 2: Data Sources and Assumptions

Table 2.13 provides information on the sectoral distribution of jobs in the regional economy. The table provides a draft-stage vehicle for collecting information from NJC on the sectoral breakdown of their past students, and it documents the information provided by the college. **Table 2.13** appears with four columns briefly described below.

Column 1 appears for reference and simply shows the current distribution of all jobs in the NJC Service Area economy by sector. For example, 22.4% of all regional jobs are in the Agriculture and Agricultural Services sector, 6.7% of all jobs are in the Finance, Insurance, and Real Estate sector, and so on. Column 2 shows the distribution by sector of past NJC students, i.e., an estimate of the industries where they currently work. For example, while 22.4% of all regional jobs are in the Agriculture and Agricultural Services sector, only 2.7% of past NJC students are estimated to be in that sector. In contrast, while 6.7% of all jobs are in the Finance, Insurance, and Real Estate sector, 16.3% of past NJC students are estimated to be in that sector.

There is a long-standing theory of regional development known as *stage theory*. The notion is that regional economies develop by progressing from "low stage industries" (agriculture, mining, logging, etc.), to "higher stage industries" (process manufacturing, fabricative manufacturing, etc.), and finally to specialized industries such as finance, engineering, and so on. The distribution of past NJC students shown in Column 2 is derived mechanically, on the assumption that past NJC students tend to find jobs in the higher development stage industries.²¹

In the course of assembling the data for our analysis, NJC has examined the distribution of past students as indicated in Column 2, and made any adjustments needed to accurately reflect the current realities. The revised distribution appears in Column 3.²²

Column 4 applies the distribution of student percentages in Column 3 to the total historic CHEs embodied in the workforce. This latter total is obtained from **Table 2.12**, and reappears at the bottom of Column 4 as the total. In **Chapter 3**, we estimate the

contribution to student earnings per CHE of NJC instruction. This product provides our estimate of the direct effect of past NJC operations on regional earnings by industry.

The Indirect Economic Development Effects of Students

The previous section described how we estimated the increment of regional earnings directly attributable to the NJC skills embodied in the current region workforce. Next, we turn to the indirect effects on both the demand- and supply-sides.

First, consider demand-side effects. Regional earnings are larger because of the NJC skills embodied in past students still active in the workforce. As earnings increase, so do industry outputs and industry purchases of inputs.²³ These in turn generate subsequent rounds of increased earnings, which are measured with the familiar multiplier effects. These indirect effects on the demand-side are estimated in the regional IO model by converting the embodied CHEs shown in **Table 2.13** into direct increased industry sales.

Second, consider the supply-side indirect effect. Economic development theory describes a process of "cumulative causation," or "agglomeration," whereby growth becomes in some degree self-perpetuating. The location of a new industry (A) in the region attracts other industries (B, C, and D) that use industry A's outputs as inputs. This, in turn, produces subsequent rounds of industry growth, and so on.²⁴ To estimate agglomeration effects, we configure our economic region IO model to provide a set of so-called supply-driven multipliers (see for example Miller and Blair, 1985). We estimate the supply-side effects by converting the embodied CHEs shown in **Table 2.13**

²¹ Parr (1999) describes four stages of economic development: primary production, process manufacturing, fabricative manufacturing, and producer services and capital export. We apply a

[&]quot;development score" to Parr's stages: low scores for lower stage sectors and higher scores for higher development sectors. The scores are applied to employment in each sector, then normalized to form weights for distributing past NJC students. The end result is that past students favor higher stage industries. For additional detail on the use of this approach for classifying industries by industrial stage, see Rutgers et al, 2002.

²² In the case where there is no difference between Columns 2 and 3, the college has accepted the default allocation between the different sectors.

²³ For example, associated with the increased output and earnings is an increased demand for both consumer goods and services, and goods and services purchased by businesses as inputs. These in turn produce a set of regional economic multiplier effects. These are all captured and included as part of the demand-side indirect effects.

²⁴ For a more complete discussion of agglomeration and cumulative causation see Fujita, Krugman, and Venables, 1999.

into direct increased industry value added, and then apply these to the multipliers of the supply-driven regional IO model.²⁵

Industries	Distribution of All Jobs 1	Provisional Distribution of Past Students 2	Final Distribution of Past Students 3	Distribution of Historic CHEs Embodied in Current Workforce 4
Agriculture and Agricultural Services	22.4%	2.7%	2.7%	26,802
Mining, Sand, and Gravel	1.4%	0.2%	0.2%	1,687
Construction	4.1%	0.5%	0.5%	4,908
Manufacturing: Food, Wood, Paper, and Textiles	1.1%	0.7%	0.7%	6,734
Manufacturing: Chemicals, Petroleum, Stone, and Glass	1.1%	1.3%	1.3%	12,927
Manufacturing: Computer and Electronic Equipment	0.1%	0.2%	0.2%	1,838
Manufacturing: Other	0.6%	0.8%	0.8%	7,535
Transportation	3.3%	2.0%	2.0%	19,610
Public Utilities	1.0%	0.6%	0.6%	5,818
Publishing and Communications	0.5%	1.1%	1.1%	11,250
Trade	18.9%	23.1%	23.1%	226,141
Finance, Insurance, and Real Estate	6.7%	16.3%	16.3%	159,582
Motels, Eating/Drinking, and Amusement/Recreation	1.7%	1.1%	1.1%	10,327
Consumer Services	5.3%	3.3%	3.3%	31,919
Business Services	4.7%	5.8%	5.8%	56,545
Medical/Educational/Social services	8.1%	19.9%	19.9%	194,999
Federal Government	1.4%	1.7%	1.7%	16,375
State and Local Government	17.6%	18.7%	18.7%	183,378
Total	100%	100%	100%	978,375

Table 2.13. Estimating the Distribution of Past Students by Industrial Sectors of the Regional Economy

Sources: Column 1 shows the percentage breakdown of all jobs in the college-hosting region across the industrial sectors shown in the table. Data on overall jobs by industry are obtained from the US Department of Commerce, Regional Economic Information System, CA and SA series; the US Department of Commerce, Bureau of Labor Statistics ES-202 series. Data in Column 2 are generated based on a stages index, weighted according to relative job numbers in the industries existing in the state. Mechanics and the supporting theory behind the stages index are described in the text. Data in Column 3, where these number differ from Column 2, were provided by college personnel. Data in Column 4 are historic CHEs reported in Table 2.12, distributed according to the proportions shown in Column 3.

²⁵ Agglomeration effects are difficult to estimate. Our procedure assumes that so-called "supply-driven IO multiplier effects" capture the agglomeration effects. To increase the plausibility of this assumption, we apply only the direct effects associated with the industries in the highest stages of development.
Chapter 3 PRIVATE, PUBLIC, AND REGIONAL ECONOMIC BENEFITS

INTRODUCTION

This chapter summarizes the main NJC case study results in four sections: 1) the aggregate annual private and public benefits; 2) these same benefits measured per CHE and per student; 3) future benefits expressed in terms of net present value, rate of return, and benefit/cost ratio, and 4) the regional economic benefits.

ANNUAL BENEFITS

Higher Student Earnings

The annual benefits are summarized in **Tables 3.1** and **3.2** (see also **Figure 3.1**). We begin with earnings growth in **Table 3.1**. Last year, each student completed, on average, 7.2 CHEs at NJC (see **Table 2.4**), only a fraction of one full year of study. This is because the majority of students attend for a variety of purposes as discussed in conjunction with **Table 2.4**: for some, to make progress towards an eventual degree, and for others, to simply acquire certain skills that will increase their productivity in the workforce. A total of 7,368 students will capture \$6.1 million worth of higher annual earnings based on this average increase in educational attainment.

Social Savings

Health-Related Savings

Also in **Table 3.1**, we see that improved health, lower welfare and unemployment, and lower crime will result in annual dollar savings to the taxpayers of \$429.7 thousand, \$254.0 thousand, and \$451.3 thousand (rounded). In **Table 3.2**, these same results are presented in greater detail – health-related absenteeism will decline by 2,610 days per year, translating to a total of 10 years' worth of productivity gained per year (based on 260 workdays per year). Annual total dollar savings from reduced absenteeism days equals \$242.8 thousand. There will be 10 fewer smokers and 20 fewer alcohol abusers,

amounting to annual total dollar savings of \$28.9 thousand and \$158.0 thousand, respectively, inclusive of insurance premiums, personal payments, and withholding for Medicare and Medicaid.

Crime-Related Savings

There will be an estimated 18 fewer people incarcerated as a result of the higher education obtained, saving the taxpayers a total of about \$181.3 thousand per year. The assumptions pertaining to these results are listed in **Table 2.9** in the previous chapter. They are based on an average duration of 4.0 years incarcerated at an average cost of \$77,178 per year (inclusive of arrest, prosecution, incarceration, and rehabilitation). Fewer people incarcerated means more people gainfully employed – this translates to \$70.2 thousand in additional annual earnings for the local community. Victim costs will be reduced by \$199.7 thousand per year.

Welfare and Unemployment Savings

There will be 32 and 13 fewer people on welfare and unemployment, respectively, in the community. The corresponding total dollar savings for the local community amounts to \$254.0 thousand (\$136.5 thousand welfare + \$117.5 thousand unemployment savings) for one year, assuming that the average time spent on welfare and unemployment is 4.0 years (see **Table 2.9**).

Total Public Benefits

All told, there will be \$1.1 million in public savings per year in the community – the sum of all health, crime, and welfare/unemployment benefits in **Table 3.2**.

		Soci	al (External Benefit	ts)	
	Higher	Improved	Lower Welfare	Lower	
Level of Education	Earnings	Health	Unemployment	Crime	Total
< HS/GED	\$458,535	\$19,760	\$42,699	\$38,301	\$559,295
HS/GED equivalent	\$170,649	\$2,556	\$3,536	\$2,849	\$179,590
One year post HS or less	\$2,146,366	\$185,485	\$124,814	\$237,696	\$2,694,361
Two years post HS or less	\$3,166,394	\$157,386	\$64,920	\$147,107	\$3,535,807
> Associate Degree	\$115,476	\$64,502	\$18,013	\$25,345	\$223,336
Total	\$6,057,421	\$429,688	\$253,981	\$451,299	\$7,192,390

Table 3.1 Higher Earnings and Social Benefits by Student Body Achievements

Source: Computed from data supplied by the US Census Bureau (see also Table 1-15 in Volume 2: Detailed Results).

The Socioeconomic Benefits of Northeastern Junior College



Table 3.2. Summary of Annual Benefits					
	Units	Earnings	Social Savings		
Higher Earnings	NA	\$6,057,421			
Health Benefits					
Absenteeism savings (days)	2,610	NA	\$242,818		
Fewer smokers, medical savings (# persons)	10	NA	\$28,906		
Fewer alcohol abusers (# persons)	20	NA	\$157,964		
Crime Benefits					
Incarceration savings (# persons)	18	NA	\$181,337		
Crime victim savings	NA	NA	\$199,715		
Added productivity (fewer incarcerated)	NA	NA	\$70,247		
Welfare/Unemployment Benefits					
Welfare savings (# persons)	32	NA	\$136,482		
Unemployment savings (# persons)	13	NA	\$117,500		
Total		\$6,057,421	\$1,134,969		

Source: Computed from data supplied by Tables 1-15 in Volume 2: Detailed Results.

ANNUAL BENEFITS PER CHE AND PER STUDENT

The aggregate benefits reported in **Tables 3.1** and **3.2** above are expressed per CHE and per student in **Table 3.3**. These are also displayed in the form of a pie chart in **Figure 3.2**. On average, students capture: 1) \$120 per year in higher earnings per CHE,²⁶ and 2) \$822 per year in higher earnings on the basis of the number of CHEs completed.

²⁶ Thus, a student attending for 10 CHEs will add \$1,198 per year to the lifetime earnings. A longer curriculum will add substantially more. The earnings expectations are portrayed as linear but with many computational steps involved (see **Chapter 2**). The extrapolation is based on the averages of low earnings additions for leavers completing few CHEs, plus higher additions for leavers completing more CHEs.

The Socioeconomic Benefits of Northeastern Junior College

Converted to a full-year equivalent (30 CHEs), the annual earnings would amount to \$3,449 per student. On average, the social benefits per CHE range from a low of \$1.4 for Added Productivity to a high of \$5 per CHE for Absenteeism Savings. On a per student basis, they range from a low of \$10 per student for Added Productivity to a high of \$33 for Absenteeism Savings. On a full-year equivalent basis (30 CHEs), the social savings would amount to \$646 per student (the total of \$4,096 less \$3,449 of higher private earnings as indicated in **Table 3.3**).²⁷

Table 3.3. Annual	Benefits Per C	HE and Per Stud	dent
	Per CHE	Per Student	Annualized
Higher earnings	\$120	\$822	\$3,449
Absenteeism Savings	\$5	\$33	\$138
Medical Cost Savings	\$4	\$25	\$106
Incarceration Savings	\$4	\$25	\$103
Crime Victim Savings	\$4	\$27	\$114
Added Productivity	\$1	\$10	\$40
Welfare Savings	\$3	\$19	\$78
Unemployment Savings	\$2	\$16	\$67
Total	\$142	\$976	\$4,096

Note: The annualized values exclude benefits from retired students.

Source: Computed from data supplied by Table 2.4 and Tables 17-18 in Volume 2: Detailed Results.



The Socioeconomic Benefits of Northeastern Junior College

²⁷ The values in **Table 3.3** and **Figure 3.2** are calculated based on the various statistical sources referenced in **Table 2.9**, in conjunction with the student profile and headcount numbers provided by the college.

THE INVESTMENT ANALYSIS: INCORPORATING FUTURE BENEFITS

The results in **Tables 3.1** and **3.2** provide only a single-year snapshot of the benefits. As long as the students remain in the workforce, however, the college-acquired skills continue to add productivity over time. In the investment analysis, the higher earnings and avoided costs are projected into the future over the working life of the student, discounted to the present, and then compared to the present costs of education. The investment is feasible if all discounted future benefits are greater than or equal to the costs.²⁸

The investment analysis results are shown in **Table 3.10** (in the aggregate, per CHE, and per student). The end results sought are the Net Present Value (NPV), the Rate of Return (RR), the Benefit/Cost (B/C) ratio and the Payback Period. These are simply different ways of expressing the results. All of the present value results shown are intermediary steps that ultimately generate the NPVs, RRs, and B/C ratios.

Expressing the Investment Analysis Results

Economists and financial experts have different ways of expressing investment analysis results. The standard and most familiar ones are those we present here: the **net present value** (NPV) is a dollar measure of future values discounted to the present, the **internal rate of return** (IRR) is expressed as a percentage return on investment; the **benefit/cost ratio** (B/C) is a ratio of how many dollars worth of benefits are received per cost dollar; and the **payback period** is a simple calculation of how many years worth of benefits are required to fully recover the all of the investments made. The criteria for feasibility: 1) the net present value must be positive or equal to zero; 2) the rate of return must be equal to or greater than the returns from other similar risk investments; and 3) the benefit/cost ratio must be equal to or greater than 1.

The net present values, rates of return, benefit/cost ratios and payback periods are all derived from the same data shown later in this chapter in **Tables 3.6**, **3.7**, and **3.8** (for the student and the broad and narrow taxpayer perspectives, respectively). Readers unfamiliar with the interpretation of these standard investment analysis results are encouraged to consult the short layman's guide provided in **Appendix 2** of this report: "Explaining the Results – a Primer." A glossary of terms is also provided in **Appendix 1**.

²⁸ Future benefits are worth less than present benefits. The present value of \$5,000 to be received thirty years from today is worth only \$1,603 given a 4% discount rate $(\$5,000/(1.04)^{30} = \$1,603)$. If the same benefits occur each year for thirty years, each year's benefit must be discounted to the present, summed and collapsed into one value that represents the *cumulative* present value of all future benefits. Thus, the present value of 30-years' worth of \$5,000 per year is \$90,000.

The Socioeconomic Benefits of Northeastern Junior College

We begin with some definitions in **Table 3.4.** Private benefits are the higher earnings captured by the students themselves. Broad taxpayer benefits are the additions to regional earnings plus lower overall expenditures related to health, crime, welfare, and unemployment. Narrow taxpayer benefits include increased state tax revenues (from increased regional income), and savings from reduced state government expenditures for incarceration, health, and welfare.

	Table 3.4. Some Definitions
Terms	Definitions
Student (Private) Benefits	Higher earnings captured by the students
Taxpayer Benefits: Broad	Additions to earnings plus lower overall expenditures related to
	health, crime, welfare, and unemployment
Taxpayer Benefits: Narrow	Increased state and local government tax collections plus lower government
	expenditures related to health, crime, welfare, and unemployment
Student Costs	Tuition (Table 2.1) plus the opportunity cost of time
Taxpayer Costs	State and local taxes (see Table 2.1)
Results:	
Student Perspective	Student Benefits / Student Costs
Taxpayer Perspective: Broad	Taxpayer Benefits (Broad) / Taxpayer Costs
Taxpayer Perspective: Narrow	Taxpayer Benefits (Narrow) / Taxpayer Costs

On the cost side, student costs consist of the tuition paid by the students (31.0% of the total budget in **Table 2.1**) and, most importantly, the opportunity cost of time (the earnings foregone). Also included here are the other sources of institutional revenues from private sources (25.8% in the case of NJC). The taxpayer costs consist of the state tax items in **Table 2.1**, or a total of 38.5%.

The opportunity cost (earnings foregone) incurred by the student body in the aggregate is estimated in **Table 3.5**. The first number in the table is the overall average annual income of the student body (given gender and ethnicity characteristics). This number, however, reflects the midpoint of the lifetime trajectory of earnings, while what is needed are the earnings of the students while enrolled (which is expected to be less than earnings at the midpoint). This is the second number in the table, \$16,831 per year, assuming full-time employment. The adjustment from the first to the second number takes into account the average age of the student body and the relationship between earnings and age as specified by the well-known and tested "Mincer equation" (see, for example, Willis, 1986).

	,,, .	1	Opp. Cost
Average statistical annual income of given gender and ethnicity profile		\$24,696	
Annual income, given gender and ethnicity profile, at current age of students		\$16,831	
CHEs per student (net of retired)	7.2		
% of full year in attendance and earnings foregone while attending	24%	\$4,011	
Total number of students		7,368	
Less retired students, %	4.0%	295	
Remaining students subject to opportunity cost computation		7,073	
Students not working while attending college and opportunity cost	15%	1,061	\$4,256,085
Number of working students	85%	6,012	
Earnings relative to statistical averages (%) and opportunity cost	78%	\$883	\$5,305,920
Value of leisure time (at 1/3 working time)	20%	\$802	
Value of leisure time forgone			\$4,823,563
Total opportunity cost			\$14,385,568
Pell and other student aid		\$1,859,759	
Restricted portion of student aid (tuition and fees)	71%	\$1,323,473	(\$536,286)
GRAND TOTAL STUDENT OPPORTUNITY COST			\$13,849,282

Table 3.5. Opportunity Costs (Earnings Foregone), \$ per Year

Sources: Computed from data supplied by the college and by the US Census Bureau. See also James Henderson and Richard E. Quandt, Microeconomic Theory: A Mathematical Approach (New York: McGraw-Hill Book Company, 1971).

We then deduct the retired student body (4.0%) to arrive at the net number of students subject to opportunity cost calculations — 7,073 students. The 1,061 students not working are charged the full opportunity cost of time (based on the average term in attendance), or \$4.3 million. The 6,012 working students are charged only a fraction of the full opportunity cost, or \$5.3 million as indicated in the table. Finally, we adjust the opportunity cost downward by the Pell and other student aid grants and the estimated 71% adjustment for the restricted use of these grants for tuition and fees.

We also present the results in different ways. First, the student perspective results indicate whether the NJC education pays by comparing the private benefits (higher earnings) to the private costs. Second (as discussed in the previous chapter), we compare *all* private and public benefits to the public costs (the state taxpayer contributions in **Table 2.1**) in a broad taxpayer perspective in present value terms. Third and finally, in a narrow taxpayer perspective, we compare only a portion of the public benefits (taxpayer actual savings) to the public costs; i.e., do state taxpayer investments of \$6.2 million (**Table 2.1**) pay off in terms of the public savings generated?

The Student Perspective

The collective investment of the students (time and money) is assessed in **Table 3.6.** Column 1 tracks the increased earnings of the student body as they leave the college,

The Socioeconomic Benefits of Northeastern Junior College

and follows them over the course of their working lives (65 - 31 = 34 years in **Table 2.4**). The upward trend in earnings mimics the Mincer equation (see Willis, 1986). It reflects both the growth in students' earnings over time and the spread in the increased earnings attributable to education.²⁹ Column 2 is simply Column 1 reduced by the 10% discount value that accounts for causation factors affecting student earnings. Column 3 shows the cost of the single year's education. Finally, Column 4 looks at the educational investment from a cash flow perspective, subtracting annual costs from the annual benefits.

Does attending NJC make economic sense for the students? The answer is a resounding **yes**. The future stream of benefits (higher earnings) accruing to the students has a net present value of \$114.6 million—a positive net present value (greater than zero) indicates that the investments made are strongly feasible. The benefit/cost ratio of 6.0 is strongly positive since the ratio is well above 1. The rate of return of 22.8% is also well above the long-term rates of return obtainable in the stock or bond markets, and certainly above the 4.0% discount rate used in the analysis. In the long run, therefore, the average NJC student will be substantially better off attending the college. The payback period for a student (tuition plus the earnings foregone) is 6.3 years—the higher earnings received beyond that period are pure economic rent—or a persistent earnings flow over and beyond the initial investments.

Discount Rate

The **discount rate** is a rate of interest that converts future costs and benefits to present values. For example, a \$1,000 higher earnings benefit to be realized 30 years in the future is worth much less than \$1,000 in the present. We must therefore express all future values in present value terms in order to compare them with the investments (i.e., the 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. If the desired end is to portray the investment as feasible and attractive, the discount rate selected is typically low. On the other hand, if the desired end is to portray the proposed investment as poor and unattractive, then the selected discount rate is high. The **4.0%** discount rate used in the CCbenefits impact study is a typical and relatively low rate often applied in public investment projects, since governments are large and can therefore spread their risks over a larger and more diverse investment portfolio than the private sector can.

The Socioeconomic Benefits of Northeastern Junior College

²⁹ We computed a Mincer equation based on the estimated coefficients presented in Willis, 1986, p. 545. These were adjusted to current year dollars in the usual fashion by applying the "GDP Implicit Price Deflator."

Table 3.6. Student Earnings (\$ Thousands)						
	1	2	3	4		
	Higher	Higher				
Veer	Earnings	Earnings	Cont	Net Cash		
rear	Gross	¢2 505	¢22.990	(\$20,284)		
1	\$2,704 \$2,171	\$2,303 \$2,854	\$22,009 ¢0	(J20,304)		
ו ר	\$3,171 \$2,029	\$2,004 \$2,525	\$0	φ2,004 ¢2,525		
2	\$3,920 \$4,201	\$3,000 \$3,000	\$0	\$3,000 \$3,000		
3	\$4,291 \$4,669	\$3,002 \$4,202	\$0	\$3,002 \$4,202		
4	\$4,000 \$5,060	\$4,202 \$4,554	\$0	\$4,202 \$4,554		
5	\$5,000 \$5,000	\$4,554 \$4,017	\$0	\$4,554 \$4,017		
0	\$3,403 ¢5 977	\$4,917 \$5,200	\$0	\$4,917 \$5,200		
1	\$5,677	\$5,290	\$U \$0	\$5,290 \$5,290		
8	\$6,301	\$5,670	\$U \$0	\$5,670		
9	\$6,730 \$7,465	\$6,057 \$6,440	\$U ©0	\$6,057		
10	\$7,165	\$6,449	\$U \$0	\$6,449		
11	\$7,602	\$6,842	\$U \$0	\$6,842		
12	\$8,039	\$7,235	\$U	\$7,235		
13	\$8,474	\$7,626	\$0 \$0	\$7,626		
14	\$8,903	\$8,013	\$0 \$0	\$8,013		
15	\$9,325	\$8,392	\$0 \$0	\$8,392		
16	\$9,736	\$8,762	\$0	\$8,762		
17	\$10,134	\$9,121	\$0 \$0	\$9,121		
18	\$10,516	\$9,464	\$0	\$9,464		
19	\$10,880	\$9,792	\$0	\$9,792		
20	\$11,222	\$10,100	\$0	\$10,100		
21	\$11,541	\$10,387	\$0	\$10,387		
22	\$11,835	\$10,651	\$0	\$10,651		
23	\$12,100	\$10,890	\$0	\$10,890		
24	\$12,336	\$11,102	\$0	\$11,102		
25	\$12,540	\$11,286	\$0	\$11,286		
26	\$12,712	\$11,440	\$0	\$11,440		
27	\$12,849	\$11,564	\$0	\$11,564		
28	\$12,951	\$11,656	\$0	\$11,656		
29	\$13,018	\$11,716	\$0	\$11,716		
30	\$13,049	\$11,744	\$0	\$11,744		
31	\$13,043	\$11,739	\$0	\$11,739		
32	\$13,002	\$11,702	\$0	\$11,702		
33	\$12,925	\$11,633	\$0	\$11,633		
0	\$0	\$0	\$0	\$0		
0	\$0	\$0	\$0	\$0		
0	\$0	\$0	\$0	\$0		
0	\$0	\$0	\$0	\$0		
0	\$0	\$0	\$0	\$0		
NPV		\$137,508	\$22,889	\$114,620		
IRR				22.8%		
B/C ratio				6.0		
Payback (v	rears)			6.3		

Real vs. Nominal Rates of Return

It must be understood that the returns reported in Tables 3.6, 3.7, and 3.8 are real returns, not *nominal*. When a bank promises to pay a certain rate of interest on passbook savings account, it employs an implicitly nominal rate. Bonds also 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 any inflation. For example, if inflation is running at 3.0% and a nominal percent of 5.0% is paid, then the real rate of return on the investment is only 2.0%. In Table 3.6, the 22.8% student rate of return is a real rate. With a rate of inflation of 3.1% (the average rate reported over the past 20 years as per the U.S. Department of Commerce, Consumer Price Index), the corresponding nominal rate of return is 26.7%, substantially higher than what we report. Since the literature on the economic returns of higher education is often unclear on this point, we would like to stress that the returns presented in this study are real, not nominal rates, and do not account for the influence of inflation.

Sources: Functional relationships for earnings computed on the basis of the "Mincer Equation." See Jacob Mincer, "Investment in Human Capital and Personal Income Distribution" (*Journal of Political Economy*, 1958): 281-302. Cost data in Column 3 are derived from Tables 2.1 and 3.5 (tuition plus earnings foregone).

The Broad Taxpayer Perspective

Table 3.7 assesses one year's operation of NJC from the broad taxpayer perspective. The Legislature, on behalf of the taxpayers, must weigh requests for NJC funding against the myriad of other public needs. As such, they need information to better allocate increasingly scarce resources between alternative and competing ends. Column 1 shows the stream of total benefits, including increased regional earnings, and social savings from reduced spending on incarceration, health, welfare, and unemployment. Specifics on the estimation of values in Column 1 are presented in Table 19 of Volume 2: Detailed Results. Column 2 adjusts for the 14% alternative education opportunity assumption (the percentage of the student body able to avail themselves of similar education elsewhere, absent the Colorado community and technical colleges).

Column 3 conveys an adjustment needed to account for the fact that the college might be able to operate at some level of enrollment absent state government support. Our overall modeling approach includes a sub-model with the students' demand curve for NJC enrollment. The sub-model simulates a reduction to zero state support by progressively increasing tuition. As tuition increases, enrollment declines as indicated by the demand curve (see **Appendix 4** for technical details). Below some minimum level of enrollment, the college would have to shut down; our analysis assumes this level to be 35% of the present enrollment. Suppose with zero state funding the school is still able to operate. In this case, the benefits generated by the college at that level are shown in Column 3. In the case of NJC, the zero state government funding level is 50% of the current level, above the assumed 35% shutdown level, so the adjustment in Column 3 applies. Column 4 is simply Column 1 less Columns 2 and 3. Column 5 shows the state taxpayer costs for a single year, as reflected in state tax items in **Table 2.1**. Finally, Column 6 considers the broad perspective on the taxpayer's investment in a cash flow sense, subtracting annual costs from annual benefits.

The net present value given this broad perspective is \$68.1 million and the benefit/cost ratio is 12.1. More succinctly, every dollar of tax monies spent on NJC education will generate a cumulative total of \$12.05 worth of social savings (accrued incrementally) for as long as the students are active in the workforce.³⁰

³⁰ A word of caution – the RR approach sometimes generates percentage results that defy the imagination. Technically, the approach requires at least one negative cash flow (tuition plus opportunity cost of time) to offset all subsequent positive flows. A very high percentage return may be technically correct, but perhaps not consistent with conventional understanding of returns expressed as percentages. For

The Socioeconomic Benefits of Northeastern Junior College

	Tab	ole 3.7. Taxpa	er Perspective	e: Broad (\$ The	ousands)	
	1	2	3	4	5	6
		Benefits	Benefits w/o	N	Total	Less College
Voar	All Bonofits	from Alt. Ed.	State Govt.	Net	Taxpayer	Income Cash Flow
	\$20.005	¢/88	\$8.004	\$11 /22	\$6 160	\$5 263
4	\$20,000 \$2,000	\$ 4 00	\$0,094	\$11,423 \$4,604	\$0,100 ¢0	\$5,205
2	\$3,730 \$4368	\$534 \$624	\$1,512 \$1,767	\$1,691 \$1,077	\$U \$0	\$1,691 \$1,077
2	\$4,500 \$4,659	\$665	\$1,885	\$2,109	\$0 \$0	\$2,109
4	\$4 961	\$708	\$2,007	\$2,105	\$0 \$0	\$2,105
5	\$5,272	\$753	\$2,133	\$2,386	\$0	\$2,386
6	\$5,591	\$798	\$2,262	\$2,530	\$0	\$2,530
7	\$5,916	\$845	\$2,394	\$2,678	\$0	\$2,678
8	\$6,247	\$892	\$2,528	\$2,827	\$0	\$2,827
9	\$6,581	\$940	\$2,663	\$2,979	\$0	\$2,979
10	\$6,917	\$988	\$2,799	\$3,131	\$0	\$3,131
11	\$7,252	\$1,036	\$2,934	\$3,282	\$0	\$3,282
12	\$7,585	\$1,083	\$3,069	\$3,433	\$0	\$3,433
13	\$7,913	\$1,130	\$3,202	\$3,582	\$0	\$3,582
14	\$8,235	\$1,176	\$3,332	\$3,727	\$0	\$3,727
15	\$8,548	\$1,221	\$3,459	\$3,869	\$0	\$3,869
16	\$8,850	\$1,264	\$3,581	\$4,006	\$0	\$4,006
17	\$9,140	\$1,305	\$3,698	\$4,137	\$0 \$	\$4,137
18	\$9,414	\$1,344	\$3,809	\$4,261	\$0	\$4,261
19	\$9,671	\$1,381	\$3,913	\$4,377	\$0	\$4,377
20	\$9,910	\$1,415	\$4,010	\$4,485	\$0	\$4,485
21	\$10,128	\$1,446	\$4,098	\$4,584	\$0 \$0	\$4,584
22	\$10,324	\$1,474	\$4,177	\$4,673 \$4,750	\$0 \$0	\$4,673
23	\$10,490 \$10,643	\$1,499 \$1,500	\$4,247 \$4,206	\$4,750 ¢4,917	\$0 20	\$4,750 ¢4,947
24	\$10,643 \$10,765	\$1,520 \$1,527	\$4,300 \$4,355	⊅4,017 €4,872	\$U \$0	\$4,017 \$4,872
20	\$10,703	\$1,557	\$4,333 \$1 391	ψ4,072 \$1 Q15	0¢ \$0	\$4,072
20	\$10,000	\$1,551	\$4 421	\$4 945	Φ0 \$0	\$4,915 \$4,945
28	\$10,966	\$1,566	\$4,437	\$4,963	\$0 \$0	\$4.963
29	\$10,977	\$1,567	\$4,441	\$4,968	\$0	\$4,968
30	\$10,960	\$1,565	\$4,434	\$4,960	\$0	\$4,960
31	\$10,915	\$1,559	\$4,416	\$4,940	\$0	\$4,940
32	\$10,842	\$1,548	\$4,387	\$4,907	\$0	\$4,907
33	\$10,743	\$1,534	\$4,347	\$4,862	\$0	\$4,862
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
NPV				\$74,237	\$6,160	\$68,077
						NA
B/C ratio						12.1
rayback (years)					NA

Sources: Taxpayer benefits in Column 1 are derived from Table 19 in Volume 2: Detailed Results. Alternative education assumption (Column 2) and taxpayer costs (Column 5) are obtained from NJC.

The Narrow Taxpayer Perspective

purposes of the reports, therefore, we express all rates of return over 100% as: "NA" or ">100%" (particularly for the broad taxpayer perspective where high returns are expected). Only the benefit/cost ratio is reported for the broad taxpayer perspective.

The Socioeconomic Benefits of Northeastern Junior College

Table 3.8 provides an investment analysis of NJC from the narrow taxpayer perspective. Recall from **Chapter 2** that the narrow perspective considers only monies that actually appear on the books of the state governments: revenue items such as tax receipts, and expenditure items such as road, bridge and street maintenance, police, public libraries and hospitals, jails and prisons, welfare payments, and so on.

Table 3.8, Column 1 shows additions to state government revenues stemming from the operation of NJC during the single analysis year. The values in Column 1 are computed by applying average state government tax rates to the net increase in regional income attributed to NJC.³¹ Also included in Column 1 are reductions (entered as negatives) in state government expenditures on crime, welfare, unemployment, and health. Projected dollar amounts in Column 1 are thus the sum of additional taxes collected, plus associated tax dollars saved as a result of the education provided by NJC during the single analysis year. As in **Table 3.7**, Column 2 reflects the adjustment attributable to the alternative education variable.

Column 3 reflects the ability of the college to operate without the current level of state government support, as discussed above and in **Appendix 4**. Our analysis assumes that if NJC enrollment drops to 35% of the current level due to reduction of state support and the subsequent tuition increase, the college would have to shut its doors. The economic benefits that the college would generate from operating at this level without the state government support are calculated in Column 3. In the case of NJC, the zero state government funding level is 50% of the current level, above the 35% shutdown level, so the adjustment in Column 3 applies. Column 4 is simply Column 1 less Columns 2 and 3.

Column 5 shows the state government expenditure in support of NJC for the analysis year, a value obtained directly from **Table 2.1**. Finally, Column 6 subtracts state government cost (Column 5) from the net benefits (Column 4), thereby providing the temporal cash flow needed for the investment analysis. As shown at the bottom of the table, NJC provides the state government with an annual return of \$5.3 million expressed as a net present value on its one year investment. Alternatively, the one year investment generates a 10.1% rate of return and a benefit/cost ratio of 1.9, both indicating that the investment is attractive. The payback period is 12.1 years.

³¹ Increased regional income includes a portion of direct student earnings, as well as salaries and wages at the college during the single analysis year, and an additional increment aimed at a collection of backward and forward multiplier effects.

The Socioeconomic Benefits of Northeastern Junior College

The returns shown in **Table 3.8** would be attractive even in the private sector, and they are very attractive in the public sector. Recall that the public sector generally undertakes those activities that the private sector finds unprofitable, i.e., investments that generate book revenues insufficient to cover book costs, thus requiring taxpayer subsidy. For example, state governments fund the operation and maintenance of state parks at a substantial loss, collecting revenues in the form of camping and entrance fees that cover only a fraction of costs. Taxpayers are willing to subsidize parks because they perceive off-budget benefits, e.g., access to the outdoors, local development effects, environmental protection, and so on, that justify the budgetary losses. Note that this broader collection of off-budget benefits would normally be captured in the broad taxpayer perspective.

Investments in public education are usually viewed in the same way as investments in parks and other publicly subsidized activities, i.e., activities that generate losses from a narrow investment perspective but are justified by net benefits from a broad investment perspective. As shown in **Table 3.8**, however, NJC is a notable exception to this general net-subsidy rule. The narrow perspective rate of return is strongly positive, and thereby indicates that the taxpayers' investments in the college generate increased public revenues and reduced expenditures that actually exceed the subsidy by taxpayers. **The practical effect of this is the following: if the investments made in NJC were reduced, taxes would actually have to be raised in order for the state government to continue its support of other activities at current levels. The taxpayer investments of 39% of the NJC budget (Table 2.1), in effect, subsidize other sectors of the economy that also receive taxpayer support. The simple bottom line from the narrow taxpayer perspective is that benefits accruing to the taxpayers far outweigh the relatively low investments they make in NJC.**

With and Without Social Benefits

In **Chapter 2** the social benefits attributable to college education (reduced crime, welfare and unemployment, and improved health) were defined as *external benefits*, incidental to the operations of the college. Colleges do not directly aim at creating these benefits. Some would question the legitimacy of including these benefits in the calculation of the rates of return to higher education, arguing that only the direct benefits – the higher earnings – should be counted. **Tables 3.7** and **3.8** are both inclusive of the social benefits reported here as attributable to the college. Recognizing the other point of view, **Table 3.9** shows the rates of return for both the broad and narrow perspectives exclusive of the

social benefits. As indicated, the returns are still well above the threshold values (a benefit/cost ratio greater than 1 and a rate of return greater than 4.0%) confirming that the taxpayers receive great value from investing in NJC.

	Та	ble 3.8. Taxpay	er Perspective:	Narrow (\$ Tho	usands)	
	1 Total Taxpayer	2 Benefits from Alt. Ed.	3 Benefits w/o State Govt.	4 Net Taxpayer	5 Total Taxpayer	6 Net Cash
Year	Benefits	Opportunities	Funding	Benefits	Costs	Flow
0	\$3,045	\$55	\$1,232	\$1,758	\$6,160	(\$4,402)
1	\$600	\$86	\$243	\$271	\$0	\$271
2	\$694	\$99	\$281	\$314	\$0	\$314
3	\$738	\$105	\$298	\$334	\$0	\$334
4	\$783	\$112	\$317	\$354	\$0	\$354
5	\$829	\$118	\$336	\$375	\$0	\$375
6	\$877	\$125	\$355	\$397	\$0	\$397
/	\$926	\$132	\$375	\$419	\$0	\$419
8	\$975	\$139	\$395	\$441	\$0	\$441
9	\$1,025	\$146	\$415	\$464	\$0	\$464
10	\$1,075	\$154	\$435	\$487	\$0	\$487
11	\$1,125	\$161	\$455	\$509	\$0	\$509
12	\$1,175	\$168	\$475	\$532	\$0	\$532
13	\$1,224	\$175	\$495	\$554	\$0	\$554
14	\$1,272	\$182	\$515	\$576	\$0	\$576
15	\$1,319	\$188	\$534	\$597	\$0	\$597
16	\$1,364	\$195	\$552	\$618	\$0	\$618
17	\$1,408	\$201	\$570	\$637	\$0	\$637
18	\$1,449	\$207	\$586	\$656	\$0	\$656
19	\$1,487	\$212	\$602	\$673	\$0	\$673
20	\$1,523	\$217	\$616	\$689	\$0	\$689
21	\$1,555	\$222	\$629	\$704	\$0	\$704
22	\$1,585	\$226	\$641	\$717	\$0	\$717
23	\$1,610	\$230	\$651	\$729	\$0	\$729
24	\$1,632	\$233	\$660	\$739	\$0	\$739
25	\$1,650	\$236	\$668	\$747	\$0	\$747
26	\$1,664	\$238	\$673	\$753	\$0	\$753
27	\$1,674	\$239	\$677	\$758	\$0	\$758
28	\$1,680	\$240	\$680	\$760	\$0	\$760
29	\$1,681	\$240	\$680	\$761	\$0	\$761
30	\$1,678	\$240	\$679	\$760	\$0	\$760
31	\$1,671	\$239	\$676	\$756	\$0	\$756
32	\$1,660	\$237	\$672	\$751	\$0	\$751
33	\$1,645	\$235	\$666	\$745	\$0	\$745
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
0	\$0	\$0	\$0	\$0	\$0	\$0
NPV				\$11,486	\$6,160	\$5,325
IRR						10.1%
B/C ratio						1.9
Payback (years)					12.1

Sources: Total taxpayer benefits in Column 1 are derived from Table 19 in Volume 2: Detailed Results. Alternative education assumption (Column 2) and taxpayer costs (Column 5) are obtained from NJC.

18	ible 3.9. Taxpaye	r Perspective ((\$ Thousands)
	Broad Pe	rspective	Narrow Pe	erspective
	With Soci	al Savings	With Soci	al Savings
	Included	Excluded	Included	Excluded
NPV	\$68,077	\$57,600	\$5,325	\$3,771
IRR	NA	NA	10.1%	8.2%
B/C ratio	12.1	10.7	1.9	1.6
Payback (years)	NA	NA	12.1	14.3

Table 3.9. Taxpayer Perspective (\$ Thousands)

Source: See Tables 3.7 and 3.8.

Summary

A summary of the investment analysis results (also reported in **Tables 3.6 – 3.8** above) is provided in **Table 3.10**, on aggregate, per CHE, and per student bases. The pie chart in **Figure 3.3** shows the breakdown of the present values of the aggregate benefits, taken from the table. **Figure 3.4** shows the breakdown of the investments made by the students (tuition and fees plus opportunity cost of time) and the contribution made by the state through taxes and appropriations (see "PV of all costs" in **Table 3.10**).

Table 3.10. Summary of Inve	estment Analysis	Results			
	Aggregate	Per CHE	Per Student		
PV of student benefits, increased earnings	\$ 137,508,298	\$2,719	\$ 19,441		
Health benefits, captured by society					
PV of absenteeism savings	\$ 3,824,435	\$76	\$ 541		
PV of tobacco and alcohol abuse medical savings	\$ 2,836,285	\$56	\$ 401		
Crime					
PV of reduced incarceration	\$ 2,752,306	\$54	\$ 389		
PV of reduced victim costs	\$ 3,031,253	\$60	\$ 429		
PV of earnings (added productivity)	\$ 1,106,411	\$22	\$ 156		
Unemployment and welfare					
PV of reduced welfare rolls	\$ 2,071,501	\$41	\$ 293		
PV of reduced unemployment	\$1,740,812	\$34	\$ 246		
Sum of all present values, benefits	\$ 154,871,301	\$ 3,062	\$ 21,895		
PV of all costs					
PV of state contribution to college budget	\$6,160,374	\$122	\$ 871		
PV of opportunity cost of education plus tuition	\$ 22,889,000	\$453	\$ 3,236		
Sum of all present values, costs	\$ 29,049,374	\$ 574	\$ 4,107		
NPV, Student Perspective (\$ Thousands)		\$114,620			
RR, Student Perspective		23%			
B/C Ratio, Student Perspective		6.0			
Payback Period, Student Perspective		6.3			
NPV, Taxpayer Perspective: Broad (\$ Thousands)		\$68,077			
RR, Taxpayer Perspective: Broad		NA			
B/C Ratio, Taxpayer Perspective: Broad	12.1				
Payback Period, Taxpayer Perspective: Broad	NA				
NPV, Taxpayer Perspective: Narrow (\$ Thousands)	\$5,325				
RR, Taxpayer Perspective: Narrow	10.1%				
B/C Ratio, Taxpayer Perspective: Narrow		1.9			
Payback Period, Taxpayer Perspective: Narrow		12.1			
Source: Computed from data supplied by Tables 2.4, 2.1, and 3.6	6-3.8; see also Table 19	and 20 in Volume	e 2: Detailed		

Source: Computed from data supplied by Tables 2.4, 2.1, and 3.6-3.8; see also Table 19 and 20 in Volume 2: Detailed Results.

The Socioeconomic Benefits of Northeastern Junior College



REGIONAL ECONOMIC BENEFITS

NJC plays an important role in the resiliency, growth, and development of the regional economy. In 2003, the NJC Service Area generated overall earnings (wages, salaries, and proprietors' income) equal to \$659.4 million.³² The portion of this total credited to the existence of NJC is discussed in the four subsections below, both in the aggregate and

³² Total earnings for the NJC Service Area are obtained from Woods and Poole Economics, Inc. (see <u>www.woodsandpoole.com</u>). Woods and Poole Economics, Inc. specializes in county-level economic and demographic projections. Their earnings estimates are based on estimates published by the US Department of Commerce, Regional Economic Information System (REIS), projected forward on the basis of historic trends.

The Socioeconomic Benefits of Northeastern Junior College

with industry detail. The industry-specific analysis highlights NJC's contribution to the local business community.

We begin with the day-to-day operating and capital expenditures of the college. These are fed into the regional IO model to estimate the earnings impacts generated by industry. Next, we consider the value of workforce-embodied CHEs to the earnings of past NJC students, and we then estimate the net portion that can be counted as increased regional income – the *direct impact* of past NJC instruction. In the third section we utilize the multipliers of the regional IO model and estimate the *indirect impact* of past NJC instruction on regional earnings. In the fourth and final subsection we combine the three separate effects: 1) college operations and capital spending effects, 2) past-NJC student direct effects, and 3) past-NJC student indirect effects, to arrive at the overall aggregate effect of NJC on earnings in the NJC Service Area.

Earnings Linked to NJC Operation and Capital Spending

Table 2.10 in **Chapter 2** shows NJC's operating and capital spending during the analysis year. The last column (Column 6) of that table shows how much of the overall spending is captured by local vendors and other suppliers, i.e., the portion that stays in the local economy. The values in Column 6 are applied to the NJC Service Area IO model to estimate the associated multiplier effects.

Table 3.11 shows the results of the IO multiplier analysis of NJC operating and capital spending. Column 1 is for reference, showing 2003 total earnings by industry. Column 2 shows the portion of total earnings explained by (or accounted for by) NJC spending, and Column 3 shows college-linked earnings as a percentage of total earnings by industry. For example, the construction sector in the NJC Service Area had \$25.3 million in total earnings in 2003. Of this, NJC spending accounts for \$116.7 thousand (or 0.5%). Similarly, the business services sector (services to buildings, advertising, reproduction, legal and accounting services, etc.) had \$34.6 million in total earnings in 2003, of which \$478.3 thousand (or 1.4%) was explained by NJC spending. All told, NJC spending explained \$12.8 million, or 1.9% of all regional earnings in 2003.

Table 3.11. Earnings Linked to N	JC Operations	Expenditures		
Earnings				
	Baseline	College-Linked	% College-	
	(\$ Thou	sands)	Linked	
Industries	1	2	3	
Agriculture and Agricultural Services	\$145,245	\$38	0.0%	
Mining, Sand, and Gravel	\$20,234	\$10	0.1%	
Construction	\$25,323	\$117	0.5%	
Manufacturing: Food, Wood, Paper, and Textiles	\$6,743	\$13	0.2%	
Manufacturing: Chemicals, Petroleum, Stone, and Glass	\$7,972	\$12	0.2%	
Manufacturing: Computer and Electronic Equipment	\$663	\$3	0.5%	
Manufacturing: Other	\$5,580	\$5	0.1%	
Transportation	\$37,065	\$74	0.2%	
Public Utilities	\$13,312	\$106	0.8%	
Publishing and Communications	\$8,010	\$76	0.9%	
Trade	\$95,943	\$1,090	1.1%	
Finance, Insurance, and Real Estate	\$38,599	\$321	0.8%	
Motels, Eating/Drinking, and Amusement/Recreation	\$6,601	\$88	1.3%	
Consumer Services	\$23,759	\$192	0.8%	
Business Services	\$34,550	\$478	1.4%	
Medical/Educational/Social Services	\$46,062	\$473	1.0%	
Federal Government	\$12,818	\$44	0.3%	
State and Local Government (less the college)	\$121,485	\$213	0.2%	
NJC	\$9,404	\$9,404	100.0%	
Total	\$659,368	\$12,759	1.9%	

Sources: Data in Column 1 are assembled from the US Department of Commerce, Regional Economic Information System, CA and SA series; the US Department of Commerce, County Business Patterns; and the US Department of Commerce, Bureau of Labor Statistics ES-202 series. Data in Column 2 are based on college spending indicated in Table 2.10 and outputs from the EMSI Regional IO Model for the college-hosting region (Moscow, ID: Economic Modeling Specialists, Inc., 2002).

Past Student Economic Development Effects: The Direct Effect

Switching now to the past students, the objective is to assign value to the embodied CHEs still operative in the local workforce. These skills increase the productivity of the regional workforce, causing existing industry to become more efficient, competitive, and able to expand product lines. Also, new industry can be attracted to the region. The net effect is an enlargement of regional income whether existing industry expands or new industry is created.

In **Table 2.13** we derived an estimate of 978.4 thousand of past NJC CHEs embodied in the present-day regional workforce. In **Table 3.12**, we detail the steps that take us from CHEs embodied in the workforce to an estimate of the *net* impact of NJC instruction on regional earnings:

• Step 1: We show the 978.4 thousand of past NJC CHEs embodied in the current workforce.

The Socioeconomic Benefits of Northeastern Junior College

- Step 2: As shown earlier in this chapter (**Table 3.3**), the average net value for earnings was reported as \$120. The net value was derived as the gross value less 10%.³³ For the regional economic development effect, however, we need to begin with the *gross* value per CHE, or \$132.
- Step 3: The product of the total embodied CHEs and the gross value per CHE comprises the initial estimate of the aggregate addition of NJC instruction to past student earnings.
- Step 4: In **Chapter 2**, **Table 2.9** we described the source and meaning of the alternative education opportunity variable: absent all the community and technical colleges in the state, 14.3% of the students would still be able to obtain their education elsewhere. This portion of the added earnings is not credited to NJC in the calculation of regional growth effects for reasons stated in the previous chapter. The initial estimate of the aggregate addition to past student earnings, therefore, is restated as the net of the alternative education opportunity, indicated in **Table 3.12**.
- Step 5: Finally, the last adjustment reduces the earnings of past students to all but 50% of the previous number. As discussed in detail in **Chapter 2** (see text box on polar cases), the reasons for the significant discounting of past student earnings pertains largely to issues of worker substitution, i.e., the substitution of local skilled for local unskilled workers, and the substitution of out-of-area workers for in-area workers. As for the specific 50% value, this is borrowed from the economics literature on national income growth and education (see Bils and Klenow, 2000).

³³ **Table 3.3** assigns a \$120 net value per CHE of NJC instruction. This is a net value reflecting a 10% reduction from the gross value to account for a collection of correlation-causation factors as discussed in **Chapter 2** under the section "Annual Private Benefits." Rather than *personal* income effects, however, the present section looks at *regional* income effects. Estimating the latter entails an entirely different set of correlation-causation adjustments; hence, we start again with the gross value.

The Socioeconomic Benefits of Northeastern Junior College

	Variables
Total embodied CHEs	978,375
Gross value per CHE	\$132
Increased earnings of past students	\$129,075,559
Alternative Education Variable, %	14%
Gross earnings attributable to NJC, net of alt. ed. variable	\$110,643,639
Substitution Effects Rate	50%
Net earnings attributable to NJC	\$55,321,819

Table 3.12. Estimating the Net Regional Income Effect of Embodied CHEs

Sources: Computed internally by model based on data supplied by NJC. See also Table 2.13. The gross value per CHE is derived from Table 3.3, w ithout the 10% adjustment used to account for correlation-causation factors.

As shown in the last entry of **Table 3.12**, our analysis concludes that earnings in the NJC Service Area are \$55.3 million larger than they would be otherwise, because of the skills of past NJC students embodied in the present-day workforce.

The local and regional business community is naturally interested in how NJC affects its operations. This is shown in **Table 3.13**. Beginning with Column 4 in **Table 2.13**, the distribution of CHEs by industrial sector is translated in **Table 3.13** into the increase in aggregate earnings across these same industrial sectors. The distribution of aggregate earnings is based on the distribution of past student CHEs, weighted according to relative industry earnings.

The dollar figures shown in Column 2 of **Table 3.13** indicate how much larger the earnings in these industries are as a direct result of the NJC skilled workers they employ. The Publishing and Communications sector, for example, is estimated to employ NJC students with a combined 11,250 hours of NJC CHEs (see **Table 2.13**). Because of the skills of these past students, the Publishing and Communications sector is estimated to generate earnings that are \$1.7 million (or 21.0%) larger than they would be otherwise. The benefit to the business community is simply this: additional earnings mirror additional business volume, sales revenues, and property incomes. The direct effect of past NJC students on other sectors is shown in the table. The economy-wide direct effects of past NJC student skills in the NJC Service Area are shown in the bottom row of **Table 3.13**: overall regional earnings are \$55.3 million (or 8.4%) higher than they would be if NJC did not exist.

Earnings are larger because outputs are larger, existing industries produce more, and new industries are attracted to the region by the existence of a skilled workforce. The

The Socioeconomic Benefits of Northeastern Junior College

earnings effects shown in **Table 3.13** are called *direct effects*, because they reflect a portion of the increased earnings of past NJC students themselves.

	Earn		
	Baseline	College-Linked	% College
	(\$ Thous	ands)	Linked
Industries	1	2	3
Agriculture and Agricultural Services	\$145,245	\$1,522	1.0%
Mining, Sand, and Gravel	\$20,234	\$212	1.0%
Construction	\$25,323	\$265	1.0%
Manufacturing: Food, Wood, Paper, and Textiles	\$6,743	\$353	5.2%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	\$7,972	\$835	10.5%
Manufacturing: Computer and Electronic Equipment	\$663	\$139	21.0%
Manufacturing: Other	\$5,580	\$585	10.5%
Transportation	\$37,065	\$1,942	5.2%
Public Utilities	\$13,312	\$698	5.2%
Publishing and Communications	\$8,010	\$1,679	21.0%
Trade	\$95,943	\$10,056	10.5%
Finance, Insurance, and Real Estate	\$38,599	\$8,091	21.0%
Motels, Eating/Drinking, and Amusement/Recreation	\$6,601	\$346	5.2%
Consumer Services	\$23,759	\$1,245	5.2%
Business Services	\$34,550	\$3,621	10.5%
Medical/Educational/Social Services	\$46,062	\$9,655	21.0%
Federal Government	\$12,818	\$1,343	10.5%
State and Local Government	\$130,889	\$12,733	9.7%
Total	\$659,368	\$55,322	8.4%

Table 3.13. Past Student Direct Effe	cts
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Sources: Data in Column 1 are assembled from US Department of Commerce, Regional Economic Information System, CA and SA series; the US Department of Commerce, *County Business Patterns*; and the US Department of Commerce, Bureau of Labor Statistics ES-202 series. Data in Column 2 are based on direct earnings benefits per student reported in Table 3.12, allocated across industries in proportions indicated in Table 2.13.

Past Student Economic Development Effects: The Indirect Effect

To the direct effects shown in **Table 3.13**, we must now add *indirect effects* stemming from the action of the regional multiplier process. As earnings increase because of higher industry output, the demand for additional industry inputs increases as well. Moreover, with the higher *direct* earnings (shown in **Table 3.13**), workers have more money to spend, which increases sales in consumer-oriented sectors of the economy. On top of these added business inputs and worker expenditures, the action of the regional multiplier generates still further rounds of industry output and earnings.³⁴

³⁴ The multiplier effects described in this paragraph are traditional "backward" multiplier effects, and are estimated by applying the change in sectoral earnings shown in **Table 3.13** to the NJC Service Area IO model.

There is another part to the indirect effect. Economic development theory describes an *agglomeration effect* whereby regional growth itself stimulates growth (see "The Indirect Economic Development Effects of Students" discussion in **Chapter 2**). In general, agglomeration occurs when additional regional output attracts new industry, facilitates economies of scale, enhances workforce efficiency through information sharing, and otherwise enhances the regional business climate.³⁵

Table 3.14 shows the total of the various indirect effects that accompany the direct effects of **Table 3.13**. These effects reflect increased business outputs independent of the actual employment of past NJC students in particular sectors (i.e., they reflect the action of the multiplier process).

	Earr		
	Baseline	College-Linked	% College-
	(\$ Thou	usands)	Linked
Industries	1	2	3
Agriculture and Agricultural Services	\$145,245	\$3,527	2.4%
Mining, Sand, and Gravel	\$20,234	\$586	2.9%
Construction	\$25,323	\$405	1.6%
Manufacturing: Food, Wood, Paper, and Textiles	\$6,743	\$228	3.4%
Manufacturing: Chemicals, Petroleum, Stone, and Glass	\$7,972	\$240	3.0%
Manufacturing: Computer and Electronic Equipment	\$663	\$30	4.5%
Manufacturing: Other	\$5,580	\$166	3.0%
Transportation	\$37,065	\$1,924	5.2%
Public Utilities	\$13,312	\$1,121	8.4%
Publishing and Communications	\$8,010	\$1,081	13.5%
Trade	\$95,943	\$7,849	8.2%
Finance, Insurance, and Real Estate	\$38,599	\$4,329	11.2%
Motels, Eating/Drinking, and Amusement/Recreation	\$6,601	\$765	11.6%
Consumer Services	\$23,759	\$1,803	7.6%
Business Services	\$34,550	\$3,110	9.0%
Medical/Educational/Social Services	\$46,062	\$3,958	8.6%
Federal Government	\$12,818	\$295	2.3%
State and Local Government	\$130,889	\$7,483	5.7%
Total	\$659,368	\$38,899	5.9%

Table 3.14. Past Student Indirect Effects

³⁵ We estimate agglomeration effects as "forward" multiplier effects. The NJC Service Area IO model is configured to provide a set of so-called supply-driven multipliers (see for example Miller and Blair, 1985). Agglomeration effects are obtained by applying the change in higher stage sectoral earnings from **Table 3.13** to the supply-driven form of the NJC Service Area IO model.

Focusing on particular effects, we can now say that because of the indirect effect of past NJC students, earnings in the Publishing and Communications sector will be \$1.1 million (or 13.5%) higher than would otherwise be the case. Other indirect sectoral effects are as shown in the table. The bottom row of **Table 3.14** indicates that region-wide total earnings are \$659.4 million, of which \$38.9 million (or 5.9%) are due to the indirect effect of past NJC students.

Overall Effect of NJC on the Regional Economy

The tables above detail the regional economic effects attributable to NJC in three parts. The effect of day-to-day college operations and capital spending is shown in **Table 3.11**. The direct effect of past NJC students still active in the workforce is shown in **Table 3.13**. Finally, the indirect effect of past NJC students still active in the workforce is shown in **Table 3.14**. **Table 3.15** combines these separate effects into one summary table.

	Earnings			
	Baseline	College-Linked	% College-	
	(\$ Tho	ousands)	Linked	
Industries	1	2	3	
Agriculture and Agricultural Services	\$145,245	\$5,087	3.5%	
Mining, Sand, and Gravel	\$20,234	\$809	4.0%	
Construction	\$25,323	\$787	3.1%	
Manufacturing: Food, Wood, Paper, and Textiles	\$6,743	\$594	8.8%	
Manufacturing: Chemicals, Petroleum, Stone, and Glass	\$7,972	\$1,088	13.6%	
Manufacturing: Computer and Electronic Equipment	\$663	\$172	25.9%	
Manufacturing: Other	\$5,580	\$756	13.5%	
Transportation	\$37,065	\$3,940	10.6%	
Public Utilities	\$13,312	\$1,925	14.5%	
Publishing and Communications	\$8,010	\$2,836	35.4%	
Trade	\$95,943	\$18,994	19.8%	
Finance, Insurance, and Real Estate	\$38,599	\$12,741	33.0%	
Motels, Eating/Drinking, and Amusement/Recreation	\$6,601	\$1,199	18.2%	
Consumer Services	\$23,759	\$3,239	13.6%	
Business Services	\$34,550	\$7,209	20.9%	
Medical/Educational/Social Services	\$46,062	\$14,086	30.6%	
Federal Government	\$12,818	\$1,683	13.1%	
State and Local Government (less the college)	\$121,485	\$20,428	16.8%	
NJC	\$9,404	\$9,404	100.0%	
Total	\$659,368	\$106,980	16.2%	

Table 3.15. Total Effect

The Socioeconomic Benefits of Northeastern Junior College

Individual rows in **Table 3.15** show how particular industries benefit from the past and present existence of NJC. For example, our analysis suggests the NJC Service Area's Publishing and Communications sector owes \$2.8 million (or 35.4%) of its overall earnings to the past and present existence of NJC. The effect of NJC on other industries is shown in the table. The bottom row of **Table 3.15** indicates that region-wide earnings are \$659.4 million, of which \$107.0 million (or 16.2%) are due to the past and present existence of NJC.

Table 3.16 provides one last view of the regional economic effects of NJC, a fully aggregated view with no industry detail. Consider the items under the heading "Earnings Attributable to College Operations." The first item is simply the earnings of NJC faculty and staff, \$9.4 million, or 1.4% of overall regional earnings (this item is also shown in college spending, **Table 2.10**). The second item shows the indirect effect of the college's operations and capital spending: \$3.4 million, or 0.5% of all regional earnings. All told, NJC's operations and capital spending can be credited with \$12.8 million, or 1.9% of the NJC Service Area's \$659.4 million in overall earnings.

The next set of items detail the effect of past NJC students still active in the NJC Service Area workforce. Past students directly explain \$55.3 million, or 8.4% of all regional earnings (shown on the total row of **Table 3.13**). These same students indirectly explain \$38.9 million, or 5.9% of all regional earnings (shown on the total row of **Table 3.14**). In all, past NJC students still active in the workforce can be credited with \$94.2 million, or 14.3% of all earnings in the NJC Service Area.

Finally, the bottom row of **Table 3.16** shows NJC's overall role in the NJC Service Area economy: \$107.0 million, or 16.2% of all regional earnings.

Table 3.16. Summary of NJC Role in the Regional Economy					
	Earnings	% of			
	(\$ Thousands)	Total	Multipliers		
Total Earnings in College-Hosting Region	\$659,368	100%			
Earnings Attributable to College Operations					
Direct Earnings of Faculty and Staff	\$9,404	1.4%			
Indirect Earnings	\$3,354	0.5%			
TOTAL	\$12,759	1.9%	1.36		
Earnings Attributable to Past Student Economic Development Effects					
Direct Earnings	\$55,322	8.4%			
Indirect Earnings	\$38,899	5.9%			
TOTAL	\$94,221	14.3%	1.70		
GRAND TOTAL	\$106,980	16.2%			

Sources: Total earnings for the region are assembled from the US Department of Commerce, Regional Economic Information System, CA and SA series; the U.S. Department of Commerce, County Business Patterns; and the U.S. Department of Commerce, Bureau of Labor Statistics ES-202 series. Earnings attributable to college operations and to past students, in addition to the associated multiplier effects, are calculated in the model based on data supplied by the college. Indirect earnings are based on data from Tables 3.13 - 3.15, and outputs from the EMSI Regional IO Model for the college-hosting region (Moscow , ID: Economic Modeling Specialists, Inc., 2002).

Chapter 4 SENSITIVITY ANALYSIS OF KEY VARIABLES

INTRODUCTION

We conclude this study with a sensitivity analysis of some key variables on both the investment and regional economic development sides. The purpose of the sensitivity analysis is twofold:

- To set our approach apart from "advocacy" education impact analyses that promote community and technical college education. These studies may lack uniformity and use assumptions that will not stand up to rigorous peer scrutiny, and they often generate results that grossly overstate benefits. The approach taken here is to account for all relevant variables on both the benefit and cost sides as reflected in the conservatively estimated base case assumptions laid out in Chapter 2. The sensitivity tests include: a) the impacts associated with changes in the student employment variables for the investment analysis, and b) the addition of student spending and sales (as opposed to earnings only) to the regional economic development analysis.
- To test the sensitivity of the results associated with the assumptions for which college researchers have applied judgment and innovative thinking rather than hard data. Some may even refer to these variables as educated guesswork. They include the "Alternative Education" and "Attrition Rate" variables discussed in Chapter 2.

THE STUDENT EMPLOYMENT VARIABLES

Probably the most difficult data to collect are the two employment variables, because colleges generally do not collect this kind of information as a matter of formal routine. These variables include: 1) the percent of the students employed, and 2) of those employed, the earnings received by the students relative to the full earnings they would have received if not attending NJC. Both employment variables relate to the earnings foregone by the students – the opportunity cost of time – and they affect the investment analysis results (net present value, rate of return, benefit/cost ratio, and payback period).

Percent of Students Employed

The students incur substantial expense by attending NJC because of the time they spend not gainfully employed. Some of that cost is recaptured if the student remains partially (or fully) employed while attending. It is estimated that 85% of the current student body is employed. We test this variable in the sensitivity analysis by changing this assumption to 100%. This change would mean that *all* of the students are employed, reducing the average opportunity cost of time accordingly.

Percent of Earnings Relative to Full Earnings

The second opportunity cost variable is more difficult to estimate. For NJC it is estimated that the students working while attending classes earn only 78%, on average, of the earnings they would have statistically received if not attending the community or technical college. This suggests that many of the students hold part-time jobs earning minimum wage (or less than their "statistical" wages). The model captures these differences and counts them as a part of the opportunity cost of time. As above, we test this variable in the sensitivity analysis by changing the assumption to 100%. This would mean that the students are fully employed, and the average opportunity cost of time would be reduced accordingly.

Results

The changed assumptions (both of which would be consistent with advocacy analyses) generate the results summarized in **Table 4.1**. Here, the base case assumptions taken from **Table 2.2** are reflected in the two shaded rows for the variables tested –85% for the portion of students employed, and 78% for their earnings relative to the statistical averages. These base case assumptions are held constant in the shaded rows for the student perspective. The sensitivity analysis results are shown in the non-shaded rows – the extent to which the investment analysis results would change if the two base case variables were increased to 100%, first separately, and second, together. Changing both assumptions to 100% (all students fully employed) would automatically increase the benefits because the opportunity cost of time would reduce to zero.

1. Increasing the students employed assumption from 85% to 100% first (holding all of the other assumptions constant), the rate of return, benefit/cost ratio, and payback period results would improve to 33.8%, 9.7, and 4.5 years, respectively,

relative to the base case results. The improved results are attributable to a lower opportunity cost of time – all students would be employed in this case.

- 2. Increasing the earnings relative to the statistical averages from 78% to 100% second (holding the second employment assumption constant at the base case level), the rate of return, benefit/cost ratio, and payback period results would improve to 38.9%, 11.2, and 4.0 years, respectively, relative to the base case results a strong improvement over the base case results, again attributable to a lower opportunity cost of time.
- 3. Finally, increasing both of the above assumptions to 100% simultaneously, the rate of return, benefit/cost ratio, and payback period results would improve yet further to 56.4%, 15.8, and 3.0 years, respectively, relative to the base case results. This scenario assumes that all students are fully employed and earning full salaries (equal to the statistical averages) while attending classes. These results are unrealistic, albeit not uncommon for advocacy analyses.

Table 4.1	Sensitivity Analysis of Student Perspective			
Variables	Assumptions	RR	B/C	Payback
1. Percent	85%	22.8%	6.0	6.3
Employed	100%	33.8%	9.7	4.5
2. Percent of	78%	22.8%	6.0	6.3
Earnings	100%	38.9%	11.2	4.0
1 = 100%, 2 = 100%		56.4%	15.8	3.0

A final note to this section – we strongly emphasize that the base case results are very attractive – the results are all well above their threshold levels, and the payback periods are short. As clearly demonstrated here, advocacy results *appear* much more attractive, although they would overstate the benefits. The results presented in **Chapter 3** are *realistic*, indicating that investments in NJC will generate excellent returns, well above the long-term average percent rates of return of roughly 7% in the stock and bond markets.

REGIONAL ECONOMIC DEVELOPMENT

The economic impacts of higher education can be calculated in different ways. Our approach was to estimate the regional economic impacts of NJC based on college

operations and capital spending (**Table 3.16**), and the increased productivity effects of past NJC students in the regional workforce. The impacts are expressed in terms of regional *earnings*, i.e., area wages, salaries and proprietors' income, published by the U.S. Department of Commerce.³⁶ Others often add student spending to the impacts and express the results in terms of sales instead of earnings – both will substantially inflate the numerical measures of the impacts so that they appear larger than they really are. In the present section we address these two issues: 1) the addition of student spending effects to impact estimates, and 2) the expression of economic impacts in terms of regional gross sales rather than earnings.

The Economic Impact of Student Spending

Students spend money while attending college: they buy books and supplies, rent rooms, purchase food, pay for transportation, attend sports events, go to movies, and so on. These expenditures create jobs and incomes for local businesses, which, as argued by some, should be counted among the regional economic impacts attributable to the college.

In our analysis, however, we exclude student spending because most of the students already reside in the college region. Student expenditures, therefore, do not represent new monies in the region, but rather a redirection of monies that would have been spent anyway. The other side of the argument is that, even though the college-related spending of a resident student does not constitute new money, some students would leave the region to obtain an education elsewhere if the colleges in the state were not present. Thus, the region loses the spending and related jobs and incomes. Both cases have merit, although we believe the former is more reasonable than the latter. This is because only a few students will actually be able to avail themselves of an education elsewhere (see **Table 2.9**). Our approach, therefore, is to exclude student spending, recognizing at the same time, that the regional impact estimates may err on the conservative side.

In **Table 4.2** we show the potential magnitude of student spending effects in the NJC region economy. The table parallels **Table 3.16** in the previous chapter, but adds the

³⁶ U.S. Department of Commerce, Regional Economic Information System (REIS) data includes earnings estimates for counties and states, and is published annually in the *Department's Survey of Current Business*. It is also readily available in electronic form.

The Socioeconomic Benefits of Northeastern Junior College

section "Earnings Attributable to Student Spending,"³⁷ creating some \$7.2 million in additional earnings for the local businesses patronized by students (the direct effects), plus another \$5.6 million in earnings stemming from related multiplier effects (indirect effects). Adding the student spending to the mix increases the NJC total "explanatory power" of the regional earnings from 16.2% in **Table 3.16** to 18.2% in **Table 4.2**.

		90
	Earnings	% of
	(\$ Thousands)	Total
Total Earnings in College-Hosting Region	\$659,368	100%
Earnings Attributable to Student Spending		
Direct Earnings	\$7,159	1.1%
Indirect Earnings	\$5,604	0.8%
TOTAL	\$12,763	1.9%
Earnings Attributable to College Operations		
Direct Earnings of Faculty and Staff	\$9,404	1.4%
Indirect Earnings	\$3,354	0.5%
TOTAL	\$12,759	1.9%
Earnings Attributable to Past Student Economic Development	nt Effects	
Direct Earnings	\$55,322	8.4%
Indirect Earnings	\$38,899	5.9%
TOTAL	\$94,221	14.3%
GRAND TOTAL	\$119,743	18.2%

Table 4.2. Summary of NJC Role in the Regional Economy- Earnings

Sources: Data shown for student spending are based on spending information appearing in Robert Resek, David Merriman, Susan Hartter, and eds, Illinois Higher Education (Springfield, IL: IBHE, University of Illinois, 2000), applied to the EMSI Regional IO Model for the college-hosting region (Moscow, ID: Economic Modeling Specialists, Inc., 2002). Data for college operations and past student effects are obtained from Table 3.16.

Economic Impacts Reported as Gross Sales

Advocates sometimes favor gross sales over earnings as an impact measure, because sales are always larger than the earnings. Using this as an impact measure has notable drawbacks, however. An immediate drawback is that, unlike earnings, there is generally no published total against which a sales impact can be measured. More importantly though, the most troublesome aspect of gross sales impact measures is captured in the following example:

³⁷ We estimated student spending effects by borrowing average college student information from a study conducted for higher education economic impacts in Illinois (University of Illinois, 2000). Student spending by broad expenditure category was bridged to the sectors of the NJC regional economy input-output model. Adjustments were made consistent with the model's regional accounts to allow for spending leakages.

The Socioeconomic Benefits of Northeastern Junior College

Two visitors spend \$50,000 each in the economic region. One visits a local auto dealer and purchases a new luxury automobile. The other undergoes a medical procedure at the local hospital. In terms of direct economic impact, both have spent \$50,000. However, the expenditures will likely have very different meanings to the local economy. Of the \$50,000 spent for the luxury automobile, perhaps \$10,000 remains in the county as salesperson commissions and auto dealer income (part of the economic region's overall earnings), while the other \$40,000 leaves the area for Detroit or somewhere else as wholesale payment for the new automobile. Contrast this to the hospital expenditure. Here perhaps \$40,000 appears as physician, nurse, and assorted hospital employee wages (part of the county's overall earnings), while only \$10,000 leaves the area, to pay for hospital supplies, or to help amortize building and equipment loans. In terms of sales, both have the same impact, while in terms of earnings, the former has one-fourth the impact of the latter.

Table 4.3 expresses the NJC impacts in terms of gross sales rather than earnings. Note that gross sales measures are everywhere larger than earnings. The economy-wide measure of total gross sales estimated by the economic model is \$2.0 billion.³⁸ Direct local spending by students reflects their total spending, reduced by the estimated portion that leaks out-of-region to purchase goods produced elsewhere.³⁹ In the usual fashion, indirect effects reflect the action of local economic multiplier effects, also estimated by the economic model.

Direct local expenditures include all spending by the college for consumer items and for faculty and staff salaries. Both items are reduced to reflect purchases from outside the region. All told, the operation of NJC is estimated to explain some \$297.7 million in regional gross sales, a number substantially larger than the \$119.7 million explained by the college in regional gross earnings shown in **Table 4.2**.

While the gross sales impacts shown in **Table 4.3** are not incorrect, we prefer to report college impacts in terms of earnings (**Table 3.16**) rather than gross sales, because they reflect the economic realities in the local community much more accurately. Advocacy studies, on the other hand, will often opt to express the results in terms of sales because the numbers are much more impressive. Such results, however, will likely not stand up to rigorous peer scrutiny in the economics profession.

³⁸ Simply stated, economy-wide gross sales are obtained by multiplying sector-specific regional earnings by a national estimate of sales-to-earnings.

³⁹ Students purchase gasoline for their cars, for example, and while the trade margin stays in the area, in most cases the producer price of gasoline itself will leak out to the oil-producing region.

The Socioeconomic Benefits of Northeastern Junior College

	Gross Sales	% of			
	(\$ Thousands)	Total			
Total Gross Sales in College-Hosting Region	\$1,975,641	100%			
Gross Sales Attributable to Student Spending					
Direct Local Spending by Students	\$19,635	1.0%			
Indirect Spending Effect	\$15,125	0.8%			
TOTAL	\$34,760	1.8%			
Gross Sales Attributable to College Operations					
Direct Local Expenditures of NJC	\$2,874	0.1%			
Indirect Spending Effect	\$6,052	0.3%			
TOTAL	\$8,926	0.5%			
Gross Sales Attributable to Past Student Economic Development Effects	S				
Direct Gross Sales	\$145,375	7.4%			
Indirect Gross Sales	\$108,669	5.5%			
TOTAL	\$254,044	12.9%			
GRAND TOTAL	\$297,730	15.1%			

Table 4.3. Summary of NJC Role in the Regional Economy - Sales

Sources: Data are obtained by multiplying earnings data shown in Table 4.3 by sales-labor ratios obtained from the EMSI Regional IO Model for the college-hosting region (Moscow, ID: Economic Modeling Specialists, Inc., 2002).

VARIABLES REQUIRING "JUDGMENT"

The sensitivity analysis is a simple tool often used to determine "switching" values, which occur when the investment results turn from positive to negative, or from attractive to non-attractive as the assumptions are varied up and down. If the results change dramatically with only a small variation in the assumption, then that assumption is sensitive. If the results do not change much, the assumption is not sensitive, and minute accuracy in its specification is less important. The sensitivity analysis is also used to demonstrate how some results become unrealistic when advocacy assumptions are invoked.

Two variables have consistently raised concerns among institutional researchers – the "Alternative Education Opportunity" and "Attrition Rate" variables discussed in detail in **Tables 2.9** and **2.2**, respectively. Neither can be specified on the basis of hard data collected regularly by the college; rather, they are based on well-informed judgments made by faculty and staff intimately familiar with the student body. Recall from **Chapter 2** that the alternative education opportunity variable (14.3% in **Table 2.9**) is characterized as a "negative benefit" – the taxpayer benefits are reduced by the percent indicated to account for the portion of the current student body who could obtain a similar education elsewhere, absent the community and technical colleges in the state.

The attrition rate (25% in **Table 2.2**) characterizes the mobility of the exiting students out of the region over the next thirty years or so through retirement, out-migration and/or death.

Given the nature of these variables and the difficulty in accurately specifying them, the obvious question is: how great a role do they play in the magnitudes of the results? The results are presented in the sensitivity analysis **Table 4.4**.

Table 4.4 Sensitivity Analysis of Alternative Education and Attrition Rate Variables (\$ Thousands)								
		-75%	-50%	-25%	Base Case	25%	50%	75%
Alternative Education	Variable	3.6%	7.1%	10.71%	14%	17.85%	21.4%	25.0%
Narrow Taxpayer Pe	erspective							
	(NPV	\$6,428	\$6,060	\$5,693	\$5,325	\$4,958	\$4,590	\$4,223
Investment	J RR	11.0%	10.7%	10.4%	10.1%	9.8%	9.4%	9.1%
results	B/C ratio	2.0	2.0	1.9	1.9	1.8	1.7	1.7
	Pay Back	11.3	11.5	11.8	12.1	12.4	12.7	13.0
		-75%	-50%	-25%	Base Case	25%	50%	75%
Attrition Rate Variable)	6.3%	12.5%	18.75%	25%	31.25%	37.5%	43.8%
Regional Economic	: Development							
Earnings Attributabl	le to NJC	\$118,099	\$114,490	\$110,787	\$106,980	\$103,055	\$98,996	\$94,782
% of Total Earnings	in Region	17.9%	17.4%	16.8%	16.2%	15.6%	15.0%	14.4%
Credits Embodied in	n the Workforce	1,093,838	1,056,355	1,017,906	978,375	937,624	895,478	851,719

Alternative Education Opportunity

Variations in the Alternative Education assumption are calculated around the base case assumptions listed in the middle column of **Table 4.4** for the taxpayer perspective results (the variable does not affect the student investment analysis results). The net present value, rate of return, benefit/cost ratio, and payback results listed in the base case column were all presented and discussed in **Chapter 3**. Next, we bracket the base case assumption on either side with plus or minus 25%, 50% and 75% variation in the assumptions. The analyses are then redone introducing one change at a time, holding all the other variables constant. For example, an increase of 25% in the Alternative Education assumption (from 14% to 18%) will reduce the narrow taxpayer perspective rate of return from 10.1% to 9.8%. Likewise, a decrease of 25% (from 14% to 11%) in the assumption will generate an increase in the rate of return from 10.1% to 0.4%.

Based on this sensitivity analysis, the conclusion can be drawn that the NJC investment analysis results from the narrow taxpayer perspective are not very sensitive to relatively large variations in the Alternative Education variable. As indicated, the results are still well 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 4.0%) even when the Alternative Education assumption is increased by as much as 75% (from 14% to 25%). The conclusion is simply that, although the assumption is difficult to specify and will require judgment on the part of the institutional researcher, its impact on the overall investment analysis results for the narrow taxpayer perspective is not very sensitive.

Attrition Variable

The attrition rate variable only affects the regional economic development results (**Table 3.16**). As above, we increase and decrease the assumption relative to the base case assumption of 25% (from **Table 2.2**) by the increments indicated in the table. The impacts on the results are more pronounced, as indicated in **Table 4.4**. Earnings attributable to the college, for example, range from a high of \$118.1 million at -75% to a low of \$94.8 million at a 75% variation from the base case assumption for this variable. This means that, if the attrition of the ex-students over time increases, the number of CHEs embodied in the current local workforce decreases; hence, the earnings attributable to the college decrease accordingly.

The Socioeconomic Benefits of Northeastern Junior College

RESOURCES AND REFERENCES

- Anderson, D.A. "The Aggregate Burden of Crime." *Journal of Law and Economics* XLII 2 (October 1999): 611-642.
- Beck, Allen J. and Paige M. Harrison. *Prisoners in 2000*. Washington, D.C.: US Department of Justice, Bureau of Justice Statistics, August 2001. NCJ 188207.
- Becker, Gary S. Human Capital: A Theoretical Analysis With Special Reference to Education. New York: Columbia University Press for NBER, 1964.
- Bils, M. and P.J. Klenow. "Does Schooling Cause Growth?" *American Economic Review* 90 no. 5 (2000): 1160-1183.
- Bonczar, Thomas P. and Alan J. Beck. Lifetime Likelihood of Going to State or Federal Prison. Washington, D.C.: US Department of Justice, Bureau of Justice Statistics, March 1997. NCJ 160092.
- Borts, G. H., and J. L. Stein. *Economic Growth in a Free Market*. New York: Columbia University Press, 1964.
- Bureau of Justice Statistics. "Table 1: State (1) average annual pay for 2000 and 2001 and percent change in pay for all covered workers (2)." Criminal Justice Expenditure and Employment Extracts Program (CJEE). Washington D.C.: US Department of Labor, 2000.

Bureau of Labor Statistics. *BLS Online*. Home page on-line. Available from <u>http://www.bls.gov/</u>; Internet.

_____. Office of Employment and Unemployment, *BLS Online*. Home page on-line. Available from <u>http://www.bls.gov/bls/proghome.htm#OEUS</u>; Internet.

. "Table 1. State (1) average annual pay for 2000 and 2001 and percent change in pay for all covered workers (2)." Washington, D.C.: US Department of Labor, 2001. Database on-line. Available from http://www.bls.gov/news.release/annpay.t01.htm.

- Christaller, Walter. *Central Places in Southern Germany*. Translated by C.W. Baskins. Englewood Cliffs, NJ: Prentice-Hall, 1966.
- Christophersen, Kjell A. and M. Henry Robison. "The Socioeconomic Benefits of Community Colleges, Illustrated with Case Studies of Everett Community College and

The Socioeconomic Benefits of Northeastern Junior College

Walla Walla Community College in Washington State." Volume 1: Summary Report. EMSI, Consulting Economists. Moscow, ID: by the authors, 2000.

- Committee on Ways and Means. 2000 Ways and Means Green Book, 17th ed. Washington D.C.: US House of Representatives, October 2000.
- Drake, R. L. "A Shortcut to Estimates of Regional Input-Output Multipliers: Methodology and Evaluation." *International Regional Science Review* 1 no. 2 (Fall 1976).
- Economic Modeling Specialists, Inc. Regional Input-Output Modeling System (data and software). Moscow, ID: 2002. Database on-line. Available from <u>http://www.economic modeling.com</u>.
- Fujita, Masahisa, Paul Krugman, and Anthony J. Venables. *The Spatial Economy: Cities, Regions, and International Trade.* Cambridge: Massachusetts Institute of Technology, 1999.
- Governor's Office of Planning and Budget, Demographic and Economic Analysis Section, and Consulting Economists. "The Base Period 1992 Utah Multiregional Input-Output (UMRIO-92) Model: Overview, Data Sources, and Methods." Utah State and Local Government Fiscal Impact Model, Working Paper Series 94-1. Salt Lake City, UT: Demographic and Economic Analysis (DEA), June 1994.
- Grubb, W. Norton. *The Economic Benefits of Sub-Baccalaureate Education: Results from National Studies*. CCRC Brief No. 2, ISSN 1526-2049. New York, NY: Community College Research Center, June 1999.
- Hamilton, J. R., N. K. Whittlesey, M. H. Robison, and J. Ellis. "Economic Impacts, Value Added and Benefits in Regional Project Analysis." *American Journal of Agricultural Economics* 31 no. 2 (1991): 334-344.
- Health Care Financing Administration. *A Profile of Medicaid: Chartbook* 2000. Washington, D.C.: US Department of Health and Human Services, September 2000.
- Henderson, James M. and Richard E. Quandt. *Microeconomic Theory: A Mathematical Approach*. New York: McGraw-Hill Book Company, 1971.
- Kerka, Sandra. "Prison Literacy Programs. ERIC Digest No. 159." 1995. Database on-line. Available from ERIC, ED383859.

The Socioeconomic Benefits of Northeastern Junior College
Labor Market Reporter. "US Employee Absences by Industry: 1997." *The Public Purpose*. Home page on-line. Available from http://www.publicpurpose.com/lm-97abs.htm; Internet; accessed 30 September 2001.

. "US Employee Absences by Industry Ranked: 1997," *The Public Purpose*. Home page on-line. Available from http://www.publicpurpose.com/lm-97absr.htm; Internet; accessed 30 September 2001.

- Losch, August. *The Economics of Location*. Translated by W. H. Woglom and W. F. Stolper. New Haven: Yale University Press, 1954.
- Miller, Ron and Peter Blair. *Input-Output Analysis: Foundations and Extensions*. Englewood Cliffs, NJ: Prentice Hall, 1985.
- Miller, Ted R., Mark A. Cohen, and Brian Wiersema. Victim Costs and Consequences: A New Look. National Institute of Justice Research Report. Washington, D.C.: US Department of Justice, National Institute of Justice, January 1996. NCJ 155282.
- Mincer, Jacob. "Investment in Human Capital and Personal Income Distribution." *Journal of Political Economy* (1958): 281-302.
- Minnesota IMPLAN Group, Inc. IMPLAN System (data and software). Stillwater, MN, annual. Database on-line. Available from <u>www.implan.com</u>.
- Molitor, Chris and Duane Leigh. "Estimating the Returns to Schooling: Calculating the Difference Between Correlation and Causation." Paper prepared for CCbenefits, Inc. Pullman, WA: by the authors, March 2001.
- National Center for Chronic Disease Prevention and Health Promotion. Behavioral Risk Factor Surveillance System, *CDC Online*. Home page on-line. Available from <u>http://www.cdc.gov/brfss/</u>; Internet; accessed 30 September 2001.
- National Center for Education Statistics. *Digest of Education Statistics*, 2000. Washington D.C, US Department of Education, 2000. Database on-line. Available from <u>http://nces.ed.gov/pubs2001/digest/foreword.asp</u>.

_____. *Literacy Behind Prison Walls*. Washington, D.C.: US Department of Education, October 1994.

The Socioeconomic Benefits of Northeastern Junior College

National Center for Health Statistics. Centers for Disease Control and Prevention, Division of Data Services. Hyattsville, MD, 2000. Database on-line. Available from http://www.cdc.gov/nchs/.

_____. "Health Promotion and Disease Questionnaire of the 1990 National Health Interview Survey."

. "Table 60. Current cigarette smoking by persons 18 years of age and over according to sex, race, and age: United States, selected years 1965-1999." in *Health, United States, 2001*. Hyattsville, MD, 2001.

______. "Table 61. Age-adjusted prevalence of current cigarette smoking by persons 25 years if age and older, according to sex, race, and education: United States, selected years 1974-1999." in *Health, United States, 2001*. Hyattsville, MD, 2001.

National Clearinghouse for Alcohol and Drug Information. *Prevention Online*. Home page on-line. Available from <u>http://www.health.org</u>; Internet.

National Institute for Literacy. "Correctional Education Facts," *NIFL Online*. Home page on-line. Available from <u>http://www.nifl.gov/nifl/facts/facts_overv\iew.html</u>; Internet; accessed 18 March 2001.

- National Institute of Alcohol Abuse and Alcoholism. "Percent reporting alcohol use in the past year by age group and demographic characteristics: NHSDA, 1994-97." August 1999. Database on-line. Available from <u>http://www.niaaa.nih.gov/databases/dkpat3.htm</u>.
- National Institute on Drug Abuse. *The Economic Costs of Alcohol and Drug Abuse in the United States* 1992. Bethesda, MD: National Institute of Health, 1998. NIH Publication Number 98-4327.
- Nephew, Thomas M., Gerald D. Williams, and Frederick Stinson, eds. Surveillance Report #55: Apparent Per Capita Alcohol Consumption: National, State and Regional Trends, 1977-98.
 Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, Division of Biometry and Epidemiology, December 2000.
- Office of International Criminal Justice (OICJ). "The Extent and Costs of Victimization, Crime and Justice," *The Americas* 8 no.6 (Dec-Jan 1995).
- Parr, J.B. "Regional Economic Development: An Export-Stages Framework," *Land Economics* 77 no. 1 (1999): 94-114.

The Socioeconomic Benefits of Northeastern Junior College

- Rector, Robert. *Means-Tested Welfare Spending: Past and Future Growth.* Heritage Foundation, Policy Research and Analysis, March 2001. Database on-line. Available from <u>http://www.heritage.org/Research/Welfare/Test030701b.cfm</u>.
- Resek, Robert W., David F. Merriman, Susan R. Hartter, and eds. *Illinois Higher Education: Building the Economy, Shaping Society*. Springfield, IL: Illinois Board of Higher Education, University of Illinois, 2000.
- Robison, M. H. "Community Input-Output Models for Rural Area Analysis: With an Example from Central Idaho." *Annals of Regional Science* 31 no. 3 (1997): 325-351.
 - _____, R. Coupal, N. Meyer, and C. C. Harris. *The Role of Natural-Resource-Based Industries in Idaho's Economy*. University of Idaho, College of Agriculture Bulletin 731. Moscow, ID: University of Idaho, College of Agriculture, 1991.
- _____. "The Oregon Economic Modeling System (OREMS): A Tool for Analyzing Changes in Jobs, Incomes, and the Spatial Structure of the Oregon Economy." Missoula, MT: 29th Annual Pacific Northwest Economic Conference, May 1995.
- Rutgers, State University of New Jersey, et . "The Impact of EDA RLF Loans on Economic Restructuring." Paper prepared for US Department of Commerce, Economic Development Administration. New Brunswick: Rutgers State University of New Jersey, 2002.
- Social Security Bulletin. "Annual Statistical Supplement, 2000," *Social Security Bulletin Online*. December 2000. Home page on-line. Available from <u>http://www.ssa.gov/</u> <u>policy/docs/statcomps/supplement/2000/</u>; Internet; accessed 30 January 2001.
- Steurer, Stephen J., Linda Smith, and Alice Tracy. "Three State Recidivism Study." Paper submitted to the Office of Correctional Education, United States Department of Education. Lanham, MD: Correctional Education Association, September 2001.
- Stevens, B. H., G. I. Treyz, D. J. Ehrlich, and J. R. Bower. "A New Technique for the Construction of Non-Survey Regional Input-Output Models." *International Regional Science Review* 8 no. 3 (1983): 271-186.
- Tanner, Michael, Stephen Moore, and David Hartman. *The Work Versus Welfare Trade-Off: An Analysis of the Total Level of Welfare Benefits by State.* Policy Analysis No. 240. Washington D.C.: Cato Institute, September 1995. Database on-line. Available from <u>http://www.cato.org/pubs/pas/pa240es.html</u>.

The Socioeconomic Benefits of Northeastern Junior College

Temporary Assistance for Needy Families (TANF) Program. "Table 12: Percent distribution of TANF adult recipients by race, October 1997 – September 1998" in *Characterisitics and Financial Circumstances of TANF Recipients, Fiscal Year 1998*. Washington D.C.: US Department of Health and Human Services, May 1999.

_____. "Table 17: Percent distribution of TANF adult recipients by educational level, October 1997 – September 1998" in *Characterisitics and Financial Circumstances of TANF Recipients, Fiscal Year 1998*. Washington D.C.: US Department of Health and Human Services, May 1999.

US Census Bureau and Bureau of Labor Statistics. Current Population Survey. Database online. Available from <u>http://www.bls.census.gov/cps/</u>.

_____. Historical Income Data. Database on-line. Available from <u>http://www.census.gov/</u> <u>hhes/income/histinc/histinctb.html</u>.

_____. Housing and Household Economic Statistics Division. Database on-line. Available from <u>http://www.census.gov/hhes/www/</u>.

_____. Income Surveys Branch/HHES Division. "Median for 4-Person Families, by State." October 2003. Database on-line. Available from <u>http://www.census.gov/hhes/income/</u><u>4person.html</u>.

_____. *Money Income in the United States* 1998. Current Population Reports. Washington, D.C.: US Department of Commerce, Economics and Statistics Administration, 1999.

_____, Population Division. "Table ST-EST2002-01 - State Population Estimates: April 1, 2000 to July 1, 2002." December 2002. Database on-line. Available from http://eire.census.gov/popest/data/states/tables/ST-EST2002-01.php.

. "Table 1. Educational Attainment of the Population 15 Years and Over, by Age, Sex, Race, and Hispanic Origin" in *Educational Attainment in the United States, March* 2000. December 2000. Database on-line. Available from http://www.census.gov/population/www/socdemo/education/p20-536.html.

_____. "Table P-3. Race and Hispanic Origin of People by Mean Income and Sex: 1947 to 2000." September 2002. Database on-line. Available from <u>http://www.census.gov/hhes/income/histinc/p03.html</u>.

The Socioeconomic Benefits of Northeastern Junior College

_____. "Table P-18. Educational Attainment – People 25 Years Old and Over by Mean Income and Sex: 1991 to 2000." September 2002. Database on-line. Available from http://www.census.gov/ hhes/income/histinc/p18.html.

US Department of Commerce. County Business Patterns. [CD-ROM], annual.

_____. REIS, Bureau of Economic Analysis: County data. [CD-ROM], annual.

_____. REIS, Bureau of Economic Analysis: Zip Code Business Patterns. [CD-ROM], annual.

_____. Statistical Abstract of the United States. [CD-ROM], annual.

- US Department of Health and Human Services. *HHS Online*. Home page on-line. Available from <u>http://www.hhs.gov/</u>; Internet.
- US Department of Treasury. *The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation*. Report-3113. Washington, D.C., 1998. Database on-line. Available from <u>http://www.treas.gov/press/releases/report</u> <u>3113.htm</u>.
- Willis, Robert J. "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions." In *Handbook of Labor Economics, Vol. 1*. Edited by Kenneth J. Arrow and Michael D. Intriligator. Amsterdam: Elsevier Science Publishers, 1986: 525-602.
- Woods and Poole Economics, Inc. W&P System (data and CD-ROM). Washington, D.C., 2000. Database on-line. Available from http://woodsandpoole.com.

The Socioeconomic Benefits of Northeastern Junior College

Appendix 1: Glossary of Terms

Alternative education	The alternative education variable is a "with" and "without" measure. It is a measure of the percent of students who would still be able to avail themselves of alternative education opportunities absent the community or technical colleges in the state. An estimate of 20%, for example, means that 20% of the students do not depend directly on the existence of the colleges in order to obtain their education. We then back 20% out the impact calculations.
Attrition rate	An attrition (decay) rate of students is applied to benefits occurring in the future. The rate refers to the fact that not all students remain in the local region once exiting the college, but some will out-migrate, retire, or die. This rate is either estimated by the college institutional researchers, or it is derived from the literature as a default value if the variable cannot be estimated by the college.
Benefit/cost ratio	The benefit/cost ratio separately discounts the flow of benefits and costs over time to the present and then divides the sum of the discounted benefits by the sum of the discounted costs. If the benefit/cost ratio is greater than one, then the benefits exceed costs and the investment is feasible. For every dollar expended we get more than one dollar back. This, however, does not necessarily mean that the investment is the best one. There are many feasible projects but only one optimal one. We must compare between investments – the higher the benefit/cost ratio, the more attractive the project.
Demand	The demand for education describes the 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

The Socioeconomic Benefits of Northeastern Junior College

Appendix 1: Glossary of Terms

conversely, enrollment decreases if the price (tuition and fees) increases.

DiscountingDiscounting is the process of expressing future revenues and costsin present value terms. The discount rate converts future revenuesinto present values so they can be compared to costs incurred in
the present.

EconomicsEconomics is the 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).
Allocation of resources is the key focus of economics. Taxpayer
dollars, for example, are scarce and there will be competing uses
and pressures. Taxpayers vote to tax themselves to fund
transportation, the health sector, education, and/or other
priorities. They have choices and must allocate between them.

Elasticity of demand In this report, the elasticity of demand refers to the degree of responsiveness of the quantity of education demanded (enrollment) to changes in market prices (tuition and fees). If a decrease in tuition increases total revenues, the demand is elastic. If it decreases total revenues, the demand is inelastic. If total revenues remain the same, the elasticity of demand is said to be unitary.

ExternalitiesExternalities (positive and negative) occur when impacts are
generated for which there is no compensation. Hillside logging,
for example, may create a negative externality because of erosion
that lowers the productivity of downstream farms, but the logger
does not compensate the farmers. For community and technical
colleges, positive external benefits could be improved social
behaviors manifested in lower crime, reduced welfare and
unemployment, and improved health. Colleges cannot take direct
credit, nor do they receive compensation for these manifestations,
but the benefits still occur by virtue of the fact that the colleges

exist and that the higher education they provide ultimately leads to improved social behaviors.

Input-output analysis	Input-output analysis is a branch of economics that addresses production relationships in an economy. In particular, it refers to the relation between a given set of demands for final goods and services, and the implied amounts of manufactured inputs, raw materials, and labor this requires. In an educational setting, as colleges pay wages and salaries and spend money for supplies in the local economic region, they also generate earnings in all of the sectors of the economy, thereby increasing the demand for goods and services and jobs. Moreover, as the students enter or rejoin the workforce with higher skille obtained at the colleges they also			
	earn higher salaries and wages. In turn, this generates more consumption and spending in other sectors of the economy, subject to the familiar multiplier effect (see below).			
Internal rate of return	The internal rate of return (IRR) is the rate of interest which, when used to discount the cash flows associated with investing in education, reduces its net present value to zero (i.e., where the present value of the revenues accruing from the investment are just equal to the present value of the costs incurred). This, in effect, is the breakeven rate of return on the investment since it shows the highest rate of interest at which the investment makes neither a profit nor a loss. IRR results are expressed as a percentage.			
Multiplier	Multipliers are a measure of the overall regional earnings per dollar of earnings at the community or technical college (i.e., per dollar of college faculty and staff earnings). In our context, the multiplier can be defined as the total of on- and off-campus earnings divided by on-campus earnings. Multiplier effects are the result of in-area spending by the college on locally supplied goods and services, and of the local everyday spending of college faculty and staff. We also include in the off-campus portion of the multiplier the added regional earnings attributable to past- students still active in the local labor force. The regional economy			

The Socioeconomic Benefits of Northeastern Junior College

Appendix 1: Glossary of Terms

	is larger because of the skills of these past students, and because of the added spending associated with their higher incomes, and from spending associated with the enlarged output of the industries where these past students are employed.
Net cash flow	The net cash flow (NCF) is benefits minus costs, i.e., the sum of the revenues accruing from an investment minus the costs incurred.
Net present value	The net present value (NPV) is the net cash flow discounted to the present. All future cash flows are, in this way, collapsed into one number, which, if positive, indicates feasibility. The result is expressed as a monetary measure. If the net present value is positive, we have done better than alternative investment schemes, all else being equal.
Opportunity cost	The opportunity cost comprises the benefits foregone from alternative B once a decision is made to allocate resources to alternative A. Or, if an individual chooses not to attend college, he or she foregoes the higher future earnings associated with higher education. The benefit of higher education, therefore, is the "price tag" of choosing not to attend college.
Payback Period	This is a measure of the period of time required to recover an investment. The shorter the period, the more attractive is the investment. The formula for computing payback period is:
	Payback period = cost of investment/net return per period

Appendix 2: Explaining the Results – a Primer

The purpose of this appendix is to provide some context and meaning to investment analysis results in general, using the simple hypothetical example summarized in **Table 1** below. The table shows the projected (assumed) benefits and costs over time for one student and the associated investment analysis results.⁴⁰

Table 1. Costs and Benefits						
	Opportunity			Higher		
Year	Tuition	Cost	Total Cost	Earnings	NCF	
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	
NPV			\$20,673	\$35,747	\$15,074	
IRR					18%	
B/C Ratio					1.7	
Payback Perio	bd				4.2 years	

The assumptions are as follows:

- The time horizon is 10 years—i.e., we project the benefits and costs out 10 years into the future (Column 1). Once the higher education has been earned, the benefits of higher earnings remain with the student into the future. Our objective is to measure these future benefits and compare them to the costs of the education.
- 2) The student attends the community or technical college for one year for which he or she pays a tuition of \$1,500 (Column 2).

⁴⁰ Note that this is a hypothetical example. The numbers used are not based on data collected from any community or technical college.

The Socioeconomic Benefits of Northeastern Junior College

- 3) The opportunity cost of time (the earnings foregone while attending the community or technical college for one year) for this student is estimated at \$20,000 (Column 3).
- 4) Together, these two cost elements (\$21,500 total) represent the out-of-pocket investment made by the student (Column 4).
- 5) In return, we assume that the student, having completed the one year of study, will earn \$5,000 more per year than he would have without the education (Column 5).
- 6) Finally, the net cash flow column (NCF) in Column 6 shows higher earnings (Column 5) less the total cost (Column 4).
- 7) We assume a "going rate" of interest of 4%, the rate of return from alternative investment schemes, for the use of the \$21,500.

Now the "mechanics" – we express the results in standard investment analysis terms: the net present value (NPV), the internal rate of return (IRR – or, as referred to in the Main Report, simply the rate of return – RR), the benefit/cost ratio (B/C), and the payback period. Each of these is briefly explained below in the context of the cash flow numbers in **Table 1**.

THE NET PRESENT VALUE (NPV)

"A bird in hand is worth two in the bush." This simple folk wisdom lies at the heart of any economic analysis of investments lasting more than one year. The student we are tracking in **Table 1** has choices: 1) to attend a community or technical college, or 2) forget about higher education and hold on to the present employment. If he or she decides to enroll, certain economic implications unfold: the tuition must be paid and earnings will cease for one year. In exchange, the student calculates that, with the higher education, his or her income will increase by at least the \$5,000 per year as indicated in the table.

The question is simple: will the prospective student be economically better off by choosing to enroll? If we add up the higher earnings of \$5,000 per year for the remaining nine years in **Table 1**, the total will be \$45,000. Compared to a total investment of

The Socioeconomic Benefits of Northeastern Junior College

Appendix 2: Explaining the Results-a Primer

\$21,500, this appears to be a very solid investment. The reality, however, is different – the benefits are far lower than \$45,000 because future money is worth less than present money. The costs (tuition plus foregone earnings) are felt immediately because they are incurred today – in the present. The benefits (higher earnings), on the other hand, occur in the future. They are not yet available. We must discount all future benefits by the going rate of interest (referred to as the discount rate) to be able to express them in present value terms.⁴¹ 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 ten, the present value would reduce to \$3,377. Or put another way, \$4,807 deposited in the bank today earning 4% interest will grow to \$5,000 in one year; and \$3,377 deposited today would grow to \$5,000 in ten years. An "economically rational" person would, therefore, be equally satisfied receiving \$3,377 today or \$5,000 ten years from today given the going rate of interest of 4%. The process of discounting – finding the present value of future higher earnings – allows us to express values on an equal basis in future or present value terms.

Our goal is to express all future higher earnings in present value terms so that we can compare them to the investments incurred today – the tuition and foregone earnings. As indicated in **Table 1**, the cumulative present value of the flow of \$5,000 worth of higher earnings between years 2 and 10 is \$35,747 given the 4% interest rate, far lower than the undiscounted \$45,000 discussed above.

The measure we are looking for is the net present value of \$15,074. It is simply the present value of the benefits less the present value of the costs, or \$35,747 - \$20,673 = \$15,074. In other words, the present value of benefits exceeds the present value of costs by as much as \$15,074. 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 college education is very strong.

⁴¹ 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 we reverse the process – determining the present value of future earnings.

THE INTERNAL RATE OF RETURN (IRR)

The internal rate of return is another way of measuring the worth of the investment in education using the same cash flows shown in **Table 1**. In technical terms – the internal rate of return is a measure of the average earning power of the money used over the life of the investment. It is simply the interest rate that makes the net present value equal to zero. In the NPV example above we applied the "going rate" of interest of 4% and computed a positive net present value of \$15,074. The question now is: what would the interest rate have to be in order to reduce the net present value to zero? Obviously it would have to be higher – 18% in fact, as indicated in **Table 1**. Or, if we applied 18% to the NPV calculations instead of the 4%, then the net present value would reduce to zero.

What does this mean? The internal rate of return of 18% 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%, the higher incomes of \$5,000 per year for the next nine years will earn back all the investments of \$21,500 made plus pay 18% for the use of that money (the \$21,500) in the meantime. Is this a good return? Indeed it is — first, if we compare it to the 4% "going rate" of interest we applied to the net present value calculations, 18% is far higher than 4%. We can conclude, therefore, that the investment in this case is solid. Alternatively, we can compare the rate to the long-term 7% rate or so obtained from investments in stocks and bonds. Again, the 18% is far higher, indicating that the investment in community or technical education is strong relative to the stock market returns (on average).

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

THE BENEFIT/COST RATIO (B/C)

The benefit/cost ratio is simply the present value of benefits divided by present value of costs, or 335,747 / 21,500 = 1.7 (based on the 4% discount rate). Of course, any change in the discount rate will also change the benefit/cost ratio. If we applied the 18% internal rate of return discussed above, the benefit/cost ratio would reduce to 1.0 -or the breakeven solution where benefits just equal the costs. Applying a discount rate higher than the 18% would reduce the ratio to less than one 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.

THE PAYBACK PERIOD

This is the length of time from the beginning of the investment (consisting of the tuition plus the earnings foregone) until the higher future earnings return the investments made. In **Table 1**, it will take roughly 4.2 years of \$5,000 worth of higher earnings to recapture the student's investment of \$1,500 in tuition and the \$20,000 earnings he or she foregoes while attending the community or technical college. The higher earnings occurring *beyond* the 4.2 years are the returns (the "gravy") 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 is, the stronger the investment will be.

Appendix 3: Methodology for Creating Income Gains by Levels of Education

The US Bureau of the Census reports income in two ways:

1) Mean income by race and Hispanic origin and by sex.

2) Mean income by educational attainment and sex.

The first and second data sets can be found at the following sources:

U.S. Census Bureau and U.S. Department of Commerce. Table P-3: Race and Hispanic Origin of People by Mean Income and Sex: 1947 to 2000, and Table P-18: Educational Attainment--People 25 Years Old and Over by Mean Income and Sex: 1991 to 2000. Also consult:

http://www.census.gov/ftp/pub/hhes/income/histinc/histinctb.html

Further contact information: 1) Income Surveys Branch, 2) Housing and Household Economic Statistics Division, 3) U.S. Census Bureau, and 4) U.S. Department of Commerce.

The data needed for this analysis is mean income by educational attainment reported by race/ethnic origin and by sex. A model was developed to translate these two data sets into the data needed for the analysis. This was accomplished in the following way:

- 1. Mean income by race and sex is calculated as a percent of all races.
- This percent is then applied to mean income by educational attainment. For example, African-American males make an average income of \$28,392 versus \$40,293 for all males, or 70% of the average income of all males.
- 3. This percent (70%) is then applied to the income levels by educational attainment for all males to estimate the income levels by educational attainment for African-American males.

The Socioeconomic Benefits of Northeastern Junior College

- 4. To simplify the analysis, all minority males are averaged together as are all minority females. The same process is repeated for white males and white females.
- 5. The educational levels of attainment are aggregated together in some categories to model the educational system of community and technical colleges. These numbers are then adjusted for inflation to current year dollars.
- 6. The final step is to adjust these income levels by state. The *Four Person Median Family Income by State* from the Bureau of the Census was used to make state level adjustments. Each state's median family income is taken as a percentage of the national average. These percentages are then applied to the income levels by educational attainment by race, ethnicity, and sex, as calculated earlier.

The Socioeconomic Benefits of Northeastern Junior College

Appendix 4: Adjusting for the Benefits Available Absent State Government Support

INTRODUCTION

The investment analysis presented in the Main Report weighs the benefits of college enrollment (measured in terms of CHEs) against the support provided by state government. If, without state government support a college would have to shut its doors, then it is entirely appropriate to credit all the benefits to that support. This brings up the question: is it in fact true that the college would have to close its doors absent state government support? Increased tuition could almost certainly make up for some of the lost funds, although this would result in reduced enrollment. Still, if the school could remain open and operate at this "zero state government support level," then state government support can only be credited with the difference (i.e., the actual enrollment less the enrollment at zero state government support). This appendix documents our procedures for making these adjustments, which feed the broad and narrow taxpayer benefit/cost ratios, rates of return, and payback analyses estimates in the Main Report.

STATE GOVERNMENT SUPPORT VERSUS TUITION

We start by exploring the issue with the aid of some graphics. **Figure 1** presents a simple model of student demand and state government support. The right side of the graph is a standard demand curve (D) showing student enrollment as a function of tuition and other student fees. Enrollment is measured in total CHEs and expressed as a percentage of current CHEs. The current tuition rate is p', and state government support covers C% of all costs. At this point in the analysis, we assume that the college has only two sources of revenues: student tuition payments and state government support.



Figure 2 shows another important reference point in the model – where state government support is 0%, tuition rates are increased to p", and enrollment is Z% (less than 100%). The reduction in enrollment reflects price elasticity in the students' school vs. no-school decision. Neglecting for the moment those issues concerning the college's minimum operating scale (considered below in the section on "The College Shutdown Point"), the implication for our investment analysis is that the benefits of state government support for the college must be adjusted to net out the benefits associated with a level of enrollment at Z% (i.e., the school can provide these benefits absent state government support).



The Socioeconomic Benefits of Northeastern Junior College

FROM ENROLLMENT TO BENEFITS

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

Let B equal the benefits attributable to state government support. B might be understood as applying to either our broad or narrow taxpayer perspectives. The analysis in the Main Report derives all benefits as a function of student enrollments (i.e., CHEs). For consistency with the graphical exposition elsewhere in this appendix, B will be expressed as a function of the percent of current enrollment (i.e., percent of current CHEs). Accordingly, the equation

(1) B = B(100%)

reflects the total benefits generated by enrollments at their current levels, measured in our Main Report and shown in **Table 3.7** for the broad taxpayer perspective, and in **Table 3.8** for the narrow taxpayer perspective.

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

(2) B = B(Z%)

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

(3) B = B(100%) - B(Z%)

THE COLLEGE SHUTDOWN POINT

College operations will cease when fixed costs can no longer be covered. The shutdown point is introduced graphically in **Figure 3** as S%. The location of point S% indicates that this particular college can operate at an even lower enrollment level than Z% (the

Appendix 4: Adjusting for the Benefits Available Absent State Government Support

point of zero state funding). At point S%, state government support is still zero, and the tuition rate has been raised to p^{'''}. At tuition rates still higher than p^{'''}, the college would not be able to attract enough students the keep the doors open, and it would shut down. In **Figure 3**, point S% illustrates the college shutdown point but otherwise plays no role in the estimation of state government benefits. These remain as shown in equation (3).



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



ADJUSTING FOR ALTERNATIVE EDUCATION OPPORTUNITIES

Because there may be education alternatives to the two-year colleges in the state, we must make yet another adjustment. The question asked is: "Absent the CCs, what percentage of the students would be able to obtain their education elsewhere?" The benefits associated with the college education of these students are deducted from the overall benefit estimates.

The adjustment for alternative education is easily incorporated into our simple graphic model. For simplicity, let A% equal the percent of students with alternative education opportunities, and N% equal the percent of students without an alternative. Note that: N% + A% = 100%. **Figure 5** presents the case where the college could operate absent state government support (i.e., Z% occurs at an enrollment level greater than the college shutdown level S%). In this case, the benefits generated by enrollments absent state government support must be subtracted from total benefits. This case is parallel to that indicated in equation (3), and the net benefits attributable to state government support is given by:

(4) B = B(N%100%) - B(N%Z%)



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



The Socioeconomic Benefits of Northeastern Junior College