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ABSTRACT

This paper examines the ways in which the State of Arizona and the local economy benefit from the presence of the Pima Community College (PCC) District. After the Executive Summary, Volume 1, the Main Report, discusses findings from the study. The Pima Community College District paid $68.2 million in direct faculty and staff wages and salaries in fiscal year 2001, and accounts for an additional $404 million in wages and salaries off campus. The colleges serve an unduplicated headcount of 94,334 credit and non-credit students. The existence of PCC in Arizona explains $472.6 million of all annual earnings in the PCC District economy, equal to that of 15,387 jobs. The PCC districts pay wages and salaries, which generate additional incomes as they are spent. Likewise, the aggregate college operating and capital expenditures generate still further earnings. The document argues that every dollar of state or local tax money invested in PCC today will see a return of $24 over the next 30 years. Students benefit from an annual return of 26%; for every dollar they invest in PCC education, they will receive an additional $4.59 in higher earnings over the next 30 years. The study also quantifies the effects of PCC on reduction of crime, welfare, and unemployment. Appended are: (1) Explaining the Results--A Primer: The Net Present Value; The Internal Rate of Return; The Benefit/Cost Ratio; and The Payback Period; and (2) Methodology for Creating Income Gains by Levels of Education. (Contains 14 figures, 25 tables, 23 notes, and 34 references.) (NB)

The Socioeconomic Benefits Generated by Pima College

Executive Summary

[and]

Volume 1: Main Report

Kjell A. Christophersen & M. Henry Robison

February 2002

The Socioeconomic Benefits Generated by Pima Community College

State of Arizona

Executive Summary

1-Feb-2002

Kjell A. Christophersen & M. Henry Robison

CCBenefits Inc.

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May 14, 2002
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Executive Summary

HIGHLIGHTS

- Taxpayers see a return on investments in the Pima County Community College District of >100% and recover all investments in less than 1 year.
- Pima Community College pays $68.2 million in direct faculty and staff wages and salaries, and explains an additional $404 million in wages and salaries off campus.
- Students enjoy an attractive 26% annual return on their investment of time and money —for every $1 the student invests in PCC, he or she will receive a cumulative $4.59 in higher future earnings over the next 30 years.
- The State of Arizona benefits from improved health and reduced welfare, unemployment, and crime, saving the

INTRODUCTION

How do the Pima County Community College District economy and the State of Arizona benefit from the presence of Pima Community College (PCC)? An obvious question often asked, but rarely answered with more than anecdotes. In this study, CCbenefits, Inc. applied a comprehensive economic model they have developed to capture and quantify the economic and social benefits of community colleges (CCs). The model took over a year to develop with funding from the Association for Community College Trustees (ACCT), it relies on data collected from individual CCs, and translates these into common sense benefit-cost and investment terms. It has been subjected to peer review, field tested on over 100 different CCs throughout the nation, and now applied to PCC. Model results are based on solid economic theory, carefully drawn functional relationships, and a wealth of national and local education-related data. The model provides relief from the all-too-common "advocacy analyses" that inflate benefits, understate costs, and thus discredit the process of higher education impact assessment.

Four types of benefits are tracked: (1) contributions to local job and income formation (regional economic benefits); (2) higher earnings captured by exiting students; (3) a broad collection of social benefits (improved health, reduced crime, and lower welfare and unemployment); and (4) the return to taxpayers for their CC support.

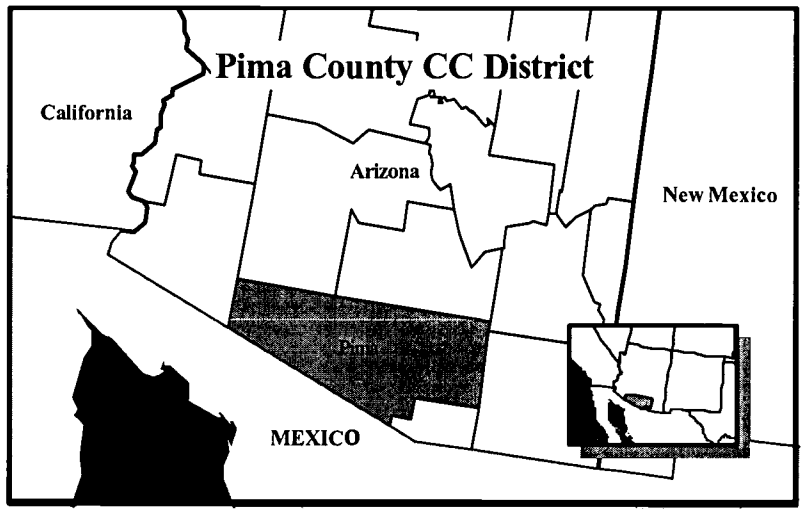
THE RESULTS

For a more in depth exploration of this topic, the reader is encouraged to consult the main report "The Socioeconomic Benefits Generated by Pima Community College" containing the detailed

assumptions, their context, and the computation procedures.

➢ **Regional Perspective—the Pima Community College Economy**

The existence of PCC explains $472.6 million of all annual earnings in the Pima County Community College District economy (see map). The earnings explained by PCC are equal to that of roughly 15,387 jobs. The earnings and job effects break down as follows:



- PCC *Operations and Capital Spending*

PCC pays wages and salaries, which generate additional incomes as they are spent. Likewise, PCC operating and capital expenditures generate still further earnings. Altogether, these earnings account for $102.3 million annually in the Pima County Community College District economy (equal to that of 3,331 jobs).

- *Higher Earnings due to Past Instruction*

Each year students leave PCC and join or rejoin the local workforce. Their added skills translate to higher earnings and a more robust Pima County Community College District economy. Based on current enrollment, turnover, and the growth of instruction over time, the local region workforce embodies an estimated 9.5 million credits of past instruction (credit and non-credit hours). The accumulated contribution of past PCC instruction adds some $370.3 million in annual earnings to the Pima County Community College District economy (equal to that of 12,055 jobs).

➢ **Student Perspective**

The student's perspective on the benefits of higher education is the most obvious: he or she sacrifices tuition and current earnings for a lifetime of higher earnings. For every credit completed PCC students will, on average, earn $133 more per year, every year they are in the workforce. Alternatively, for every full-time year they attend they will earn an additional $3,993 per year. In the aggregate (all exiting students), the higher earnings amount to some $101.2 million per year, every year they remain in the workforce.

From an investment standpoint, PCC students will enjoy a 26% rate of return on their investments of time and money, which compares favorably with the returns on other investments, e.g., the long-term return on US stocks and bonds. The corresponding

B/C ratio (the sum of the discounted future benefits divided by the sum of the discounted costs) is 4.6, i.e., for every $1 the student invests in PCC education, he or she will receive a cumulative of $4.59 in higher future earnings over the next 30 years or so. The payback period (the time needed to recover all costs) is 5.0 years.

➢ Taxpayer Perspectives

State and local government spent $86,515,355 in support of PCC during the analysis year. Is this a good use of taxpayer money? Our analysis indicates that the answer is a resounding yes: returns far outweigh the costs, particularly when a collection of social savings is included in the assessment. For example, persons with higher education are less likely to smoke or abuse alcohol, draw welfare or unemployment benefits, or commit crimes. This translates into associated dollar savings (avoided costs) amounting to some $53 per credit per year, counted as an indirect benefit of PCC education. When aggregated across all exiting students, the State of Arizona will benefit from $25.9 million worth of avoided costs per year, broken down as follows:

- *Improved Health*

Pima County Community College District area employers will see health-related absenteeism decline by 43,366 days per year, with a corresponding annual dollar savings of $4.5 million. The state will benefit from the health-related savings of 1,511 fewer smokers and 388 fewer alcohol abusers. The corresponding dollar savings are $4,475,993 and $3,086,221 per year, now and into the future (these savings include insurance premiums, co-payments and deductibles, and withholding for Medicare and Medicaid).

- *Reduced Crime*

Studies show that incarceration drops with each year of higher education. In the Pima County Community College District, 616 fewer individuals will be incarcerated per year, resulting in annual savings of $6,414,731 (combined savings from reduced arrest, prosecution, jail, and reform costs). Reductions in victim costs (e.g., property damage, legal expenses, lost workdays, etc.) result in savings of $1,347,160 per year. Finally, people employed rather than incarcerated add $2,203,090 of earnings per year to the economy.

- *Reduced Welfare/Unemployment*

There will be 1,050 fewer people on welfare, and 397 fewer drawing unemployment benefits per year, respectively, saving some $304,924 and $3,577,441 per year in the state.

➢ Taxpayer Return on Investment

The return on a year's worth of state and local government investment in PCC is obtained by projecting the associated educational benefits into the future, discounting them back to the present, and weighing these against the $86,515,355 state and local taxpayers spent during the analysis year to support the college. The analysis assumes that without the state and local government support (68% of the

budget) PCC would have to shut its doors. Two investment perspectives are possible, one broad and one narrow.

- *Broad Perspective*

Taxpayers expect their annual investment in PCC to result in higher lifetime earnings for students and social savings from lifestyle changes (reduced crime, welfare and unemployment, and improvements in health). From a broad investment perspective, the value of all future earnings and associated social savings is compared to the year's worth of state and local taxpayer support that made the benefits possible. Following this procedure, PCC provides a state and local taxpayer return on investment of >100% per year. The B/C ratio is 24.3, i.e., every dollar of state or local tax money invested in PCC today returns a cumulative of $24 over the next 30 years. Finally, the payback period is less than 1 year.

- *Narrow Perspective*

The narrow perspective limits the benefit stream to state and local government budgets, namely increased tax collections and expenditure savings. For example, in place of total increased student earnings, the narrow perspective includes only the increased state and local tax receipts from those higher earnings. Similarly, in place of overall crime, welfare, unemployment and health savings, the narrow perspective includes only those portions that translate to actual reductions in state and local government expenditures.

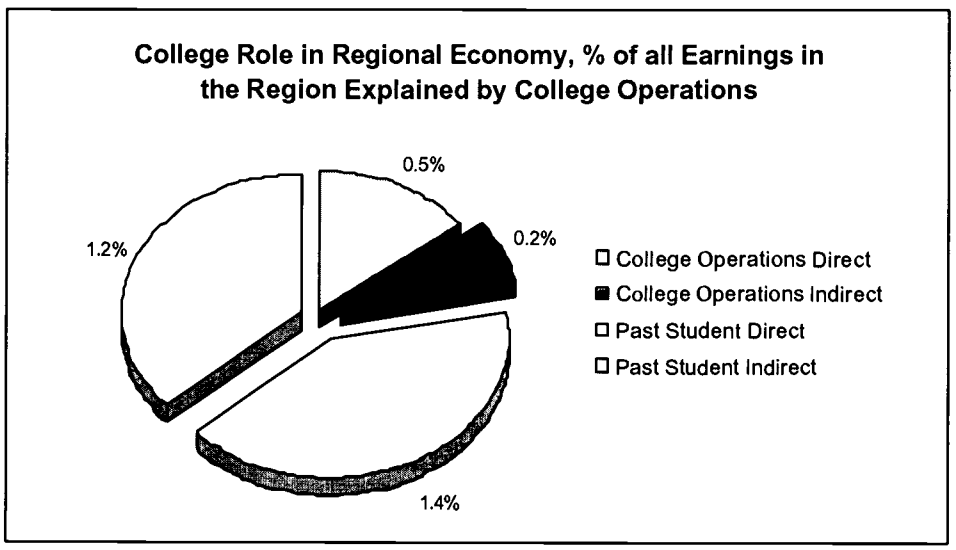
Note here that it is normal for the state government to undertake activities wanted by the public, which are unprofitable in the marketplace. This means that positive economic returns are generally not expected from government investments. From the narrow taxpayer perspective, therefore, even a small positive return (a B/C ratio equal to just greater than 1, and/or a rate of return equal to or just greater than the 4.0% discount rate used in this analysis) would be a most favorable outcome, certainly one that justifies continued taxpayer support of the college. For PCC, the narrow perspective results greatly exceed the minimum expectations. The results indicate strong and positive returns: a RR of 35%, a B/C ratio of 4.4 (every dollar of state or local tax money invested in PCC today returns $4.37), and a short payback period of only 3.9 years.

CONCLUSION

The results of this study demonstrate that PCC is a sound investment from a multiple of perspectives. It enriches the lives of students while reducing the demand for taxpayer-supported social services. Finally, it contributes to the vitality of both the local and state economies.

Benefits at a Glance

Regional Analysis			Reg. Impact
Regional Economic Development			
Increment from college operations			$102,320,000
Increment from past student productivity			$370,258,000
Total			$472,578,000
Job equivalent			15,387
Annual Benefits			
Higher earnings			
Aggregate (all student)			$101,176,973
Per Credit			$133
Per year per full time student			$3,993
Social savings			
Aggregate (all students)			$25,879,917
Per Credit			$53
Per year per full time student			$1,585
Investment Analysis	**RR**	**B/C Ratio**	**Payback**
Students	26%	4.6	5.0
Taxpayers: Broad Perspective	>100%	24.3	less than 1 year
Taxpayers: Narrow Perspective	35%	4.4	3.9



In sum, the graph shows that the college explains a total of 3.4% of all earnings ($14.00 billion) generated from all sources in the economic region.

This short summary report is one of four products generated for this impact study. In addition, one long report intended for economists and CC institutional researchers (65 pp) lays out the detailed assumptions and analysis. Another report (10 pp) provides detailed tabular results by gender, ethnicity, and entry levels of education. Lastly, a PowerPoint presentation is developed showing the main results for CC Presidents to adapt and use in speeches before state legislators and other education stakeholders.

PimaCommunityCollege

The Socioeconomic Benefits Generated by Pima Community College

State of Arizona

Volume 1: Main Report

1-Feb-2002

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Pima Community College commissioned this study from CCbenefits, Inc., a company created in collaboration with the Association of Community College Trustees (ACCT) to provide economic analysis services to community and 2-year 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, 121 Sweet Ave., Moscow ID 83843, phone: 208-883-3500, fax: 208-885-3803, e-mail: ccb@turbonet.com.

ACRONYMS

PCC	Pima Community College
AD	Associate Degree
ABE	Adult basic education
ACCT	Association of Community College Trustees
B/C	Benefit-cost ratio
CC	Community College
CHE	Credit hour equivalent
ESL	English as a second language
GED	General Equivalency Diploma (also Education Development Certificate)
HS	High school
IO	Input-output analysis
NCF	Net cash flow
NPV	Net present value
REIS	Regional Economic Information System
RR	Rate of return
TC	Technical College
TD	Technical Diploma

Chapter 1
INTRODUCTION

OVERVIEW

Community colleges (CCs) 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 part 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, Pima Community College (PCC) 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.

The study has four chapters and two 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 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 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 2** explains how the earnings related to higher education data were derived.

ANNUAL PRIVATE AND PUBLIC BENEFITS

Private benefits are the higher earnings captured by the students; these are well known and well documented in the economics literature. Less well-known and documented is a collection of public benefits captured by society at large, the indirect benefits, or what economists call *positive externalities*, such as improved health and lifestyle habits, lower crime, and lower incidences of welfare and unemployment. These stem from savings to

society from reduced burdens on taxpayer-provided services. We estimate dollar savings (or avoided costs) from reduced arrest, prosecution, jail, and reform expenditures based on published crime statistics arranged by education levels. 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 present value analysis determines the economic feasibility of investing in CC 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.

The present values 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 investments made (see **Appendix 1** for a more detailed explanation of the meaning of these terms).

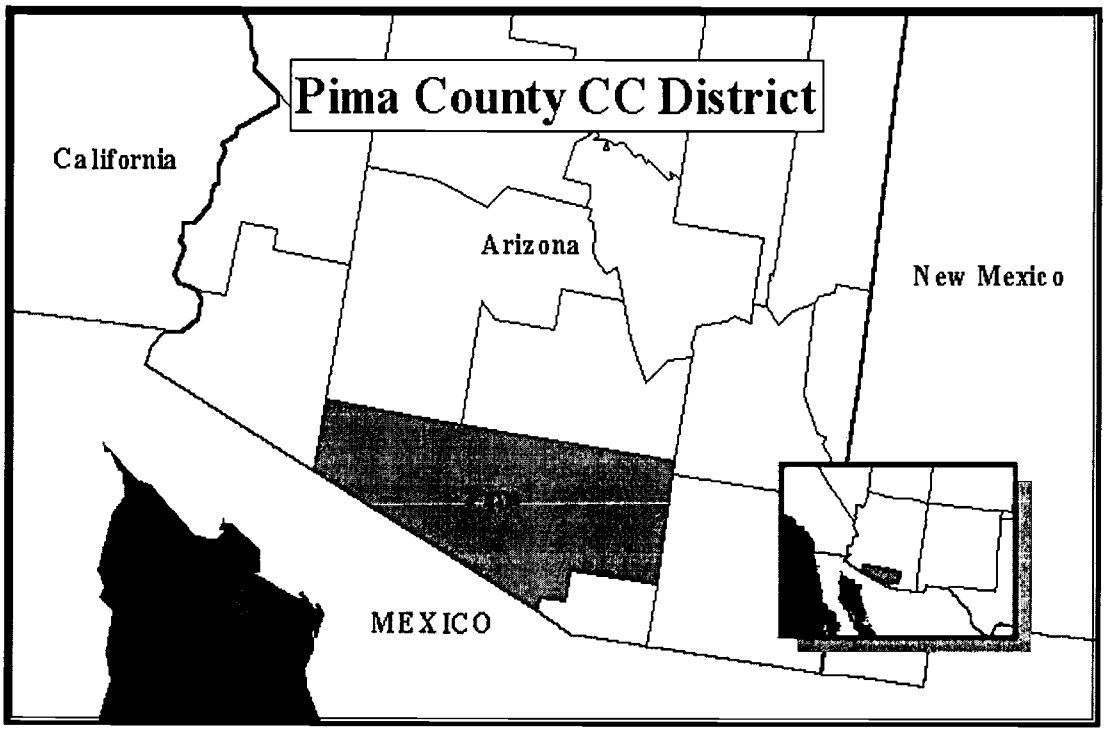
REGIONAL ECONOMIC BENEFITS

The benefits of a robust local economy are many: jobs for the young, increased business revenues, greater availability of public investment funds, and eased tax burdens. In this study we estimate the role of PCC in the local

[1]Instruction hours are not the same as credit hours. CCs prepare people for jobs and are less concerned with (ceremonial) 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.

community economy in terms of its share of total community earnings, defined as indicated in **Figure 1.1.** In general, these CC-linked regional earnings fall under two categories: 1) earnings generated by the annual operating expenditures of the college, and 2) earnings attributable to the CC skills embodied in the local workforce.

Figure 1.1: The Economic Region



Chapter 2
DATA SOURCES AND ASSUMPTIONS

INTRODUCTION

To the extent possible, documented statistics are used to estimate model parameters. In the few cases where hard data are scarce, however, institutional researchers on the scene apply best judgments and estimations on the basis of their intimate knowledge of the college and the student body.

This chapter contains six assumption sections, all based on various data imbedded in the analytic model: 1) the PCC 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.

PROFILE

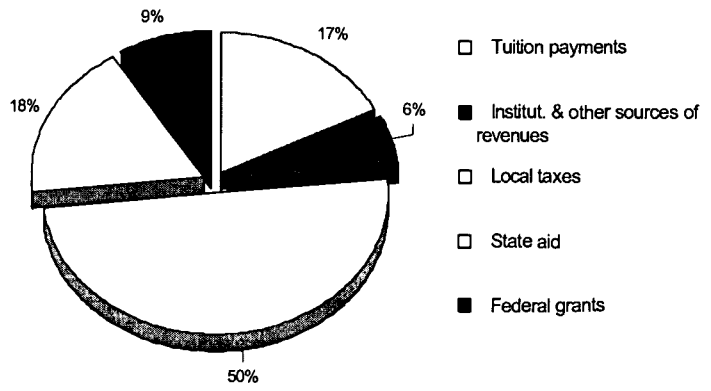
Faculty, Staff, and Operating Budget

PCC employed 995 full- and 2,801 part-time faculty and staff in year 2000 amounting to a total annual payroll of some $68.2 million. **Table 2.1** shows PCC's annual revenues by funding source: a total of $127 million. Two main revenue sources—private and public—are indicated. Private sources include tuition and fees (17%) plus 6% from other private sources (such as contract revenues, interest payments and the like). Public funding is comprised of local taxes (50%), state aid (18%), and federal grants (8.8%). These budget data are critical in identifying the annual costs of educating the CC student body from the perspectives of the students and the taxpayers alike.

Table 2.1. Aggregate Revenues, the Budget

Sources	Revenues	Total	% of Total
Private Funding			
Tuition payments	$22,149,336		17%
Institut. & other sources of revenues	$7,525,213	$29,674,549	6%
Public Funding			
Local taxes	$63,767,655		50%
State aid	$22,747,700		18%
Federal grants	$11,152,636	$97,667,991	8.8%
Total		$127,342,540	100%

Figure 2.1. Revenues: The Budget



The Students

Students attend community colleges for different reasons: to prepare for transfer to four-year institutions, to obtain Associate Degrees or Certificates, obtain basic skills, or perhaps most importantly, to take refresher courses in non-credit programs—workforce students, for example. 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 unduplicated student body (headcount) is 94,334 (FY99-00 enrollment).

Some students forego earnings entirely while attending college while others may hold part- or full-time jobs. Information about student employment plays a role in determining the *opportunity cost* of education incurred by the

students while attending PCC[2]. **Table 2.2** rows labeled: "% Employed While Attending" and "% of Full-Time Earning Potential" provide the percentage estimates of the students who held jobs (75%) while attending PCC, and how much they earned (65%) relative to full-time employment (or what they would statistically be earning if they did not attend PCC).

Table 2.2. Student Body Profile

		Values
Total enrollment, all campuses		94,334
Enrollment on campus for which analysis is carried out	100%	94,334
% of students employed while attending college		75%
% of full-time earning potential		65%
Students remaining in the local community after leaving		90%
Attrition rate over time (leaving local community)		33%
"Settling In" factors (years):		
Completing AA		0.5
Completing Certificate		0.5
Non-completing transfer track		2.5
Non-completing workforce		0.0
ABE/ESL/GED		0.5

As indicated in the table, it is estimated that 90% of the students remain in the local community (as defined in **Figure 1.1**) and thereby generate local community benefits. The remaining 10% leave the local community and are not counted as part of the regional economic development benefits. The 90% local retention rate applies only to the first year, however. We assume that 33% of the students, and associated benefits, will leave the area over the next 30 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 (June 1999). Settling-in factors have the effect of delaying the onset of the benefits to the students and to society at large.

[2] The opportunity cost is the measure of the earnings foregone; the earnings the individual would have collected had he or she not attended PCC .

Entry-Level Education, Gender, and Ethnicity

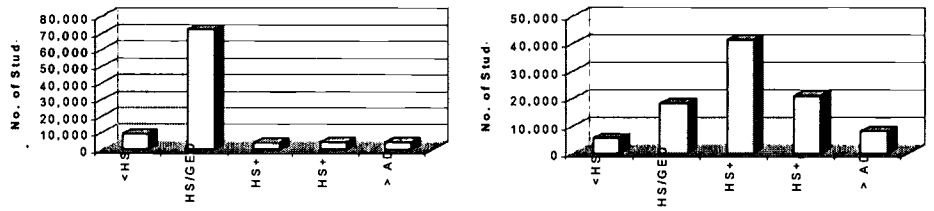
Table 2.3 shows the education level, gender, and ethnicity of the PCC student body. This breakdown is used only to add precision to the analysis, not for purposes of comparing between different groups. Five education entry levels are indicated in approximate one-year increments, ranging from less than 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 upper class students who had accumulated credits during their community 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 1,890 white males who **first** entered with less than HS/GED, it is estimated that only 1,103 still remain in that category at the beginning of the analysis year, meaning that 787 students have actually moved up from the "<HS/GED" category to the "HS/GED equivalent" category or beyond since they first entered PCC. 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 initial entry level.

Table 2.3. Education Entry Level of Student Body

	White Male		Minority Male		White Female		Minority Female		Total	
Entry Level	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year	Entry Level	Begin Year
< HS/GED	1,890	1,103	2,200	1,284	2,268	1,323	2,991	1,745	9,349	5,454
HS/GED equivalent	19,522	4,796	13,391	3,492	22,607	5,572	16,732	4,417	72,253	18,277
1 year post HS or less	1,006	11,081	471	7,611	1,847	13,182	603	9,549	3,927	41,423
2 years post HS or less	1,214	5,646	561	3,631	1,914	7,256	743	4,583	4,431	21,116
> AD	1,497	2,504	277	883	2,202	3,504	398	1,173	4,374	8,065
Total	25,129	25,129	16,900	16,900	30,838	30,838	21,467	21,467	94,334	94,334

Figure 2.2. Student Body Education Level: Entry vs. Beginning of Analysis Year



The Achievements

Table 2.4 shows the student breakdown in terms of analysis year academic pursuits and/or achievements according to four categories: 1) retirees who attend largely for self enrichment, 2) Associate Degree completers, 2) Diploma and Certificate completers, 3) all transfer students, 4) all workforce students, and 5) ABE/ESL students[3].

As indicated in the table, students achieving their graduation goals would be those completing Associate Degrees or Certificates (1.3% and 1.3%, 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 (43.6% + 37.9% = 81.5% in the transfer track and workforce categories, respectively). The retired (2.3%) and ABE/ESL/GED students (13.6%) 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 PCC to acquire skills that will increase their earnings. 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 third column shows the average age of the students generating the benefits (excluding retirees). The difference between the average age (31.7 years) and retirement at 65, or 33.3 years is the time horizon for the analysis.

[3] ABE/ESL = Adult basic education and English as a second language

As indicated in column four, the average Associate Degree and Certificate student completed 20.6 and 23.5 CHEs of study during the analysis year, respectively. The total number of CHEs completed during the year of analysis for the entire student body is 811,943. Finally, the last column shows the average time the students are actually in residence on campus during the analysis year. This information is needed to determine the opportunity cost of their education.

Table 2.4. Levels of Achievement

Student Body	%	St. Body 94,334	Avg. Age	CHEs This Year	Total Credits	# Years Resid.
Retired	2.3%	2,170	76	3.7	7,919	0.12
Completing AA	1.3%	1,226	31	20.6	25,263	0.69
Completing Certificate	1.3%	1,226	31	23.5	28,819	0.78
Non-completing transfer track	43.6%	41,130	30	10.1	416,232	0.34
Non-completing workforce	37.9%	35,753	33	8.1	288,166	0.27
ABE/ESL/GED	13.6%	12,829	34	3.6	45,544	0.12
Total or weighted averages	100.0%	94,334	31.7	8.7	811,943	
Credits required for one full-time year equivalent of study					30	

Note: weighted average of "CHEs per year does not include the retired students

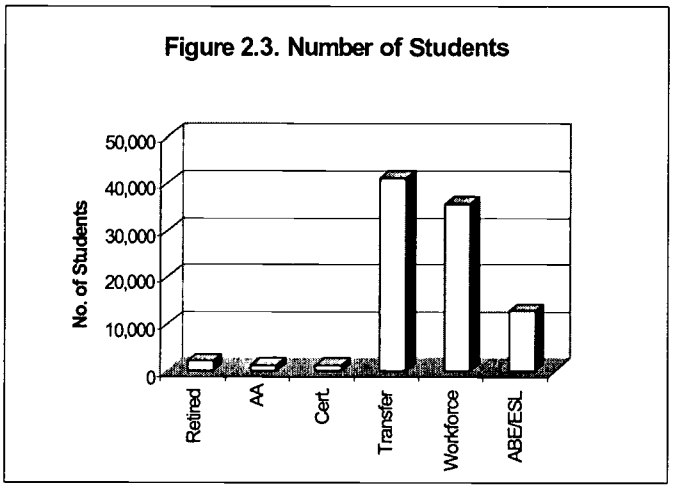
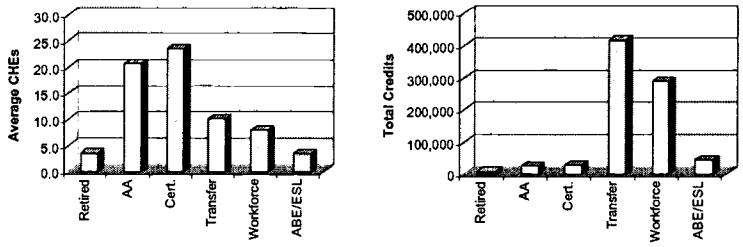


Figure 2.4. Average and Total CHEs Earned for the Analysis Year



ANNUAL PRIVATE BENEFITS

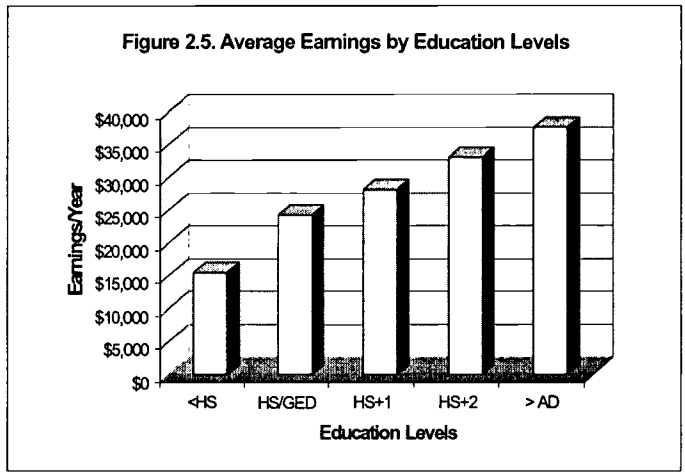
The earnings statistics in **Table 2.5,** on which the benefit estimates (reported in **Chapter 3** below) are based, reflect all occupations (technical and non-technical). The lower the education level, the lower the average earnings, regardless of the subject matters studied. The distinguishing feature among the achievement categories, therefore, is the number of CHEs completed. Statistics indicate that earnings are highly correlated with education. Correlation does not necessarily equal causation, however. 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 PCC student body. The differences between the steps are indicated in the last column. We also 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 are found in **Appendix 2: Methodology for Creating Income Gains by Levels of Education by Gender and Race.**

Table 2.5. Weighted Average Earnings

Entry Level	Average Earnings	Diff.
1 short of HS/GED	$15,566	NA
HS/GED equivalent	$24,263	$8,697
1-year Certificate	$28,150	$3,887
2-year Associate Degree	$33,103	$4,953
1 year post Associate Degree	$37,695	$4,591



ANNUAL PUBLIC BENEFITS

Students and society at large both benefit from higher earnings. Indeed, the principal motivation for publicly funded higher education is to raise the productivity of the workforce and the incomes 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. 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 PCC 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 and local 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 state and local government.

Higher Earnings

Broad Perspective: Higher education begets higher earnings. The economy generates more income than it would absent the CC skills embodied in the local labor force. From the broad taxpayer perspective, the total increase in regional earnings is counted as a benefit of CC education.

Narrow Perspective: Higher regional earnings translate into higher state and local *tax collections*. In the narrow taxpayer perspective we assume that the state and local authorities will collect 15.1% of the higher earnings in the form of taxes—the estimated composite of all taxes other than the federal income taxes.[4]

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**). 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. The table shows the calculated reductions in the incidences of smoking and alcohol abuse as a function of adding the higher education, also linked to the gender and ethnicity profile

[4] The tax data are obtained from the U.S. Census Bureau. See also **Appendix 2.**

of the PCC 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. 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.

Narrow Perspective: Taxpayers benefit from reduced absenteeism to the extent that state and local government is an employer. Accordingly, we assume a taxpayer's portion of absenteeism savings at 10.1%, equal to the estimated public portion of employment in the region.[5] As for smoking- and alcohol-related savings, the taxpayers benefit to the extent that state and local health subsidies (to hospitals, for example) are reduced. We assume that 5% of the total benefits can be counted as taxpayer savings.

Table 2.6. Reduced Absenteeism, Smoking and Alcohol Habits

	Absenteeism		Smoking		Alcohol Abuse	
Education Level	Days	%/Year	Average	Reduction	Average	Reduction
< HS/GED	10	4%	32%	NA	10%	NA
HS/GED equivalent	6	2%	28%	13%	9%	7%
1 year post HS or less	5	2%	24%	15%	8%	12%
2 years post HS or less	4	2%	19%	19%	7%	14%
> AD	3	1%	15%	23%	5%	20%

1. Absenteeism: U.S. Department of Labor, Bureau of Labor Statistics, Division of Labor Force Statistics, ftp://ftp.bls.gov/pub/special.requests/lf/aat46.txt

2. Smoking: *Health*, United States, 2001, Table 61: Centers for Disease Control and Prevention; National Center for Health Statistics; and *The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation*, U.S. Treasury Department, http://www.ustreas.gov/press/releases/docs/tobacco.pdf

3. Alcoholism: *Health Promotion and Disease Questionnaire* of the 1990 National Health Interview Survey of the Center for Health Statistics; and National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism,http://www.nida.nih.gov/EconomicCosts/Index.html.

[5] The ratio of state and local earnings over total earnings in the US (Regional Economic Information System – REIS, Bureau of Economic Analysis, Dept. of Commerce, 1998)

Figure 2.6. Days of Absenteeism by Education Levels

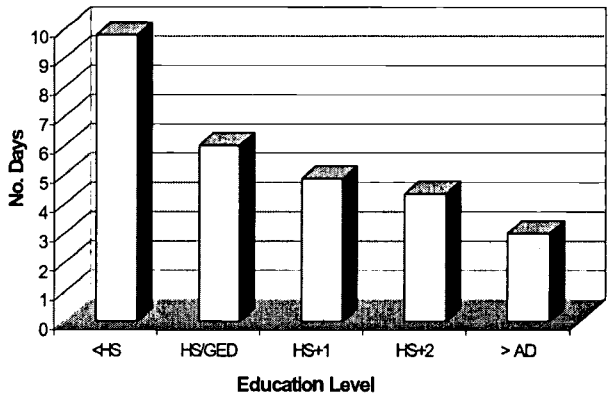


Figure 2.7. Average Incidence of Smoking by Education Levels

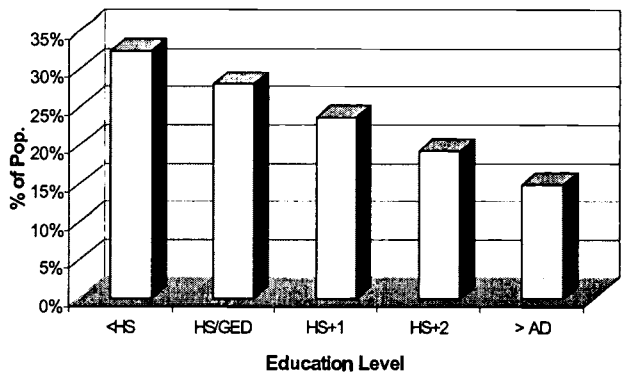
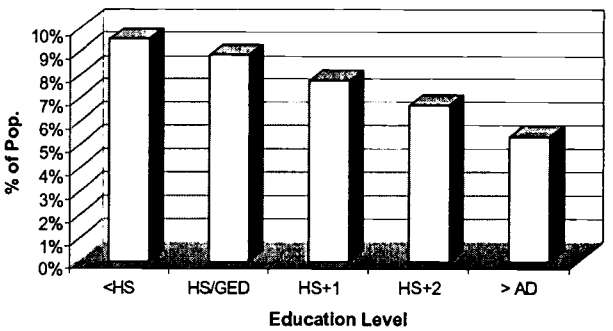


Figure 2.8. Average Incidence of Alcohol Abuse



Crime Reduction Benefits

The first column of **Table 2.7** relates 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 PCC student body). The percentage reductions are based on total prison population relative to the population at large.[6] The implication is, as people achieve higher education levels, they are statistically less likely to commit crimes. The difference between before and after comprises the benefit attributable to education.

We identify three types of crime-related expenses, 1) the expense of prosecution, imprisonment, and reform, tracked as incarceration expense, 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.

Narrow Perspective: We assume that nearly all (80%) of the incarceration savings accrue to the state and local 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 and local government average tax rate (15.1%) to the added productivity of persons *not* incarcerated to arrive at the taxpayer benefits.

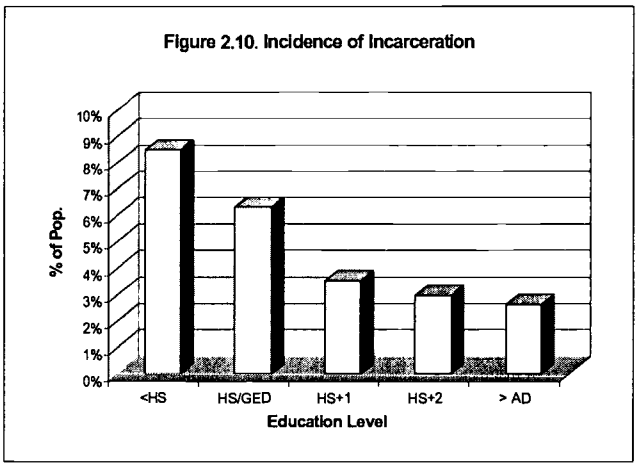
[6] See also: http://www.ojp.usdoj.gov/bjs/abstract/p00.htm.

Table 2.7. Incarceration Rates

Education Level	Average	Reduction
< HS/GED	8%	NA
HS/GED equivalent	6%	26%
1 year post HS or less	4%	44%
2 years post HS or less	3%	16%
> AD	3%	12%

1. *Literacy Behind Walls*, National Center for Education Statistics, Prison Literacy Programs, DIGEST No. 159 Literacy in Corrections, Correctional Educational Association, http://www.nifl.gov/newworld/correct.html.

2. T. P. Bonczar & Alan J. Beck; Lifetime likelihood of Going to State or Federal



Welfare and Unemployment Reduction Benefits

Higher education is statistically associated with lower welfare and unemployment. **Table 2.8** relates the probabilities of individuals applying for welfare and/or unemployment assistance to education levels (linked to the gender and ethnicity profile of the PCC 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 are counted in full as benefits in the broad taxpayer perspective.

Narrow Perspective: Local taxpayer benefits from reduced welfare are limited to 16%--the extent to which the state and local taxpayers subsidize the

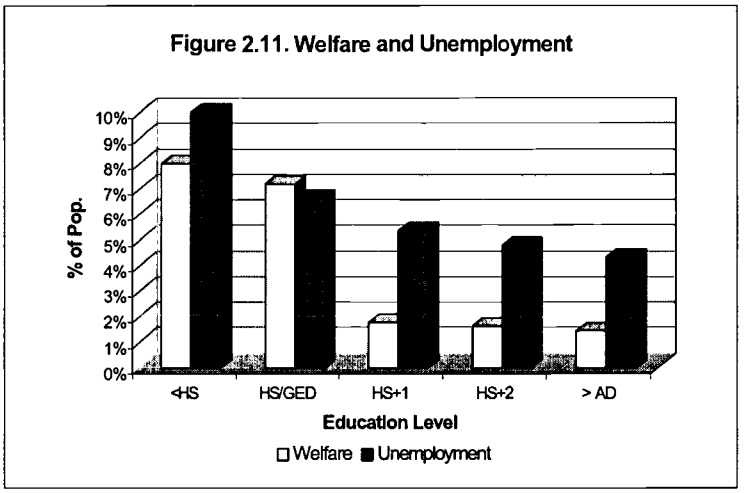
welfare system. None is claimed for unemployment, because most of these costs are borne by the Federal Government.

Table 2.8. Welfare & Unemployment

	Welfare		Unemployment	
Education Level	Average	Reduction	Average	Reduction
< HS/GED	8%	NA	11%	NA
HS/GED equivalent	7%	10%	7%	38%
1 year post HS or less	2%	75%	5%	19%
2 years post HS or less	2%	9%	5%	11%
> AD	1%	12%	4%	10%

1. Temporary Assistance for Needy Families, TANF Program 3rd annual report to Congress, US Dept of Health and Human Resources, Table 10:12.

2. The Heritage Foundation, *Means-Tested Welfare Spending: Past and Future Growth* , Testimony by Robert Rector, (3/07/01).



COSTS

There are two main cost components considered in the analytic framework: 1) the cost incurred by the student, including the opportunity cost of his or her time (represented by the earnings foregone while attending PCC), and expenses for tuition and books, and 2) the cost incurred by state and local government taxpayers, part of the college's operating and capital costs (the budget—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 PCC, most students forego some earnings, because they are not employed or are

employed only part-time. 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 CC 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. No opportunity cost of time is charged for the fully employed. The opportunity costs are derived 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 mid-point of the trajectory beginning with the average minimum wage of $12,480 we assume will be earned per year by 17-year-old workers. By the time a worker with an education level of less than HS/GED is 41 years old – the approximate working life span midpoint – he or she will have reached the level of earnings indicated in **Table 2.5**.[7]

- The opportunity cost of time is then conditioned by the average age of the student (31.7 years, see **Table 2.4**). In particular, the average earnings at age 41 are adjusted downward to reflect the average earnings at age 31.7, assuming a straight line of earnings across the assumed 17 to 65 working life span.

The Budget

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

[7] The calculation: 65 - 17 = 48 years in the workforce. The mid-point: 48 years/2 = 24 years. The average age of worker defining the $15,566 earnings level (<HS/GED) = 24 years midpoint + 17 years, or 41.

revenues, the larger will be the relative economic payback to state and local taxpayers.

OTHER ASSUMPTIONS

Table 2.9 lists several other assumptions imbedded in the analytic model: a) the discount rate and time horizon, b) crime-related costs (incarceration costs are inclusive of the cost per prison year plus all costs associated with arrest, investigation, trial and finally incarceration), c) welfare and unemployment costs per year[8], and d) health-related costs.[9] Annual real increases in costs are also included, although these are not used in the study. The alternative education opportunity assumption is discussed further below in association with the regional economic impacts.

[8] 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 30 years or so, the cumulative incidence of welfare and/or unemployment will add to this duration over the 30-year period—it is not a consecutive period.
[9] The incarceration, health, welfare and unemployment probability and cost variables are internal to the analytic model.

Table 2.9. Miscellaneous Variables

	Variables
Discount rate	4.0%
Time horizon, years to retirement	33.3
Average real earnings increase per year	0.5%
Avg. cost/prison year (all incl.: arrest, trial, incarc., rehab. etc.)	$82,415
Avg. length of incarc. (total years over 30-year time horizon)	4.0
Real cost increase per prison year	0.0%
Average victim cost	$ 60,219
Real victim cost increase per year	0.0%
Average cost per welfare year	$ 75,138
Avg. duration on welfare (total years over 30-year time horizon)	4.0
Welfare/unemployment cost increase per year	0.0%
Average cost per unemployment year	$ 36,249
Avg. duration on unempl. (total years over 30-year time horizon)	4.0
Smoking-related medical costs per year	$ 2,962
Alcohol-related medical costs/year	$ 7,946
Real medical cost increase per year	0.0%
Alternative education opportunities	50.0%

Assumptions adapted from:

1. Bureau of Justice Statistics, Table #. 05 Total direct and intergovernmental expenditure, by activity and level of government, fiscal years 1980-97, Criminal Justice Expenditure and Employment Extracts Program, 12/14/00.

2. OICJ The Extent and Costs of Victimization, Crime and Justice: The Americas, Dec-Jan 1995.

3. The Heritage Foundation, *Means-Tested Welfare Spending: Past and Future Growth*, Testimony by Robert Rector, (3/07/01).

4. U.S. Department of Labor, Bureau of Labor Statistics, http://www.bls.gov/news.release/annpay.t01.htm.

5. The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation, http://www.ustreas.gov/press/releases/docs/tobacco.pdf.

6. National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, found at: http://www.nida.nih.gov/EconomicCosts/Index.html.

REGIONAL ECONOMIC BENEFITS

In general, the regional economy is affected by the presence of PCC in two ways: from its day-to-day operations (including capital spending), and from students who enter the workforce with increased skills and know-how. 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, students expand the skill-base of the local workforce, deepening the 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 Pima Community College economic region.[10] Estimating CC operations effects requires an additional model that takes CC expenditures, deducts spending that leaks from the economy, and bridges what is left to the sectors of the IO model.

Several steps are involved in estimating the skill-enhancing effect of past students on the regional workforce, and in turn, the effect of these workforce changes on the regional economy. First, the number of past students still active in the regional workforce is estimated and converted to total workforce embodied CHEs. In the **Annual Private Benefits** section above an estimate was made of the incremental (per CHE) effect on student earnings of PCC instruction. This estimate is applied to total embodied CHEs to arrive at an initial estimate of the past student regional income effect. In arriving at the final estimate, the initial value must first be reduced to account for a collection of substitution effects, and then expanded to capture a collection of demand and supply-side effects. The end result is an estimate of the impact of past student skills and increased productivity on the size of the regional economy.

This section is divided into two subsections. The first documents our estimation of day-to-day PCC operations effects. The second documents our estimation of the effect of past student skills on the regional economy.

The Impact of PCC Operations

The first step in estimating the impact of PCC operations is to assemble a profile of its combined operating and capital expenditures (see **Table 2.10**). These data are drawn from the college budget 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 in-region, in-

[10] The Pima Community College model is constructed according to traditional practice using national model IO coefficients and secondary data. The models employ the IO accounting framework presented in Robison (1997) and are equipped with regional purchase coefficients adapted from Stevens et. al., 1983.

state and out-of-state vendors. The net local portion is derived in Column 6. The spending data shown in this column are fed into the regional IO model.[11]

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, staff is asked to use their best judgment.

The first row in **Table 2.10** shows salaries and wages. These *direct* earnings are part of the economic region's overall earnings, and appear as "Direct Earnings of Faculty and Staff" in the table of findings, **Table 3.10**. Dollar values in **Table 2.10** column 6, "net local spending," are fed into the economic region IO model. The IO model provides an estimate of indirect effects, and these appear as "Indirect Earnings" in **Table 3.10**.

[11] **Table 2.10**, by itself, provides very important information to present to local audiences—Chambers of Commerce, local business establishments, Rotary clubs, and the like. The table demonstrates that the college is a "good neighbor" in the local community, evidenced by the fact that an estimated 77% of all college expenditures benefit local vendors ($111,734 / $145,192 = 77%).

Table 2.10. Profile of College Spending in and out of Regional Economy ($ Thousands)

Spending Categories	Tot. Dollar Amount (1)	Local % (2)	Non-Local, but in-state % (3)	% Local Manufact. (4)	Manufact. % Non-Loc. in-state % (5)	Net Local Spending (6)
Salaries and Wages	$68,226	97%	3%			$66,179
Travel	$1,700	32%	2%			$550
Electricity and natural gas	$2,697	85%	0%			$2,285
Telephone	$854	1%	51%			$4
Building Materials & Gardening Supplies	$984	57%	39%	5%	10%	$558
General Merchandise Stores	$12,321	37%	18%	5%	10%	$4,551
Eating & Drinking	$255	89%	3%			$228
Maintenance & Repair Construction	$0	0%	0%			$0
New Construction	$21,123	50%	35%			$10,553
Insurance	$7,666	80%	14%			$6,095
Legal Services	$276	78%	22%			$214
Credit Agencies	$3,423	22%	21%			$746
U.S. Postal Service	$387	33%	33%			$128
Accounting, Auditing & Bookkeeping	$170	85%	4%			$144
Marketing	$323	45%	22%			$146
Other Business Services	$8,147	44%	18%			$3,598
Water Supply & Sewerage Systems	$264	94%	5%			$248
Printing & Publishing	$690	21%	0%			$147
Rental Property	$1,262	74%	19%			$936
Services to Buildings	$223	100%	0%			$223
Unemployment Compensation	$130	100%	0%			$130
Honoraria + other payments to households	$14,073	100%	0%			$14,073
Total	$145,192					$111,734

Note: this table provides details for the summary of the college role in the regional economy (Table 3.10)

The Direct Economic Development Effects of Students

In the next chapter we estimate that the average CHE of PCC instruction is worth $133 per year in increased employee earnings (see **Table 3.3**). This is the average value across the student's entire working life.[12] At any point in time, the local workforce will embody thousands of CHEs of past PCC instruction. We obtain an initial estimate of the direct past student economic development effect by multiplying the total hours of embodied instruction by the $133 value.

[12] In reality, the earnings increment due to PCC skills might be expected to start low and grow over the course of a student's working life. PCC-acquired skills open doors for the students, giving them a chance to excel and advance in their careers. Our earnings increment due to PCC attendance is an average across all age levels (as also discussed above in relation to the opportunity cost of time variable). It would thus overstate earnings in the early years and understate them in later years. Our interest, however, is to arrive at an estimate of the lifetime accumulated earnings increment. Use of the average for the entire course of student working lives should provide the proper aggregate estimate.

A separate model is constructed to estimate the CHEs of past PCC instruction embodied in the regional workforce. **Table 2.11** indicates variables critical to the model, while **Table 2.12** shows the output of the model itself. Considering **Table 2.12** one column at a time conveys the logic of the model.

Column 1 provides an estimate of enrollment history (unduplicated headcount) of PCC students. Column 2 is the same as column 1, but net of students who leave the region immediately upon leaving PCC. As shown in the table, 90% of the students remain in the area upon leaving the CC, 10% leave.

Column 3 transitions from students to leavers (i.e., the past students). A comparison of columns 2 and 3 indicates that all past students have left PCC except for the last three years (1997 - 2000) where students are still enrolled (the leaver assumptions are shown in column 8).

Column 4 further reduces leavers to focus only on those who have settled into a somewhat permanent occupation. As shown in column 9 (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 5 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 PCC and settling into the local workforce, have out-migrated, retired, or died. As shown in **Table 2.11**, roughly one-third of working past students will out-migrate, retire or die over the course of the next 30 years. This "30-year attrition" follows an assumed logarithmic decay function shown in column 10 labeled "active in local workforce."

Column 6 shows the average CHEs generated per year back to 1971. These data were obtained by dividing total year-by-year CHEs by the corresponding headcount.[13] Column 7 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 5. Looking to the total in Column 7, we

[13] We used weighted average annual CHEs prior to 1977 (accurate data before then were unavailable).

estimate that the current workforce of the Pima Community College economic region embodies some 9.5 million CHEs of past PCC instruction.

From Embodied CHEs to Direct Income Effects

An *upper-bound* estimate of the past student economic development effect is obtained by multiplying the total embodied CHEs (**Table 2.12**) by the estimated $133 per-CHE value (**Table 3.2**). The result of this calculation is still an upper bound, for reasons pertaining to economic development theory. We constructed a model to capture this dynamic, and thereby reduced the upper bound to arrive at the estimate of the direct past student economic development effect. Our model hinges on two assumptions for two polar case scenarios (**see Box**).

Note that with polar case scenario 1, we would reduce our upper-bound estimate to zero – i.e., an enhanced workforce skill base has no economic development effect. In contrast, with polar case scenario 2 we would accept the full upper-bound amount as our past student economic development effect. Obviously the true measure is somewhere in between.

There is considerable empirical literature on the economic development effects of education, and from this research we are able to adapt a documented adjustment factor. In particular, in a recent study Bils and Klenow (2000) survey past work on the economic development effects of education, and advance a model of their own. Based on their findings, we reduce the upper bound to 30% of the potential (upper bound) total to arrive at our final estimate: thus $196.8 million of the upper bound value is counted as the direct past student economic development effect. These appear in **Table 3.10** under the heading "Earnings Attributable to Past Student Economic Development Effects," "Direct Earnings."

Box: Polar Cases

Polar Case Scenario 1. Assumption #1 under this scenario is that the rate of technical substitution between local skilled and unskilled workers is infinitely elastic. This means that newly skilled past PCC students 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 is that the rate of technical substitution between local and non-local workers is infinitely elastic, and that the existence of a skilled workforce is not a factor in attracting new industry to the region. This means that existing industry can readily draw skilled workers from outside the region, and regional growth is driven by something other than skills in the local workforce. Skilled workers are easily imported without extraordinary inducements or wage premiums that would otherwise increase costs and reduce competitiveness.

Polar Scenario 2. Assumption #1 is that the rate of technical substitution between local skilled and unskilled workers is infinitely inelastic. Skilled workers are able to perform the same tasks at less expense than unskilled workers, and they are able to perform many tasks that unskilled workers cannot. Under this assumption, skilled workers increase efficiency, enable an expansion of the product line, and generally increase the competitiveness of existing industry. The result is an expansion of earnings as well as output.

Assumption #2 is that the rate of technical substitution between local and non-local workers is infinitely inelastic, and the existence of a skilled workforce is, therefore, a factor in attracting 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).

The Indirect Economic Development Effects of Students

The direct earnings attributed to the PCC skills embodied in the current region workforce are not the only past student economic development effects. 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 as increased employee and business spending ripples through the other parts of the economy.

We assume that the students will acquire jobs in the *higher-stage* sectors of the economy (e.g., technical services and advanced manufacturing sectors, see Parr, 1999). For demand-induced effects, we compute a weighted average demand-driven earnings multiplier from the impact area IO model. Higher-stage sectors receive greater weight than lower-stage sectors. Demand-side indirect effects are obtained in the usual manner by applying the multiplier to the direct effect estimate.

There is still more. Economic development theory describes an "agglomeration" effect whereby regional growth itself stimulates growth. A new plant in a region is followed by other plants that use its outputs as inputs. This in turn spawns another round of industry growth, and so on. 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 then compute a weighted average supply-driven earnings multiplier, again favoring higher-stage sectors. Agglomeration (or supply-side) effects are obtained by applying the multiplier to the direct effect estimate.

Finally, a third key element is accounted for – the *alternative education opportunity variable* (see **Table 2.9**). This is technically not a cost variable, but rather a "negative benefit," one that recognizes the fact that, absent the PCC, some portion of the aggregate student body would obtain an education elsewhere. The problem is determining what this portion is. Clearly, 100% would be incorrect because not everyone would be able to attend a technical college in a neighboring state. Indeed, an integral part of the CC mission is to provide open educational access for those who cannot avail themselves of the alternatives. For the PCC, the assumption for this variable is 50%; i.e., the statewide economic benefits are reduced across the board by this amount.

Table 2.11. Critical Variables

Assumptions	Values
Current headcount of students	94,334
Students remaining in the community after leaving CC	90%
30-year attrition	33%
Decay rate	1.3%
Overall average of credits earned per student this year	9

Table 2.12. Estimating Credits of Instruction Embodied in the Workforce

Year	Student Enrollment Headcount 1	Subtract Students Migrating Immediately 2	Students who have left college (Leavers) 3	Leavers Who Have Settled Into Jobs 4	# Settled Into Jobs - Active in the Workforce 5	Average Credit Equivalents 6	Credits Embodied in the Workforce 7	Assumptions % of Students in Workforce 8	"Settling" Factor 9	Active in Workforce 10
1971	8,651	7,786	7,786	7,786	5,193	8.52	44,262	100%	100%	66.7%
1972	14,433	12,990	12,990	12,990	8,782	8.52	74,849	100%	100%	67.6%
1973	20,938	18,844	18,844	18,844	12,913	8.52	110,060	100%	100%	68.5%
1974	29,027	26,124	26,124	26,124	18,145	8.52	154,653	100%	100%	69.5%
1975	38,356	34,520	34,520	34,520	24,303	8.52	207,134	100%	100%	70.4%
1976	42,716	38,444	38,444	38,444	27,433	8.52	233,815	100%	100%	71.4%
1977	43,559	39,203	39,203	39,203	28,354	8.52	241,669	100%	100%	72.3%
1978	43,555	39,200	39,200	39,200	28,737	8.52	244,931	100%	100%	73.3%
1979	43,361	39,025	39,025	39,025	28,998	8.52	247,154	100%	100%	74.3%
1980	41,514	37,363	37,363	37,363	28,140	8.52	239,842	100%	100%	75.3%
1981	47,366	42,629	42,629	42,629	32,543	8.52	277,371	100%	100%	76.3%
1982	53,302	47,972	47,972	47,972	37,119	8.52	316,373	100%	100%	77.4%
1983	50,514	45,463	45,463	45,463	35,656	8.52	303,900	100%	100%	78.4%
1984	53,354	48,019	48,019	48,019	38,172	8.52	325,348	100%	100%	79.5%
1985	52,521	47,269	47,269	47,269	38,087	8.52	324,621	100%	100%	80.6%
1986	61,817	55,635	55,635	55,635	45,437	8.52	387,270	100%	100%	81.7%
1987	65,826	59,243	59,243	59,243	49,042	8.52	417,990	100%	100%	82.8%
1988	67,114	60,403	60,403	60,403	50,681	8.52	431,961	100%	100%	83.9%
1989	58,352	52,517	52,517	52,517	44,663	8.52	380,671	100%	100%	85.0%
1990	57,904	52,114	52,114	52,114	44,922	8.52	382,882	100%	100%	86.2%
1991	54,695	49,226	49,226	49,226	43,010	8.52	366,578	100%	100%	87.4%
1992	54,619	49,157	49,157	49,157	43,534	8.52	371,043	100%	100%	88.6%
1993	53,420	48,078	48,078	48,078	43,157	8.52	367,830	100%	100%	89.8%
1994	53,657	48,291	48,291	48,291	43,937	8.52	374,483	100%	100%	91.0%
1995	53,049	47,744	47,744	47,744	44,030	8.52	375,271	100%	100%	92.2%
1996	53,784	48,406	48,406	48,406	45,246	8.52	385,642	100%	100%	93.5%
1997	76,248	68,623	68,623	68,623	65,016	8.52	554,143	100%	100%	94.7%
1998	83,841	75,457	75,419	67,877	65,183	8.52	555,565	100%	90%	96.0%
1999	86,398	77,758	76,009	57,006	55,488	8.52	472,933	98%	75%	97.3%
2000	94,334	84,901	72,166	36,083	36,083	8.52	307,539	85%	50%	100.0%
Embodied Total							9,477,784			

Chapter 3
PRIVATE, PUBLIC AND REGIONAL ECONOMIC BENEFITS

INTRODUCTION

This chapter summarizes the main PCC 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 NPV, RR, and B/C ratio, and 4) the regional economic benefits.

ANNUAL BENEFITS

Higher Student Earnings

The annual benefits are summarized in **Tables 3.1** and **3.2**. We begin with earnings growth in **Table 3.1**. Last year, each student completed, on average, 8.7 CHEs at PCC (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, simply to acquire certain skills that will increase their productivity in the workforce. A total of 94,334 students will capture $101.2 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 $12.0 , $3.9 , and $10.0 million (rounded). In **Table 3.2**, these same results are presented in greater detail—health-related absenteeism will decline by 43,366 days per year, translating to a total of 167 years' worth of productivity gained per year (based on 260 workdays per year). Annual total dollar savings from reduced absenteeism days equals $4.5 million. There will

be 1,511 fewer smokers and 388 fewer alcohol abusers, amounting to annual total dollar savings of $4.48 and $3.1 million, respectively, inclusive of insurance premiums, personal payments, and withholding for Medicare and Medicaid.

Crime-Related Savings

There will be 616 fewer people incarcerated as a result of the higher education obtained, saving the taxpayers a grand total of some $6,414,731 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 $82,415 per year (inclusive of arrest, prosecution, incarceration, and rehabilitation).[14] Fewer people incarcerated means more people gainfully employed—this translates to $2,203,090 in additional annual earnings for the local community. Victim costs will be reduced by $1,347,160 per year.

Welfare and Unemployment Savings

There will be 1,050 and 397 fewer people on welfare and unemployment, respectively, in the community. The corresponding total dollar savings for the local community amounts to $3,882,365 ($304,924 welfare + $3,577,441 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 $25.9 million in public savings per year in the community—the sum of all health, crime, and welfare/unemployment benefits in **Table 3.2.**

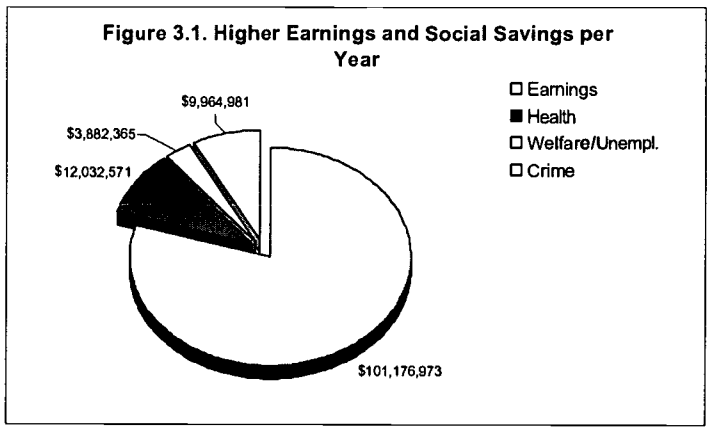
Table 3.1 Student Body Achievements, Higher Earnings

		Social (External Benefits)			
Level of Education	Higher Earnings	Improved Health	Lower Welfare Unemployment	Lower Crime	Total
< HS/GED	$5,133,914	$453,776	$469,002	$361,811	$6,418,502
HS/GED equivalent	$6,202,476	$480,979	$388,472	$317,762	$7,389,688
1 year post HS or less	$47,469,191	$5,974,286	$2,475,188	$8,626,547	$64,545,212
2 years post HS or less	$28,926,832	$2,064,318	$396,816	$324,436	$31,712,403
AD	$13,444,561	$3,069,212	$152,887	$334,425	$16,991,085
Total	$101,176,973	$12,032,571	$3,882,365	$9,964,981	$127,056,890

[14] The calculation is as follows: 616 not incarcerated x $82,415 x 4.0 years / 33.3 years to retirement from Table 2.9 = $381,217 .

Table 3.2. Summary of Annual Benefits

	Units	Earnings	Social Savings
Higher earnings	NA	$101,176,973	
Health benefits			
Absenteeism savings (days)	43,366	NA	$4,470,357
Fewer smokers, medical savings (# persons)	1,511	NA	$4,475,993
Fewer alcohol abusers (# persons)	388	NA	$3,086,221
Crime benefits			
Incarceration savings (# persons)	616	NA	$6,414,731
Crime victim savings	NA	NA	$1,347,160
Added productivity (fewer incarcerated)	NA	NA	$2,203,090
Welfare/unemployment benefits			
Welfare savings (# persons)	1,050	NA	$304,924
Unemployment savings (# persons)	397	NA	$3,577,441
Total		$101,176,973	$25,879,917



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**. On average, students capture: a) $133 per year in higher earnings per CHE,[15] and b) $1,161 per year in higher earnings per student on the basis of the number of CHEs completed. **Converted to a**

[15] Thus, a student attending for 10 CHEs will add $1,331 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.

Table 3.3. Annual $ per Credit and Student

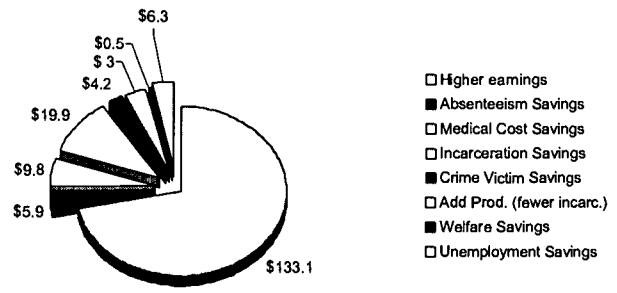
	Per Credit	Per Student	Annualized
Higher earnings	$133	$1,161	$3,993

full-year-equivalent (30 CHEs), the annual earnings would amount to $3,993 per student. On average, the social benefits per CHE range from a low of $1 for Welfare Savings to a high of $20 per CHE for Incarceration Savings. On a per student basis, they range from a low of $5 per student for Welfare Savings to a high of $174 for Incarceration Savings. On a full-year equivalent basis (30 CHEs), the social savings would amount to $1,585 per student (the total of $5,578 less $3,993 of higher private earnings as indicated in **Table 3.3**).

Table 3.3. Annual $ per Credit and Student

	Per Credit	Per Student	Annualized
Higher earnings	$133	$1,161	$3,993
Absenteeism Savings	$6	$51	$176
Medical Cost Savings	$10	$86	$294
Incarceration Savings	$20	$174	$597
Crime Victim Savings	$4	$36	$125
Add Prod. (fewer incarc.)	$6	$55	$188
Welfare Savings	$1	$5	$16
Unemployment Savings	$6	$55	$188
Total	$186	$1,622	$5,578

Figure 3.2. Annual Benefits per Credit



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 CC-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.[16]

The investment analysis results are shown in **Table 3.9** (in the aggregate, per CHE and per student). The end results sought are the **Net Present Value (NPV)**, **Rate of Return (RR)**, the **Benefit/Cost (B/C)** ratio and the **Payback Period**.[17] 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.

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 and local tax revenues (from increased regional income), and savings from reduced state and local government expenditures for incarceration, health and welfare.

[16] Future benefits are worth less than present benefits. The present value of $5,000 to be received 30 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 30 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.

[17] The criteria for feasibility: a) NPV must be positive or equal to zero; b) RR must be equal to or greater than the returns from other similar risk investments; c) the B/C ratio must be equal to or greater than 1; and d) the payback period is the number of years of benefits required to fully recover the investment made.

Table 3.4. Some Definitions

Definitions	
Student 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 & local government tax collections plus lower state & local govt. exp. related to health, crime, welfare and unemployment
Student Costs	Tuition (**Table 2.1**) + opportunity cost of time
Taxpayer Costs	Taxes (state and local, see **Table 2.1**)
Results:	
Student Perspective	Private Benefits / Private Costs
Taxpayer Perspective: Broad	Public Benefits (Broad) / Public Costs
Taxpayer Perspective: Narrow	Public Benefits (Narrow) / Public Costs

On the cost side, **student costs** consist of the tuition paid by the students (17% 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 (6% in the case of PCC). The **taxpayer costs** consist of the state and local tax items in **Table 2.1**, or a total of 50% plus 18% = 68%.

The opportunity cost (earnings foregone) incurred by the student body in the aggregate is estimated in **Table 3.5**. Beginning with the overall average statistical annual income of the student body (given gender and ethnicity characteristics), we first deduct the retired student body (2.3%) to arrive at the net number of students subject to opportunity cost calculations— 92,164 students. The 22,672 students **not working** are charged the full opportunity cost of time, or $180,838,328 . The 69,492 **working** students are charged only a fraction of the full opportunity cost (65%), or $196,213,996 as indicated in the table. Finally, we adjust the opportunity cost downward by the Pell and other student aid grants and the estimated 10%adjustment for the restricted use of these grants for tuition and fees.

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

			Opp. Cost
Avg. statistical annual income of given gender and ethncity profile		$27,429	
CHEs per student (net of retired)	8.7		
Avg. term in residence and avg. income while in residence	29%	$7,976	
Total number of students		94,334	
Less retired %	2.3%	2,170	
Remaining students subject to opportunity cost computation		92,164	
Students not working while attending college and opportunity cost	25%	22,672	$180,838,328
No. of working students		69,492	
% working part time, earnings relative to stat. averages, and opp. cost	65%	$2,824	$196,213,996
Total opportunity cost			$377,052,324
Pell and other student aid		$11,146,662	
Restricted portion of student aid (tuition and fees)	10%	$1,114,666	($10,031,996)
GRAND TOTAL STUDENT OPPORTUNITY COST			$367,020,328

We also present the results in different ways. **First**, the student perspective results indicate whether the PCC 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 and local 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 and local taxpayer investments of $86,515,355 (**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 CC, and follows them over the course of their assumed working life of 30 years or so. The upward trend in earnings reflects an assumed 0.5% per year real increase in earnings over the course of their careers. 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 PCC make economic sense for the students? The answer is a resounding yes. The future stream of benefits (higher earnings) accruing to

the students has an NPV of $1,364,509 **(Table 3.6)**—a positive NPV (greater than zero) indicates that the investments made are strongly feasible. The B/C ratio of 4.6 is strongly positive since the ratio is well above 1. The RR of 25.6% 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 PCC student will be substantially better off attending the college. The payback period for a student (tuition plus the earnings foregone) is 5.0 years—the higher earnings received beyond that period are pure economic rent—or a persistent earnings flow over and beyond the initial investments.

Table 3.6. Student Earnings ($ Thousands)

Year	1 Higher Earnings Gross	2 Higher Earnings Net	3 Cost	4 Net Cash Flow
1	$58,052	$52,247	$395,809	($343,562)
2	$58,342	$52,508	$0	$52,508
3	$105,888	$95,299	$0	$95,299
4	$106,417	$95,776	$0	$95,776
5	$106,949	$96,255	$0	$96,255
6	$107,484	$96,736	$0	$96,736
7	$108,022	$97,219	$0	$97,219
8	$108,562	$97,706	$0	$97,706
9	$109,105	$98,194	$0	$98,194
10	$109,650	$98,685	$0	$98,685
11	$110,198	$99,178	$0	$99,178
12	$110,749	$99,674	$0	$99,674
13	$111,303	$100,173	$0	$100,173
14	$111,860	$100,674	$0	$100,674
15	$112,419	$101,177	$0	$101,177
16	$112,981	$101,683	$0	$101,683
17	$113,546	$102,191	$0	$102,191
18	$114,114	$102,702	$0	$102,702
19	$114,684	$103,216	$0	$103,216
20	$115,258	$103,732	$0	$103,732
21	$115,834	$104,250	$0	$104,250
22	$116,413	$104,772	$0	$104,772
23	$116,995	$105,296	$0	$105,296
24	$117,580	$105,822	$0	$105,822
25	$118,168	$106,351	$0	$106,351
26	$118,759	$106,883	$0	$106,883
27	$119,353	$107,417	$0	$107,417
28	$119,949	$107,954	$0	$107,954
29	$120,549	$108,494	$0	$108,494
30	$121,152	$109,037	$0	$109,037
31	$121,758	$109,582	$0	$109,582
32	$122,366	$110,130	$0	$110,130
33	$122,978	$110,680	$0	$110,680
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		$1,745,094	$380,585	$1,364,509
IRR				25.6%
B/C ratio				4.6
Payback (years)				5.0

The Broad Taxpayer Perspective

Table 3.7 assesses one year's operation of PCC from the broad taxpayer perspective. The taxpayers must weigh requests for PCC 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 **Volume 2: Detailed Results, Table 19**. Column 2 is the same as column 1, save for the deduction of direct earnings at the PCC campus itself—the broad taxpayer perspective is conservative in the sense that it includes only off-campus earnings as part of public benefits. Column 3 shows the single year state and local taxpayer cost, as reflected in state and local tax items in **Table 2.1**. Finally, Column 4 considers the broad perspective on the taxpayer's investment in a cash flow sense, subtracting annual costs from annual benefits.

The NPV given this broad perspective is $1,936 million and the B/C ratio is 24.3. More succinctly, every dollar of tax monies spent on PCC education will generate a total of $24.27 worth of social savings. The corresponding RR of >100% is also indicative of a very strong investment relative to alternative investment opportunities in the economy.[18] The payback period from this broad perspective is less than 1 year, indicating that all investments made by the taxpayers will be fully recovered as early as the 1st year.

[18] 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 purposes of the reports prepared for all colleges in the statewide system, therefore, we express all results exceeding 100% simply as: "> 100%" (particularly for the broad taxpayer perspective where high returns are expected).

Table 3.7. Taxpayer Perspective: Broad ($ Thousands)

Year	1 All Benefits	2 Less CC Direct Earnings	3 Total Taxpayer Costs	4 Less CC Income Cash Flow
1	$195,267	$127,042	$86,515	$40,526
2	$77,580	$77,580	$0	$77,580
3	$118,799	$118,799	$0	$118,799
4	$118,226	$118,226	$0	$118,226
5	$117,655	$117,655	$0	$117,655
6	$117,088	$117,088	$0	$117,088
7	$116,523	$116,523	$0	$116,523
8	$115,961	$115,961	$0	$115,961
9	$115,403	$115,403	$0	$115,403
10	$114,846	$114,846	$0	$114,846
11	$114,293	$114,293	$0	$114,293
12	$113,743	$113,743	$0	$113,743
13	$113,195	$113,195	$0	$113,195
14	$112,650	$112,650	$0	$112,650
15	$112,108	$112,108	$0	$112,108
16	$111,568	$111,568	$0	$111,568
17	$111,032	$111,032	$0	$111,032
18	$110,497	$110,497	$0	$110,497
19	$109,966	$109,966	$0	$109,966
20	$109,437	$109,437	$0	$109,437
21	$108,911	$108,911	$0	$108,911
22	$108,388	$108,388	$0	$108,388
23	$107,867	$107,867	$0	$107,867
24	$107,349	$107,349	$0	$107,349
25	$106,834	$106,834	$0	$106,834
26	$106,321	$106,321	$0	$106,321
27	$105,810	$105,810	$0	$105,810
28	$105,303	$105,303	$0	$105,303
29	$104,797	$104,797	$0	$104,797
30	$104,295	$104,295	$0	$104,295
31	$103,795	$103,795	$0	$103,795
32	$103,297	$103,297	$0	$103,297
33	$102,802	$102,802	$0	$102,802
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	$2,084,729	$2,019,128	$83,188	$1,935,940
IRR				>100%
B/C ratio				24.3
Payback (years)				less than 1 year

The Narrow Taxpayer Perspective

Table 3.8 provides an investment analysis of PCC from the narrow taxpayer perspective. Recall from **Chapter 2** that the narrow perspective considers only moneys that actually appear on the books of state and local governments: revenue items such as tax receipts, and expenditures 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 and local government revenues stemming from the operation of PCC during the single analysis year. The values in column 1 are computed by applying average state and local government tax rates to the net increase in regional income attributed to PCC.[19] Also included in column 1 are reductions (entered as negatives) in state and local 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 PCC during the single analysis year.

Column 2 is simply the state and local government expenditure in support of PCC for the analysis year, a value obtained directly from **Table 2.1**. Finally, column 3 subtracts state and local government cost (column 2) from benefits (column 1), thereby providing the temporal cash flow needed for the investment analysis. As shown at the bottom of the table, PCC provides state and local government with an annual return of $280.0 million expressed as a net present value on its one-year investment. Alternatively, the one-year investment generates a 34.9% RR and a B/C ratio of 4.4, both indicating that the investment is attractive. The payback period is 3.9 years.

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 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.

[19] Increased regional income includes a portion of direct student earnings, 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.

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, PCC 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, i.e., the inflows (plus reduced outflows) exceed actual outflows. The practical effect of this is the following: If the investments made in PCC were reduced, taxes would have to be raised in order for state and local governments to continue their support of other activities at current levels. Because PCC's operations generate the kinds of direct returns it does, the taxpayer investments of 68%of the total budget in **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 PCC.

Table 3.8. Taxpayer Perspective: Narrow ($ Thousands)

Year	1 Total Taxpayer Benefits	2 Total Taxpayer Costs	3 Net Cash Flow
1	$32,313	$86,515	($54,203)
2	$14,531	$0	$14,531
3	$20,741	$0	$20,741
4	$20,641	$0	$20,641
5	$20,542	$0	$20,542
6	$20,443	$0	$20,443
7	$20,345	$0	$20,345
8	$20,247	$0	$20,247
9	$20,150	$0	$20,150
10	$20,053	$0	$20,053
11	$19,957	$0	$19,957
12	$19,861	$0	$19,861
13	$19,766	$0	$19,766
14	$19,671	$0	$19,671
15	$19,576	$0	$19,576
16	$19,482	$0	$19,482
17	$19,389	$0	$19,389
18	$19,296	$0	$19,296
19	$19,203	$0	$19,203
20	$19,111	$0	$19,111
21	$19,019	$0	$19,019
22	$18,928	$0	$18,928
23	$18,837	$0	$18,837
24	$18,747	$0	$18,747
25	$18,657	$0	$18,657
26	$18,567	$0	$18,567
27	$18,478	$0	$18,478
28	$18,390	$0	$18,390
29	$18,302	$0	$18,302
30	$18,214	$0	$18,214
31	$18,127	$0	$18,127
32	$18,040	$0	$18,040
33	$17,953	$0	$17,953
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	$363,222	$83,188	$280,034
IRR			34.9%
B/C ratio			4.4
Payback (years)			3.9

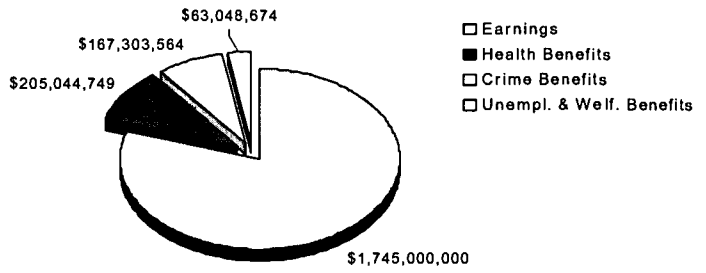
Summary

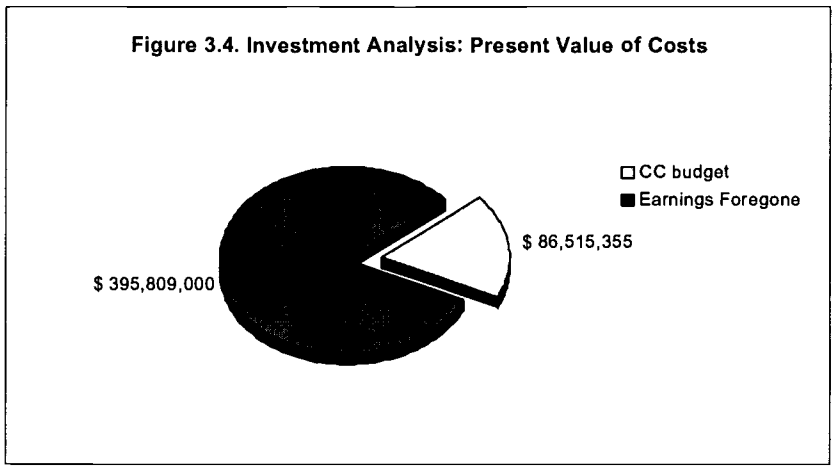
A summary of the investment analysis results (also reported in **Tables 3.6 – 3.8** above) is provided in **Table 3.9,** on aggregate, per CHE, and per student bases.

Table 3.9. Benefit - Cost Summary

	Aggregate	Per Credit	Per Student
PV of private benefits, increased earnings	$ 1,745,000,000	$2,149	$ 18,498
Health benefits, captured by society			
PV of absenteeism savings	$ 76,770,133	$95	$ 814
PV of tobacco and alcohol abuse medical savings	$ 128,274,616	$158	$ 1,360
Crime			
PV of reduced incarceration	$ 108,810,343	$134	$ 1,153
PV of reduced victim costs	$ 22,851,294	$28	$ 242
PV of earnings (opportunity gained)	$ 35,641,926	$44	$ 378
Unemployment and welfare			
PV of reduced welfare rolls	$ 5,172,294	$6	$ 55
PV of reduced unemployment	$ 57,876,381	$71	$ 614
Sum of all present values, benefits	$ 2,180,396,987	$ 2,685	$ 23,114

Figure 3.3. Investment Analysis: Present Value of Benefits



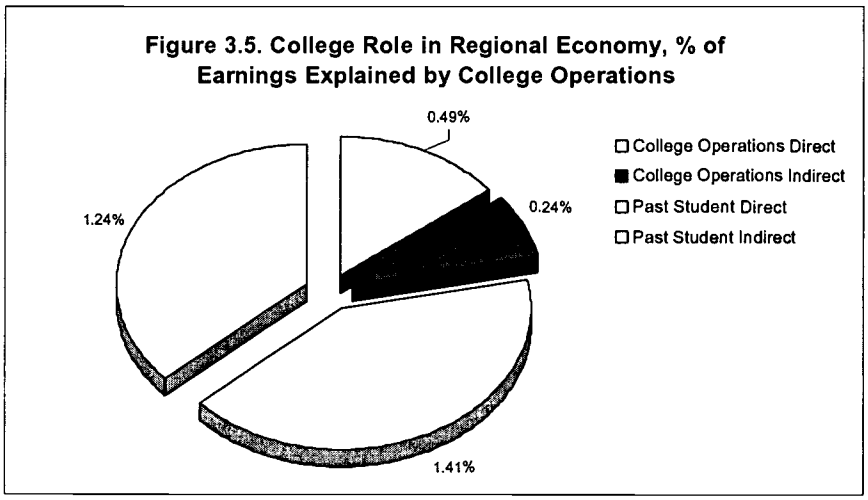


REGIONAL ECONOMIC BENEFITS

Pima Community College plays an important role in the health, growth and development of the regional economy. This section estimates that role and expresses it as a gross share of region-wide earnings. As indicated in **Table 3.10**, region-wide earnings in the Pima County Community College District economic region amount to $14.00 billion (Regional Information System, U.S. Department of Commerce).

Table 3.10. Summary of College Role in the Regional Economy

	Earnings ($Thousands)	% of Total
Total Earnings in College-Hosting Region	$13,995,960	100%
Earnings Attributable to College Operations		
Direct Earnings of Faculty and Staff	$68,226	0.5%
Indirect Earnings	$34,095	0.2%
TOTAL	$102,320	0.7%
Earnings Attributable to Past Student Econ. Dev. Effects		
Direct Earnings	$196,806	1.4%
Indirect Earnings	$173,452	1.2%
TOTAL	$370,258	2.6%
GRAND TOTAL	$472,578	3.4%



PCC Operations

As shown in **Table 3.10**, the direct earnings of faculty and staff are equal to $68.2 million per year, and thus account for 0.5% of region-wide earnings. Multiplier effects, from the spending of faculty and staff salaries and from PCC's purchase of local goods and services, account for another $34.1 million, or 0.2% of region-wide earnings. Altogether, PCC operations directly or indirectly account for $102.3 million per year, or 0.7% of region-wide earnings.

Past Student Economic Development Effects

Past students provide skills that attract new industry and make existing industry more competitive and productive. Accounting for retirement, out-migration and death, we estimate that the current Pima Community College workforce embodies 9.5 million CHEs of past instruction (see **Table 2.12**). As shown in **Table 3.10**, these directly account for $196.8 million, or 1.4% of region-wide earnings.

Associated with the increased earnings of past PCC students is a collection of *demand-induced* and *agglomeration-induced* indirect effects. As shown in **Table 3.10**, these indirect effects account for $173.5 million, or 1.2% of region-wide earnings.

Total Regional Economic Benefits

Finally, the overall role of PCC in the regional economy is equal to the sum of the direct and indirect effects. Accordingly, the college accounts for $472.6 million, or 3.4% of region-wide earnings.

Chapter 4
SENSITIVITY ANALYSIS OF KEY VARIABLES

INTRODUCTION

We conclude this study with a **base case** sensitivity analysis of some key variables on both the investment and regional economic development sides. The purpose of the sensitivity analysis is to set our approach apart from "advocacy" education impact analyses. Many of these may lack uniformity and use assumptions that will not stand up to rigorous peer scrutiny, and 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.**

INVESTMENT ANALYSIS: THE STUDENT PERSPECTIVE

The variables tested relate to the earnings foregone by the students—the opportunity cost of time. They include: 1) the % of the students employed, and 2) of those employed, the earnings received relative to the full earnings they would have received if not attending PCC. These affect the investment analysis manifested in the results (NPV, RR, B/C, and payback period).

Percent of Students Employed

The students incur substantial expense by attending PCC because of time spent not gainfully employed. Some of that cost is recaptured if the student remains partially (or fully) employed while attending PCC. It is estimated that 75% of the current student body is employed. In the sensitivity analysis this variable is tested by changing this assumption to 100%. The revised assumption would mean that *all* of the students are employed, thus the average opportunity cost of time would be reduced accordingly.

Percent of Earnings Relative to Full Earnings

The second opportunity cost variable is more difficult to estimate. For PCC it is estimated that, of the students working while attending classes, their earnings amounted to only 65%, on average, relative to earnings they would have statistically received if not attending the CC. 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. In the sensitivity analysis this variable also is tested by changing the assumption to 100%. As above, this would mean that the students are fully employed, and the average opportunity cost of time would be reduced accordingly.

RESULTS

The changed results are summarized in **Table 4.1**. Here, the base case assumptions are reflected in the two shaded rows for the variables tested—75% for the portion of students employed, and 65% for their earnings relative to the statistical averages, taken from **Table 2.2**. 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 75% to 100% first (holding all of the other assumptions constant), the RR, B/C, and payback period results would improve to 37.3%, 6.5, and 3.8 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 65% to 100% second (holding the second employment assumption constant at the base case level), the RR, B/C, and payback period results would improve to 54.8%, 9.1, and 3.0 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 RR, B/C, and payback period results would improve yet further to >100%, 96.8, and 1.3 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 not realistic, albeit not uncommon for advocacy analyses.

Table 4.1 Sensitivity Analysis of Student Perspective

Variables	Assumptions	RR	B/C	Payback
1. Percent	75%	25.6%	4.6	5.0
Employed	100%	37.3%	6.5	3.8
2. Percent of	65%	25.6%	4.6	5.0
Earnings	100%	54.8%	9.1	3.0
1 = 100%, 2 = 100%		>100%	96.8	1.3

A final note to this student perspective sensitivity analysis—we strongly emphasize that the results, given the assumptions, 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 PCC will generate excellent returns, well above the long-term average percent rates of return in the stock and bond markets of roughly 7%.

REGIONAL ECONOMIC DEVELOPMENT

We estimated the regional economic impacts of PCC in **Chapter 3, Table 3.10** based on college operations and capital spending, and the increased productivity effects of past PCC students in the regional workforce. The impacts were expressed in terms of regional earnings, i.e., area wages, salaries and proprietors' income, published by the U.S. Department of

Commerce.[20] In the present section we address two issues that occasionally arise in college economic impact studies: 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 and 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 **Table 3.10**, 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, absent the college, some students will leave the region to obtain an education elsewhere. Thus, the region loses the spending and related jobs and incomes. Both cases have merit, although we believe the former more so than the latter. This is because only a few students will actually be able to avail themselves of 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 PCC region economy. The table parallels **Table 3.10** in the previous chapter, but adds the section "Earnings Attributable to Student Spending,"[21]

[20] U.S. Department of Commerce, Regional Economic Information System (REIS) data include earnings estimates for counties and states, and are published annually in the *Department's Survey of Current Business*. They are also readily available in electronic form.

[21] 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 PCC regional economy input-output model. Adjustments were made consistent with the model's regional accounts to allow for spending leakages.

creating some $194.3 million in additional earnings for the local businesses patronized by students (the direct effects), plus another $68.7 million in earnings stemming from related multiplier effects (indirect effects). Adding the student spending to the mix increases the PCC total "explanatory power" of the regional earnings from 3.4% in **Table 3.10** to 5.3% in **Table 4.2.**

Table 4.2. Summary of College Role in the Regional Economy

	Earnings ($ Thousands)	% of Total
Total Earnings in College-Hosting Region	$13,995,960	100%
Earnings Attributable to Student Spending		
Direct Earnings	$194,314	1.4%
Indirect Earnings	$68,665	0.5%
TOTAL	$262,979	1.9%
Earnings Attributable to College Operations		
Direct Earnings of Faculty and Staff	$68,226	0.5%
Indirect Earnings	$34,095	0.2%
TOTAL	$102,320	0.7%
Earnings Attributable to Past Student Econ. Dev. Effects		
Direct Earnings	$196,806	1.4%
Indirect Earnings	$173,452	1.2%
TOTAL	$370,258	2.6%
GRAND TOTAL	$735,557	5.3%

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. But gross sales used as an impact measure has notable drawbacks. 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:

> Two visitors spend $50,000 each in the economic region. One visits a local auto dealer and purchases a new luxury automobile. The other enters the county hospital for a medical procedure. 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 $9,000 remains in the county as salesperson commissions and auto dealer income (part of the county's overall earnings), while the other $41,000 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 less than one-fourth the impact of the latter.

Table 4.3 expresses the PCC 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 $35.3 billion.[22] Direct local spending by students reflects their total spending, reduced by the estimated portion that leaks out-of-region to purchase goods produced elsewhere.[23] 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 faculty and staff salaries. Both items are reduced to reflect purchases from outside the region. All told, the operation of PCC is estimated to explain some $1,525.4 million in regional gross sales, a number roughly twice the $735.6 million explained by the college in regional gross earnings shown in **Table 4.2**.

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

[23] 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.

Table 4.3. Summary of College Role in the Regional Economy

	Gross Sales (1,000)	% of Total
Total Gross Sales in College-Hosting Region	$35,327,316	100%
Gross Sales Attributable to Student Spending		
Direct Local Spending by Students	$346,654	1.0%
Indirect Spending Effect	$148,964	0.4%
TOTAL	$495,618	1.4%
Gross Sales Attributable to College Operations		
Direct Local Expenditures of CC	$58,746	0.2%
Indirect Spending Effect	$34,848	0.1%
TOTAL	$93,594	0.3%
Gross Sales Attributable to Past Student Econ. Dev. Effects		
Direct Gross Sales	$500,962	1.4%
Indirect Gross Sales	$435,246	1.2%
TOTAL	$936,208	2.7%
GRAND TOTAL	$1,525,421	4.3%

While the gross sales impacts shown in **Table 4.3** are not incorrect, we prefer to report college impacts in terms of earnings in **Table 3.10** rather than gross sales because they reflect the economic realities in the local community much more so than the sales numbers. 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 peer scrutiny in the economics profession.

REFERENCES

Bils, M. and P.J. Klenow, 2000. Does Schooling Cause Growth? American Economic Review, 90(5), 1160-1183.

Bonczar, Thomas P. and Alan J. Beck, 1997. Lifetime Likelihood of Going to State or Federal Prison. US Department of Justice, Office of Justice Programs, March 1997.

Borts, G. H., and J. L. Stein, 1964. Economic Growth in a Free Market. NY: Columbia University Press.

Cato Institute; Policy Analysis 240, 1995. Authors: Michael Tanner, Stephen Moore, and David Hartman. The Work Versus Welfare Tradeoff, An Analysis of Total Welfare Benefits by State.

Centers for Disease Control and Prevention; National Center for Health Statistics, Health, United States, 2001, Table 61.

The Center for Health Statistics, Health Promotion and Disease Questionnaire of the 1990 National Health Interview Survey.

Christaller, 1966; Central Places in Southern Germany (C.W. Baskins, trans.). Englewood Cliffs, N.J., Prentice Hall.

Christophersen, Kjell A., and H. Robison, 2000. The Socioeconomic Benefits of Community Colleges, Illustrated with Case Studies of Everett Community College and Walla Walla Community College in Washington State. Volume 1: Summary Report. EMSI, Consulting Economists.

Drake, R. L. 1976. A Shortcut to Estimates of Regional Input - Output Multipliers: Methodology and Evaluation. International Regional Science Review, Vol. 1, No. 2, Fall 1976.

Grubb, Norton, CCRC Brief No. 2, ICCN 15-26-2049, June 1999.

Heritage Foundation, Means-Tested Welfare Spending: Past and Future Growth, Testimony by Robert Rector, (3/07/01), http://www.heritage.org/library/testimony/test080101.html.

Losch, 1954. The Economics of Location (W.H. Woglom and W.F. Stolper, trans.). New Haven: Yale University Press.

Miller, R.E. and P. Blair. 1985. Input-Output Analysis: Foundations and Extensions. Englwood Cliffs, NJ: Prentice Hall.

Molitor, Chris and D. Leigh. March 2001. Estimating the Returns to Schooling: Calculating the Difference Between Correlation and Causation. Discussion Paper prepared for CCbenefits, Inc.

National Center for Education Statistics, The Digest of Education Statistics: 2000, 1990 K Street, NW, Washington, DC 20006, USA, Phone: (202) 502-7300, http://nces.ed.gov/pubs2001/digest/list_figures.html.

National Center for Education Statistics, Literacy Behind Walls, Prison Literacy Programs, DIGEST No. 159 Literacy in Corrections, Correctional Educational Association, http://www.nifl.gov/newworld/correct.htm.

National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, http://www.nida.nih.gov/EconomicCosts/Index.html

Parr, J.B. 1999. "Regional Economic Development: An Export-Stages Framework." Land Economics, 77(1): 94-114.

Robison, M.H. 1997. "Community Input-Output Models for Rural Area Analysis: with an Example from Central Idaho," Annals of Regional Science, 31(3), 325-351.

Stevens, B.H., G.I. Treyz, D.J. Ehrlich, and J.R. Bower, 1983. "A New Technique for the Construction of Non-Survey Regional Input-Output Models," International Regional Science Review, 8(3), 271-186.

University of Illinois, Institute of Government and Public Affairs, 2000. Illinois Higher Education: Building the Economy, Shaping Society. Illinois Board of Hugher Education.

US Census Bureau, Current Population Survey, 2000.

US Dept. of Commerce, Regional Economic Information Systems, Zip Code Business Patterns, 1998.

US Dept. of Commerce, US Bureau of the Census, 1998. Money Income of the United States 1998, Current Population Reports, Household and Economic Statistics Division.

U.S. Department Of Health And Human Services,Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Data Services, Hyattsville, MD, 20782-2003, (301) 458-4636, http://www.cdc.gov/nchs/.

US Dept. of Commerce, County Business Patterns, annual.

US Dept. of Commerce, Regional Economic Information System, county data on CD ROM, annual.

US Department of Commerce Statistical Abstract, 1997-1999.

The National Clearinghouse for Alcohol and Drug Information 11426 Rockville Pike, Suite 200, Rockville, Maryland, http://www.health.org/govstudy/bkd265/Index.htm

National Institute on Alcohol Abuse and Alcoholism (NIAAA) 6000 Executive Boulevard - Willco Building Bethesda, Maryland 20892-7003, http://www.niaaa.nih.gov/

Bureau of Justice Statistics, Table #. 05 Total direct and intergovernmental expenditure, by activity and level of government, fiscal years 1980-97, Criminal Justice Expenditure and Employment Extracts Program, 12/14/00.

US Department of Labor, Bureau of Labor Statistics, Office of Employment and Unemployment, 2000.

US Department of Labor, The Public Purpose: U.S. Employee Absences by Industry, 2000.

U.S. Department of Treasury, The Economic Costs of Smoking in the United States and the Benefits of Comprehensive Tobacco Legislation http://www.ustreas.gov/press/releases/docs/tobacco.pdf.

Appendix 1: 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.

Table 1. Costs and Benefits

	Tuition	Opportunity Cost	Total cost	Higher Earnings	NCF
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 period					4.2 years

The assumptions are as follows:

1) 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 CC for one year for which he or she pays a tuition of $1,500 (column 2).

3) The opportunity cost of time (the earnings foregone while attending the CC 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 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: a) to attend the CC, or b) 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 $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.[24] A brief example: at 4%, the present value of $5,000 to be received one year from today is $4,807. If the $5,000 were to be received in year 10, the present value would reduce to $3,377. 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 10 years. An "economically rational" person would, therefore, be equally satisfied receiving $3,377 today or $5,000 10 years from today given the going rate of interest of 4%. The process of discounting—finding the present value of future higher earnings—allows us 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 NPV result 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 NPV 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 CC education is very strong.

THE INTERNAL RATE OF RETURN (IRR)

The IRR is another way of measuring the worth of the investment in education using the same cash flows shown in **Table 1**. In technical terms—

[24] 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 IRR 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 NPV equal to zero. In the NPV example above we applied the "going rate" of interest of 4% and computed a positive NPV of $15,074. The question now is: what would the interest rate have to be in order to reduce the NPV 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 NPV would reduce to zero.

What does this mean? The IRR of 18% defines a breakeven solution—the point where the present value of benefits just equals the present value of costs, or where the NPV equals zero. Or, at 18%, the higher incomes of $5,000 per year for the next 9 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 NPV 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 CC 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 IRR, but it would be a staggering 333% because only a negative $1,500 cash flow will be offsetting 9 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: "> than 100%."

THE BENEFIT/COST RATIO (B/C)

The B/C ratio is simply the present value of benefits divided by present value of costs, or $35,747 / $21,500 = 1.7 (based on the 4% discount rate). Of course, any change in the discount rate will also change the B/C ratio. If we applied the 18% IRR discussed above, the B/C ratio would reduce to 1.0—or the breakeven solution where benefits just equal the costs. Applying a discount rate higher than the 18 percent 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 10-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) before 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 CC. 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, the stronger the investment.

Appendix 2: 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) Educational attainment by mean income 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: a) Income Surveys Branch, b) Housing & Household Economic Statistics Division, c) U.S. Census Bureau, and d) 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 are calculated as a percent of all races.

2. 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.

4. To simplify the analysis, all nonwhite males are averaged together as are all nonwhite 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 colleges. These numbers are then adjusted for inflation to 2001 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 calculated earlier.

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