

THE VALUE OF HIGHER EDUCATION: INDIVIDUAL AND SOCIETAL BENEFITS

October 2005

Kent Hill, Ph.D.

**Research Professor, Department of Economics; and Principal Research Economist,
L. William Seidman Research Institute**

Dennis Hoffman, Ph.D.

**Professor, Department of Economics; Director, L. William Seidman Research Institute;
and Director, Office of the University Economist**

Tom Rex, M.B.A.

**Associate Director, Center for Competitiveness and Prosperity Research;
and Manager of Research Initiatives, Office of the University Economist**

**P³ | PRODUCTIVITY AND
PROSPERITY PROJECT**

ASU W. P. CAREY
SCHOOL of BUSINESS
ARIZONA STATE UNIVERSITY

**THE VALUE OF HIGHER EDUCATION:
INDIVIDUAL AND SOCIETAL BENEFITS
(With Special Consideration for the State of Arizona)**

**A Report from the Productivity and Prosperity Project (P3),
Supported by the Office of the University Economist**

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Center for Competitiveness and Prosperity Research
L. William Seidman Research Institute
W. P. Carey School of Business
Arizona State University
Box 874011
Tempe, Arizona 85287-4011

(480) 965-5362

FAX: (480) 965-5458

EMAIL: Dennis.Hoffman@asu.edu

wpcarey.asu.edu/research/competitiveness-prosperity-research
economist.asu.edu



PREFACE

The Value of Higher Education: Individual and Societal Benefits was undertaken under the broad research agenda of the *Productivity and Prosperity Project: An Analysis of Economic Competitiveness (P3)* at Arizona State University. *P3* is a new initiative led by existing faculty and research staff of the L. William Seidman Research Institute in the W. P. Carey School of Business at Arizona State University. Research affiliates from throughout the school and university may participate in projects that inform debate on a broad set of issues related to achieving economic prosperity for all citizens of Arizona. As part of *P3*, the role of individual initiative and incentives, labor markets, knowledge inputs, and development strategy in the creation of regional wealth and economic prosperity will be examined.

The analysis of the value of higher education contained in this report represents an important dimension of the *P3* research agenda since measuring the value of educated workers can provide empirical context for understanding the importance of an educated and skilled workforce in a modern economy. While increasing amounts of educational attainment are known by economists and sociologists to yield benefits, the absolute magnitude of the benefits sometimes is obscured by peripheral discussions regarding alternative education delivery methods, school choice, or appropriate funding mechanisms. Thus, it is important to document just how valuable education, specifically higher education, is for both individuals and society in general.

The economic value that accrues from those who earn four-year university degrees and graduate degrees is the focus of this report. Higher education influences economic well-being in other ways as well. The economic impacts of expenditures by institutions, their employees, and their students already have been well documented. The benefits of knowledge creation — research and development — at universities will be the subject of a forthcoming report undertaken by the *P3* research agenda.

In this report, the increases in individual earnings realized from enhanced educational attainment are measured and the benefits to the economy and society in general that are provided by a highly educated workforce are examined. Higher education enrollment and financing and educational attainment in Arizona are compared to the national average and to other states. Factors influencing the location decisions of highly educated individuals are reviewed. Finally, policy options that might result in enhanced educational attainment in Arizona are presented.

The analysis and conclusions provided in this report reflect a broad survey of the academic and policy report literature on this important contemporary issue as well as the expertise of faculty and staff in the L. William Seidman Research Institute. The authors acknowledge comments received from faculty of the Department of Economics and other university departments, staff of the Arizona Board of Regents, and support staff from the Seidman Institute. The authors assume responsibility for any errors and omissions.

Kent Hill
Dennis Hoffman
Tom Rex

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EXECUTIVE SUMMARY: THE VALUE OF HIGHER EDUCATION

- Higher education provides considerable value to individuals, the economies where educated individuals work and live, and society in general.

Private Returns

- Individual earnings are strongly related to educational attainment. People who have completed high school earn more than those who have not; people with a bachelor's degree earn more than those with only a high school diploma; and those with a graduate education earn more than those with only an undergraduate education.
- Average annual earnings of individuals with a bachelor's degree are more than 75 percent higher than the earnings of high school graduates. These additional earnings sum to over \$1 million over a lifetime.
- The differential in earnings based on educational attainment has increased over time. For example, for full-time male workers between the ages of 35 and 44, the earnings premium associated with having a bachelor's degree versus a high school diploma has risen from 38 percent in the 1980-84 period to 94 percent in 2000-03.
- The benefits to an individual from a university education vary with the quality of the institution attended. Those who graduate from an elite university earn substantially more than those who graduate from a lower-quality institution.
- To properly assess the economic value of a college education, the benefits realized in terms of higher future earnings must be discounted to adjust for the time value of money. The discounted earnings must then be weighed against the full costs of acquiring a college education including not only the tuition paid by the student, but the earnings foregone while the student is in college and the appropriations of state and local governments. When these calculations are made, the benefits of a college education are seen to be more than three times as large as the costs.
- If the value of a college education is expressed on the same basis as the return on a financial investment, the net return is on the order of 12 percent per year, over and above inflation. This compares favorably with annual returns on stocks that historically have averaged 7 percent.
- Despite the very high return on investment for the time and money spent on attaining a college degree, only one-quarter of the U.S. adult population has at least a bachelor's degree. Academic ability and information barriers limit the number of individuals who attain a university degree.
- Financial barriers to the completion of a bachelor's degree exist but government programs that promote access have been effective.
- The academic ability of the individual — which is shaped throughout his life by a variety of family and environmental factors — and the values and goals of the individual — which are strongly influenced by the education of his parents — are important determinants of educational attainment.

Societal Benefits

- Social benefits of a workforce with greater educational attainment and skills can be traced to the enhanced worker productivity associated with greater educational attainment. These productivity gains translate into higher output and incomes for the economy.

- Non-monetary societal benefits in regions with high proportions of college graduates include lower crime rates, greater and more informed civic participation, and improved performance across a host of socioeconomic measures.
- Intergenerational social benefits may be very large as degree attainment today translates into higher probabilities of degree attainment in future generations.
- Empirical work in econometrics suggests that after controlling for differences in amenities and individual wages, an increase in the share of college graduates in the labor force leads to significant increases in productivity and wages for all workers.
- A portion of this significant wage effect is attributable to spillovers that result from productivity gains. Simulations for Arizona using conservative estimates of these spillovers suggest that combining spillovers and individual benefits realized from a four-year college degree, degreed workers account for gross lifetime earnings that total \$1.6 to \$1.9 million more than workers with only a high school diploma.
- Accounting for costs of education and the time value of money, discounted lifetime net benefits from a university degree — including combined individual and societal benefits exceed \$600,000 per worker — a combined internal rate of return of about 16 percent.
- A statewide simulation designed to measure the impact of raising the share of college graduates in the labor force by 0.2 percent (the median annual rate of increase observed in the econometric studies) that used Arizona data on educational costs and wages reveals that total costs match benefits after about 11 years. After accounting for the time value of money, the payback period is about 13 years and the net discounted benefits (benefits less costs) that accrue after 20 years are estimated at \$364 million.
- Numerous estimates of the rate of return to investments in education prevail in the literature. Results suggest that significant portions of economic and job growth are attributable to human capital while discernible evidence of non-monetary benefits also is seen empirically.

Higher Education Enrollment and Finance

- Enrollment in degree-granting institutions of higher education in Arizona as a percentage of the state's population was about equal to the national average in 2003. Many Arizonans attend community colleges but do not complete a four-year degree.
- Combining both public and private institutions, total revenues and expenditures per student at Arizona institutions of higher education were far below the national averages in 2003, among the least in the nation. Among public institutions, Arizona's per student higher education revenues and expenditures were not as far below average, but still ranked among the bottom 10 states in the nation.
- Public financial support for higher education, as measured by government appropriations, was marginally higher in Arizona than the national per student average in 2003, with Arizona ranking just above the middle of the states. However, tuition and fees and other revenues were far below the per student average.
- Increases in public support for higher education per student have been nearly equal in Arizona and the nation.

Educational Attainment

- Arizona ranks in the middle of the states on the percentage of its residents possessing a bachelor's degree, slightly below the U.S. average. However, educational attainment has increased less in Arizona than the national average in recent decades.

- Arizona compares less favorably among labor force participants, since the state's overall educational attainment is bolstered by highly educated retirees who migrate to the state at retirement.
- The educational attainment of young adults in Arizona is substantially below the national average.
- Among those educated in Arizona and among immigrants to the state, educational attainment is relatively low. In contrast, the attainment of interstate migrants is considerably higher.

Geographic Distribution of the University-Educated Population

- To realize a high share of college graduates in its population, a region must either graduate a large number of people from local institutions of higher education or attract college graduates from other regions.
- Labor force participants with university degrees are highly mobile in terms of their residence. Thus, the number of university graduates from local institutions of higher education is not necessarily highly related to the number of college graduates living in a community.
- In any community, the retention of locally educated individuals and the attraction of highly educated people from other regions are heavily dependent on the availability of job opportunities appropriate for those with college degrees. Urban and natural amenities also are important to the attraction and retention of college graduates.
- National studies indicate that a statistically significant relationship exists between the number of new college graduates in a state and average educational attainment in the state's adult population. But the strength of this relationship appears modest.
- Studies find that if an additional 100 college-bound students choose to attend college in a given state, the long-run effect of raising the college-educated workforce in that state will be only 5-to-10 workers.

Policy Issues

- Despite the high rate of return to higher education, only one-quarter of the U.S. population has obtained a four-year college degree. Underinvestment in higher education occurs.
- Impediments to college degree attainment include family financial constraints, lack of academic skills necessary for success, and an apparent lack of knowledge or belief in the large effect that a college education has on an individual's future earnings.
- While policy interventions designed to address financial access are abundant, more attention may be needed to address the information and ability concerns
- Evidence does not exist that local production of graduates, in isolation, will be an effective economic development strategy. A portfolio approach — that incorporates higher education and that is aimed at quality workforce development, quality public infrastructure, an emphasis on quality of life and amenities, and efforts to attain and maintain business climate conducive to attracting quality employment opportunities — may yield the highest returns.

Overview

Higher education provides considerable value to individuals, to the economies where educated individuals live and work, and society in general. Economies that have experienced substantial investment in either private or public institutions of higher learning have realized considerable growth and prosperity.

Higher education influences economic well-being in three ways. First, the direct expenditures by the institutions, their employees, and their students impact the local economy. This spending multiplies through the local economy until the monies are used to purchase goods and services from outside the local area. Such economic impacts have been estimated at many institutions of higher education. For example, the total impact of Arizona State University was estimated at 37,000 jobs resulting in more than \$1 billion in wages each year. However, only the higher education revenues originating from outside the local economy — such as from National Science Foundation grants — and the spending of out-of-state students and their parents can be considered a unique economic impact of higher education.

Second, higher education provides financial and non-financial benefits to the individual who pursues an advanced education and to society in general. The average earnings of individuals are closely related to their educational attainment. In particular, those with a bachelor's degree earn substantially more than even those with some college education. Relative to those with a bachelor's degree, a postgraduate degree provides nearly as large a boost in earnings. In addition, society benefits from an educated populace. The average wage — even for those workers who do not possess much educational attainment — is higher in communities with a substantial proportion of highly educated workers. Various other benefits to society also are realized from enhanced educational attainment, such as a lower crime rate. This report provides a detailed analysis of the impacts of enhanced educational attainment.

Third, institutions of higher education are increasingly focused on knowledge creation. Thus, universities are sources of key research and development innovations that simultaneously can be beneficial to society and conducive to economic growth. This topic will be discussed in a future report of the *Productivity and Prosperity Project*.

Benefits to Individuals of Enhanced Educational Attainment

Individual earnings are directly related to educational attainment. Those with a high school diploma earn more than those who did not graduate from high school, those who received some college credits earn more than those whose education ended with a high school diploma, those with a bachelor's degree earn more than those with some college credits, and those with a graduate degree earn more than those with a bachelor's degree as their highest attainment. In particular, those with a bachelor's degree earn substantially more than those with some college credits. A postgraduate degree provides an additional boost in earnings.

Earnings vary widely with educational attainment. For example, 2000 census data revealed that average annual earnings of individuals with a bachelor's degree was from 74 to 87 percent higher (depending on age) than the earnings of individuals whose maximum educational attainment was a high school diploma. Over a career, an individual with a bachelor's degree earns on average in excess of \$1 million more than a counterpart with only a high school

diploma. Based on a cost-benefit analysis over a person's working life, the expected net return from an individual's payment of tuition and fees and foregone income while obtaining a bachelor's degree is in excess of 11 percent, a rate that compares favorably with real returns on most financial assets.

The differential in earnings based on educational attainment has increased over time. For example, for full-time male workers between the ages of 35 and 44, the earnings differential between those having a bachelor's degree and those with a high school diploma has risen from 38 percent in the 1980-84 period to 94 percent in 2000-03. This rising differential constitutes the principal evidence for the emerging "knowledge economy."

The benefits to an individual from a university education vary with the quality of the institution attended. In studies of universities, quality is defined by measures such as average faculty salaries and average test scores of entering freshmen. These studies generally find that the quality of the institution has a significant effect on the earnings of graduates later in life. Those who graduate from elite institutions earn substantially more than those who graduate from lower-quality institutions. Some evidence also exists that the value of a college education is higher for those who attend graduate degree-granting research institutions, such as Arizona State University.

A long-standing concern of researchers has been that individuals who are successful in school tend to have high cognitive and non-cognitive abilities and these abilities would have provided them with greater earnings capacity whether or not they chose to become highly educated. While controlling for innate ability when studying the effects of education on earnings is difficult, the consensus view of labor market researchers is that the effects of "ability bias" are small in data comparing educational attainment to earnings. The true benefit of educational attainment is not much below the estimate observed in a simple cross-tabulation of earnings and education.

Despite the very high return on investment for the time and money spent on attaining a college degree, only one-quarter of the U.S. adult population (28 percent of those 25-to-34 years old) has at least a bachelor's degree. Three barriers — financial, ability, and information — limit the number of individuals who attain a university degree.

The available evidence suggests that no more than 8 percent of the youth population fail to complete college simply because of a lack of financial resources, undoubtedly due in large part to government programs that help to ease financing burdens. A review of the literature reveals that the academic ability of the individual, which is shaped throughout his life by a variety of family and environmental factors, and the values and goals of the individual, which are strongly influenced by the education of his parents, are the main determinants of educational attainment. A lack of information on the costs and benefits of higher education may underlie these factors.

Societal Benefits of Enhanced Educational Attainment

In regions with a highly educated labor force, all workers — not just those with advanced educational achievements — receive higher wages than their counterparts in regions with lesser educational attainment. These monetary benefits have been measured using widely varying

techniques, such as by examining the economic performance of regions with different shares of college graduates in the labor force.

Recent research indicates that significantly higher wages are present in regions with greater shares of college graduates in the labor force. An extensive econometric analysis found that after controlling for other factors, a 1 percentage point increase in the labor force share of college graduates in a metropolitan area yields a 1.9 percent increase in the wages for high school dropouts, a 1.6 percent gain in the wages of high school graduates, and a 0.4 percent rise in the wages of the graduates themselves, over and above the average wage differential between individuals with college degrees and those with less education. One explanation for these higher wages in areas with higher educational attainment is the enhancement of productivity that comes with a workforce with more education and skills.

In a simulation that applied these wage estimates to Arizona data, a conservative estimate of the portion of this annual wage appreciation that occurs due to social spillovers is \$16,000 per university graduate. Adding social spillovers to the more than 11 percent expected net return received by individuals who have at least a bachelor's degree increases the net return to nearly 16 percent.

A second simulation was designed to measure the aggregate social costs and benefits of a program to permanently increase the labor force share of university graduates by 0.2 percent (the average annual increase measured in the econometric analysis) in Arizona, which amounts to about 4,500 workers as of 2005. After accounting for the time value of money and comparing the monetary costs and benefits, the payback period was estimated to be 13 years. After 20 years, discounted social benefits exceed discounted social costs by \$364 million. The net benefits would be higher if the costs were reduced by providing incentives for students to graduate in a timely fashion and to seek employment in Arizona after graduation from the university.

In addition to the monetary societal benefits of enhanced educational attainment, regions with greater shares of educated workers, especially highly educated workers, enjoy lower crime rates, have fewer demands placed upon social services, greater civic participation, and improved personal health. These benefits accrue to subsequent generations.

Empirical Data on Higher Education Enrollment and Finance

Enrollment in degree-granting institutions of higher education in Arizona as a percentage of the state's population was about equal to the national average in 2003. The Arizona figure was higher than the national average at private for-profit institutions, slightly greater than the national average at public institutions, but considerably below average at private not-for-profit institutions.

Total revenues and expenditures per student at Arizona institutions of higher education were far below the national averages in 2003, among the least in the nation. Among public institutions, Arizona's per student higher education revenues and expenditures were not as far below average, but still ranked among the bottom 10 states in the nation.

The ability to pay for education is below average in Arizona due to the state's subpar incomes. Thus, the state's higher education revenues and expenditures per student adjusted for income were not as far below the national average in 2003. Among public institutions, Arizona's per student revenues and expenditures were close to the national average, ranking near the middle of the states.

Public financial support for higher education, as measured by government appropriations, was marginally higher in Arizona than the national per student average in 2003, with Arizona ranking just above the middle of the states. Adjusted by the state's ability to pay, public support for higher education in Arizona was considerably higher in 2003 than the national average.

Increases in public support for higher education per student have been nearly equal in Arizona and the nation. However, the increases have not been as great as gains in the ability to pay, particularly in Arizona.

Empirical Data on Educational Attainment

As measured by the percent of the population 25 years and older with at least a bachelor's degree, educational attainment in Arizona is near average. Arizona ranked 25th among the states according to the 2000 census, with 23.5 percent possessing a bachelor's degree, slightly below the U.S. average of 24.4 percent.

However, Arizona compares less favorably among those in the labor force, since the state's overall educational attainment is bolstered by highly educated retirees who migrate to the state at retirement. The educational attainment of young adults (especially those than 35 years of age) in Arizona is considerably lower than the national average, while the attainment of those 65 or older is higher than average. The comparatively low attainment of young adults reflects both the below-average achievement of children educated in Arizona and the strong net in-migration of young, poorly educated people.

Among those born in Arizona and living in the state in 2000, the percentage of those 25 or older with a bachelor's degree was only 18 percent, just half of the figure of Arizona residents born elsewhere in the United States. Among those born in another country but living in Arizona in 2000, the share with a university degree was slightly higher than that of Arizona natives.

Educational attainment has increased in recent decades in every state. This has occurred primarily because of the deaths of the less-educated older generations. Educational attainment among young adults has increased only a little. Arizona's ranking among the states on the percentage with a bachelor's degree declined between 1980 and 2000, from 19th in 1980 to 24th in 2000. The state ranked just 39th on the change in educational attainment between 1980 and 2000.

The Geographic Distribution of the University-Educated Population

For a region to realize the benefits from a highly educated populace, it must be able to either achieve an adequate number of college graduates at its local institutions of higher education or attract such individuals from other regions. National data reveal considerable labor force migration of college graduates. Thus, the number of university graduates from local institutions

of higher education is not necessarily highly related to the number of college graduates living in a community.

The retention of locally educated individuals and the attraction of highly educated people from other regions are heavily dependent on the availability of job opportunities appropriate for those with college degrees. Urban and natural amenities also are important to the attraction and retention of college graduates.

National studies indicate that a statistically significant relationship exists between the number of new college graduates in a state and average educational attainment in the state's adult population. But the strength of this relationship appears modest. Studies find that if an additional 100 college-bound students choose to attend college in a given state, the long-run effect of raising the college-educated workforce in that state will be only 5-to-10 workers.

Public Policy Issues

A primary conclusion of this report is that college education yields high rewards that accrue to individuals and to the communities where they ultimately find employment. Policies that eliminate barriers (informational, ability, or financial) and result in tangible increases in the number of degree holders are interventions that should be pursued. Considerable effort has already been undertaken to alleviate financial barriers and these efforts have brought results. Effective policies aimed at increasing both enrollment and degree completion rates simultaneously could be equally rewarding.

The barriers pose significant challenges and debate over the efficacy and cost of alternative policy options will occur, but in the end the potential rewards are very high. Empirical estimates capturing the magnitude of these rewards are detailed in this report – including significant monetary returns as well as a long list of non-monetary returns that continue to yield benefits over generations.

A narrow policy agenda exclusively focused on producing more college graduates locally is not likely to be sufficient in attaining the ultimate goal of increasing the proportion of productive, highly skilled workers in the labor force. Greater local production of graduates can help, but interventions that encourage quality job opportunities, amenities that attract businesses that offer quality opportunities, and a business climate that nurtures entrepreneurship and innovation are important ingredients. A general policy that supports a high quality transportation, communication, and education public infrastructure will help nurture a business climate that provides gainful employment opportunities for the graduates that are produced locally and those opportunities also can serve as a magnet for the mobile set of educated people that are produced each year across the nation.

OVERVIEW

Higher education provides considerable value to individuals, economies where educated individuals reside, and society in general. Economies that have experienced substantial investment in either private or public institutions of higher learning have realized considerable growth and prosperity.

Higher education influences economic well-being in three ways, as illustrated in Figure 1. First, direct expenditures by the institutions, their employees, and their students impact the local economy, as shown in panel A of Figure 1. This spending multiplies through the local economy until the monies are used to purchase goods and services from outside the local area. Such economic impacts have been estimated at many institutions of higher education. For example, the total impact of Arizona State University was estimated at 37,000 jobs resulting in more than \$1 billion in wages each year [L. William Seidman Research Institute, 2003]. However, only the higher education revenues originating from outside the local economy — such as from National Science Foundation grants — and the spending of out-of-state students and their parents can be considered a unique economic impact of higher education.

Second, higher education provides financial and non-financial benefits to the individual who pursues an advanced education and to society in general (see panel B of Figure 1). The average earnings of individuals are closely related to their educational attainment. In particular, those with a bachelor's degree earn substantially more than even those with some college education. Relative to those with a bachelor's degree, a postgraduate degree provides nearly as large a boost in earnings. In addition, society benefits from an educated populace. The average wage — even for those workers who do not possess much educational attainment — is higher in communities with a substantial proportion of highly educated workers. Various other benefits to society also are realized from enhanced educational attainment, such as a lower crime rate. This report provides a detailed analysis of the impacts of enhanced educational attainment.

Third, institutions of higher education are increasingly focused on knowledge creation (panel C of Figure 1). Thus, universities are sources of key research and development innovations that simultaneously can be beneficial to society and conducive to economic growth. This topic will be discussed in a future report of the *Productivity and Prosperity Project*.

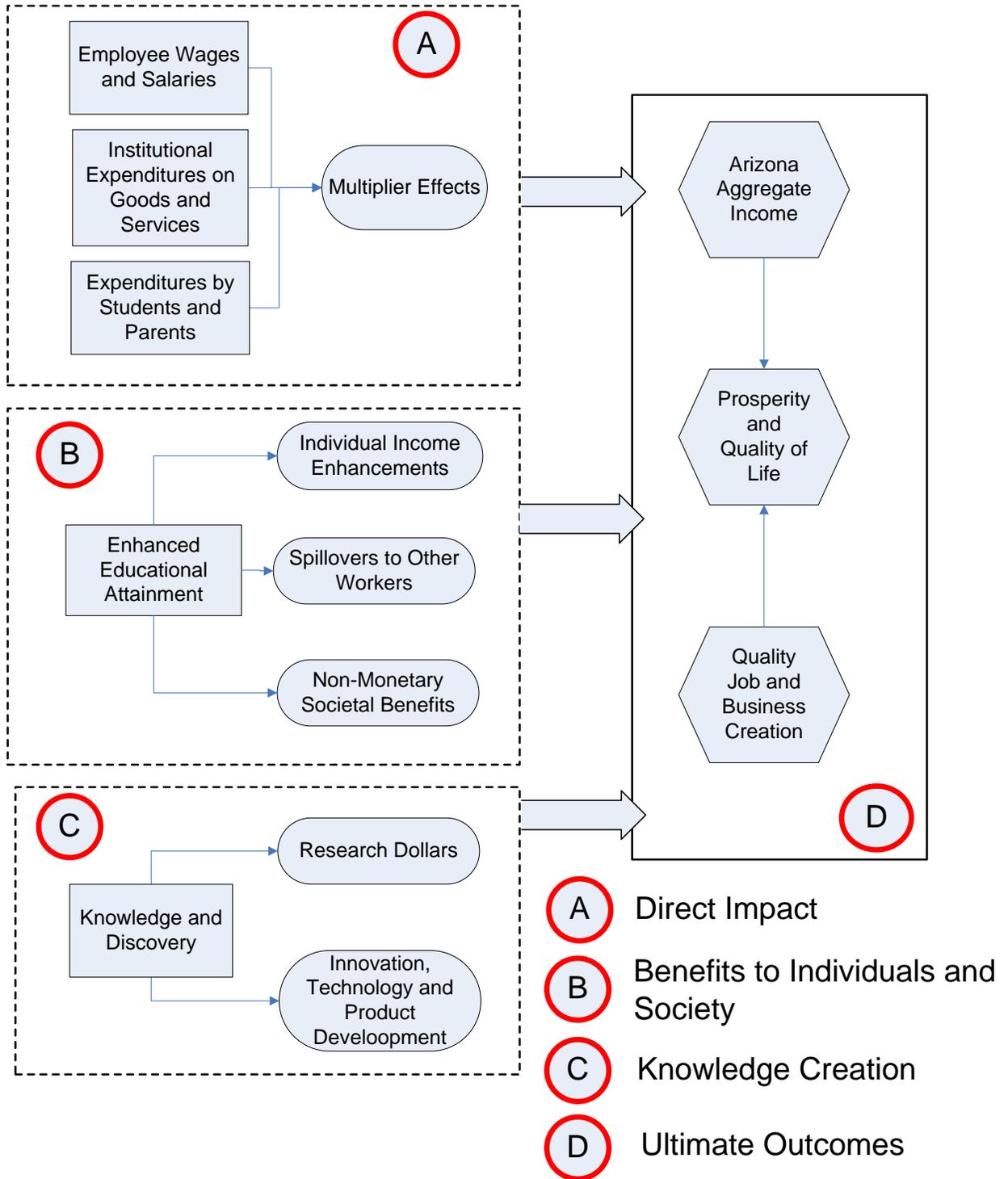
The first two chapters of this report demonstrate the value of higher education. Chapter I presents the substantial financial benefits to individuals that result from enhanced educational attainment and examines the reasons why more people do not pursue higher education given the high rate of return from doing so. Chapter II demonstrates the value to the economy and to society in general of a highly educated populace, in the forms of higher wages to all workers, increased productivity, and nonmonetary benefits to society.

The next two chapters examine factual data on how Arizona compares to the national average and to other states on measures of higher education. Chapter III looks at higher education enrollment and finance, while Chapter IV presents data on educational attainment. While Arizona falls in the middle of the states on higher education enrollment (relative to the size of the population) and the educational attainment of all adults, the educational achievement of labor

force participants is subpar and total revenues per student in institutions of higher education are far below average.

Given the benefits of a highly educated workforce and Arizona's below-average performance, the last two chapters look at issues regarding the location decisions of highly educated people. Chapter V reviews the evidence while Chapter VI presents policy options that might result in enhanced educational attainment in Arizona.

FIGURE 1
THE RELATIONSHIP BETWEEN HIGHER EDUCATION AND ECONOMIC WELL-BEING



Source: L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University.

I. BENEFITS TO INDIVIDUALS OF ENHANCED EDUCATIONAL ATTAINMENT

Summary

- Individual earnings are strongly related to educational attainment. People who have completed high school earn more than those who have not; people with a bachelor's degree earn more than those with only a high school diploma; and those with a graduate education earn more than those with only an undergraduate education.
- Average annual earnings of individuals with a bachelor's degree are more than 75 percent higher than the earnings of individuals whose maximum educational attainment is a high school diploma. Over a career, an individual with a bachelor's degree earns on average in excess of \$1 million more than a counterpart with only a high school diploma.
- The differential in earnings based on educational attainment has increased over time. For example, for full-time male workers between the ages of 35 and 44, the earnings premium associated with having a bachelor's degree versus a high school diploma has risen from 38 percent in the 1980-84 period to 94 percent in 2000-03.
- The benefits to an individual from a university education vary with the quality of the institution attended. Those who graduate from an elite university earn substantially more than those who graduate from a lower-quality institution.
- To properly assess the economic value of a college education, the benefits realized in terms of higher future earnings must be discounted to adjust for the time value of money. The discounted earnings must then be weighed against the full costs of acquiring a college education including not only the tuition paid by the student, but the earnings foregone while the student is in college and the appropriations of state and local governments. When these calculations are made, the benefits of a college education are seen to be more than three times as large as the costs.
- If the value of a college education is expressed on the same basis as the return on a financial investment, the net return is on the order of 12 percent per year, over and above inflation. This compares favorably with annual returns on stocks that historically have averaged 7 percent.
- Despite the very high return on investment for the time and money spent on attaining a college degree, only one-quarter of the U.S. adult population has at least a bachelor's degree. Academic ability and information barriers limit the number of individuals who attain a university degree.
- Financial barriers to the completion of a bachelor's degree exist but government programs that promote access have been effective.
- The academic ability of the individual — which is shaped throughout his life by a variety of family and environmental factors — and the values and goals of the individual — which are strongly influenced by the education of his parents — are the main determinants of educational attainment.

Introduction

Education provides a variety of benefits to students including enhanced social skills, greater awareness of human achievement, and an appreciation for cultural diversity. But education is increasingly viewed as an economic investment. Education provides a student with skills that are valued by employers and increases lifetime earnings capacity. In this chapter the statistical

evidence on the effect of educational attainment on earnings is examined to determine the economic rate of return realized when an individual invests in a college education. Particular emphasis is placed on the value an individual receives from completing a bachelor's degree.

In calculating the return on a college education, this chapter considers as benefits only the incremental earnings realized by the individual who earns the college degree. Spillover benefits that accrue to other parties are potentially significant, but they are not considered until the next chapter of the report. Following the conventional language used by economists, the return to education presented in this chapter is referred to as the "private return to education." When all benefits are considered, including spillovers received by other individuals, the calculated return is referred to as the "social return to education."

To determine the economic value of a college education, benefits must be weighed against the full costs of obtaining that education. These costs include the tuition payments made by the college attendee, the opportunity costs associated with earnings foregone while in college, and in the case of a public university the appropriations of state and local governments. The return on investment calculated using full costs is a more useful guide for public policy than one calculated using only the costs incurred by the student. College may represent a good personal investment for an individual if that education is highly subsidized by the government. But college is shown to represent a wise use of society's resources when the value of the enhanced skills the individual receives, as measured by increased earnings capacity, exceeds the full resource costs of providing that education.

The Relationship Between Earnings and Educational Attainment

The economic value of educational attainment is apparent from cross-tabulations of national data on individual earnings and educational attainment (see Table I:1 and the graphical depiction of this table in Chart I:1). Since annual individual earnings vary with the number of hours worked over the year, the data are for full-time, year-round workers. The latest data from the Current Population Survey, for 2002 and 2003, are depicted.

Since the age of an individual is strongly related to the number of years of work experience, and earnings rise with work experience, earnings increase with age regardless of the amount of educational attainment. In addition, in each age group, earnings increase with educational attainment.

The positive relationship between education and earnings is unmistakable and universal. Workers who have completed high school earn more than those who have not; those with some college earn more than those with only a high school education; people who have earned a college degree earn more than those with a partial college education; and those with a graduate degree earn more than those with only a bachelor's degree. These relationships hold for all age groups.

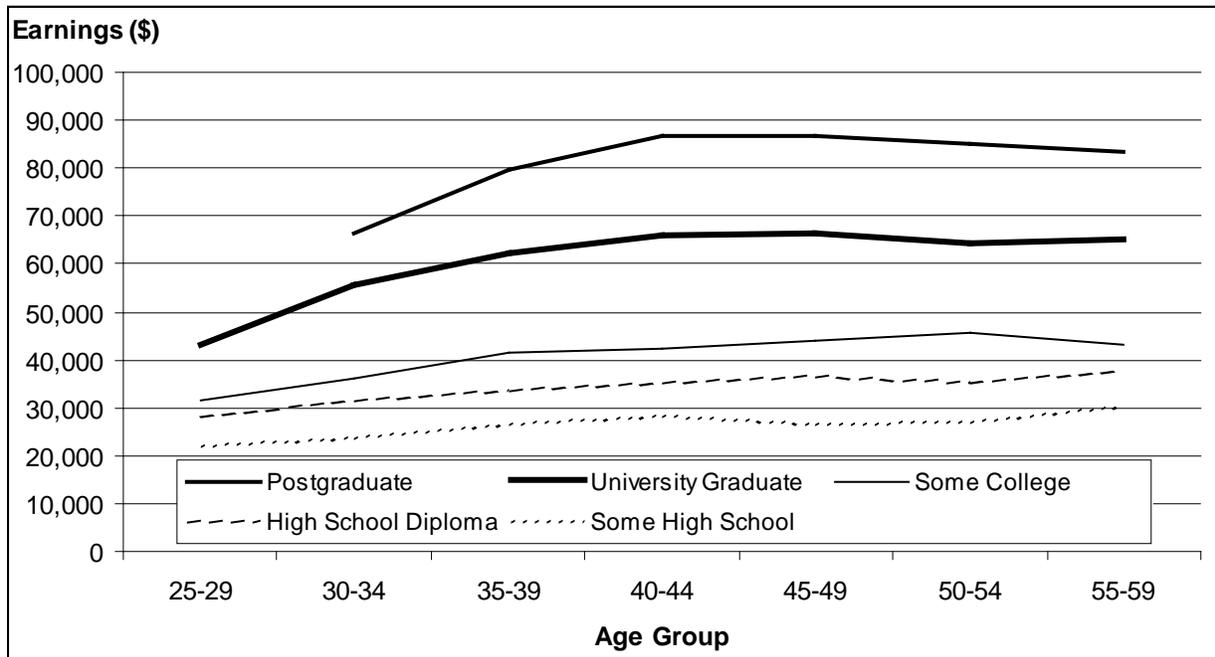
The earnings premium from a college education was substantial in 2002-03. Workers in the 30-34 age group earned on average \$24,100 or 77 percent more if they had a bachelor's degree than if they only had a high school diploma. For workers in the 40-44 age group, those with a four-year degree enjoyed an earnings premium of \$30,700 or 87 percent relative to high school

TABLE I:1
MEAN ANNUAL EARNINGS BY AGE AND EDUCATIONAL ATTAINMENT
IN THE UNITED STATES
Full-time, Year-Round Workers, 2002-03

Attainment	Age Group						
	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Postgraduate		\$66,232	\$79,464	\$86,670	\$86,676	\$85,061	\$83,543
University Graduate	\$43,121	55,440	62,244	65,973	66,280	64,253	65,240
Some College	31,338	36,271	41,635	42,295	43,829	45,453	43,330
High School Graduate	28,097	31,366	33,443	35,283	36,316	35,270	37,573
Some High School	22,168	23,553	26,351	28,026	26,430	27,155	30,452

Source: U.S. Department of Commerce, Census Bureau, Current Population Survey.

CHART I:1
MEAN ANNUAL EARNINGS BY AGE AND EDUCATIONAL ATTAINMENT
IN THE UNITED STATES
Full-time, Year-Round Workers, 2002-03



Source: U.S. Department of Commerce, Census Bureau, Current Population Survey.

graduates. For workers of age 50-to-54, those with a bachelor's degree earned \$29,000 or 82 percent more than those with a high school education.

Earnings by age and educational attainment for Arizonans are shown in Table I:2 and Chart I:2. Since the Current Population Survey data are not reliable by state, these data are from the 2000 Census and refer to earnings in the year 1999. The data are for people who live in Arizona but who may have been educated anywhere in the world.

The positive association between education and earnings also is obvious in the Arizona data. For example, for Arizona workers between the ages of 40 and 44, those with a bachelor's degree earned \$28,200 or 87 percent more than those with only a high school education.

Increasing Benefits from Educational Attainment

The value of a bachelor's degree relative to a high school diploma has been increasing steadily since the early 1980s (see Chart I:3). Looking, for example, at the 35-44 age group, male workers with a bachelor's degree earned 38 percent more than those with a high school degree over the 1980-84 period, but they earned 92 percent more than high school graduates over the 2000-03 period. For women, the college premium rose from 41 percent in 1980-84 to 80 percent in 2000-03. A rising skill premium is evident not only in the earnings of educated workers but also in the earnings of those with work experience and skills acquired on the job. These trends seem to reflect a broad-based increase in the demand for skilled workers and reduced demand for low-skill workers that is occurring throughout the industrialized world.

Labor market economists attribute the rise in the education/skills premium to several factors: the emergence of skill-using technologies (especially those involving the computer), increased trade with less-developed countries, increased immigration from labor-abundant countries, and a decline in the importance of unions. Although the high benefit of additional schooling should eventually lead to a greater supply of educated workers, the consensus opinion of experts is that the demand for knowledge workers will continue to grow and the return to education will remain high into the foreseeable future.

Importance of College Quality

Several recent studies attempt to determine whether the earnings benefits of a college education depend on the quality of the college attended. College quality is measured either in terms of inputs, such as instructional expenses per student or average faculty salaries, or in terms of peer quality, using variables such as the average SAT score of the entering class. The general finding in these studies is that college quality matters. The gross return on a college education is significantly higher for elite private colleges than it is for other institutions.

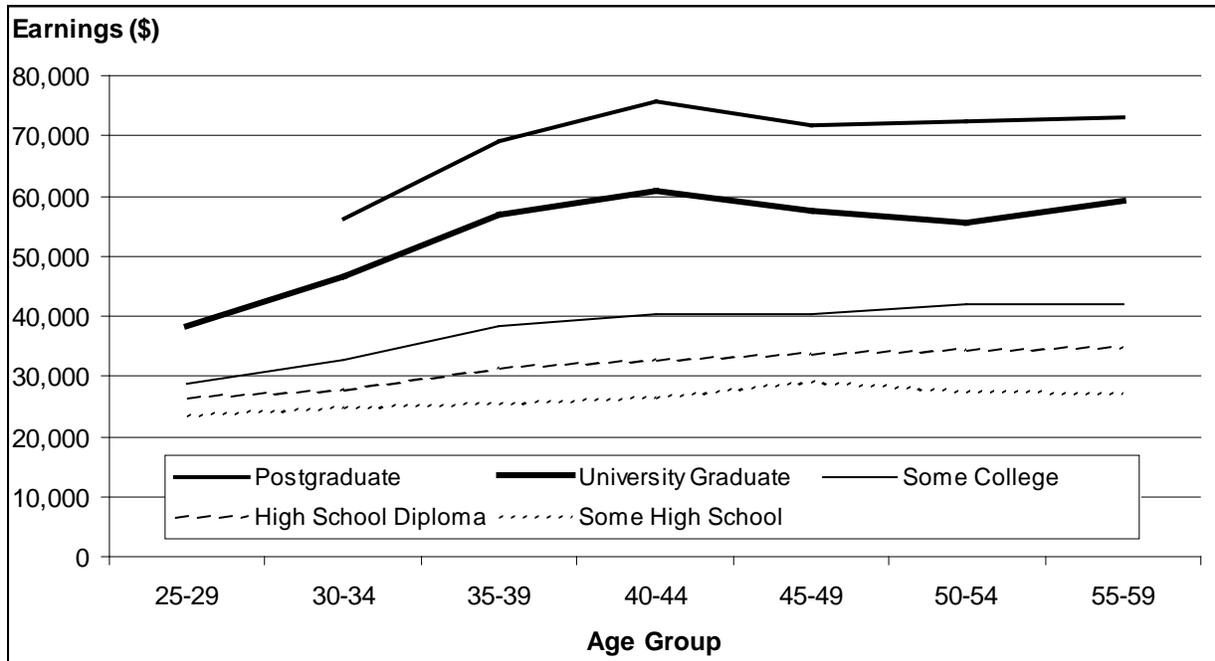
Two studies — one by Monks (2000) and another by Black and Smith (2004) — use data from the National Longitudinal Survey of Youth to match individuals and institutions. Both also use scores from the Armed Services Vocational Aptitude Battery (ASVAB) to control for ability. Ability bias is an issue in studies of college quality since students of higher ability tend to attend higher quality schools.

TABLE I:2
MEAN ANNUAL EARNINGS BY AGE AND EDUCATIONAL ATTAINMENT IN
ARIZONA
Full-time, Year-Round Workers, 1999

Attainment	Age Group						
	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Postgraduate		\$56,331	\$69,010	\$75,577	\$71,611	\$72,251	\$73,088
University Graduate	\$38,509	46,714	56,968	60,790	57,499	55,693	59,320
Some College	28,813	32,678	38,359	40,276	40,222	41,931	41,919
High School Graduate	26,599	27,904	31,417	32,587	33,672	34,401	34,678
Some High School	23,313	24,898	25,610	26,387	29,218	27,289	27,017

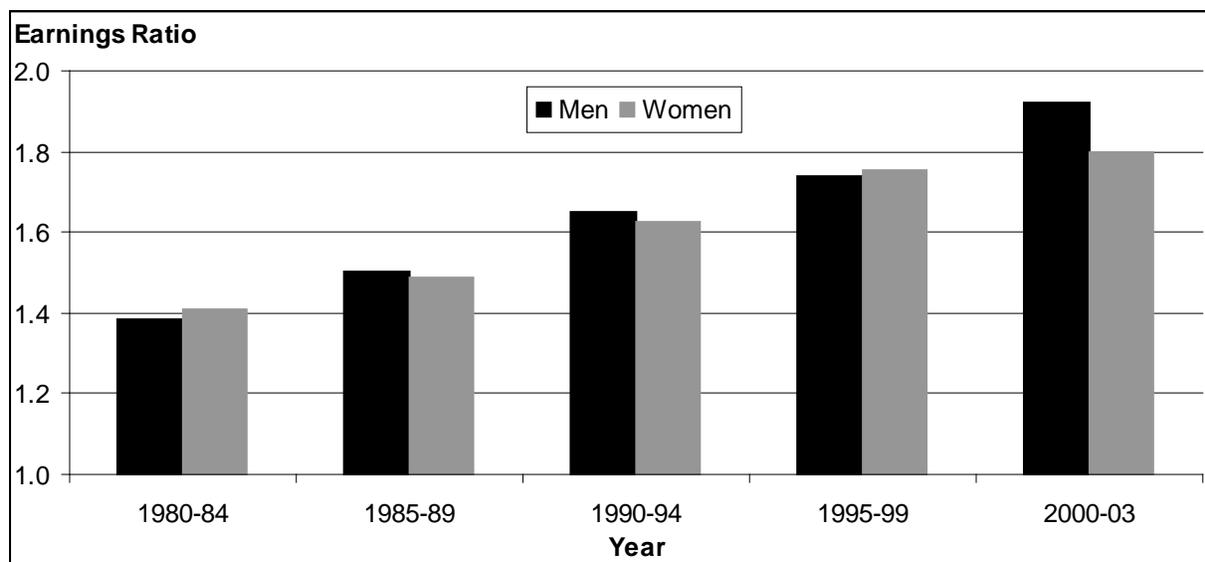
Source: U.S. Department of Commerce, Census Bureau, 2000 Census Public Use Microdata Sample.

CHART I:2
MEAN ANNUAL EARNINGS BY AGE AND EDUCATIONAL ATTAINMENT
IN ARIZONA
Full-time, Year-Round Workers, 1999



Source: U.S. Department of Commerce, Bureau of the Census, 2000 Census Public Use Microdata Sample.

CHART I:3
RATIO OF MEAN ANNUAL EARNINGS OF UNIVERSITY GRADUATES
TO HIGH SCHOOL GRADUATES
Full-time, Year-Round Workers in the United States



Source: U.S. Department of Commerce, Census Bureau, Current Population Survey.

In the Monks study, college quality was measured using selectivity ratings from Barron’s *Profiles of American Colleges*. These ratings were based on the percent of applicants accepted and on the entrance test scores, class rank, and high school grade point average of the entering class. In addition to the selectivity ratings, Monks also included variables on institutional control (public or private) and Carnegie classification (for example, “doctoral/research universities”). Control variables other than those relating to institutional type included age, gender, race, and score on the Armed Forces Qualification Test. The study used annual panel data from 1979 to 1993 to examine the effects of college characteristics on an individual’s real hourly wages.

Individuals who graduated from a college rated as “highly or most competitive” earned 15 percent more than someone who graduated from a “competitive” institution. The wage premium for those who graduated from a “very competitive” college was 8 percent relative to a “competitive” institution. Graduates from public institutions earned 4 percent less than those from private institutions. Finally, graduates from graduate degree-granting research institutions earned 14 percent more than graduates from liberal arts colleges.

In the Black and Smith study, college quality was measured using an index based on average faculty salary, the average SAT score of the entering class, and the freshmen retention rate. Other individual characteristics used as controls included age, race, parental characteristics, and an ability measure constructed from age-adjusted ASVAB scores. The variable to be explained was the respondent’s wage in 1998.

For men, those who graduated from a college in the highest quartile earned 12 percent more than those who graduated from a college in the lowest quartile. Graduates from colleges in the second-highest quartile earned 5 percent more than those from the lowest quartile, but the difference was not statistically significant. There was no discernable difference in the wages of graduates from the lowest two quartiles.

The nature of the results for women was similar to those for men, but quantitatively smaller. Women graduating from colleges in the top quartile earned only 7 percent more than women who graduated from colleges in the lowest quartile.

The Rate of Return from a Bachelor's Degree

To assess the economic value of an incremental investment in education, such as college, the costs of education must be considered and discounting techniques must be used to properly recognize the full lifetime earnings benefits of additional education. A formal cost-benefit analysis of a four-year college education is provided in Table I:3. The analysis is based on nationwide figures for college costs and the national age-education-earnings data available from the 2002-03 Current Population Surveys. Separate calculations were made for men and women.

The full costs of going to college include tuition and fees paid by the student, state and local government appropriations in the case of a public university, and foregone earnings during the time the student is attending college. For public four-year research institutions, average tuition and fees are approximately \$5,000 per year and government appropriations are around \$9,000 per full-time equivalent student per year. For private four-year research institutions, mean tuition and fees are about \$16,000 per year. In this analysis, a figure of \$15,000 is used to represent the annual direct cost of attending college as an average of the costs of public and private institutions. Over four years, the total direct costs thus are \$60,000. For someone attending a public university, the personal out-of-pocket expenses are substantially less than this amount.

Assuming that college students work only during the summer and earn what a high school graduate would make, the earnings foregone by a male when attending college are \$17,650 per year, or \$70,600 over four years. For women, foregone earnings are \$14,325 per year, or \$57,300 over four years.

Benefit calculations are made assuming the individual is fully employed from age 22 to 65. For men, this assumption may serve to underestimate the net benefit of a college education since the incidence of unemployment is lower for college graduates than it is for high school graduates. For women, however, especially those who leave the labor force for a period of time to raise a family, the full employment assumption will exaggerate the net return associated with a college education. For each gender, the net benefit would be less if a person retires before the age of 65. Given the assumption of a 44-year working life, recent Census data suggest that the total lifetime earnings of a male worker will be \$1.27 million higher if he has a college degree than if he has only a high school education. For women, the lifetime earnings differential is \$0.96 million.

When comparing streams of expenses and income that accrue over time, it is necessary to “discount” figures to a common base year. The present discounted value of receiving \$10,000 ten years from now is less than \$10,000 — not just because of inflation, but because of the time

TABLE I:3
VALUE OF A BACHELOR'S DEGREE
Based on Mean Earnings of Full-Time, Year-Round Workers in the United States
in 2002-03

	Men	Women
Costs (Ages 18 to 21):		
Tuition, Fees, Government Appropriations	\$60,000	\$60,000
Foregone Earnings	70,592	57,292
Total Costs	130,592	117,292
Total Costs Discounted at 4 Percent Real Interest	123,250	110,696
Benefits (Ages 22 to 65):		
Earnings with a High School Diploma	1,734,824	1,243,838
Earnings with a Four-Year Degree	3,012,522	2,202,327
Differential in Earnings	1,268,698	958,489
Earnings Differential Discounted at 4 Percent Real Interest	461,715	361,076
Net Present Value of a Bachelor's Degree	338,465	250,380
Internal Rate of Return	11.7%	11.6%

Note: See the text for explanations of the calculations.

Source: Center for Business Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University, using data from the U.S. Department of Commerce, Census Bureau.

value of money. If the annual real (inflation-adjusted) rate of interest is 4 percent, then \$10,000 to be received 10 years from now has a present value of \$6,756 in the sense that a present period investment of \$6,756 at a 4 percent interest rate would be worth precisely \$10,000 in 10 years.

If expenses are discounted to the time an individual enters college (assumed to be at age 18), then the total costs of attending college are \$123,200 for men and \$110,700 for women. Discounting has a more dramatic effect on the value of future earnings. The present values of the incremental earnings afforded by a college education are \$461,700 for men and \$361,100 for women. On balance, however, the benefits of a college education greatly outweigh the costs. When evaluated at a discount rate of 4 percent, the net present value of a college education is \$338,500 for men and \$250,400 for women.

To compare the return on investment offered by a university education with other investments, it is useful to compute the "internal rate of return." This is the discount rate that equalizes the present value of benefits and costs. The concept of internal rate of return is equivalent to what financial economists refer to as the "yield to maturity" on a financial asset. Returns calculated in this way can be compared across all kinds of loans or bond purchases, regardless of the time pattern of interest and principal payments. The internal rate of return also can be thought of as a hurdle or break-even interest rate. If the internal rate of return on a college education is 12 percent, this means that a college participant could borrow at 12 percent interest all of the money needed to pay for the costs of attending a four-year college and have just enough in incremental college-generated earnings to pay off the loan with interest.

For men, the internal rate of return on a college education is 11.7 percent. For women, the return (calculated assuming full lifetime employment) is almost identical at 11.6 percent. Both of these represent returns over and above inflation. These returns compare favorably with real returns on stocks that have averaged around 7 percent over the past 100 years.

The internal rate of return calculations conducted in this exercise include estimates of public subsidies on the cost side (by estimating cost per year at \$15,000 when tuition averages only \$5,000 per year at public research institutions) and only private returns in the benefit calculations. In the discussion in Chapter II, estimates of social benefits are included in the calculations.

Distinguishing the Effects of Educational Attainment from Ability

Social scientists long have been concerned that simple correlations between educational attainment and earnings may overstate the causal role played by education in determining earnings capacity. Individuals with high innate abilities, cognitive and non-cognitive, find it easier to be successful in school and will complete more years of schooling. But these innate abilities are themselves important in determining earnings capacity. Because abilities are difficult to observe, the correlation between educational attainment and unobserved ability will confound attempts to identify the true effect of education on earnings.

One method statisticians use to try to correct for unobserved and missing variables is a technique known as “instrumental variables” (IV). In the case of earnings and its relationship to educational attainment (observed) and ability (unobserved), the idea is to find another variable (the instrument), that determines and correlates with education but is itself uncorrelated with ability. The true effect of education on earnings can be estimated by replacing observed education with the value for education predicted by the instrument in an earnings regression.

Instrumental variables studies of the return to education have used as instruments college tuition, distance to college, and birth quarter (because of compulsory schooling laws, people born with birth dates earlier in the year have slightly less years of schooling than those born later in the year). The consistent and surprising finding of these studies is that IV estimates of the gross return to schooling (the marginal impact of years of education on earnings) are 20-to-40 percent higher than simple estimates uncorrected for ability (Card 1999, 2001).

One popular explanation for these results is that ability bias is small and that the benefits of schooling among low-income disadvantaged subgroups (those most likely to change their schooling status because of the instruments) must be higher than the returns in the general population. There is some debate, however, over how to interpret the findings. Carniero and Heckman (2002), for example, have argued that the instruments commonly used in IV studies are invalid since they likely are correlated with ability. Further, it does not follow from the fact that IV estimates are higher than simple estimates that disadvantaged groups have a higher return to schooling.

Some studies of the benefits of schooling have tried to deal with the issue of ability bias by using special data sets. Studies of identical twins, for example, find that the benefit of schooling is 10 percent lower than simple estimates (Card 1999). If one believes that identical twins have

identical abilities, then these findings suggest only a small upward bias in simple estimates of the effect of education on earnings. Another special data opportunity arises when countries enact broad changes in compulsory schooling laws. Britain, for example, in 1972 raised the age at which children could leave school from 15 to 16. With the new law, about one quarter of the youth population was forced to stay in school an extra year. Presumably there was no difference in the distributions of innate ability between people born in 1955/1956 and those born a little later who were affected by the law. Yet those born later, those with extra schooling, had significantly higher earnings later in adulthood. Estimates from these data suggest an earnings benefit of at least 10 percent for the extra year of schooling (Card 2002).

In summary, the issue of ability bias remains a formidable statistical problem for education researchers. But the weight of evidence from dozens of studies and the consensus view of social scientists is that the earnings differential between people with different levels of educational attainment is primarily a reflection of education itself, not differences in ability (Card 2002).

Barriers to Educational Attainment

For those who complete a four-year college program, the return on investment for the time and money spent on college is very high, something on the order of 11-to-12 percent. Yet only one-quarter of the U.S. adult population (28 percent of those 25-34 years old) has at least a bachelor's degree. If an investment in college is so worthwhile, why do so many people choose not to invest? There are three possible answers:

- (1) Some people cannot afford college, either the out-of-pocket expenses, such as tuition and books, or the opportunity cost of being out of the labor force while in school. For these people, the costs of college participation are very high.
- (2) Some people do not have the academic skills necessary to be successful in college. For these people, the benefits from college participation are very low.
- (3) Some people are unaware or unconvinced of the economic value of a college education. This is especially true of individuals whose parents never went to college.

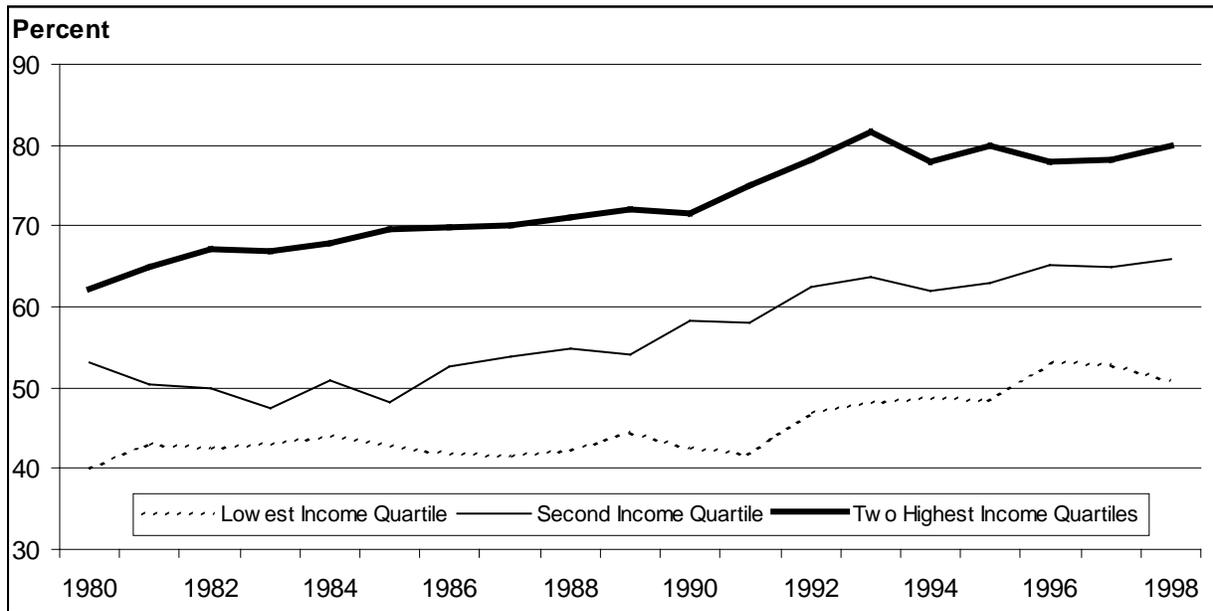
This section reviews the empirical evidence on the factors affecting college enrollment and graduation.

College Enrollment and Family Income

A strong correlation exists between college enrollment and family income. Chart I:4 shows trends in college participation by 18-to-24 year old males who have completed high school. College enrollment has risen over the past two decades, probably in response to the rise in earnings differentials between the less and more highly educated. College enrollment rates rose first among higher-income groups, beginning in the early 1980s. Enrollment rates began to increase in the early 1990s among youth from low-income families. Graduation rates, as measured by a bachelor's degree, have not increased as much.

More striking about Chart I:4, however, is the direct relationship between college enrollment and current family income. College enrollment rates in the bottom income quartile are 15 percentage points lower than they are in the third quartile and 25 percentage points lower than they are in the top half of the income distribution. A similar relationship between college enrollment and family income is apparent in data from other countries. The relationship also holds for other dimensions of college participation, including whether an individual enrolls in a two-year or four-year

CHART I:4
COLLEGE PARTICIPATION RATES OF MALES 18-TO-24 YEARS OLD
BY PARENTAL INCOME



Source: Carniero and Heckman, 2002.

college, whether college entry is delayed, and whether an individual completes a two-year or four-year program.

A common interpretation of the relationship in Chart I:4 is that college enrollment decisions are heavily influenced by the financial resources available to the family. College is a good long-term investment for most people. But children from low-income families are credit-constrained. They choose not to enroll in college because they cannot afford either the out-of-pocket expenses (such as tuition and fees) or the loss of income while spending time in college.

Economists note that loan markets for education are highly imperfect and may prevent cash-constrained individuals from making good long-term investments. Investments in human beings are unlike investments in physical assets. Students cannot offer themselves as collateral. The lack of collateral and the difficulty of monitoring performance make the market for human capital highly imperfect. This argument, together with evidence such as that presented in Chart I:4, is used to justify large-scale government programs to help finance education (Carniero and Heckman 2002).

College Enrollment and Academic Ability

Another possible interpretation of Chart I:4 is that it reflects a more fundamental relationship between college participation and the academic ability or college preparedness of the student. Current family income is highly correlated with long-run family income. Children who grew up in households that always had ample financial resources are also likely to have been enrolled in

high quality primary and secondary schools. They are also more likely to have developed the non-cognitive skills necessary to be successful in college.

Most data sets that provide information on educational attainment and family income do not contain measures of academic ability. One that does is the National Longitudinal Survey of Youth (NLSY) which contains results from the Armed Forces Qualification Test (AFQT), a measure of scholastic ability.

Cameron and Heckman (2001) use data from the 1979-91 waves of the NLSY to separate out the effects of family income from scholastic ability in explaining gaps in college enrollment between minority youth and whites. They find that when they do not control for ability in college attendance rates, 5 of the 11 point gap between blacks and whites, and 4 of the 7 point difference between Hispanics and whites, is explained by family income. When scholastic ability (as measured by AFQT scores measured before high school graduation) is accounted for, however, family income plays no role in explaining college attendance decisions, although it does continue to affect high school completion rates. Only one half of one point of the 11 point black-white gap is explained by family income. For Hispanics, the gap actually widens when family income is considered. Overall, it is ability and not current financial resources that seems to account for the gaps between minority and white schooling attainment.

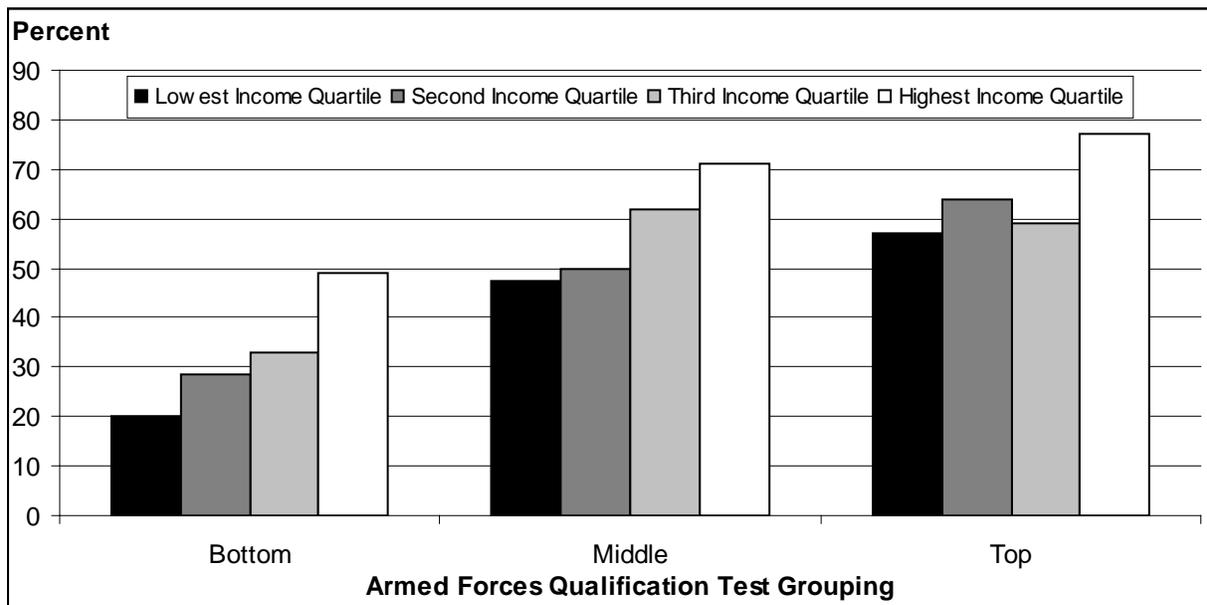
While academic ability may be a more important determinant of college entry, family income still may operate as an additional constraint. Adjusting for ability weakens but does not eliminate the statistical relationship between income and college participation. Chart I:5 shows data on college enrollment among white males broken out by both family income quartiles and AFQT test terciles. The data were prepared by Carniero and Heckman (2002) using a sample of white males from the NLSY for 1979. The data suggest that even after controlling for scholastic ability, adolescents from high-income families enroll in college at higher rates than youths from low-income families.

College Enrollment and Family Background

The relationship between family income and college enrollment is likely to be overstated not only because of the connection between income and scholastic ability but also because of a correlation between income and family background characteristics that are important for college participation. Children from low-income families are more likely to have parents who are not themselves college educated. Young adults who are 18-to-24 years old may be able to drive, drink or vote, but they often lack the wisdom, discipline and foresight to make good long-term decisions. Those who attend college often do so because of the values and expectations instilled in them by their parents.

In their study of college enrollment, Carniero and Heckman (2002) are able to control not only for ability but also for family background variables such as the educational attainment of the father and mother, whether the child is from a broken home, and place of residence. The most statistically significant of these variables are the parents' education status. The results of their analysis are summarized in Chart I:6. Controlling for family background weakens further the relationship between family income and college enrollment. Comparing the highest and lowest

**CHART I:5
COLLEGE PARTICIPATION RATES OF WHITE MALES
BY PARENTAL INCOME AND ARMED FORCES QUALIFICATION TEST**



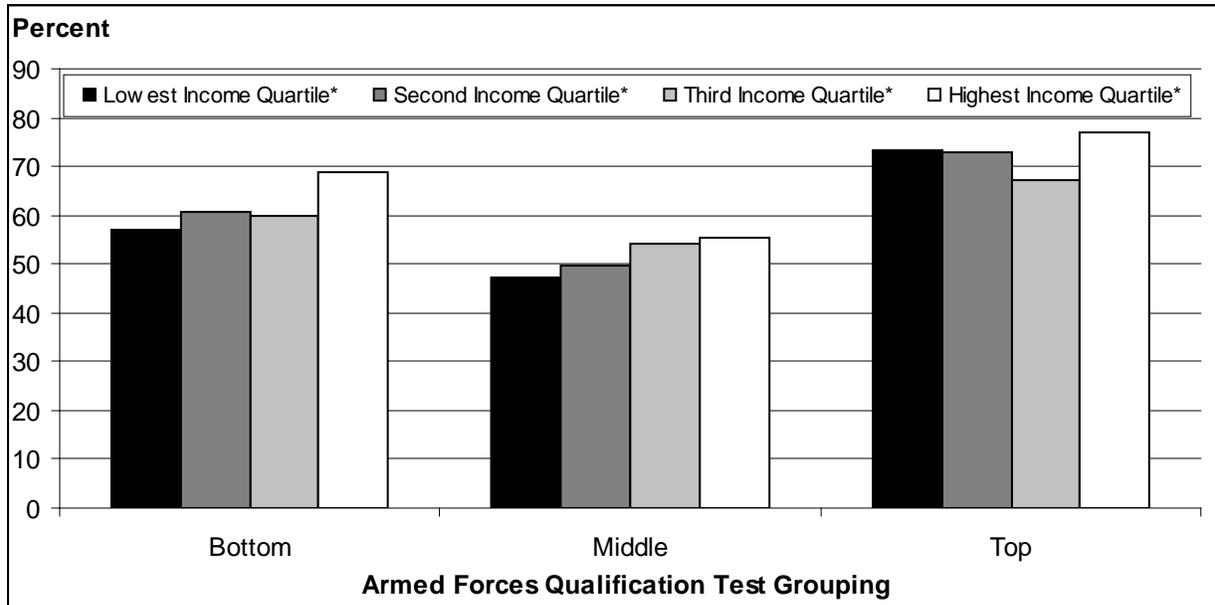
Source: Carniero and Heckman, 2002.

income quartiles, there is only 4 percentage point gap in college enrollment in the group with the highest ability and a 12 point gap in the lowest ability group.

Carniero and Heckman also look at other dimensions of college participation. After adjusting for both ability and family background, they find no meaningful or significant remaining effect of family income on whether an individual completes a four-year college program. Weak evidence exists of a relationship between income and delay of entry into college. Overall Carniero and Heckman conclude that at most 8 percent of American youth are subject to short-run liquidity constraints that affect their post-secondary schooling. The present lack of liquidity-constrained individuals in the population is undoubtedly due in large part to government programs that help to ease financing burdens.

Thus, the simple correlation between college participation and current family income greatly overstates the causal role played by family financial resources in college entry decisions. What seem to be more important for college educational attainment are (1) the academic ability of the individual, which is shaped throughout his life by a variety of family and environmental factors, and (2) the values and goals of the individual, which are strongly influenced by the education of his parents.

**CHART I:6
COLLEGE PARTICIPATION RATES OF WHITE MALES BY PARENTAL INCOME
AND ARMED FORCES QUALIFICATION TEST ADJUSTED FOR FAMILY
BACKGROUND**



* Adjusted for Family Background

Source: Carniero and Heckman, 2002.

II. SOCIETAL BENEFITS OF ENHANCED EDUCATIONAL ATTAINMENT

Summary

- Societal benefits of a workforce with greater educational attainment and skills can be traced to the enhanced worker productivity associated with greater educational attainment. These productivity gains translate into higher output and incomes for the economy.
- Non-monetary societal benefits in regions with high proportions of college graduates include lower crime rates, greater and more informed civic participation, and improved performance across a host of socioeconomic measures.
- Intergenerational social benefits may be very large as degree attainment today translates into higher probabilities of degree attainment in future generations.
- Empirical work in econometrics suggests that after controlling for differences in amenities and individual wages, a 1 percentage point increase in the share of college graduates in the labor force leads to significant increases in wages for all workers.
- A portion of this significant wage effect is attributable to spillovers that result from productivity gains. Simulations for Arizona based on conservative estimates of these spillovers suggest that combining social spillovers and individual benefits realized from a four-year college degree, degreed workers earn and are responsible for gross lifetime earnings that total \$1.6 to \$1.9 million more than workers with only a high school diploma.
- Accounting for costs of education and the time value of money, discounted lifetime net benefits from a university degree — including combined individual and societal benefits — exceed \$600,000 per worker: a combined internal rate of return of about 16 percent.
- An statewide simulation designed to measure the impact of raising the share of college graduates in the labor force by 0.2 percent (the median annual rate of increase observed in the econometric studies) that used Arizona data on educational costs and wages reveals that total costs match benefits after about 11 years. After accounting for the time value of money, the payback period is about 13 years and the net discounted benefits (benefits less costs) that accrue after 20 years are estimated at \$364 million.
- Numerous estimates of the rate of return to investments in education prevail in the literature. Results suggest that significant portions of economic and job growth are attributable to human capital while discernible evidence of non-monetary benefits also is seen empirically.

Introduction

Investments in physical capital, such as machinery, generally lead to higher worker productivity, greater output, and enhanced economic prosperity. Economists also have noted that significant benefits result from investments in human capital. Acquiring a university degree is a form of human capital investment; the benefits to the individual of acquiring a college education are large, as discussed in Chapter I.

Broader economic and societal benefits (also known as “social returns”) also result from enhanced educational attainment. Social returns accrue from “spillovers” — the benefits that extend to third parties other than students and institutions of higher education. The greater labor productivity that educated workers bring to the labor force is the source of these spillovers. In addition to monetary benefits, a long list of non-monetary societal benefits from enhanced educational attainment has been documented.

Simulations based on the demographics of Arizona, the social cost of producing college graduates, and recent estimates of social returns (taken from the academic literature) indicate that monetary societal benefits potentially are very large. Non-monetary societal benefits are extensive but not easily quantified. The significant benefits that accumulate across generations are virtually impossible to quantify in a finite sample.

Evidence of Societal Benefits

The benefits to society from investments in higher education may be separated into two types: monetary and non-monetary. Monetary social returns result from the addition of more educated workers to the labor force, specifically by increasing the labor force share of college graduates. The rationale for monetary social returns follows:

- **Technological Spillovers:** Social interaction is a catalyst for learning and overall knowledge creation. The more contact that takes place among educated people, the more the stock of knowledge expands. Learning and networking are important determinants of knowledge creation. According to Lucas (1988), productivity spillovers are large enough to explain the differences between rich and poor countries.
- **Human and Physical Capital Complementarities:** Physical and human capital can be complementary. Increased education, knowledge, and skills create an increase in the quality of the existing physical capital stock — increasing the productivity of capital that translates in higher labor productivity for all workers. For example, more educated workers use more sophisticated equipment that results in improved productivity. Moretti (2004) provides empirical evidence of this productivity enhancement.
- **Increasing Returns:** Romer (1988) argues that there are increasing benefits to investments in human capital. As the knowledge economy increases in importance, the role of human capital may outstrip physical capital and labor in determining aggregate growth rates across countries. Using this argument, the acquisition of knowledge capital creates “endogenous” growth — growth that feeds on itself — and economic returns that accelerate.

A portion of the societal benefits generated in this fashion are attributable to spillovers that provide a basis for public investment in endeavors that increase the number of college graduates in the workforce.

Monetary benefits may be large for subsequent generations. Thus, capturing total returns to the investment in education may not be a matter of just discounting a future stream of income over a single lifetime.

Spillovers from college-educated workers result in non-monetary societal benefits that have been widely documented:

- **Reduced crime rates:** Crime statistics suggest that higher educational attainment is associated with a lower incidence of crime. As illustrated in Chapter I, greater educational attainment results in substantial monetary benefits to an individual, which increases the cost of incarceration in terms of foregone earnings. To the non-economist, this argument is based on the notion that individuals with low educational attainment and skills risk little financially by resorting to crime.
- **Civic participation:** Social and behavioral statistics suggest that higher educational attainment is associated with greater civic participation, ranging from work with local civic groups to greater voter participation. Milton Friedman, a conservative economist, believed

that public support for the laissez-faire approach to economic market mechanisms could be achieved by increasing knowledge: more educated individuals are less influenced by populist rhetoric and make more rational, informed decisions in voting behavior.

- **Other socioeconomic benefits:** Additional years of educational attainment are associated with a number of other benefits. The following list taken from Wolfe and Havemen (2002) does not exclusively pertain to college graduates:
 - Non-wage labor market remuneration, such as fringe benefits, and the quality of working conditions are positively affected by educational attainment levels.
 - Consumer choices are more rational and efficient.
 - Job searches are more extensive among the more highly educated, resulting in a better match between the individual and the company, which enhances efficiency.
 - Savings rates are higher among the more highly educated.
 - Research and development activities are more common and numerous in regions with higher educational attainment.
 - Less dependence on transfer payments and the social safety net occur among the more highly educated.
 - Less criminal behavior and lower incarceration rates occur among the more highly educated.
 - Charitable giving increases with educational attainment.
 - Social cohesion is higher among the more highly educated, as reflected in higher voting rates.
 - The educational attainment and cognitive development of children are positively affected by the educational attainment of parents (first-generation effects).
 - The health of the individual, their spouse, and their children are positively related to educational attainment.
 - Desired family size is more commonly attained among those with higher educational attainment.

Quantifying Societal Benefits

While widely discussed, relatively few authors have attempted to quantify the social benefits of higher education investments. One way to do so is to examine whether regional economies with greater proportions of college trained workers exhibit evidence of prosperity that may be attributed to the higher levels of education attainment. Recent work by Enrico Moretti (2004a, 2004b) is a notable exception. Moretti examines the relationship between greater labor force shares of college graduates and the wages attained by all workers, as well as the productivity of manufacturing enterprises.

The challenge in quantifying the social benefits of higher education is to establish statistical evidence of a causal relationship linking additional education to observed outcomes. Otherwise, the relationship may be simply a correlation of higher wage employment opportunities and greater numbers of college graduates, or a relationship of both to unobservable attributes. The following provides a technical perspective:

- If changes in the share of college graduates are positively related to unobservable factors that influence labor supply, then simple ordinary least squares (OLS) estimates (e.g. simple correlations) of the impact of college graduates on wages would be biased **downward**, understating the extent that college graduates actually contribute to wage determination.

Essentially the positive labor supply shocks dampen wages and obscure the positive impact that graduates have on the labor market.

- If changes in the share of college graduates are positively related to unobservable factors that influence labor demand, then simple OLS estimates of the impact of college graduates on wages would be biased **upward**, overstating the extent that college graduates actually contribute to wage determination. Essentially the positive demand shocks increase wages so the observed wage effect is the combination of the demand shock and the effect of increased graduates in the area.
- Moretti (2004a, 2004b) controls for a host of factors that explain wage and productivity differentials across cities and through time, uses instrumental variable techniques to account for potential reverse causation, and checks results against a distinct longitudinal data set. These approaches are designed to establish evidence, or lack thereof, of a causal relationship.

Moretti's estimates of the effect of college graduates on wages employs census data for 1970, 1980 and 1990 from 282 cities using nearly 2 million observations. The results are checked against a sample of 6,791 individuals in a national longitudinal sample spanning 201 cities from 1979 to 1994. Results are remarkably consistent across the two distinct samples and yield estimates of the social benefit of attracting greater numbers of college graduates to a city. Moretti finds, after controlling for other factors, that a 1 percent increase in the labor force share of college graduates in a city drives up wages for all workers:

- 1.9 percent for labor force participants without a high school diploma
- 1.6 percent for labor force participants with a high school diploma
- 0.4 percent for college graduates.

Moretti argues that the observed wage benefits are a combination of spillovers, complementarities and substitution effects that are induced by changes in the labor force composition that take place as a natural consequence of labor market adjustments triggered by the change in the supply of educated workers. Together, these effects are large. Moretti estimates that for cities experiencing an increase in the share of university graduates of about 0.2 percent per year (the median in the sample) and an average salary of \$25,000 (in his historical sample), the additional graduates in the labor force induced wage increments of \$95.00 per high school dropout, \$80.00 per high school graduate, and \$20.00 per college graduate.

All of these wage effects cannot be attributed to spillovers generated by the additional graduates because other labor market effects also exist. However, estimates of the net wage effect on college graduate wages alone help establish a lower bound for the spillover effect. The wage increment represents the net effect of the social spillovers and the wage-dampening supply shock induced by the greater number of college graduates. If the additional supply of graduates has a greater impact on wages than does the social spillover, the net impact on wages of college graduates would be negative. Instead, Moretti's estimates suggest a net positive increment to wages of 0.4 percent. Assuming that the supply shock has zero effect (unlikely but arithmetically conceivable), a lower bound for the social spillover effect for college graduates is obtained at 0.4 percent though the actual spillover effect is likely to be larger. For purposes of discussion in the examples that follow, the social spillover is assumed to be only 0.4 percent for all workers. That is, the examples will presume that the social spillover accounts for only about 25 percent (0.4

percent of the 1.6 percent) wage increment for high school degree holders and just over 20 percent (0.4 percent of the 1.9 percent) for high school dropouts. Thus, the examples adopt a very conservative estimate of the portion of these estimates that pertain to spillovers.

A Simulation Based on Moretti Estimates

Moretti's estimates apply on average to hundreds of cities and nearly 2 million workers across the better part of three decades. For illustration purposes, it is useful to examine the impact of wage inducements of this order of magnitude on the labor force (25-to-64 years of age) of the Arizona economy.

While Moretti's work focused on cities, the simulation in this section applies to the entire state. Since the dominant share of economic activity in Arizona takes place in the metropolitan areas, this need not skew results. The simulation contains several distinct steps:

1. Estimate the percentage of the workforce with particular educational attainment levels as well as estimate earnings attained by these individuals using numbers from the decennial census.
 - High School Dropout
 - High School Diploma
 - College Graduate or Higher
2. Determine the number of college educated people that must be added to the labor force to change the proportion of college graduates by 0.2 percentage point, the median annual increase in Moretti's sample.
3. Estimate the social cost of locally educating college graduates by examining the cost of taking a new college entrant to graduation. The simulation accounts for natural attrition rates and the observation that not all locally educated students remain in the state upon graduation.
4. Compare the costs of locally educating and graduating university students with the benefits that accrue to higher labor-force wages using a life-cycle scenario that tracks when costs are borne and when benefits accrue. Assessment of benefits adopt the conservative 0.4 percent estimated wage increment for all workers so the results are consistent with establishing a lower bound for the impact of social benefits that accrue to greater numbers of college graduates in the labor force.

The data used as the foundation for the simulation are in Table II:1. Using estimates from the decennial census and disaggregating labor force participants by both age and educational attainment provides more precise estimates of the wage effects. An increase in the labor-force share of graduates in the 2000 sample yields estimates of an annual wage increase of \$183 million. The lower bound for the social spillover benefits (applying 0.4 percent to all workers) yields an aggregate wage increment of about \$64 million.

In 2000, nearly 2 million labor force participants between the ages of 25 and 64 were reported by the census in Arizona. An increase of 4,000 graduates to the labor force would increase the college share by about 0.2 percent. Hence, the social spillover per additional graduate is \$16,000 (\$64 million divided by 4,000) using the lower bound estimates.

TABLE II:1
BASE DATA FOR MORETTI SIMULATION
Aggregate Wages by Educational Attainment and Age
(Dollars in Millions except Per Worker Lines)

2000 Census						
Education Level						
Age	Some High School	High School Graduate	Some College	College Graduate	Post-graduate	Total
25-34	\$2,271	\$3,473	\$6,134	\$4,673	\$1,937	\$18,487
35-44	\$2,303	\$4,677	\$9,090	\$6,353	\$3,911	\$26,335
45-54	\$1,649	\$3,447	\$8,131	\$5,283	\$4,789	\$23,299
55-64	\$927	\$2,088	\$3,691	\$2,357	\$2,438	\$11,501
Total	\$7,150	\$13,685	\$27,046	\$18,665	\$13,075	\$79,621
Moretti Estimates	0.019	0.016	0.016	0.004	0.004	
Total with 0.2% more graduates in labor force	\$7,178	\$13,729	\$27,132	\$18,680	\$13,086	\$79,804
Increase	\$27	\$44	\$87	\$15	\$10	\$183
Per worker	\$98.63	\$100.65	\$120.76	\$42.59	\$55.51	

Lower Bound for Social Externality Portion, 2000 Estimates						
Education Level						
Age	Some High School	High School Graduate	Some College	College Graduate	Postgraduate	Total
25-34	\$2,271	\$3,473	\$6,134	\$4,673	\$1,937	\$18,487
35-44	\$2,303	\$4,677	\$9,090	\$6,353	\$3,911	\$26,335
45-54	\$1,649	\$3,447	\$8,131	\$5,283	\$4,789	\$23,299
55-64	\$927	\$2,088	\$3,691	\$2,357	\$2,438	\$11,501
Total	\$7,150	\$13,685	\$27,046	\$18,665	\$13,075	\$79,621
Moretti Estimates at 1% more grads in labor force: lower bound for social externality	0.004	0.004	0.004	0.004	0.004	
Total with 0.2% more graduates in labor force	\$7,156	\$13,696	\$27,067	\$18,680	\$13,086	\$79,685
Increase	\$6	\$11	\$22	\$15	\$10	\$64
Per worker	\$20.76	\$25.16	\$30.19	\$42.59	\$55.51	

Note: Moretti estimates account only for the social impact of the additional labor force share of graduates on the existing labor force and do not include the aggregate wages earned by the new graduates themselves.

Source: Center for Business Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University, using data from the U.S. Department of Commerce, Census Bureau.

The social contribution per graduate can be added to the benefits to the individual estimated in Chapter I to obtain a combined social plus private internal rate of return. Rather than using Arizona-specific costs of attending college, the cost estimates used in the simulation are the same as those applied in Chapter I in the analysis of private returns. The full costs of going to college include tuition and fees paid by the student, state and local government appropriations in the case of a public university, and foregone earnings during the time the student is attending college. For public four-year research institutions, average tuition and fees are approximately \$5,000 per year and government appropriations are around \$9,000 per full-time equivalent student per year. For private four-year research institutions, mean tuition and fees are about \$16,000 per year. In this analysis, a figure of \$15,000 is used to represent the annual direct cost of attending college as an average of the costs of public and private institutions. Over four years, the total direct costs would be \$60,000. Assuming that college students work only during the summer and earn what a high school graduate would make, the earnings foregone by a male when attending college are \$17,650 per year, or \$70,600 over four years.

Benefit calculations are made assuming the individual is fully employed from age 22 to 65. For men, this assumption may serve to underestimate the net benefit of a college education since the incidence of unemployment is lower for college graduates than it is for high school graduates. For women, however, especially those who leave the labor force for a period of time to raise a family, the full employment assumption exaggerates the net return associated with a college education. Given the assumption of a 44-year working life, recent Census data suggest that the total lifetime earnings of a male worker will be \$1.27 million higher if he has a college degree than if he has only a high school education. For women, the lifetime earnings differential is \$0.96 million. An increment of \$16,000 per year for ages 25 and older is added to account for the lower bound of social spillovers. Hence the benefit stream contains the private benefits that accrue to the individual plus the social benefits that the employment of the individual generates for the rest of the economy.

As in Chapter I when comparing streams of expenses and income that accrue over time, it is necessary to “discount” figures to a common base year. The present value of receiving \$10,000 ten years from now is less than \$10,000—not just because of inflation, but because of the time value of money. If the annual real rate of interest is 4 percent, then \$10,000 to be received 10 years from now has a present value of \$6,756 in the sense that a present period investment of \$6,756 at a 4 percent interest rate would be worth precisely \$10,000 in 10 years.

Again, as in Chapter I, if expenses are discounted to the time an individual enters college (assumed to be at age 18), the total costs of attending college are \$123,200 for men and \$110,700 for women. However, additional social benefits of \$640,000 accrue to society over the lifetime of each worker. Including these social benefits and assuming a discount rate of 4 percent, the net present value of a college education is \$591,277 for men and \$503,193 for women, as seen in Table II:2.

To compare the return on investment offered by a university education with other investments, it is useful to compute the internal rate of return that now combines social costs and benefits with private costs and benefits. This is the discount rate that equalizes the present value of all benefits and costs. For men, the internal rate of return on a college education is 15.7 percent. For women,

TABLE II:2
SOCIETAL VALUE OF A BACHELOR'S DEGREE
Based on Mean Earnings of Full-Time, Year-Round Workers in the United States
in 2002-03

	Men	Women
Costs (Ages 18 to 21):		
Tuition, Fees, Government Appropriations	\$60,000	\$60,000
Foregone Earnings	70,592	57,292
Total Costs	130,592	117,292
Total Costs Discounted at 4 Percent Real Interest	123,250	110,696
Benefits (Ages 22 to 65):		
Earnings with a High School Diploma	1,734,824	1,243,838
Earnings with a Four-Year Degree	3,652,522	2,842,327
Differential in Earnings	1,908,698	1,598,489
Earnings Differential Discounted at 4 Percent Real Interest	714,528	613,889
Net Present Value of a Bachelor's Degree	591,277	503,193
Internal Rate of Return	15.7%	16.6%

Note: See the text for explanations of the calculations.

Source: Center for Business Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University, using data from the U.S. Department of Commerce, Census Bureau.

the return (calculated assuming full lifetime employment) is similar at 16.6 percent. Both of these represent returns over and above inflation. These returns compare very favorably with real returns on stocks that have averaged around 7 percent over the past 40 years.

An Aggregate Simulation

The aggregate net benefit from an enhancement of educational attainment in Arizona is estimated using data on the Arizona labor force. In this simulation, an increase in the labor force share of university graduates is targeted at 0.2 percent and only social costs and benefits are included. In 2005, this would require an addition of about 4,500 graduates. A plan to add 0.2 percent by the time 18-year-old students in 2005 reach the age of 25 would require about 5,500 graduates assuming current trend growth of the Arizona labor force. The social cost (government appropriations) to produce 5,500 graduates who will work in the Arizona labor force is estimated at about \$440 million assuming current per student funding levels, normal attrition rates in college attendance, a normal pattern of migration of university graduates to other states, and the possibility that many students will take five years to graduate. Programs that accelerate graduation rates could reduce the costs.

Since there is natural growth in the Arizona labor force, ongoing costs estimated at 7 percent of this total per year would be incurred to maintain the labor force share of graduates at 0.2 percent greater for all time periods. After 10 years the total cost of producing these degrees is estimated at \$615 million and after 20 years the total cost increases to \$1,210 million. Costs are assumed to increase by 7 percent per year in nominal terms. It would be possible to reduce costs, by instituting scholarship plans that provide incentives to complete degrees in a more timely fashion and to seek employment within the state of Arizona upon completion of degree.

Social benefits are obtained by using estimates of the lower bound for the social spillovers, which in 2005 are estimated at \$88.7 million. But benefits do not accrue until the graduates reach the age of 25 in this scenario and at that point the wage increment swells in nominal terms to \$152.5 million, growing at a rate of 7 percent per year thereafter, estimated from the nominal impact of inflation plus growth in the Arizona labor force at current trends. Comparing aggregate social benefits and costs in this simulation reveals that the nominal benefit and cost streams are equal after about 11 years following the implementation of the plan. Accounting for both nominal and real effects and by discounting each stream at 7 percent extends the payback period to 14 years since the costs are largely incurred prior to realizing the benefits. However, after 20 years, discounted social benefits exceed discounted social costs by \$364 million.

A number of alternative simulations are conceivable. In the example above, it is assumed that only a 0.2 percent increase in the labor force share of graduates is targeted. Programs that continually increase the labor force share could be adopted, and private costs and benefits could be added. Because of the large internal rates of return that accrue to investment in higher education, results similar to those in the simple simulation discussed in the prior subsection are likely to prevail. Decreases in ability to retain graduates in the state will reduce net benefits while programs that lead to migration of college graduates will lead to increases in net benefits.

Social Returns Simulation: Caveats and Qualifications

- The simulation applies estimates obtained from the 2000 census to labor force participants between the ages of 25 and 64 across the state, whereas Moretti's estimates were obtained from a historical sample of cities. The simulation is supply driven in the sense that it measures the impact of increasing the supply of college graduates on the economy. It presumes that there will be sufficient demand for the knowledge and skills that these workers possess.
- The simulation does not account for the opportunity cost of social investments (the use of public monies for other purposes). The direct economic benefits that would accrue due to the additional expenditures on the production of additional local graduates also are not included. In addition, the social and private returns that accrue to those who do not complete their college education are not estimated but the social costs of students who do not graduate are included in the analysis. Finally, the simulation employs "lower bound" estimates for the spillover effect.
- The simulation assumes an increased number of university graduates from local institutions of higher education. Even greater economic impact could be obtained if a region could become a "magnet" for educated workers — attracting them from outside the region to work locally. In this case the region reaps the benefits of the educated workers without bearing all the costs. However, greater local production of university graduates may assist in inducing this "magnet" effect.
- Local production of university graduates invariably entails adding degreed students at the low end of the age and experience profile.
- Additional cost reduction could occur if student retention rates increase, if the social subsidy per student is reduced, or if greater numbers of locally produced students remain in the state.

- The aggregate simulation does not address economic activity that occurs from age 16 to 24. College students and recent graduates (ages 22 to 24) earn income. The opportunity cost of not attending college is the income forgone while attending college. The net effect of these factors is not measured in the analysis.
- The estimates obtained in Moretti's analysis reflect the combination of greater productivity produced by higher levels of human capital. Education combined with quality employment opportunities results in higher remuneration for workers. This process may take time to evolve.
- Moretti effects prevail on average across hundreds of cities. The effect on any single region or state can vary.
- Despite Moretti's best attempts to identify a causal relationship, it remains possible that higher educated workers are simply attracted by quality job opportunities and migrate accordingly. Regardless, the availability of quality job opportunities will be necessary for these effects to take place. And the empirical evidence suggests that an educated workforce is an inducement for attracting and retaining these quality job opportunities.

Additional Work on Social Benefits

The empirical analysis of the size of monetary social benefits induced by higher education will continue as economists learn more about the spillover effects of investments in human capital. The estimates used in the social benefit simulations are designed to illustrate the types of social returns that accrue due to the addition of more graduates into the labor force. The impact is substantial despite the use of estimates at the lower bound of the range of possible effects of the social benefit.

Additional literature suggests that there are many avenues that the production of college degrees can take in influencing economic activity. Using growth accounting techniques, King and Smith (1988) estimated that only 1.9 percent of annual economic growth rates from 1940 to 1980 was non-education related. Pencavel (1991) estimates that from 1913 to 1950 only 1.3 percent of total growth was directly attributable to higher education, but higher education accounted for 14.6 percent of the growth from 1973 to 1984. Aschauer (1994) estimates that 15-to-to-20 percent of economic growth observed in the U.S. is attributable to the accumulation of education capital. Howe (1994) examines the incidence of unemployment across individuals with different levels of educational attainment, finding that the lowest incidence of unemployment occurred in worker populations that had college degrees. Hoenick (1994) argues that attainment of advanced degrees increases the likelihood that workers can adapt to technological change — as in Shumpeter's notion of creative destruction — and thus are important in building a labor force that can better withstand the pace of technological change.

Glaeser et al. (2000, 2003) examines wages in cities — identifying effects that accrue to those cities with higher education and skill levels. Results point to agglomeration spillovers that manifest themselves in faster growth and higher wages as educated people interact. Gottlieb and Fogarty (2003), using similar data, confirm the result and note that it persists across a wide range of cities even after controlling for region. Jorgensen (2000) et al. estimates that a considerable portion of the late 1990s growth was directly attributable to roles played by research innovation at institutions of higher education and the greater absorptive capacity of a labor force with greater proportions of college graduates. Wang (2003), in an extensive study of the impact of

universities on surrounding cities, finds that proximity to institutions of higher learning induce greater rates of job growth.

As difficult as the social monetary benefits are to quantify, the implicit value of non-monetary benefits are even less conducive to measurement. However, the non-monetary contributions that more educated individuals bring to society, coupled with the reduction in social costs that they incur over their lifetimes, suggests that the non-monetary benefits represent considerable return on social investments made to support higher education.

Perhaps most important are the intergenerational effects that accrue to investments in higher education. The quantitative importance of these effects is very difficult to estimate precisely since costs to society incurred today to create opportunities for individuals to acquire college degrees must be compared to benefits realized two, three or four generations in the future.

III. EMPIRICAL DATA ON HIGHER EDUCATION ENROLLMENT AND FINANCE

Summary

- Enrollment in degree-granting institutions of higher education in Arizona as a percentage of the state's population was about equal to the national average in 2003. The Arizona figure was higher than the national average at private for-profit institutions, slightly greater than the national average at public institutions, but considerably below average at private not-for-profit institutions.
- Combining both public and private institutions, total revenues and expenditures per student at Arizona institutions of higher education were far below the national averages in 2003, among the least in the nation. Among public institutions, Arizona's per student higher education revenues and expenditures were not as far below average, but still ranked among the bottom 10 states in the nation.
- The ability to pay in Arizona is below average due to the state's subpar incomes. Thus, the state's higher education revenues and expenditures per student adjusted for income were not as far below the national averages in 2003. Among public institutions, Arizona's per student revenues and expenditures were close to the national average, ranking near the middle of the states.
- Public financial support for higher education, as measured by government appropriations, was marginally higher in Arizona than the national per student average in 2003, with Arizona ranking just above the middle of the states. However, tuition and fees and other revenues were far below the per student average.
- Adjusted by the state's ability to pay, public support for higher education in Arizona was considerably higher in 2003 than the national average.
- Increases in public support for higher education per student have been nearly equal in Arizona and the nation. However, the increases have not been as great as gains in the ability to pay, particularly in Arizona.

Introduction

Higher education is defined to include all public and private degree-granting institutions, which primarily consist of two-year colleges and four-or-more-year (hereafter referred to as four-year) universities. The National Center for Education Statistics (NCES) is the primary source of statistics on higher education. The NCES provides various measures of higher education enrollment and finance annually, but their latest complete data by state are for 2001 (the 2000-01 fiscal year). Incomplete data are available for 2003.

Education finance and enrollment data are adjusted by other data — population, gross product, and personal income — that are produced by the U.S. Department of Commerce. Data for Arizona are compared to the national average, all states (including the District of Columbia), and two smaller groups of states: 10 competitor states (California, Colorado, Florida, Georgia, Nevada, New Mexico, Oregon, Texas, Utah, and Washington) designated by the Greater Phoenix Chamber of Commerce, and 10 new economy states (California, Colorado, Connecticut, Maryland, Massachusetts, Minnesota, New Jersey, Utah, Virginia, and Washington) selected by the Milken Institute.

For more detail on higher education enrollment and finance than presented in this chapter, see the report “Higher Education Enrollment and Finance in Arizona Compared to All States” available at (www.wpcarey.asu.edu/seid/Reports.cfm).

All Institutions

The NCES database for 2003 includes 76 degree-granting institutions of higher education in Arizona. Of these, all enrollment and financial data were missing from three and financial data were missing from eight others. Thirty-four of the 76 were private for-profit institutions, with the share of both two-year and four-year institutions above the national average. In contrast, the 17 private not-for-profit institutions accounted for a below-average share of the total. The five public four-year universities (the three campuses of Arizona State University plus Northern Arizona University and the University of Arizona) also made up an unusually low share of the total.

The significance of missing data varies widely by state, with data for some major institutions in other states missing from the NCES 2003 database. Thus, the incompleteness of the data needs to be considered in evaluating the information presented in this section. The financial data are for fiscal year 2003. Enrollment figures are on a full-time-equivalent (FTE) basis for Fall 2003. Total revenues and expenditures in Arizona in 2003 are compared to the national average and to each of the comparison groups of states based on three classifications of degree-granting institutions of higher education: all institutions, public and not-for-profit institutions (excluding for-profit institutions), and public institutions only.

Enrollment

Enrollment at public institutions in Arizona was nearly 196,000, split almost equally among two-year colleges (99,000) and four-year universities (nearly 97,000). Enrollment at public institutions accounted for 2.1 percent of the national total, compared to the state’s population share of 1.9 percent. The share of the nation was above average among two-year colleges at 2.7 percent but slightly below average at four-year universities at 1.7 percent. All three of Arizona’s original public universities had enrollment in excess of 15,000 and ASU West had 5,000 students. Three public community colleges had enrollment of more than 10,000 and three others exceeded 5,000.

In contrast, enrollment at private not-for-profit schools in Arizona totaled just 10,700, only a tiny share of the national total at 0.2 percent for two-year institutions and 0.4 percent for four-year schools. None of the private not-for-profit institutions in Arizona are large. Grand Canyon University had the greatest enrollment at 2,000.

The enrollment of 104,000 at private for-profit schools in Arizona consisted largely of the 71,000 students in the online campus of the University of Phoenix that the NCES includes in the Arizona statistics. However, even after excluding these students, for-profit institutions in Arizona still made up a large share of the national enrollment total: 5.4 percent of two-year schools and 5.3 percent of four-year schools. The University of Phoenix was the only for-profit institution with enrollment of more than 2,500, with nearly 8,000 at their Phoenix campus and a little more than 3,000 at their Tucson campus. Excluding the online campus, total private school enrollment in Arizona made up only 1.3 percent of the national total.

Accounting for 23 percent of the state's enrollment total, the online campus at the University of Phoenix greatly influences the Arizona enrollment and finance data. It was not excluded from the following analyses because of similar institutions being included in other states. Instead, given this anomaly, the specialized nature of many degree-granting for-profit institutions — such as the Arizona Automotive Institute, the Refrigeration School, and the Scottsdale Culinary Institute — and extremely high per-student revenue and expenditure figures at some for-profit institutions, some of the following analyses exclude for-profit schools.

Total enrollment in Arizona was 311,000. As a percentage of the state's population, enrollment was 27 percent higher than the national average, ranking sixth in the nation and second among both the competitor states and the new economy states. However, excluding the for-profit institutions, enrollment totaled 206,000; enrollment as a percentage of the population was 12 percent below average in Arizona, ranking near the bottom of the states: 43rd overall, eighth among the 11 competitor states and ninth among the 11 new economy states. Looking only at public institutions, Arizona's enrollment as a percentage of population was 9 percent above average, ranking in the middle of the states among all comparison groups of states.

Enrollment at public institutions as a share of enrollment at all institutions was below average in Arizona, ranking 42nd overall, last among the competitor states, and ninth among the new economy states. Excluding for-profit institutions, the comparison reverses, with the public share in Arizona well above average, ranking fifth overall, third among the competitor states, and first among the new economy states.

Total Revenues and Expenditures

Revenues and expenditures are measured three ways: per FTE student, per FTE student relative to per capita personal income (PCPI), and per FTE student relative to per capita gross state product (PCGSP). The latter two measures reflect ability to pay.

Based on the classification including all institutions, revenues per student in Arizona were 40 percent below the national average, ranking the state 48th overall, 10th among the 11 competitor states, and last among the new economy states. Excluding the for-profit institutions does not substantially change the results, with Arizona 29 percent below the national average, the national rank 46th, and the rank among the two other comparison groups unchanged. Looking only at public institutions, the shortfall is smaller at 15 percent, but the national rank goes up only to 44th and the rank among the competitor states to eighth; Arizona still ranks last among the new economy states.

The comparisons of expenditures per student are similar to those of revenues per student except for the classification of all institutions, in which Arizona ranked last among all states at 50 percent below average (see Table III:1). Thus, higher education revenues and expenditures per student are quite low in Arizona regardless of the set of higher education institutions included.

Per capita personal income and per person gross product in Arizona are considerably below the national averages, according to data reported by the U.S. Department of Commerce's Bureau of Economic Analysis. (The 2000 census, however, indicated that per capita income in Arizona was not so far below average.) Thus, comparing revenues and expenditures per student to PCPI and

**TABLE III:1
REVENUES AND EXPENDITURES PER FULL-TIME-EQUIVALENT STUDENT, 2003**

Ratio to the U.S. Average	Revenues			Expenditures		
	Per FTE Student	Versus PCPI	Versus PCGSP	Per FTE Student	Versus PCPI	Versus PCGSP
All Institutions	60%	70%	69%	50%	58%	57%
Excluding For-Profit	71	82	81	74	85	84
Public Only	85	98	97	88	102	100
Ranking Among All States						
All Institutions	48	42	42	51	51	48
Excluding For-Profit	46	40	41	47	39	41
Public Only	44	31	34	44	31	32
Ranking Among 11 Competitor States						
All Institutions	10	7	8	11	10	11
Excluding For-Profit	10	7	8	10	7	7
Public Only	8	6	6	8	5	5
Ranking Among 11 New Economy States						
All Institutions	11	8	8	11	11	11
Excluding For-Profit	11	8	8	11	7	7
Public Only	11	5	5	11	5	4

Source: Calculated from National Center for Educational Statistics (nces.ed.gov/ipeds) and U.S. Department of Commerce, Bureau of Economic Analysis (www.bea.gov).

PCGSP somewhat raises Arizona's higher education rankings and ratio to the national average. However, among all institutions and the classification excluding for-profit schools, the state still was far below the national average. Among public institutions, Arizona's per student revenues and expenditures were close to the national average, ranking near the middle of the states.

Categories of Revenues and Expenditures

The NCES divides revenues into three categories: tuition and fees, state and local government appropriations, and other. Since appropriations are made only to public institutions, they are analyzed in the following section. Expenditures are split into five categories: instructional support, academic support, student services, institutional support, and other.

Tuition and fees per student in Arizona were considerably below the national average in 2003 in each of the three classifications of institutions, though Arizona's ranking was above the middle of the states in the all institutions classification. Among public institutions, per-student tuition and fees were 15 percent below average, ranking 36th overall, fifth among the competitor states and 10th among the new economy states. Arizona still was a little below average after considering ability to pay.

Arizona was far below average in the category of "other" revenues, ranking last among the states among all institutions and in the classification excluding for-profit institutions, and 47th among public institutions. Even after considering ability to pay, Arizona's public-sector figure was 20 percent below average, ranking among the bottom 10 states overall and third to last among the competitor and new economy states.

Arizona was far below average on expenditures per student in each of the five expense categories, ranking at the bottom of the states among all institutions and near the bottom in the classification excluding for-profit institutions. Among public institutions, Arizona's figure ranged from 7 percent below average in the academic support category (ranking 26th) to 30 percent below average in the student services category (ranking 45th).

Public Institutions

This section focuses on public support for higher education, defined as state and local government appropriations for higher education expressed on a full-time-equivalent student basis. While appropriations are only a portion of the total funding available to public institutions of higher education, the other sources (such as tuition and fees) do not represent public support.

Traditionally, public support for higher education has been defined as state government appropriations; for example, the Grapevine project of Illinois State University has collected state government appropriations for higher education since 1961. The focus on state government, however, fails to recognize that in some states local governments contribute substantially to the funding of higher education while in other states all of the funding comes from the state government. The State Higher Education Finance project (SHEF) of the State Higher Education Executive Officers organization (SHEEO) reports that local government's share of total appropriations in 2004 averaged 10 percent nationally, but was 35 percent in Arizona — the highest proportion in the nation. (Wisconsin ranked second at 23 percent.) Thus, looking only at state government appropriations results in a misleading evaluation of government support for higher education across the states.

The Grapevine data on state government appropriations for higher education is timelier than the NCES data. In 2004, Illinois State University for the first time included local government appropriations (collected by SHEF). However, since enrollment data are not available for 2004, the Grapevine project compares appropriations data by state on a per capita basis. By not reflecting the state-to-state fluctuations in public institution enrollment as a percentage of the number of residents, per capita appropriation measures produce an incomplete picture of public support. Similarly, state and local government appropriations for higher education as a share of total government spending or of tax revenues also present an incomplete picture since enrollments are not considered.

Through 2001

Complete annual data through 2001 are available from the NCES; data for 2001 are compared especially to those of 1991, a comparable year in the economic cycle. Nationally, the percentage of the population enrolled in public institutions of higher education held nearly steady near 3 percent between the mid-1980s and 2001. The Arizona percentage was higher than the national average in each year, but the differential declined from a little more than 1 percentage point between the mid-1980s and early 1990s to 0.4 in 2000 and 2001 (see Chart III:1).

The main reason for Arizona's higher-than-average percentage of the population enrolled in public institutions of higher education is the relative shortage of private not-for-profit institutions of higher education in Arizona. The readily available and affordable nature of the community college system in Arizona is another reason.

State and local government appropriations for higher education per full-time-equivalent public student averaged \$7,159 nationally in 2001 according to the NCES. The Arizona figure of \$6,711 was 6.3 percent less. In 1991, the Arizona figure was 4.8 percent less than the national average. Arizona's figure fluctuated from 1 to 8 percent less than the national average between 1991 and 2001 (see Chart III:2). The differential typically was somewhat larger during the 1980s. State and local government higher education appropriations per FTE student in 2001 in Arizona ranked 30th among all states and the District of Columbia according to the NCES data. In 1991, Arizona had ranked 29th.

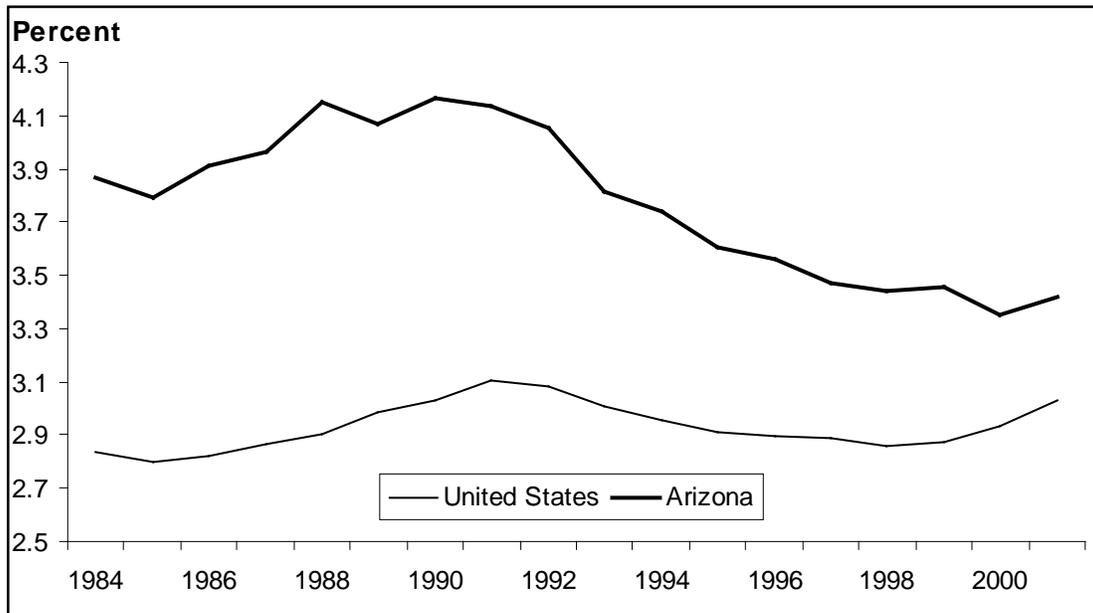
This measure of appropriations per FTE student does not consider Arizona's lesser ability to pay. State and local government appropriations as a percentage of gross product was higher in Arizona (0.74 percent) than the national average (0.61 percent) in 2001. The 2001 percentages were less than those in 1991, especially in Arizona, as seen in Chart III:3. However, this measure of appropriations as a percentage of gross product does not reflect Arizona's above-average proportion of residents enrolled in public institutions of higher education.

Appropriations by state and local governments for higher education rose an inflation-adjusted 30 percent nationally between 1991 and 2001. Arizona's real increase was a little larger at 35 percent, but both the national and Arizona increases were less than real economic growth. Nationally, real gross product gained 41 percent during the decade, while in Arizona real GSP surged 95 percent.

On a per FTE student basis, the 17 percent real increase in appropriations in Arizona was slightly less than the national average of 18 percent. While inflation-adjusted appropriations rose even on a per student basis, the increase was less than the rate of economic growth, especially in Arizona. Per capita real gross product rose 25 percent nationally and 39 percent in Arizona between 1991 and 2001. Thus, whether measured in aggregate terms or on a per person basis, appropriations for higher education did not keep up with economic gains between 1991 and 2001, especially in Arizona.

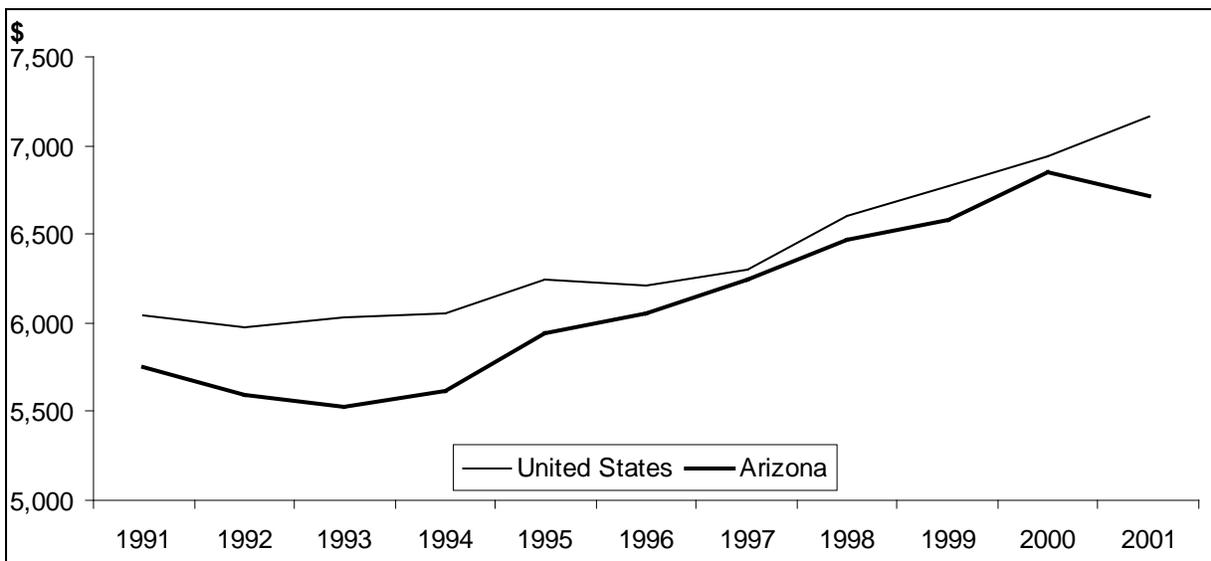
In order to incorporate both enrollments and ability to pay in one measure, state and local government appropriations per FTE student were calculated as a share of gross product per capita. As seen in Chart III:4, Arizona's figure has been greater than the national average, but the differential was less in 2001 than over the prior decade. Thus, public support for higher education in Arizona has waned relative to the national average, but the state's effort remains higher than the national average because of its limited ability to pay.

**CHART III:1
ENROLLMENT IN PUBLIC INSTITUTIONS OF HIGHER EDUCATION
AS A PERCENTAGE OF THE TOTAL POPULATION**



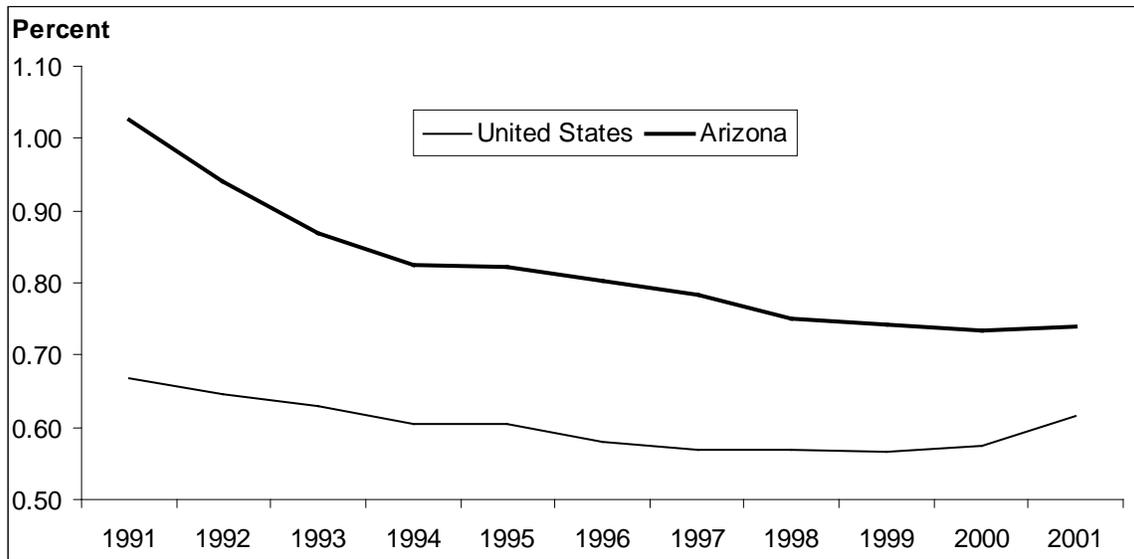
Source: Enrollment from the National Center for Educational Statistics. Population from the U.S. Census Bureau.

**CHART III:2
INFLATION-ADJUSTED STATE AND LOCAL GOVERNMENT APPROPRIATIONS
FOR HIGHER EDUCATION PER FULL-TIME-EQUIVALENT STUDENT**



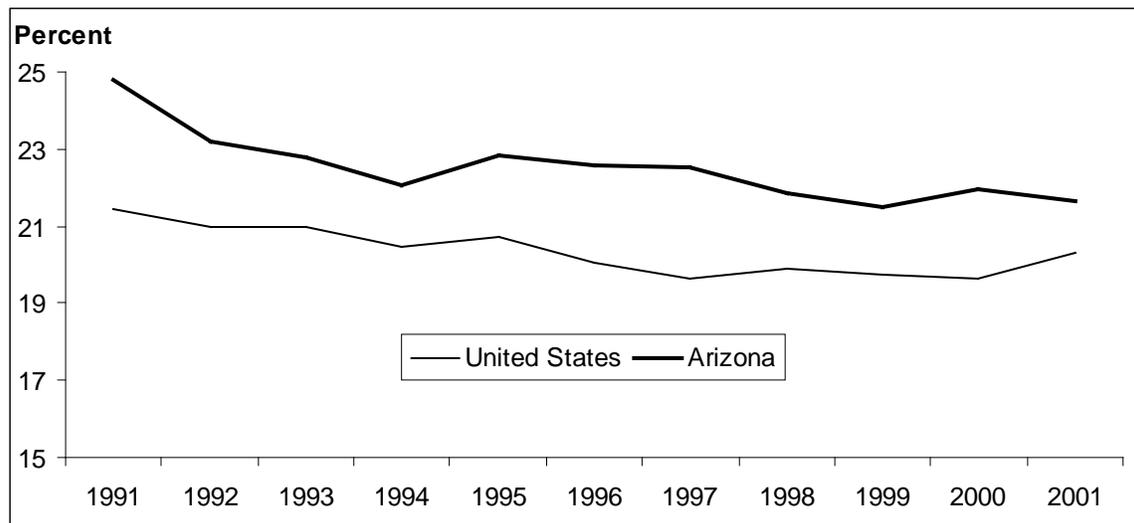
Source: National Center for Educational Statistics. Appropriations deflated by the U.S. GDP price deflator produced by the U.S. Bureau of Economic Analysis, expressed in 2001 dollars.

**CHART III:3
STATE AND LOCAL GOVERNMENT APPROPRIATIONS
FOR HIGHER EDUCATION AS A PERCENTAGE OF GROSS STATE PRODUCT**



Source: Appropriations from the National Center for Educational Statistics. Gross state product from the U.S. Bureau of Economic Analysis.

**CHART III:4
STATE AND LOCAL GOVERNMENT APPROPRIATIONS FOR HIGHER EDUCATION
PER FULL-TIME-EQUIVALENT STUDENT AS A SHARE OF GROSS STATE
PRODUCT PER CAPITA**



Source: Appropriations and enrollment from the National Center for Educational Statistics. Gross state product from the U.S. Bureau of Economic Analysis. Population from the U.S. Census Bureau.

In 2003

Arizona's total higher education appropriation per FTE student at public institutions was 3 percent higher than the national average in 2003, ranking just above the middle of the states at 20th. Arizona ranked third among the competitor states and fifth among the new economy states. Considering Arizona's reduced ability to pay, the figure was 20 percent above average relative to PCPI, ranking 14th, and 18 percent above average relative to PCGSP, ranking 15th. On each ability-to-pay measure, Arizona ranked second among both the competitor states and new economy states.

IV. EMPIRICAL DATA ON EDUCATIONAL ATTAINMENT

Summary

- Arizona ranks in the middle of the states on the percentage of its residents possessing a bachelor's degree, slightly below the U.S. average. However, educational attainment has increased less in Arizona than the national average in recent decades.
- Arizona compares less favorably among labor force participants, since the state's overall educational attainment is bolstered by highly educated retirees who migrate to the state at retirement.
- The educational attainment of young adults in Arizona is substantially below the national average.
- Among those educated in Arizona and among immigrants to the state, educational attainment is relatively low. In contrast, the attainment of interstate migrants is considerably higher.

Introduction

Two basic trends impact educational attainment statistics. First, regardless of the year in which a group was born, educational attainment rises rapidly until the group reaches the age of the early-to-mid-20s, then advances much more gradually. (For example, the average educational attainment of those born in 1965 was considerably higher in 1990 than 1980, but not much higher in 2000 than in 1990.) Second, average educational attainment climbed considerably with the year born through the mid-20th century, then much more gradually. (For example, the average educational attainment of those born in 1950 was much higher than the average of those born in 1900, but the average attainment of those born in 1970 was not much different than that of those born in 1950.)

The only accurate statistics on educational attainment by state come from the decennial censuses. Thus, this chapter reports data from 2000, with some comparisons to earlier censuses. Of the many ways in which to measure educational attainment, the percentage with a bachelor's degree is used in this chapter. Based on another measure, such as the proportion with a high school diploma, the geographic pattern of educational attainment may be quite different. For example, the correlation by state between high school graduates and university graduates was only a moderate 0.43. For other measures and more detail see the report *Educational Attainment in Arizona Compared to All States*, available at <http://economist.asu.edu/p3/education>.

Educational Attainment in Arizona Relative to All States

Educational attainment statistics generally are expressed for the population 65 or older. Most of the states with the highest educational achievement as measured by the proportion with a bachelor's degree were located along the Atlantic Coast, from New Hampshire and Vermont south to Virginia. Colorado and Washington also were among the top 10. Southern states had the lowest attainments, but were joined by Nevada and Indiana. Arizona ranked tied for 25th, with a percentage slightly below the national average. As seen in Table IV-1, a substantial variation by state exists in the proportion with a bachelor's degree.

Focusing on the small proportion of the population who had earned at least a master's or professional degree (just 8.9 percent nationally), the leading states were similar to the list for

TABLE IV-1
EDUCATIONAL ATTAINMENT BY STATE IN 2000 AND CHANGE OVER TIME
Percentage of Population 25 or Older Ranked by 2000 Percentage of University Graduates

	2000	1990-to-2000 Change	1980-to-2000 Change
District of Columbia	39.1%	5.8	11.6
Massachusetts	33.2	6.0	13.2
Colorado	32.7	5.7	9.7
Maryland	31.4	4.9	11.0
Connecticut	31.4	4.2	10.7
New Jersey	29.8	4.9	11.5
Virginia	29.5	5.0	10.4
Vermont	29.4	5.1	10.4
New Hampshire	28.7	4.3	10.5
Washington	27.7	4.8	8.7
Minnesota	27.4	5.6	10.0
New York	27.4	4.3	9.5
California	26.6	3.2	10.0
Hawaii	26.2	3.3	5.9
Utah	26.1	3.8	6.2
Illinois	26.1	5.1	9.9
Kansas	25.8	4.7	8.8
Rhode Island	25.6	4.3	10.2
Oregon	25.1	4.5	7.2
Delaware	25.0	3.6	7.5
Alaska	24.7	1.7	3.6
Montana	24.4	4.6	6.9
United States	24.4	4.1	8.2
Georgia	24.3	5.0	9.7
Nebraska	23.7	4.8	8.2
Arizona	23.5	3.2	6.1
New Mexico	23.5	3.1	5.9
Texas	23.2	2.9	6.3
Maine	22.9	4.1	8.5
North Carolina	22.5	5.1	9.3
Wisconsin	22.4	4.7	7.6
Pennsylvania	22.4	4.5	8.8
Florida	22.3	4.0	7.4
North Dakota	22.0	3.9	7.2
Wyoming	21.9	3.1	4.7
Michigan	21.8	4.4	7.5
Idaho	21.7	4.0	5.9
Missouri	21.6	3.8	7.7
South Dakota	21.5	4.3	7.5
Iowa	21.2	4.3	7.3
Ohio	21.1	4.1	7.4
South Carolina	20.4	3.8	7.0
Oklahoma	20.3	2.5	5.2
Tennessee	19.6	3.6	7.0
Indiana	19.4	3.8	6.9
Alabama	19.0	3.3	6.8
Louisiana	18.7	2.6	4.8
Nevada	18.2	2.9	3.8
Kentucky	17.1	3.5	6.0
Mississippi	16.9	2.2	4.6
Arkansas	16.7	3.4	5.9
West Virginia	14.8	2.5	4.4

Source: U.S. Department of Commerce, Census Bureau.

those with at least a bachelor's degree. States in the South, as well as several in the northern Plains and northern Rocky Mountain regions, had the lowest percentages of residents with a graduate degree. Arizona's figure of 8.4 percent was a little less than the national average but ranked tied for 20th.

Several of the Plains and Great Lakes states that had among the higher attainments based on high school diplomas or more education had among the lower attainments based on the percentage with at least a bachelor's degree. In contrast, several northeastern states and California compared more favorably on university graduates than on high school graduates.

Between 1990 and 2000, the educational attainment of the 25-or-older population rose nationally, by 4 points based on the percentage with at least a bachelor's degree. The national proportion advanced 8 percentage points between 1980 and 2000. Most of the gain resulted from deaths in the oldest age groups, when even a high school diploma was not common, and the addition of those born after 1950, a group with greater educational attainment.

Most of the states with the strongest gains in the percentage of university graduates were located along the Atlantic Coast, with most of these states among the leaders in the share of university graduates in 2000. Almost all of the states with the least gain in percentage of university graduates were in the southern portion of the country, particularly in the Southwest during the 1990s. Arizona ranked tied for 41st in the change between 1990 and 2000 and 39th in the 1980-to-2000 change. The southwestern states generally still were average on the percentage of university graduates in 2000 while the other southern states were below average on attainment.

Educational attainment is higher in all states among those active in the labor market. From an economic development perspective, the educational attainment of those active in the labor market (particularly those between 25 and 64 years of age, most of whom have completed their educations and are not of traditional retirement age) is of more relevance than overall attainment of the entire 25 or older population.

This is particularly true in Arizona, which attracts a large number of well-educated retirees (many under the age of 65) who boost the state's average educational attainment but do not participate in the labor market. Thus, the most commonly reported educational attainment figures, which are for the entire population 25 or older, present Arizona more favorably than is the reality of labor market participants. This is the case across much of the West, which has stronger relative educational attainments among retirees than young adults, largely due to strong net in-migration of educated retirees and either poor educational attainment of natives and/or strong in-migration of relatively uneducated young people.

Educational attainment in Arizona in the young-adult age groups of 18 to 24 and 25 to 34 was considerably less than the national average. This poor performance partially resulted from the low educational attainments of children educated in Arizona, but the strong net in-migration of young, poorly educated people, especially from Mexico and Central America, also contributed. In contrast, educational attainment among those 65 or older was higher than the national average (see Chart IV-1).

**CHART IV-1
EDUCATIONAL ATTAINMENT IN ARIZONA IN 2000
RELATIVE TO NATIONAL AVERAGE
By Age Group**



Source: U.S. Department of Commerce, Census Bureau.

Arizona's educational attainment among the younger age groups was considerably below that of most of the competitor states (California, Colorado, Florida, Georgia, Nevada, New Mexico, Oregon, Texas, Utah, and Washington) designated by the Greater Phoenix Chamber of Commerce. Arizona ranked next-to-last or last among the new economy states (California, Colorado, Connecticut, Massachusetts, Maryland, Minnesota, New Jersey, Utah, Virginia, and Washington) identified by the Milken Institute. However, Arizona ranked above the middle in the retirement age group.

The percentage of Arizona natives (those born in Arizona) with a bachelor's degree was only 18 percent in 2000, just half the 36 percent figure of Arizona residents born elsewhere in the United States. The proportion of those born in another country with a bachelor's degree slightly exceeded that of Arizona natives. This is an indication of the high migration rates of those with college degrees.

Educational Attainment Relative to Job Quality

A strong correlation of 0.75 by state existed between job quality and educational attainment in 2000 when attainment is measured as the percentage of college graduates. Little correlation (0.02) was present when the attainment measure is the percentage of high school graduates. For more information on job quality, see <http://economist.asu.edu/p3/job-quality>.

Job quality and educational attainment are not perfectly related for a variety of reasons. Generally, some people will never move, whether due to family ties or other reasons. Yet if educational attainment is encouraged in their family or community, these residents may gain too

much education for the limited available job opportunities in their community (particularly true of less populous areas) and accept underemployment rather than migrate to an area with job opportunities.

Those states with a lesser job quality than expected given their educational attainment (as measured by university graduates) mostly are less populous states without large urban areas nearby. Some of these states (e.g. Vermont, Hawaii, and Montana) have considerable natural beauty. It is likely that these states attract a certain type of educated migrant who is willing to be underemployed in exchange for perceived noneconomic advantages.

Those states with higher job quality than expected given their educational attainment are states with an abnormally high share of jobs that are high-paying but do not require much educational attainment, such as many mining and some manufacturing jobs. Michigan, West Virginia, Louisiana and Texas are among the states in this group.

V. GEOGRAPHICAL DISTRIBUTION OF THE UNIVERSITY-EDUCATED POPULATION

Summary

- To realize a high share of college graduates in its population, a region must either graduate a large number of people from local institutions of higher education or attract college graduates from other regions.
- Labor force participants with university degrees are highly mobile in terms of their residence. Thus, the number of university graduates from local institutions of higher education is not necessarily highly related to the number of college graduates living in a community.
- In any community, the retention of locally educated individuals and the attraction of highly educated people from other regions are heavily dependent on the availability of job opportunities appropriate for those with college degrees. Urban and natural amenities also are important to the attraction and retention of college graduates.
- National studies indicate that a statistically significant relationship exists between the number of new college graduates in a state and average educational attainment in the state's adult population. But the strength of this relationship appears modest.
- Studies find that if an additional 100 college-bound students choose to attend college in a given state, the long-run effect of raising the college-educated workforce in that state will be only 5-to-10 workers.

Introduction

The college-educated share of the population depends on both demand and supply factors. In places with an intrinsically strong local demand for educated labor, as in places that border the nation's capital or contain a major financial center, employers will be able to attract workers from other states by offering high wages. Amenities that appeal to college graduates also are important to attract a large number of educated migrants. Alternatively, a place may be able to assemble a highly educated population by having a large number of people graduate from local colleges and universities (hereafter referred to as "local production of college graduates").

The purpose of this chapter is to review evidence relating to the effect of local production of college graduates on the number of adult college-educated people that end up living in the area.

Determinants of the Size of the University-Educated Population

Given the high mobility of the U.S. population, and of college-educated labor in particular, much of the variation across states in college educational attainment derives from differences in abilities to attract college-educated workers from other states. Some states have a comparative advantage in the use of college-educated labor. States bordering the nation's political and financial capitals (Washington, D.C. and New York City), for example, long have been important importers of educated workers. The strong demand for educated labor in these areas derives, in large part, from an arbitrary historical concentration of firms and institutions that make intensive use of highly educated labor.

Some states are successful in attracting educated labor not because they have an abundance of high-paying jobs, but because they offer natural or urban amenities that are valued by educated people. Regional and urban economists are increasingly impressed by the important role

amenities now play in U.S. interstate migration decisions. As real incomes rise, people are choosing to spend a greater share of their income on quality of life, either directly through the purchases of private amenities such as fine dining or live entertainment, or indirectly through lower wages and/or higher home prices in areas with public amenities. Amenities are thought to be especially important in the location decisions of highly educated people, those who can afford to pay for them.

To identify which amenities are most important to workers and their families, researchers have looked both at differences in population growth rates and at differentials in wages and land prices (the idea being that people who place a high value on the public locational attributes of an area will be willing to accept lower wages and/or pay more for housing to live there). Foremost among the amenities that explain domestic U.S. migration patterns is weather. Residents both young and old have been moving in large numbers to places with warm winters and/or cool dry summers (Rappaport 2004). Studies of compensating wage and home price differentials also show weather variables to be important, especially number of heating degree days, precipitation, humidity and sunshine. The annual differential needed to compensate someone for living in Chicago rather than San Francisco is now thought to be around \$10,000 (Costa and Kahn 2003).

Other natural amenities that are significant in explaining wage and home price differentials are proximity to the coast and proximity to wilderness areas and national parks. Certain man-made, urban amenities also have been found to be important in household location decisions. Cities that have been most successful in attracting people are those with a rich variety of consumer goods and services (e.g., restaurants and live entertainment venues), good schools, and low crime (Glaeser, et al. 2001).

Despite the high degree of mobility in the U.S. population, most people never make an interstate move, or migrate just once. People who grow up in a state, for example, are much more likely to live there in their adult years than is someone drawn randomly from the national population. One particular aspect of locational persistence that has been studied involves the decision about where to go to college. People build relationships in college, relationships that often have value in the workplace later in life. As a result, a person tends to work and live in the same area that he or she went to college.

A large number of graduates from local institutions of higher education can translate into a large number of college-educated workers in the labor force only if the local labor market can absorb new graduates without a substantial decline in wages (which would end up causing workers to leave the area). The wage sensitivity of the demand for labor depends on the nature of the skills and degrees being acquired by graduates. Local markets for medical doctors, for example, have little ability to absorb new graduates. Almost no relationship exists between the number of MDs trained in an area and the number of adult doctors living there. Producers of goods and services that can be exported out of state, on the other hand, have the potential to absorb large numbers of new graduates. A positive relationship between the number of graduates from local institutions and use of college-educated labor in that area is present for sectors producing goods and services traded across states (Bound, et al. 2004).

Importance of Graduates from Local Universities

The remainder of this chapter summarizes the empirical evidence of how the production of college graduates influences the size of the college-educated population. Table V:1 shows information for each state on the percent of the adult population with at least a bachelor's degree and the number of undergraduate and graduate degrees awarded in the state expressed per 1,000 adult residents. The table helps to identify the states that are net importers and net exporters of college graduates.

States with a more favorable ranking in population share of college graduates than in degrees awarded tend to experience net inflows of college-educated people. The leading net importers of university graduates are New Jersey (with a difference in rankings between degrees awarded and population share of +42), Hawaii (+30), Alaska (+29), Washington (+27), Maryland (+23), Virginia (+23) and California (+23). These states are successful in attracting college-educated migrants either because they have a strong demand for educated labor or because they offer amenities that are highly valued by educated people.

In contrast, states with a ranking of population share that is less favorable than their ranking based on degrees produced are likely to be net exporters of college graduates. The largest differentials are in Indiana (-29), Iowa (-29), Missouri (-29), North Dakota (-27), South Dakota (-22), Alabama (-21), and West Virginia (-20). These states lack either the jobs or the quality of life necessary to keep their graduates in state.

Arizona is a large net recipient of migrants, both domestic and foreign, and gains more college-educated residents through in-migration than it loses through out-migration. The fact that Arizona has about the same ranking in share of the population with a bachelor's degree as it does in degrees produced per 1,000 residents is evidence not of an approximate balance between inflows and outflows of people with college degrees but rather of the fact that a large number of migrants without college degrees also choose Arizona as a place to live.

A positive and statistically significant correlation exists between the variables in Table V:1, suggesting that local production of college degrees raises the share of college graduates in a state's population. Other factors also could be affecting the share of college graduates. The simple correlation likely underestimates the effect of degrees awarded on the share of the population that is college educated because weather — the single most important factor explaining U.S. migration patterns — is correlated with the geographic distribution of U.S. colleges and universities.

As explained by Goldin and Katz (1999), the current geographic distribution of colleges and universities heavily reflects the settlement patterns of the late 19th and early 20th centuries and was essentially set by 1940. States with a relatively high production of degrees are disproportionately located in the East and upper Midwest, parts of the country with a climate generally perceived to be undesirable. Sunbelt states, with weather that has attracted large numbers of migrants for decades, are underrepresented by colleges and universities. Because of this relationship between weather and degrees awarded, a simple correlation between degrees awarded and share of the population with a college degree will serve to understate the causal role played by local production of degrees.

**TABLE V:1
EDUCATIONAL ATTAINMENT AND DEGREES AWARDED LOCALLY**

	Population with College Degree, 2000		Degrees Awarded, 2001-02	
	Percent*	Rank	Number per Thousand**	Rank
Alabama	19.0	44	10.5	23
Alaska	24.7	20	4.8	49
Arizona	23.5	24	10.7	22
Arkansas	16.7	49	7.6	45
California	26.6	12	9.0	34
Colorado	32.7	2	11.7	16
Connecticut	31.4	4	10.3	25
Delaware	25.0	19	13.5	8
Florida	22.3	31	7.5	46
Georgia	24.3	22	8.8	38
Hawaii	26.2	13	8.4	43
Idaho	21.7	35	8.1	44
Illinois	26.1	15	11.7	17
Indiana	19.4	43	11.7	14
Iowa	21.2	38	13.4	9
Kansas	25.8	16	12.3	11
Kentucky	17.1	47	8.6	39
Louisiana	18.7	45	10.2	28
Maine	22.9	27	8.4	42
Maryland	31.4	3	10.3	26
Massachusetts	33.2	1	17.6	2
Michigan	21.8	34	11.5	18
Minnesota	27.4	10	11.2	19
Mississippi	16.9	48	9.2	32
Missouri	21.6	36	13.6	7
Montana	24.4	21	11.0	21
Nebraska	23.7	23	13.8	6
Nevada	18.2	46	4.8	50
New Hampshire	28.7	8	12.0	12
New Jersey	29.8	5	7.3	47
New Mexico	23.5	25	8.5	41
New York	27.4	11	12.9	10
North Carolina	22.5	28	9.2	33
North Dakota	22.0	32	14.6	5
Ohio	21.1	39	10.3	27
Oklahoma	20.3	41	10.4	24
Oregon	25.1	18	9.2	31
Pennsylvania	22.4	30	12.0	13
Rhode Island	25.6	17	16.4	3
South Carolina	20.4	40	8.6	40
South Dakota	21.5	37	11.7	15
Tennessee	19.6	42	9.0	35
Texas	23.2	26	8.8	37
Utah	26.1	14	18.9	1
Vermont	29.4	7	15.8	4
Virginia	29.5	6	10.1	29
Washington	27.7	9	8.8	36
West Virginia	14.8	50	9.6	30
Wisconsin	22.4	29	11.1	20
Wyoming	21.9	33	7.2	48
United States	24.4		10.4	

*Percent of population 25 or older with at least a bachelor's degree.

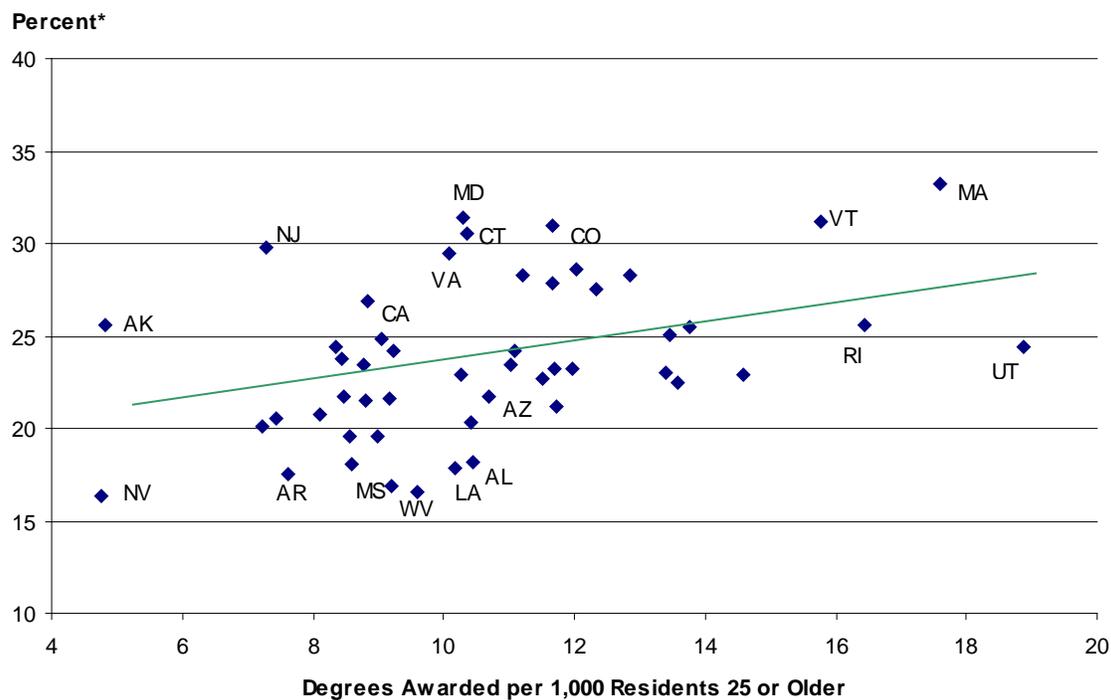
** Bachelor's, master's, doctorate and professional degrees per 1,000 25 or older.

Source: U.S. Department of Commerce, Census Bureau, and National Center for Education Statistics.

Chart V:1 is a scatter diagram plotting degrees awarded against share of the population with a degree, after adjusting the population share for the effect of weather. The measure of weather used to make these adjustments was based on Rappaport's (2004) analysis of population growth patterns and their relationship to a variety of measures of weather and other natural amenities. His analysis found warm winters to be the most important factor driving population growth. Rappaport used his results to rank cities on the basis of weather. These results, in turn, were used to rank states. Those with the most favorable weather include Arizona, California, Colorado, Florida, Hawaii, Nevada, Utah and Wyoming. The population shares shown in Chart V:1 are adjusted by the effects of weather. (The specific coefficient used to make the weather to make the weather adjustments was derived from a multiple regression of population share on both weather quintile and degrees awarded.)

After adjusting for weather, a statistically significant relationship exists between degrees awarded in a state and the share of the population that is college educated. If Arizona were to permanently raise the number of degrees awarded in the adult population from the current rate of 10.7 per thousand to 11.7 per thousand, the long-run effect would be to raise the share of the population with at least a bachelor's degree from its current level of 23.5 percent to 24.1 percent.

**CHART V:1
THE RELATIONSHIP BETWEEN EDUCATIONAL ATTAINMENT AND DEGREES AWARDED AFTER ADJUSTMENT FOR WEATHER**



* Of population 25 or older with at least a bachelor's degree.

Source: Groen (2004), Table 4, p. 135. Based on a national sample of 12,781 students from 30 selected colleges and universities. Students entered college in 1976 and were surveyed for current state of residence in 1996 (when they were 38 years old on average).

The estimated effect meets the standards of statistical significance, but it is not quantitatively large. The evidence from state-level data indicates that states with high production of undergraduate students tend to also have a high concentration of college graduates in their populations, but the relationship is a modest one. Migration clearly plays an important role in determining educational attainment in a state's adult population.

The scatter of points around the regression line in Chart V:1 confirms the importance of other factors in determining average educational attainment in a state. Some amenities that affect interstate migration may not be well summarized by the weather variables used in the analysis.

For example, Colorado has a much larger share of college graduates than expected on the basis of its weather and the number of degrees awarded in the state. Educated migrants may be attracted to Colorado by other amenities, such as skiing and national parks.

More importantly, the analysis has not accounted for factors that influence the demand for educated labor in a state. Maryland and Virginia benefit from the large number of jobs requiring a university degree that are located in the vicinity of the District of Columbia. A strong financial services industry helps attract educated workers to New Jersey and Connecticut. Massachusetts has the most educated population in the nation, partly attributable to the large supply of college graduates that comes out of the state's colleges and universities. But the state also has a strong high-tech sector that helps to attract professional and highly-educated labor.

In contrast, some states have a relatively weak demand for educated labor that makes it difficult to attract or retain college graduates. Most notable are the South Central states of Alabama, Arkansas, Louisiana and Mississippi. Low educational attainment in these states is not simply a matter of not producing enough college graduates.

Favorable weather helps Arizona attract educated migrants. After adjusting for weather, Arizona's educational attainment is 2 percentage points below what would be expected on the basis of the number of degrees awarded in the state. That Arizona lies below the regression line in Chart V:1 may be a consequence more of the attractiveness of the state as a destination for less-educated migrants than of an inability to generate jobs to retain college graduates.

Effect of College Location on Later Residence

An alternative way of evaluating the contribution local universities make to determining the size of the college-educated population in a state is to use information on where individuals grow up, go to college, and reside later in their adult lives. Groen (2004) used information from the Mellon Foundation's College and Beyond data files, which contain background information and college records for students at 30 selected colleges and universities. Groen's analysis focuses on the cohort that entered college in 1976 and was later surveyed in 1996 (when respondents were approximately 38 years old). By using information on the geographic range of schools to which individuals applied, Groen was able to control for students that chose to go to school in a state because they wanted to live there after graduation. In this case, simple correlations would overstate the causal role played by college location.

Table V:2 provides a brief summary of Groen’s results. The table shows that the probability that a college graduate will reside in a given state in his adult life depends on whether he resided in that state before going to college and whether he attended college in the state. For example, the number in the northwest cell means that of 100 college graduates who resided in a given state before going to college and who also went to college in that state, 49 out of the 100 would still be living there in their adult years.

The most important factor determining state of residence in adult life is where a person grows up. Comparing numbers down the columns of the table, a person is 5-to-8 times more likely to reside in a state later in life if it is his home state (as defined by state of residence before college entry). The contribution made by college location is found by comparing across rows. For a person who grows up in a given state, he is 10 percentage points more likely to reside there as an adult if he also went to college in the state. Looking across the second row of the table, the results indicate that for someone who did not grow up in a given state, he is only 5 percentage points more likely to choose to reside there as an adult if he went to college there.

The results in Table V:2 once again point to the modest role college location plays in decisions among educated people about where to live later in life. For every 100 in-state college-bound residents, 39 of them would choose to work and reside in the state in their adult life even if they attend college out of state. Policies that encourage students to remain in state when going to college increase this number from 39 to 49.

Information from Arizona State University alumni records indicates that 50-to-60 percent of ASU graduates remain and work in Arizona following graduation. These numbers are higher than the figures in the first column of Table V:2. The alumni statistics are not directly comparable to Groen’s figures, however. The alumni records include students who may have wanted to live in Arizona to begin with and chose an Arizona university for that reason. In this case, the alumni figures would overstate the role of local university attendance in the selection of Arizona as a state of residence. Groen tried to control for this factor by restricting his sample to individuals who applied to universities in more than one state.

**TABLE V:2
LIKELIHOOD OF WORKING IN A STATE AFTER GRADUATION**

	Received Bachelor's Degree in State	Received Bachelor's Degree in Another State
Lived in State Before College	49%	39%
Did not Live in State Before College	10%	5%

Source: Groen (2004), Table 4, p. 135. Based on a national sample of 12,781 students from 30 selected colleges and universities. Students entered college in 1976 and were surveyed for current state of residence in 1996 (when they were 38 years old on average).

It is also important to note that, from a policy perspective, the key feature of the frequencies in Table V:2 is not their general size, but the differences across columns. Alumni records say nothing about the second column of frequencies. It may be that 60 percent rather than 49 percent of in-state graduates from Arizona universities end up staying in state. But if it is also the case that 50 percent rather than 39 percent of in-state residents who attend college out of state return to Arizona to live, then policies that get 100 in-state students to remain in state when going to college still end up increasing the college-educated workforce by only 10 students.

VI. PUBLIC POLICY ISSUES

Summary

- Despite the high rate of return to higher education, only one-quarter of the U.S. population has obtained a four-year college degree. Underinvestment in higher education occurs.
- Impediments to college degree attainment include family financial constraints, lack of academic skills necessary for success in college, and an apparent lack of knowledge or firm belief in the large effect that a college education has on an individual's future earnings.
- While policy interventions designed to address financial access are abundant, more attention may be needed to address the information and ability concerns.
- Evidence does not exist that local production of graduates, in isolation, will be an effective economic development strategy. A portfolio approach — that incorporates higher education and that is aimed at quality workforce development, quality public infrastructure, an emphasis on quality of life and amenities, and efforts to attain and maintain business climate conducive to attracting quality employment opportunities — may yield the highest returns.

Introduction

Higher education represents an economic investment with a very high return — almost twice the size of long-run returns on stocks. Yet only one-quarter of the U.S. population has obtained a four-year college degree. Undoubtedly, many people underinvest in education and as a result fail to reach their economic potential. One very important role for public policy is to help more people realize the high returns afforded by a college education.

When people become college educated, society and the economy as a whole also benefit. Governments function better, because educated people make good voters. Highly educated workers also make a net positive contribution to the budgets of state and local governments. They provide funds to the fiscal system, which allows governments to pursue goals of social justice through public assistance programs and programs that equalize economic opportunity. The general economy is strengthened by having an educated workforce. Cities with highly educated workers have been shown to be more resilient and better able to adapt to economic change. College-educated workers also infuse an economy with knowledge and creativity, providing a boost to productivity and wages over and above the direct effects that an enhanced education has on their own earnings. Thus, as a way of promoting overall growth and development in a state economy, a role exists for public policy in higher education.

In the language of economics, market failures exist in higher education. When left alone, the private decisions of individuals will lead to an underinvestment in higher education. While referencing points developed earlier in the report, this concluding chapter reviews specific policy measures that have been proposed or implemented to help address the market failures in higher education.

Helping People Realize their Economic Potential

Three reasons explain why so many people fail to invest in a college education when the benefits to the individual so greatly outweigh the costs: (1) family financial constraints, (2) lack of academic skills necessary for success in college, and (3) an apparent lack of knowledge or firm belief in the large effect that a college education has on an individual's future earnings. The

appropriate policy is for dealing with underinvestment in higher education depends on which of these barriers are most important.

Economists long have recognized that the private financial system may fail to provide loan support for investments in education in the same way that it supports investments in physical capital. Government loan programs have been developed to try to mitigate these financial barriers, and the evidence suggests the programs have been highly successful. Estimates indicate that less than 10 percent of the youth population fails to complete college simply because of a lack of financial resources. This means that additions to college financial assistance programs are unlikely to significantly raise college educational attainment. Cuts in assistance, on the other hand, in either loan availability or tuition subsidies, may significantly reduce college enrollment.

Academic ability or college preparedness now seems to be more important than financial resources in influencing college entry and success. Unfortunately, this factor is difficult to address. Studies of educational attainment show that success in school depends on both the cognitive and non-cognitive skills (such as motivation and study habits) of the student. Cognitive ability is formed very early in life, much of it in the preschool years. Non-cognitive skills are more malleable than cognitive skills, but they too are largely set by late adolescence. High quality interventions in early childhood among at-risk children have proven effective, but they are expensive. College-preparedness can also be improved, of course, by raising the quality of elementary and secondary schools.

Also important as determinants of college entry and completion are family background factors, especially parents' level of education. Uneducated parents may not instill sufficient education goals in their children, perhaps because the benefits seem abstract, remote, and essentially unattainable to them. Education loans may prove ineffective in this case, since the financial benefits of education are being undervalued. A reduction in the cost of education through tuition subsidies, on the other hand, may help to tilt decisions in favor of education. Efforts also can be made to disseminate information in schools that informs students about the economic advantages of having a college degree. While it is difficult to change family values toward education, the good news is that any success that is achieved will cascade across generations.

Studies indicate that the size of the increase in lifetime earnings realized by a college graduate depends on the quality of the institution he attends. Misallocations of resources also occur when a gifted student enrolls in a low-quality college or university. As is the case in many western states, Arizona lacks elite private colleges. Arizona has historically adopted policies that encourage student accessibility and instructional expenditures per student are well below the national average. Maintaining low costs allow the state to make college education affordable and accessible, but these policies create pressures for cost savings (such as large class sizes and a historical tendency to hire faculty at salaries below the national average). Recent efforts to develop Honors Colleges represent a much-needed response to the absence of high quality college programs in the state.

While financial constraints are no longer a major barrier to investments in undergraduate college education, the same cannot be said for graduate study. Because of their high earnings potential, long-term loans are available to people who wish to become doctors, dentists, or earn other

advanced degrees. However, with high tuitions and an inability to earn income because of the time demands of the program of study, the typical graduate student will be far in debt when they finish. Alternatives to debt are equity-financing options first proposed by Friedman (1955) and recently evaluated by Lleras (2005). Graduate education can be financed by equity claims on the future earnings of the student. The claim is paid only if the graduate obtains gainful employment. There is no onerous debt obligation for those who are unable to realize the financial benefits of their degrees.

Economic Development through Higher Education

An argument can be made to include college educational attainment as an economic development policy goal. Educated workers make a net positive contribution to government budgets, and they help to raise the wages of all workers in an area. While the share of the total population in Arizona that is college educated is near the national average, the share of college graduates in the state workforce is well below average.

One way to realize a high share of college graduates in a state's workforce is to produce a large number of graduates at local universities. Examples of states that have an above-average share of college graduates in their populations partly because of high rates of local production include Massachusetts, New Hampshire, New York, and Vermont. However, given the high mobility of the U.S. population, especially among educated people, in general only a modest link exists between local production of degrees and collegiate educational attainment in a state's population. Indiana, Michigan, Missouri, and North Dakota are states that produce college graduates at a rate above the national average but have relatively low college attainment in the general population. So local production alone may not be a sufficient remedy.

One condition for local production of degrees to translate into high educational attainment in the adult population is that students must be able to find jobs in the state after they graduate. The local labor market must be able to absorb new graduates without a significant drop in wages, or else workers will leave the area. The absorptive capacity of the local economy depends upon the nature of the skills and degrees being acquired. Local markets for medical doctors, for example, have little ability to absorb new graduates. Statistically, there is little connection between the number of new MDs trained in an area and the number of adult doctors practicing there. Export-based industries, on the other hand, have more potential to absorb new graduates. A state is more likely to generate new jobs for graduates receiving degrees in engineering and science than it is for people acquiring skills for the delivery of local services such as public education and health care.

As an alternative to producing graduates locally, a state can raise educational attainment in the population by attracting educated migrants from other states or countries. States that have an above-average share of college graduates in their populations despite relatively low rates of local production include Maryland, New Jersey, Virginia, and Washington. These states have a strong demand for educated workers that can be traced in large part to an arbitrary historical concentration of firms and institutions that make intensive use of highly educated labor (i.e., these states border the nation's political capital, its financial center, or are home to the nation's aircraft industry). Such comparative advantages in the use of highly educated labor are not

possible for every state to replicate. But it is certainly reasonable for a state to selectively target economic development incentives to industries with highly educated personnel.

In-migration of educated workers also can be encouraged by offering amenities or public services that are especially important to educated people. The amenity that is very important in household migration decisions is weather. Arizona is fortunate to have warm winters and dry summers, weather characteristics that are preferred by many people. These are natural advantages provided to the state without cost. Educated migrants with high incomes also are attracted to states with great natural beauty and outdoor recreational opportunities. Arizona is well endowed with national and state parks, open space, and beautiful landscapes. Arizona should play to these strengths by making sure that people have easy access to parks and wilderness areas, that forests are well managed, and that scenic beauty is maintained through such policies as the exchange of state trust lands with high commercial value for private land with high amenity value.

Educated people value education and want it for their children. They will not choose to live in places without good elementary and secondary schools. States with poor schools do not miss out on the opportunity to attract uneducated migrants as much as they do educated ones. Another public good that is important to people with high incomes is transportation. Arizona has much to gain by being ahead of the curve in transportation policy. The automobile is an important source of external costs and economic inefficiencies. The consensus among policy experts is that the United States fails to make drivers internalize the full costs of driving their cars. U.S. gasoline taxes are too low, and the country fails to make sufficient use of road pricing to relieve congestion.

Goals of State Tuition Policy

Educational attainment should be an important part of a state's economic development plan. Rather than focusing on a one-dimensional agenda, policymakers could adopt a portfolio of strategies. Increasing local production of college graduates is an option, but it may not yield desired outcomes if pursued in isolation. Policies that reduce incentives to migrate from the state, that improve amenities in the state or that nurture a business climate that attracts businesses that employ highly educated labor may be effective. In thinking about state university tuition policy, it may be wiser to focus on the benefits realized by the student, not on the benefits he may provide to other people since it is difficult to control state educational attainment through tuition policy when people are so mobile. The large individual benefits realized by a college graduate, on the other hand, are present whether or not he chooses to live and work in the state in which he attended college.

If state tuition subsidies are used to ease student financial constraints or to reduce the perceived cost of college for families who tend to undervalue education, cost recovery is necessary at some point. States like Arizona are fortunate to have amenities that encourage graduates remain in the state long after they graduate. The taxes they pay as an adult serve to reimburse the state for the college subsidies they receive when they are young. In many states, however, a large share of graduates leaves the state in pursuit of better jobs or more attractive amenities. These states must either make tuition subsidies conditional upon subsequent state employment (the tuition subsidy is a loan that will not have to be paid back if the student lives and works in the state as an adult) or

ensure cost recovery before the student attends college by maintaining strict residency requirements for students to be eligible for subsidized tuition.

REFERENCES

Overview

“Contributions of Arizona State University to the Arizona Economy FY 2002,” Center for Business Research, L. William Seidman Research Institute, Arizona State University, April 2003, <http://economist.asu.edu/arizona-universities>

“Innovation and Opportunity: Harvard University’s Impact on Boston Area Economy,” report prepared by Appleseed Consultants, November 2004, http://www.allston.harvard.edu/background/invest_future.htm

Chapter I

U.S. Department of Commerce, Census Bureau, 2000 Census. Retrieved August 2005, from <http://www.census.gov/main/www/cen200.html>.

D. Black and J. Smith, “How Robust is the Evidence on the Effects of College Quality? Evidence from Matching,” *Journal of Econometrics*, July/August 2004, pp. 99-124.

D. Card, “The Causal Effect of Education on Earnings,” *Handbook of Labor Economics*, Ed. O. Ashenfelter and D. Card, Vol. 3A, North-Holland, 1999, pp. 1801-1863.

D. Card, “Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems,” *Econometrica*, September 2001, pp. 1127-60.

D. Card, “Education Matters: Commentary,” *The Milken Institute Review*, Fourth Quarter 2002, pp. 73-77.

P. Carniero and J. Heckman, “The Evidence on Credit Constraints in Post-Secondary Schooling,” *The Economic Journal*, October 2002, pp. 705-734.

R. Ehrenberg, “Econometric Studies of Higher Education,” *Journal of Econometrics*, July/August 2004, pp. 19-37.

J. Monks, “The Returns to Individual and College Characteristics: Evidence from the National Longitudinal Survey of Youth,” *Economics of Education Review*, June 2000, pp. 279-289.

G. Cameron and J. Heckman, “The dynamics of Educational Attainment for Black, Hispanic, and White Males,” *Journal of Political Economy*, Vol. 109, No. 3, June 2001, pp. 455-499.

Chapter II

R. E. Lucas, “On the Mechanics of Economic Development,” *Journal of Monetary Economics*, 1988, 22, pp.3-42.

P. M. Romer, "Increasing Returns and Long Run Growth," *Journal of Political Economy*, Vol. 98, No. 5, Part 2, October 1990, pp. 1002-1037.

B. Wolf and R. Havemen, "Accounting for the Social and Non-Market Benefits of Education," *The Contributions of Human and Social Capital to Sustained Economic Growth and Well-Being*, ed. J. Helliwell, International Symposium Report, OECD and HRDC, pp. 221-250, 2002.

E. M. King and J. P. Smith, *Computing Economic Loss in Cases of Wrongful Death (R-3549-ICJ)* Santa Monica: The Rand Corporation, 1988.

J. Pencavel, "Higher Education Productivity and Earning: A Review." *Journal of Economic Education*, Vol. 22, No. 4, 1991, pp 331-359.

D. Aschauer, "Is Public Education Productive?" *Higher Education and Economic Growth*, ed. William E. Becker and Darrel R. Lewis, Kluwer Publications, 1994.

W. J. Howe, "Effects of Higher Education on Unemployment Rates," *Higher Education and Economic Growth*, ed. William E. Becker and Darrel R. Lewis, Kluwer Publications, 1994.

S. Hoenick, "Higher Education and Economic Growth," *Higher Education and Economic Growth*, ed. William E. Becker and Darrel R. Lewis, Kluwer Publications, 1994.

E. Glaeser and D. Mare, "Cities and Skills," *Journal of Labor Economics*, April 2000.

P. Gotlieb and M. Fogarty, "Educational Attainment and Metropolitan Growth," *Economic Development Quarterly*, November 2003, pp. 325-336.

D. Jorgenson and K. Stiroh, "Raising the Speed Limit: U.S. Economic Growth in the Information Age," *Brooking Papers on Economic Activity*, 2000.

H. Wang, "Long-term Effects of Institutions of Higher Education on the Regional Economy," PhD Dissertation manuscript, University of Michigan, 2005.

Chapter III

J.C. Palmer, E. R. Hines, and M. M. Chambers editors, *Grapevine: An Annual Compilation of Data on State Tax Appropriations for the General Operation of Higher Education*, Center for the Study of Education Policy, Illinois State University, Retrieved August 2005, from <http://www.coe.ilstu.edu/grapevine/Welcome.htm>.

State Higher Education Executive Officers Organization. *State Higher Education Finance FY 2004*, August 2005.

National Center for Education Statistics, IPEDS Peer Analysis System, Retrieved August 2005, from <http://nces.ed.gov/ipeds/pas/firstTime.asp>.

U. S. Department of Commerce, Bureau of Economic Analysis, Retrieved August 2005, from <http://www.bea.gov/>.

U.S. Department of Commerce, Census Bureau, 2000 Census. Retrieved August 2005, from <http://www.census.gov/main/www/cen200.html>

Chapter IV

U.S. Department of Commerce, Census Bureau, 2000 Census. Retrieved August 2005, from <http://www.census.gov/main/www/cen200.html>

Chapter V

J. Bound, et al., "Trade in University Training: Cross-State Variation in the Production and Stock of College-Educated Labor," *Journal of Econometrics*, July/August 2004, pp. 143-173.

D. Costa and M. Kahn, "The Rising Price of Nonmarket Goods," *American Economic Review*, May 2003, pp. 227-232.

S. Gabriel, J. Matthey, W. Wascher, "Compensating Differentials and Evolution in the Quality of Life Among U.S. States," *Regional Science and Urban Economics*, 2003, pp. 619-649.

E. Glaeser, et al., "Economic Growth in a Cross-Section of Cities," *Journal of Monetary Economics*, 1995, pp. 117-143.

E. Glaeser, et al., "Consumer City," *Journal of Economic Geography*, January 2001, pp. 27-50.

E. Glaeser and A. Saiz, "The Rise of the Skilled City," *Brookings-Wharton Papers on Urban Affairs*, 2004, pp. 47-94, from <http://post.economics.harvard.edu/hier/2003papers/2003list.html>

C. Goldin and L. Katz, "The Shaping of Higher Education: The Formative Years in the United States, 1890 to 1940," *Journal of Economic Perspectives*, Winter 1999, pp. 37-62.

J. Groen, "The Effect of College Location on Migration of College-Educated Labor," *Journal of Econometrics*, July/August 2004, pp. 125-142.

B. Long, "How Have College Decisions Changed Over Time? An Application of the Conditional Logistic Choice Model," *Journal of Econometrics*, July/August 2004, pp. 271-296.

E. Moretti, "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics*, July/August 2004, pp. 175-212.

J. Rappaport, "Moving to Nice Weather," Federal Reserve Bank of Kansas City Working Paper RWP 03-07, March 2004.

U.S. Department of Commerce, Census Bureau, 2000 Census. Retrieved August 2005, from <http://www.census.gov/main/www/cen200.html>

National Center for Education Statistics, IPEDS Peer Analysis System, Retrieved August 2005, from <http://nces.ed.gov/ipeds/pas/firstTime.asp>

Chapter VI

M. Lleras, "Investing in Human Capital: A Capital Markets Approach to Student Funding," Cambridge University Press, 2004.

Milton Friedman, "The Role of Government in Education," *Economics and the Public Interest*, ed. Robert A. Solo, New Brunswick, NJ. Rutgers University Press, 1955.

BIOGRAPHICAL PROFILES OF THE AUTHORS

Dr. Kent Hill

Kent Hill, Ph.D., is a Research Professor working jointly in the Department of Economics and the L. William Seidman Research Institute of the W. P. Carey School of Business at Arizona State University. For the Department of Economics he teaches an MBA course in global economics, and undergraduate courses in international trade and finance, honors macroeconomics, and principles of macroeconomics.

Dr. Hill was an assistant professor at ASU from 1978 to 1983. After leaving the university for seven years, he returned in 1991 and has been teaching at ASU since that time. He also has taught economics at Clemson University, Southern Methodist University, and the American Graduate School of Management.

From 1984 to 1991, Dr. Hill worked in the research department of the Federal Reserve Bank of Dallas. His responsibilities included briefing the Bank president and other officials on the state of the economy and contributing to and editing the Bank's *Economic Review*. From 1992 to 1996, Dr. Hill served as a consultant to Arizona Public Service Corporation. His work at APS included preparing forecasts of regional energy demand and investigating the impact of deregulation on electricity rate structures. His activities at the Seidman Research Institute include tax analysis, economic impact analysis, and industry studies. Dr. Hill's research has been published in such professional journals as the *Journal of Political Economy*, the *Journal of International Economics*, and the *Journal of Development Economics*.

Dr. Dennis Hoffman

Dennis Hoffman, Ph.D., is a professor of economics at Arizona State University, where he has published numerous academic articles and a book on the topics of macroeconomics and econometrics, and has chaired several Ph.D. committees. He received the Distinguished Faculty Research Award in 1992. His research has been funded by the National Science Foundation, a Fulbright Research Grant, and The Prochnow Foundation.

Dr. Hoffman holds the title of Dean's Council of 100 Distinguished Scholar, has won both undergraduate and graduate teacher of the year awards in the W. P. Carey School of Business, and was named Arizona professor of the year in 1997 by the Carnegie Foundation. Dr. Hoffman is the Associate Dean for Research in the W. P. Carey School of Business, directs doctoral programs as well as the L. William Seidman Research Institute, and administers the Office of the University Economist.

In addition to academic research, Dr. Hoffman has participated in numerous applied research projects in Arizona, including the construction and maintenance of the tax revenue forecasting model used by the Executive Budget Office of the State of Arizona. Spanning six gubernatorial administrations, Dr. Hoffman has served in this capacity since 1982. Dr. Hoffman headed groups of economists who measured the economic impact of several fiscal initiatives for the State of Arizona in 1989 and 1990. The 1989 study was commissioned by Governor Mofford as an input to fiscal initiatives that were contained in her State of the State speech in 1989. The 1990 study was requested by the Joint Select Committee on Fiscal Reform of the Arizona Legislature. In

1996, Dr. Hoffman was appointed to the Joint Select Committee on Economic Incentives of the Arizona Legislature. Dr Hoffman has served as the external advisor for the Arizona Legislature's tax and incentive committee, and for Governor Napolitano's Citizens Finance Review Commission. He has provided consulting expertise on Arizona economic and fiscal matters for various state agencies and municipal governments.

Tom R. Rex

Tom Rex is associate director of the Center for Business Research, L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University. He received his Master of Business Administration from Arizona State University. Prior to joining the Center for Business Research in 1980, Mr. Rex worked in the private sector as a planning analyst for a financial institution and as a consultant for a public accounting firm.

The Center for Business Research conducts public service and applied research on economic and demographic topics, focusing on Arizona and Maricopa County. In addition to the Center's public service projects, Mr. Rex has worked on various multidisciplinary projects, mostly in his role as policy research associate with the Morrison Institute for Public Policy or for the Central Arizona-Phoenix Long-Term Ecological Research project, each at Arizona State University. He has participated in numerous funded research projects, including several projects for the Arizona Department of Commerce for which he has been the principal investigator.

Mr. Rex serves on the Population Technical Advisory Committee of the Arizona Department of Economic Security and on the Economic Research Advisory Committee of the Arizona Department of Commerce.

THE PRODUCTIVITY AND PROSPERITY PROJECT

The Productivity and Prosperity Project: An Analysis of Economic Competitiveness (P3) is an ongoing initiative begun in 2005, sponsored by Arizona State University President Michael M. Crow. P3 analyses incorporate literature reviews, existing empirical evidence, and economic and econometric analyses.

Enhancing productivity is the primary means of attaining economic prosperity. Productive individuals and businesses are the most competitive and prosperous. Competitive regions attract and retain these productive workers and businesses, resulting in strong economic growth and high standards of living. An overarching objective of P3's work is to examine competitiveness from the perspective of an individual, a business, a region, and a country.

THE CENTER FOR COMPETITIVENESS AND PROSPERITY RESEARCH

The Center for Competitiveness and Prosperity Research is a research unit of the L. William Seidman Research Institute in the W. P. Carey School of Business, specializing in applied economic and demographic research with a geographic emphasis on Arizona and the metropolitan Phoenix area. The Center conducts research projects under sponsorship of private businesses, nonprofit organizations, government entities and other ASU units. In particular, the Center administers both the Productivity and Prosperity Project, and the Office of the University Economist.

CENTER FOR COMPETITIVENESS AND PROSPERITY RESEARCH
L. WILLIAM SEIDMAN RESEARCH INSTITUTE
W. P. CAREY SCHOOL OF BUSINESS
AT ARIZONA STATE UNIVERSITY

P. O. Box 874011 – Tempe, AZ 85287-4011
Phone (480) 965-5362 – FAX (480) 965-5458
wpcarey.asu.edu/research/competitiveness-prosperity-research