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SHOULD GOVERNMENTS SUBSIDIZE TUITION AT PUBLIC UNIVERSITIES?

Assessing the Benefits of Tuition Subsidies
Provided by the University of Minnesota and the
Minnesota State Colleges and Universities System

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The International Science and Technology Practice and Policy (InSTePP) center is located in the Department of Applied Economics at the University of Minnesota. InSTePP brings together a community of scholars at the University of Minnesota and elsewhere to engage in economic research on science and technology practice and policy, emphasizing the international implications. Center research deals with the innovation incentives and R&D actions of private entities as well as government behavior that affect the conduct, performance and economic consequences of R&D worldwide.

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ACKNOWLEDGEMENTS

For helpful discussion and comments, we thank Laura Kalambokidis, Philip Pardey and Arthur Rolnick. Of course, we alone are responsible for the contents of this report.

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EXECUTIVE SUMMARY

In 2005, the state of Minnesota provided \$1.29 billion for operating expenses at higher education institutions in Minnesota. The University of Minnesota received \$591 million, while the seven state universities operated by the Minnesota State Colleges and Universities (MnSCU) system received about \$241 million (most of the remaining \$460 million was allocated to community and technical colleges operated by MnSCU). These subsidies clearly benefit the students who enroll in these universities, but what benefits are received by Minnesota taxpayers who never attend a public university in their state? In this report we address this question by estimating the private and public benefits that accrue to Minnesotans from the *additional* education activities (but not the research activities) of these institutions that are generated by State Government subsidies to higher education.

The higher education sector in Minnesota is dynamic and generally thriving. In 2005, roughly 196,000 students, about 3.8 percent of the state's population, were enrolled in bachelors or graduate degree programs in one of Minnesota's institutions of higher education. These students are divided roughly evenly between the University of Minnesota, the seven MnSCU state universities, and private colleges and universities. One major shift in the higher education landscape has been the growth of graduate degrees granted by private institutions of higher education, which have eroded the University of Minnesota's share of graduate degrees granted in Minnesota from over 70 percent in 1966 to 38 percent in 2004. Even so, the existence of public higher education in Minnesota still accounts for a large number of degree holders in the state, many of whom would not have been able to attend college were it not for the subsidized tuition rates charged by these public institutions.

The private or individual benefits of higher education are well documented. They include higher individual lifetime earnings, lower

probability of unemployment, and improved health. However, the public benefits, or externalities, are less well documented. The public benefits of higher education evaluated in this report include:

1. Wage "spillover" effects—increases in individual wages derived from skills obtained from social interactions off the job with educated individuals.
2. Increased voter participation.
3. Reduced costs of incarceration due to reduced crime rates.

The private benefits, as well as each of these three public benefits, of higher education are measured by applying Minnesota specific data to parameter estimates from studies of higher education in the U.S. They are then summed to calculate the total benefit of the education services provided by the University of Minnesota and the seven MnSCU state universities. This study also examines the tax revenues generated by higher levels of education. These revenues are used in a variety of ways that benefit the general public, but this phenomenon does not increase the total amount of resources available to society and is therefore omitted from our estimates of the total public benefit.

Methods

This report presents simulations that quantify the public benefits of state government subsidies to higher education in Minnesota. Four steps are used to calculate these public benefits:

1. Assume that tuition at the University of Minnesota increases to \$22,500 for all students and that tuition at the seven MnSCU state colleges and universities increases to \$14,000 for all students. Both of these tuition increases will generate tuition revenue somewhat higher than that of the current subsidy for each institution, thus allowing them to operate without subsidies

even if they experience some reductions in enrollment.

2. Using research results from a prior study that examined the impact of tuition rates on student enrollment, estimate the number of students who would *not* enroll in higher education because of higher tuition rates, and use these estimates to assess the change in the distribution of education levels across Minnesota's working age population.
3. Calculate the reductions in private benefits and the reductions in public benefits (wage spillovers, reductions in voter participation, and increases in incarceration costs due to increased crime rates), implied by our estimates of the change in the distribution of educational attainment among Minnesota's working age population.
4. Compare the current cost of state government subsidies to the University of Minnesota and the seven MnSCU state universities to the estimated loss of public and private benefits in the absence of those subsidies, and do so in a way that compares the present discounted value of future benefit streams with today's costs.

Results

We estimate that the *economic* cost of state government support to the educational activities of the University of Minnesota and the seven MnSCU state universities is \$284 million per year. This is much lower than annual state government appropriations to those two institutions because almost all of those appropriations are essentially income transfers from taxpayers to students (and their families), which are not economic costs from the viewpoint of the state economy as a whole. The real economic costs are the increased academic resources that need to be diverted from other economic activities to accommodate the increased enrollment generated by the lower tuition rates that are financed by the state appropriations (\$58 million per year), the lost wages of those additional students while they

are enrolled in higher education (\$107 million per year), and the deadweight loss (efficiency cost) of the taxes imposed to raise the funds used for those appropriations (\$119 million per year).

The two largest estimated benefits are the increased (life-cycle) wages of "marginal" students (students who would obtain less education if subsidies were removed), which is a private benefit, and the increase in the wages of all workers caused by spillover effects (increases in skills due to interactions with more educated individuals off the job), which is a public benefit. After discounting these benefits to account for the fact that the benefits continue to accrue many years after the subsidies are provided, we estimate that the total value of benefits (both public and private) is between \$784 and \$932 million per year when a 3 percent discount rate is used, and between \$562 and \$672 million per year when a 5 percent discount rate is used. With either discount rate, these estimated benefits are much higher than the estimated costs.

The report also estimates some of the distributional consequences arising from state government subsidies to Minnesota's public universities. Non-marginal students at those institutions are the biggest beneficiaries, receiving \$765 million per year from Minnesota's taxpayers. Marginal students, which are a much smaller group, obtain \$26 million per year from those taxpayers. On the other hand, the increase in the education levels of the marginal students generates as much as \$441 million per year in higher wages for all Minnesotans, due to spillover effects from social interactions off the job, and those students also pay \$42 million more per year in taxes and donate \$71 million more per year to charitable causes. Benefits to the general public in terms of lower incarceration rates, lower unemployment benefit payments and increased civic participation are much smaller.

The benefit estimates presented in this study are arguably the most comprehensive for any study of this type for a public U.S. university

system. They are subject to several caveats, yet they represent the most plausible estimates that can be provided given the data available and the (unfortunately, fairly sparse) parameter estimates. They also represent only a partial accounting of the private and public benefits from subsidies to Minnesota's public institutions of higher education, notably omitting any research benefits attributable to the activities

of those institutions. Thus our estimates are likely to be a lower bound of the public benefits accruing to Minnesota. Therefore, although our estimates are not particularly precise, the evidence suggests that the benefits of these subsidies greatly outweigh the costs. Determining the level of subsidies that are optimal from the point of view of the state as a whole will require much more research.

1. INTRODUCTION

The United States has a large and diverse assortment of both public and private higher education institutions. Each state subsidizes at least one public university system. Tuition and fees at public colleges and universities are generally much lower than those charged by their private-sector counterparts. Most of this difference in cost is financed by subsidies provided by state governments to their public colleges and universities. The tuition reductions financed by these subsidies increase access to higher education and clearly benefit the students who enroll in public colleges and universities. However, taxpayers who never attend those colleges and universities, and whose children do not attend, may rightly question why their tax dollars should be used to benefit those citizens who do enroll in public institutions of higher education.

Public and private higher education institutions play a central role in the cultural, economic, and intellectual life of Minnesota. Overall, Minnesota offers a wide variety of higher-education options, including public and private universities, public and private 4-year and 2-year colleges, and many technical schools and colleges. About two thirds of the students in bachelor's or graduate degree programs in Minnesota are enrolled in public institutions. There is ongoing discussion in Minnesota about the benefits to the general public of higher education, and on the most appropriate means to provide public funds to support higher education. This report contributes to this discussion by evaluating the benefits to Minnesotans of publicly funded higher education, focusing on the University of Minnesota and the Minnesota State Colleges and Universities (MnSCU) system.

There are at least three justifications for state governments to subsidize higher education. First, the educational services provided by public institutions of higher education are likely to generate “public benefits” well beyond the “private benefits” accruing to their graduates. Second, publicly provided higher education may

redistribute resources from better off citizens to those with lower incomes. Historically, state colleges and universities have provided access to higher education to lower income individuals who otherwise may be excluded from such opportunities. Finally, public universities produce research that benefits the general public (Pardey, Dehmer and Beddow, 2007). All three of these functions provide a public benefit that would be underprovided if higher education were offered only by private colleges and universities.

Here we focus on the first of these three justifications for state-funded higher education. More specifically, we examine whether educational services offered by the bachelor and graduate degree programs at Minnesota's public universities provide benefits to the general public beyond the benefits accruing to students who receive graduate and undergraduate (bachelor's) degrees from these institutions. We attempt to quantify both the private and the public benefits, and compare them to the cost of state government support to public higher education in Minnesota. The report also examines the redistributive impact (the impact on the distribution of income) in Minnesota of the educational activities of Minnesota's public universities. The primary omission from this assessment is the benefits enjoyed by the general public from research done by the faculty and students at Minnesota's public universities. This omission of the research benefits that accrue to the general public will lead to a downward bias in our estimates of the benefits of government spending to support higher education.¹ Another limitation of this study is that we do not consider education benefits that accrue to states or countries other than Minnesota due to migration of University of Minnesota and MnSCU graduates to those states or countries. Thus from the perspective

1 Pardey, Dehmer and Beddow (2007) provide detailed information on investments on research activities at the University of Minnesota (which are much larger than investments in research activities conducted at MnSCU system institutions).

of the United States as a whole, and the world more broadly, the report underestimates the national and global benefits provided by Minnesota's public universities.

This study also makes a contribution to the methodology of assessing the economic impacts of government subsidies to colleges and universities. Many previous studies of the economic impact of universities have focused on student or state government spending in the municipality or county where the university is located, often estimating "multiplier effects" of that spending. Yet both student and government spending involve a redistribution of, rather than an increase in, overall spending in the state and thus have no impact on the overall size of the state economy. Another problem with many past studies is that they fail to distinguish between "private benefits"—that is benefits that accrue directly to college or university graduates—and "public benefits," which accrue to other members of society. A final problem is that virtually all previous studies do not consider what happens to students at public institutions of higher education when those institutions either cease to exist or increase their tuition rates dramatically in response to reduced state government support for higher education. If most or all of these students still get a degree at either a public or private institution there will be little effect on aggregate economic and social phenomena (although there will a change in who pays for education costs). Thus previous studies are unlikely to provide accurate or even plausible estimates of the public benefits of state government subsidies to public higher education institutions.

The rest of this report is organized as follows. Chapter 2 describes the higher education sector in Minnesota. Chapters 3 and 4 provide discussions, based on economic theory, of the private and public benefits, respectively, of college and university level education, and Chapter 5 examines the distributional impact of public spending on higher education. Chapter 6 presents estimates of the private and public benefits of the educational services provided

by the University of Minnesota and the MnSCU system, and compares them to the costs of state subsidies for those services. It also discusses the distributional consequences of public funding for higher education in Minnesota. A final chapter summarizes the findings and provides suggestions for future research.

2. HIGHER EDUCATION IN MINNESOTA

This chapter describes the main characteristics of higher education in Minnesota, focusing on student enrollment, student characteristics, tuition and financial aid, and budgetary support from the state government. Given the focus of this report, the emphasis is on bachelor's and graduate degree programs. Shorter degree programs (such as associate degrees and vocational and technical certificates) come in a wide variety of forms, and there is much more limited data and antecedent literature to draw upon for the purpose of evaluating the public and private benefits of such degrees.

2.1 ENROLLMENT

In 2005, Minnesota's population was 5.2 million people. About 196,000 individuals, 3.8 percent of the state's population, were enrolled in bachelor's or graduate degree programs in one of Minnesota's public and private colleges and universities. About two thirds of these students were enrolled in Minnesota's public universities (either the University of Minnesota or one of MnSCUs seven state universities).²

Enrollment in bachelor's (4-year) and graduate degree programs in Minnesota has steadily increased over the past 10 years from about 171,000 students in 1996-97 to about 196,000 students in 2005-06, a rate of increase of 1.5 percent per year. This compares to a population growth rate of 1.1 percent per year over the

² All students in the MnSCU system who are enrolled in a bachelor's (4-year) or graduate degree program are enrolled on one of the seven state universities in that system, which are described below.

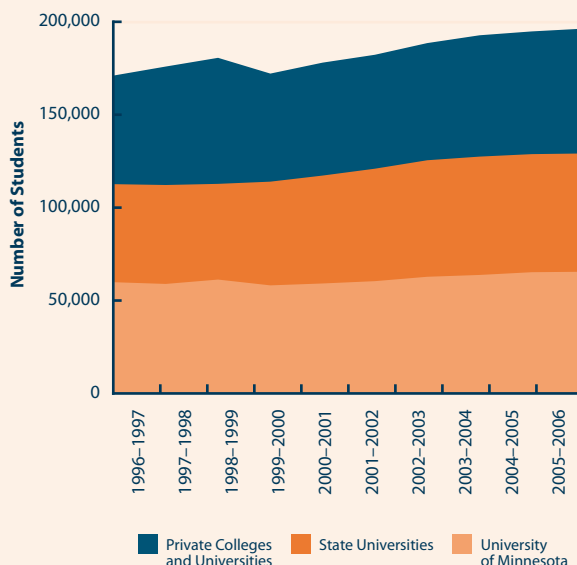
same time period. For four-year (bachelor's) degree and graduate degree programs, the University of Minnesota currently accounts for approximately 33 percent of all enrollment (both public and private), the MnSCU system for about 32 percent of all enrollment, and private colleges and universities for the remaining 34 percent.

Figure 1 shows the total enrollment by institution type from 1996-97 to 2005-06. Student enrollment at the University of Minnesota increased slowly (about 0.9 percent per year) from 1996-97 to 2005-06 (from about 60,000 students to about 65,000 students). In contrast, enrollment in the MnSCU state universities grew by 2.1 percent per year over this time period, from 53,000 students in 1996-97 to 64,000 students in 2005-06. Finally, enrollment at private colleges and universities in Minnesota increased by 15 percent over this time period (an annual rate of 1.6 percent), from 58,000 students in 1996-97 to 67,000 students in 2005-06. Thus the number of students at these three types of institutions has remained fairly equally split during the past 10 years, the only notable change being a slight decrease in the University of Minnesota's share and a slight increase in the share accounted for by MnSCU state universities.

2.2 STUDENT CHARACTERISTICS

The college and university student population in Minnesota is less diverse compared with the national average, a reflection of the comparatively low diversity in Minnesota's general population. For example, 85 percent of Minnesota's undergraduate students are white, compared with the national average of 63 percent (Table 1). Further, 94 percent of higher education students in Minnesota speak English as their first language, compared with 88 percent nationally. Nine out of ten of these

Figure 1. Higher Education Enrollment in Minnesota, by Type of Institution



Source: Minnesota Office of Higher Education (2006).

students (89 percent) come from families where both parents were born in the United States, and a larger share of students in Minnesota are still dependent on their parents while enrolled in higher education (compared with the national average).

Box 1 provides a summary of additional demographic characteristics of college and university students in Minnesota.

2.3 MINNESOTA'S PUBLIC UNIVERSITIES: ENROLLMENT AND STUDENT PROFILE

The University of Minnesota is a publicly funded, land grant, research university with campuses in the Twin Cities (Minneapolis and St. Paul), Duluth, Crookston, and Morris.³ In the fall of 2006, the University of Minnesota system had an enrollment of 65,489 students. The largest share of these students (76 percent)

³ A new campus opened in Rochester in 2006; nearly all of the data presented in this report pertain to years before that campus was opened.

Table 1. Undergraduate Characteristics in Minnesota and the United States

	Minnesota	United States
	(percent)	(percent)
Race and Ethnicity		
White	85	63
Black or African America	6	14
Hispanic or Latino	2	13
Asian/Pacific Islander	5	6
American Indian or Alaska Native	1	1
Other, More Than One Race	2	3
English is the Primary Language		
Yes	94	88
No	6	12
Parents' Place of Birth		
Both Parents were Born in United States	89	76
One Parent was Born in United States	3	6
Neither Parent was Born in United States	9	18
Dependency Status		
Dependent	59	50
Independent	41	50

Source: Grimes and Mehta (2006).
Note: Figures are for the year 2003-2004.

Box 1. Characteristics of Minnesotans in Bachelor's (4-Year) Degree Programs

- 65 percent were enrolled in a public four-year institution in Minnesota.
- 26 percent were the first generation in their family to attend college.
- 20 percent had children, and 8 percent were single parents.
- 83 percent work during the academic year.
- 15 percent are non-white.

Source: Grimes and Mehta (2006).
Note: Data are for the 2005-2006 academic year.

were on the Twin Cities campus, which had 51,469 enrolled students in the fall of 2006. The Twin Cities and Duluth campuses both have professional and graduate degree programs, yet the Twin Cities campus awards over 95 percent of the professional and graduate degrees granted by the four University of Minnesota campuses. Figure 2 shows the distribution of

University of Minnesota students by degree program from 1992 to 2006. Undergraduate enrollment increased from about 35,000 in the mid 1990s to about 40,000 by 2006. Graduate and professional school enrollment increased at a much faster rate, from about 12,000 in the mid-1990s to about 19,000 in 2006. Finally, non-degree students increased from about 2,000 in the 1990s to about 6,000 in recent years, mainly due to a large increase from 1999 to 2000.⁴

The University of Minnesota is composed of 42 colleges on four campuses. The College of Liberal Arts on the Twin Cities campus has the largest undergraduate enrollment, and the Medical School and the College of Education and Human Development, both of which are also on that campus, have the most professional degree students and graduate degree students, respectively. Graduate education enrollment as a share of total enrollment at the University of Minnesota increased from 25 to 28 percent between 1996 and 2006. Table A.1 in the appendix gives a detailed breakdown of students by campus and college of enrollment for the 2005-06 academic year.

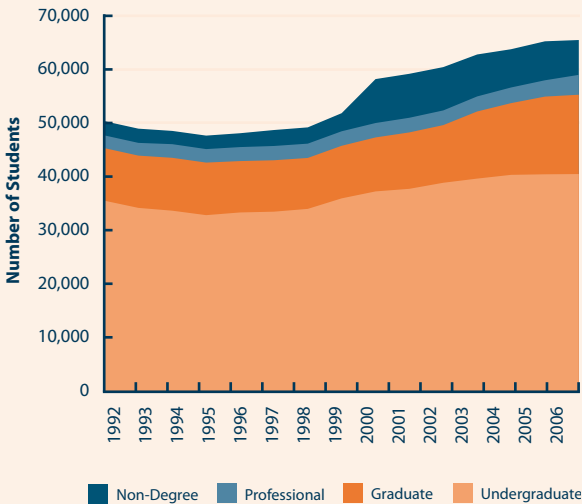
The Minnesota State Colleges and Universities (MnSCU) system is an extensive higher education system comprising 32 institutions located in 46 communities throughout the state (some institutions have more than one campus). MnSCU emphasizes vocational training, training more than 90 percent of

⁴ The data plotted in Figure 2 are from the University of Minnesota and are somewhat different from the data used to construct Figure 1, which are from the Minnesota state government. We have been unable to determine the reasons for these discrepancies.

Minnesota’s law enforcement officers and construction workers, and over half the state’s teachers and nurses. MnSCU primarily focuses on undergraduate education, but does have some graduate education: in the past 40 years, MnSCU has awarded approximately 9 percent of the graduate degrees granted in the state (MnSCU 2006).

In the 2005-2006 academic year, the MnSCU system accounted for 48 percent (175,000 students) of all students enrolled in higher education in Minnesota, nearly 90 percent of whom were Minnesota residents when they entered (MnSCU 2006). Of these students, about 112,000 (64 percent) were enrolled in 2-year degree, vocational or technical degree, or non-degree programs, about 57,000 (33 percent) were enrolled in bachelor’s degree programs, and about 6,000 (3 percent) were enrolled in graduate degree programs. The MnSCU system has seven state universities that grant bachelor’s and graduate degrees. The other 25 MnSCU institutions grant only 2-year degrees or vocational/technical diplomas and certificates, while the seven state universities rarely grant these types of degrees. The number of bachelor’s degrees granted from these seven state universities, shown in Table 2, increased from slightly under 7,000 per year in the 1970s

Figure 2. University of Minnesota Enrollment by Degree Program, 1992–2006



Source: Office of Institutional Research University of Minnesota (2006).

and 1980s to about 9,500 per year in the past 15 years.

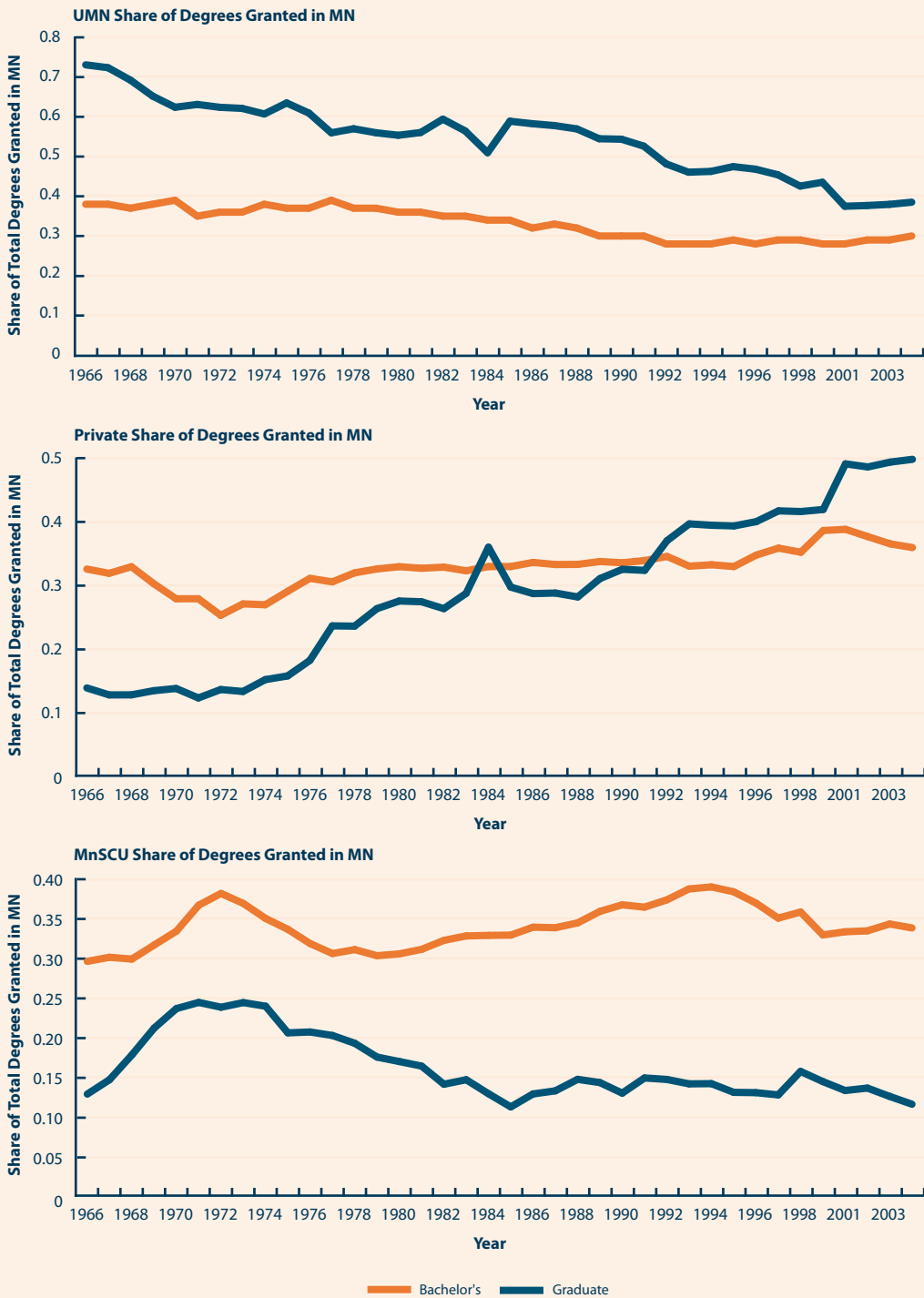
While the absolute number of bachelor’s and graduate degrees granted by the University of Minnesota grew over the past four decades, the University of Minnesota’s share of bachelor’s and graduate degrees granted in Minnesota has steadily declined (Figure 3). More specifically, the University of Minnesota granted 38 percent of all bachelor’s degrees in 1966, but only 30 percent of those degrees in 2004. This reflects a steady increase in the bachelor’s degrees

Table 2. Bachelor’s Degrees Awarded by MnSCU State Universities, 1974–2004

State University	1974	1984	1994	2004
Bemidji State University	926	622	792	796
Mankato State University	1,946	1,913	2,133	1,939
Metropolitan State University	101	415	1,007	1,018
Moorhead State University	972	1,128	1,560	1,180
Southwest State University	537	295	349	425
St Cloud State University	1,613	1,637	2,602	2,460
Winona State University	706	759	1,142	1,348
Total	6801	6769	9585	9166

Source: National Science Foundation (2006).

Figure 3. Shares of Bachelor's and Graduate Degrees Granted by University of Minnesota, Private Colleges and Universities, and the MnSCU System



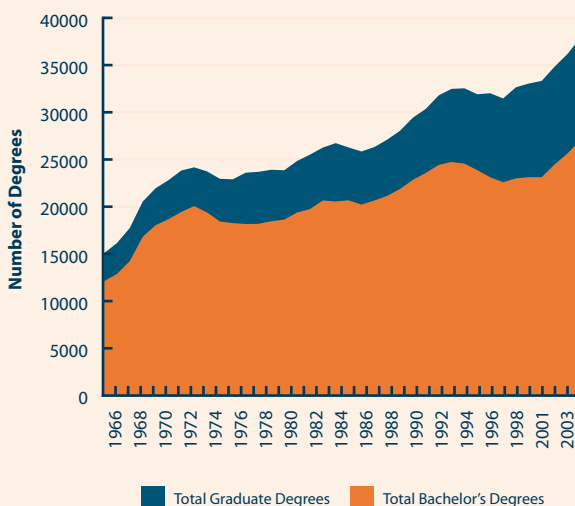
Source: National Science Foundation, 2006.

Note: Numbers are percentages of bachelor's and graduate degrees granted by the MnSCU system, as a share of all degrees granted in Minnesota.

granted by other institutions (also in Figure 3).⁵ The private share has steadily increased from about 30 percent in the 1970s to between 35 and 40 percent from 2000 to 2004. The MnSCU state universities' share fluctuated between 30 and 40 percent in the past 40 years, and is currently around 34 percent.

An even sharper decline is seen in the University of Minnesota's share of graduate degrees. In 1966 it granted 71 percent of all graduate degrees awarded in the state, but by 2004 its share had fallen to only 38 percent. This is primarily due to expansion into graduate degrees by private sector institutions. The share of the graduate degrees granted by those institutions increased from about 15 percent in the late 1960s to nearly 50 percent since the year 2000 (Figure 3, middle panel). This also lead to a drop in MnSCU's share of graduate degrees awarded, from over 20 percent in the early 1970s to only about 12 percent in 2004. The underlying phenomenon here is not a reduction in graduate degrees granted by the University of Minnesota and MnSCU state universities—indeed the number of degrees granted by those institutions slowly increased—but instead is driven by a sharp increase in the number of total graduate degrees granted in Minnesota, from about 3,000 in the mid 1960s to about 11,000 in 2004, as seen in Figure 4. Most strikingly, two institutions—St. Mary's University and the University of St. Thomas—increased their combined “market share” from 5.3 percent in 1966 to 26.7 percent in 2004 (See Table A.2 in the appendix for details).

Figure 4. Graduate and Bachelor's Degrees Granted in Minnesota, 1966–2004



Source: National Science Foundation (2006).

While the University of Minnesota is enrolling a smaller percentage of students in higher education, it attracts and admits above average students, and University of Minnesota students are becoming increasingly “above average” over time. For undergraduates, this can be seen by examining the ACT composite scores of University of Minnesota students and of all students who took the ACT exam in Minnesota. Figure 5 provides a comparison of ACT scores across the University of Minnesota campuses and also compares University of Minnesota students to the state and national ACT averages. Over the past five years the average ACT composite score for entering students at the University of Minnesota was 25.3 for in-state students and 24.9 for out-of-state students. The five year Minnesota state average was 22.2. Moreover, this gap has increased over time; the gap in ACT scores between University of Minnesota students (Twin Cities Campus only) and the state average was about 1.8 points in 1999, but by 2006 this gap had increased to about 2.8 points.

In 2005, the University of Minnesota had over 368,000 alumni of working age throughout

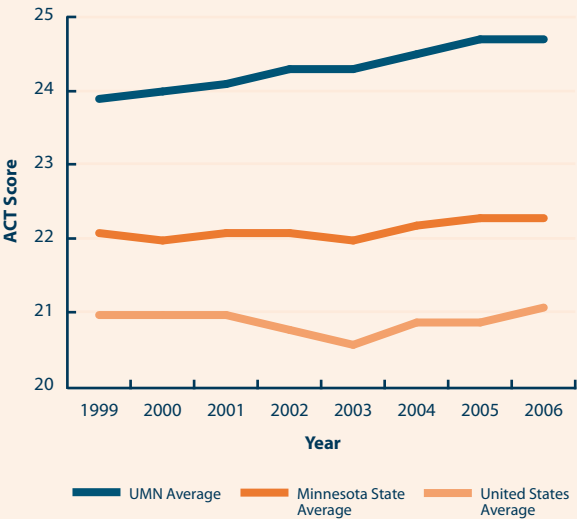
⁵ Figure 3 excludes degrees granted by new on-line institutions based in Minnesota, such as Walden University. The economic value of these degrees is unknown, and most of the degrees are granted to individuals who are currently residing in other states and thus are unlikely to contribute anything to Minnesota. Yet this phenomenon is increasing and deserves further study.

the world (this information is based on the data base maintained by the University of Minnesota Alumni Association). Approximately 61 percent of these working age alumni resided in Minnesota in 2005, representing 8.7 percent of the total Minnesota workforce. The University of Minnesota system attracts students from other, mostly neighboring, states, with approximately 22 percent of its graduates coming from out of state. An estimated 37 percent of these students from out of state remain in Minnesota after they graduate.

Table 3 compares the distribution of educational degrees among the adult population in Minnesota, using two data sources. The first is the Current Population Survey (CPS), which is collected by the U.S. Bureau of Labor Statistics, and the second is a database of University of Minnesota alumni maintained by the University of Minnesota Alumni Association. The distribution of degrees among University of Minnesota alumni who currently live in Minnesota is similar to the CPS distribution of all post-secondary degrees in the state, except that the University of Minnesota alumni data

report a slightly larger proportion of bachelor's degrees and an even larger proportion of professional and doctoral degrees. This reflects the fact that, until recently, Minnesota's private colleges and universities granted relatively few professional and doctoral degrees.

Figure 5. State, National, and University of Minnesota ACT scores, 1999–2006



Sources: University of Minnesota Office of Institutional Research, and Minnesota Office of Higher Education (2006).

Table 3. Distribution of Minnesota's Population by Education Levels

Education Level	General Population Survey (CPS data)			Alumni Database	
	Frequency	Share		Frequency	Share
		Of Total	Of Degree Holders		
					(percent)
Less than High School	132,028	5.1	—	—	—
High School Diploma	689,709	26.8	—	—	—
Some College	843,394	32.8	—	—	—
Bachelor's	609,633	23.7	67.2	143,085	69.8
Master's	204,601	8.0	22.6	32,506	15.9
Professional Degree	57,072	2.2	6.3	19,356	9.4
Doctorate	35,333	1.4	3.9	9,900	4.8
Total	2,571,770	100.0	100.0	204,847	100.0

Source: Current Population Survey and University of Minnesota Alumni Database.
Note: General population data are Minnesota residents between 30 and 70 years old.

2.4 TUITION, FEES AND FINANCIAL AID

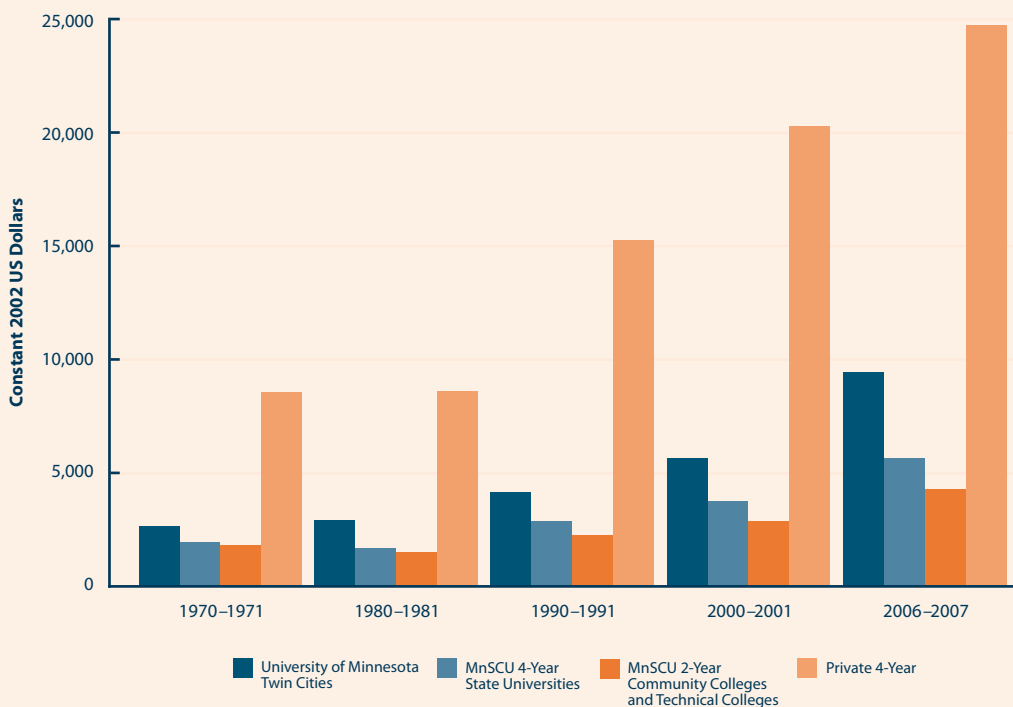
Tuition and fees have increased significantly over time for all higher education institutions in Minnesota, and dramatically so after 1980. Figure 6 compares undergraduate tuition between MnSCU (separately for community and technical colleges and for the seven state universities), University of Minnesota, and private 4-year colleges and universities in the state (the figures for MnSCU and the University of Minnesota are those for Minnesota residents). It clearly shows an increase in tuition and fees, most notably for University of Minnesota and for private 4-year colleges and universities. For example, in the past six years, the University of Minnesota's tuition and fees increased by 66 percent in constant dollars while the private colleges and universities, on average,

experienced an increase in tuition and fees of 22 percent.

In the 2006-07 academic year, Minnesota resident undergraduate students paid \$9,432 in tuition and fees to attend the University of Minnesota, \$5,656 to attend one of the seven MnSCU state universities, and an average of \$24,744 in tuition and fees at private colleges and universities in the state. Table 4, which represents some of the data shown in Figure 7, provides a snapshot comparison of tuition rates across different types of higher education institutions in Minnesota.

Figure 7 compares the University of Minnesota's undergraduate tuition and fees with those at private 4-year institutions in Minnesota, using the data in Figure 6. In the 2006-2007 academic year the University of Minnesota's tuition and fees were 38 percent of those charged by private

Figure 6. Average Annual Resident Undergraduate Tuition and Required Fees (Constant 2002 \$^a)



Source: Minnesota Office of Higher Education (2006).

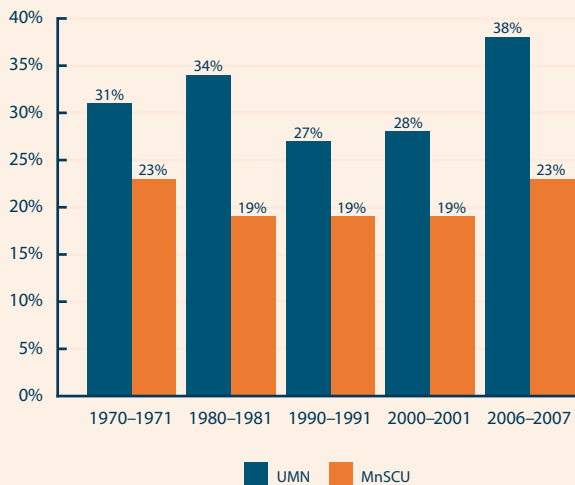
^a Constant Dollars based on Consumer Price Index (All Urban) through August 2006, with 2007 estimated and converted to fiscal years. United States Department of Labor, Bureau of Labor Statistics.

Table 4. Tuition and Fees of Higher Education Institutions in Minnesota, 2002–2007

Academic Year	University of Minnesota Twin Cities	MnSCU 4-Year State Universities	Private 4-Year Colleges and Universities
2001-02	6,295	4,049	20,591
2002-03	7,008	4,429	21,380
2003-04	7,746	4,917	22,237
2004-05	8,514	5,406	23,116
2005-06	8,871	5,403	23,918
2006-07	9,432	5,656	24,744

Source: Minnesota Office of Higher Education (2006).

Note: Annual costs for in-state undergraduates, in constant 2002 dollars.

Figure 7. University of Minnesota and MnSCU Undergraduate Tuition and Fees, as a Percent of Private Institution Tuition and Fees, 1970–2006

Source: Minnesota Office of Higher Education (2006).

Note: Private Institutions are 4 year colleges and universities.

colleges and universities, up significantly from academic year 2000–2001, when the University of Minnesota’s tuition and fees were only 28 percent of those charged by private colleges and universities in the state. Tuition and fees at the seven MnSCU state universities also increased, but not as dramatically. They were 19 percent of the average tuition and fees at private colleges and universities in 2000–01, increasing to 23 percent in 2006–07. The longer run

trends in tuition at the University of Minnesota, MnSCU state universities and private 4-year colleges and universities are as follows. In real terms tuition was stable at both public and private institutions in the 1970s. In the 1980s, tuition increased at both types, but at a faster rate for private institutions. In the 1990s, tuition again increased at both, at about the same rate of increase. Finally, from 2000–2001 to 2006–2007 tuition increased at both again, but this time the rate of increase was higher at the University of Minnesota and, to a lesser extent, at the MnSCU state universities.

While undergraduate tuition and fees have increased dramatically since around 1980, this has been accompanied by an increase in financial aid, both need based and merit based. Using data from the Minnesota Office of Higher Education (see Table A.3) we estimate that the average private college student in Minnesota receives tuition reductions and grants from that institution of about \$5,700 per year, so actual average tuition paid is about \$19,300. In contrast, the average University of Minnesota student received only about \$1000 in financial aid, and the average MnSCU student received only about \$200.

2.5 MINNESOTA STATE FUNDING FOR HIGHER EDUCATION

Minnesota has a long tradition of strong government support for higher education. Table 5 shows state appropriations, in per capita per year terms, for Minnesota, nine neighboring states, and California and Colorado.⁶ In 1996 and

⁶ Colorado is included in this list given its recent decision to provide money directly to students instead of to institutions.

Table 5. Trends in State Appropriations for Higher Education, in Per Capita Terms

States	FY 1996		FY 2001		FY 2006		Percent Change	
	Appropriations per Capita		Appropriations per Capita		Appropriations per Capita		1996–2006	2001–2006
	Dollars	Rank	Dollars	Rank	Dollars	Rank		
California	144	33	262	11	303	13	110.9	15.4
Colorado	124	43	173	41	156	47	25.5	-9.6
Illinois	156	23	219	25	219	34	40.3	0.1
Indiana	156	24	211	29	245	28	57.3	16.4
Iowa	227	6	291	5	274	23	20.5	-5.8
Kansas	191	12	254	12	290	17	52.0	14.5
Michigan	166	18	223	22	207	37	25.1	-7.2
Minnesota	208	10	273	10	294	15	41.3	7.4
Nebraska	219	7	288	8	329	9	50.1	14.4
North Dakota	239	5	290	6	336	7	40.8	16.0
South Dakota	152	28	180	38	226	32	49.3	25.6
Wisconsin	176	14	218	26	219	35	24.6	0.4
Average	180	19	240	19	258	25	44.8	7.3

Source: <http://www.grapevine.ilstu.edu/Tables.htm>

2001, Minnesota ranked 10th (out of 50) in per capita terms regarding state higher education appropriations, but it had dropped to 15th by 2006.

The decline in state support for higher education in recent years is seen in Table 6. Compared with other states, Minnesota ranks 36th in *growth* of state appropriations to higher education over the past 10 years. Among its peer group (9 neighboring states, plus California and Colorado), Minnesota ranks 8th (out of 12) in state appropriations growth.

Minnesota increased state expenditure for higher education by 28.0 percent from 1996 to 2006. Neighboring states to the west, namely North and South Dakota, both saw much higher increases in state expenditures (41.7 and 40.6 percent respectively) than expenditure growth in Minnesota. In contrast, neighboring states to the east and south had smaller increases; the increases in Wisconsin and Iowa were only about 16 percent.

Almost all of the state government appropriations for higher education in Minnesota are devoted to three purposes: support of the University

of Minnesota, support of the MnSCU system, and scholarships for undergraduate students who attend either public or private institutions in Minnesota. Table 7 shows figures for three of the last 10 years. Overall, the University of Minnesota and the MnSCU system each receive about 45 percent of the total state appropriations to higher education, while the student scholarship program that gives grants directly to students (whether they attend a private or a public college or university) receives about 10 percent.

It is useful to examine the percent of University of Minnesota revenues that come from these state appropriations (Table 8). In 2006, budget revenues for the University of Minnesota were \$2.5 billion. In that year, tuition and fees accounted for about one fifth of total operating revenues, while gifts and endowment earnings accounted for about one tenth. Sponsored grants and contracts provided about another fifth of operating revenue, state appropriations provided about one fourth, and other sources were about one fifth. Comparing these figures with the figures for 1996, state appropriations have dropped from one third to one fourth of total costs, while tuition and fees have risen

Table 6. Trends in Total State Appropriations for Higher Education Operating Expenses

States	Fiscal Year					Ranking for 10-Year Growth
	1996	2001	2006	5-Year Change	10-Year Change	
	<i>(millions of dollars)</i>			<i>(percent)</i>	<i>(percent)</i>	
California	5,190.7	8,922.9	9,627.5	7.9	85.5	2
Colorado	579.9	746.5	594.6	-20.3	2.5	47
Illinois	1,990.2	2,719.7	2,615.4	-3.8	31.4	35
Indiana	977.2	1,283.2	1,430.4	11.5	46.4	21
Iowa	674.0	851.2	779.8	-8.4	15.7	45
Kansas	524.4	683.1	754.6	10.5	43.9	25
Michigan	1,676.6	2,222.3	2,017.6	-9.2	20.3	41
Minnesota	1,066.9	1,349.1	1,365.5	1.2	28.0	36
Nebraska	385.6	492.9	542.4	10.1	40.7	29
North Dakota	151.9	185.7	215.3	16.0	41.7	26
South Dakota	117.6	136.2	165.4	21.5	40.6	30
Wisconsin	971.6	1,170.1	1,131.5	-3.3	16.5	44
Total	44,407.2	60,636.4	66,642.9	9.9	50.1	

Source: <http://www.grapevine.ilstu.edu/Tables.htm>

from one sixth to one fifth. In other words, in 1996 state appropriations were more than twice as high as tuition revenues, but by 2006 those appropriations were only slightly higher than tuition revenues.

The annual operating budget for the MnSCU system was 1.5 billion dollars in 2005-2006. During this time, state appropriations accounted for about \$600 million and the remaining budget revenues came from tuition, fees, and other sources (MnSCU 2006). The state appropriates funds to the MnSCU system as a whole, and these funds are allocated among the college and university campuses according to a distribution formula. Appropriations for the seven state universities, which are the only MnSCU institutions that grant bachelor's degrees and graduate degrees, are shown in Table 9. Thus the total state appropriation to MnSCU state universities was \$241 million in 2006, which is slightly more than a third of state appropriations for the entire MnSCU system.

Table 7. State Appropriations for Higher Education Operating Expenses in Minnesota

Institutions	1996-1997	2000-2001	2005-2006
<i>(millions of dollars)</i>			
University of Minnesota	405.4	607.2	591.2
MN State Colleges and Universities	476.2	579.8	600.7
MN Higher Education Services Office (Grants)	120.3	160.5	172.1
Mayo Medical	0.9	1.6	1.4
Total	1,091.6	1,349.1	1,365.5

Source: http://www.coe.ilstu.edu/grapevine/Minnesota_07.htm

3. PRIVATE BENEFITS FROM A UNIVERSITY EDUCATION

To assess the merits of public funding for higher education in Minnesota, or in any other state or country, the cost of that funding must be compared to the benefits. The cost of public funding for higher education is relatively simple to calculate, but the benefits are harder

Table 8. Sources of Operating Revenues for the University of Minnesota

	1996	2006
Total Budget	\$1.4 billion	\$2.5 billion
Budget Share, by Revenue Source	(percent)	(percent)
Tuition and Fees	15.6	21.3
Gifts and Endowment Earnings	16.7	10.8
Sponsored Grants and Contracts	20.2	21.4
State Appropriation	33.8	25.0
Other Sources	13.7	21.4

Source: http://www1.umn.edu/twincities/01_abt_gen_bud.php

Table 9. State Appropriations to MnSCU State Universities, 2005

State University	2005 Appropriations
	(millions of dollars)
Bemidji State University	\$24.7
Mankato State University	\$21.3
Metropolitan State University	\$32.4
Moorhead State University	\$55.5
St. Cloud State University	\$16.7
Southwest State University	\$57.7
Winona State University	\$32.8
Total	\$241.0

Source: MnSCU Finance Division (2007).

to quantify.⁷ This chapter reviews the *private* benefits of both undergraduate and graduate education from an economic perspective. Chapter 4 then uses standard economic theory to provide a framework for assessing the *public* benefits of state government support to higher education.

The private benefits from obtaining a bachelor or graduate degree from public colleges and universities (or from private colleges and universities) are defined as those benefits that accrue only to the individuals who obtain those degrees. Private benefits can be divided into two types. The first is direct income benefits:

7 In fact, the cost of public funding for higher education has some complexities which involve separating distributional effects and true resource costs. This is discussed in detail in Sections 5 and 6.

people who receive college and university degrees are able to obtain higher wages in the labor market. The second is non-income benefits: education provides non-pecuniary advantages, the most important of which are better health and the direct satisfaction of having a high level of education.

3.1 HIGHER INCOME EFFECTS

It is generally recognized that higher levels of education typically lead to higher paying jobs. This phenomenon has been studied by economists since the 1960s, beginning with the pioneering studies of Becker (1964) and Mincer (1974). Economists' interpretation of the relationship between schooling and earnings is that schooling provides skills that individuals use in their work. These skills make them more productive, and in a competitive labor market they will be paid wages that are equal to the market value of their (marginal) productivity.

There are many estimates of the impact of education on wages and earnings in the United States. Comprehensive reviews of this literature by Card (1999 and 2001) found that, on average, an additional year of schooling in the United States increases earnings by 7 to 9 percent. While most of these results are not disaggregated by level of education, the few studies that do calculate separate impacts by level of schooling (e.g., Ashenfelter and Rouse 1998) find estimated impacts on wages of an additional year of higher education in the same 7 to 9 percent range.

Table 10 shows annual earnings in the United States in 2003 for men and women with different levels of education. For men, the typical (median) college graduate earned about \$56,500 per year, while the typical high school

graduate earned only about 63 percent of this (about \$35,400). Men with “some college” earned about \$41,300 per year, while men with less than a high-school education earned

only \$24,100 per year. Men with graduate degrees earned from \$70,600 to \$100,000 per year. Turning to women, the typical (median) college graduate earned about \$41,300 per year, while high school graduates earned only about 63 percent of this (about \$26,100). Women with “some college” earned about \$30,100 per year, and women with less than a high school education earned only about \$18,100 per year. Women with graduate degrees earned \$50,200 to \$67,200 per year.

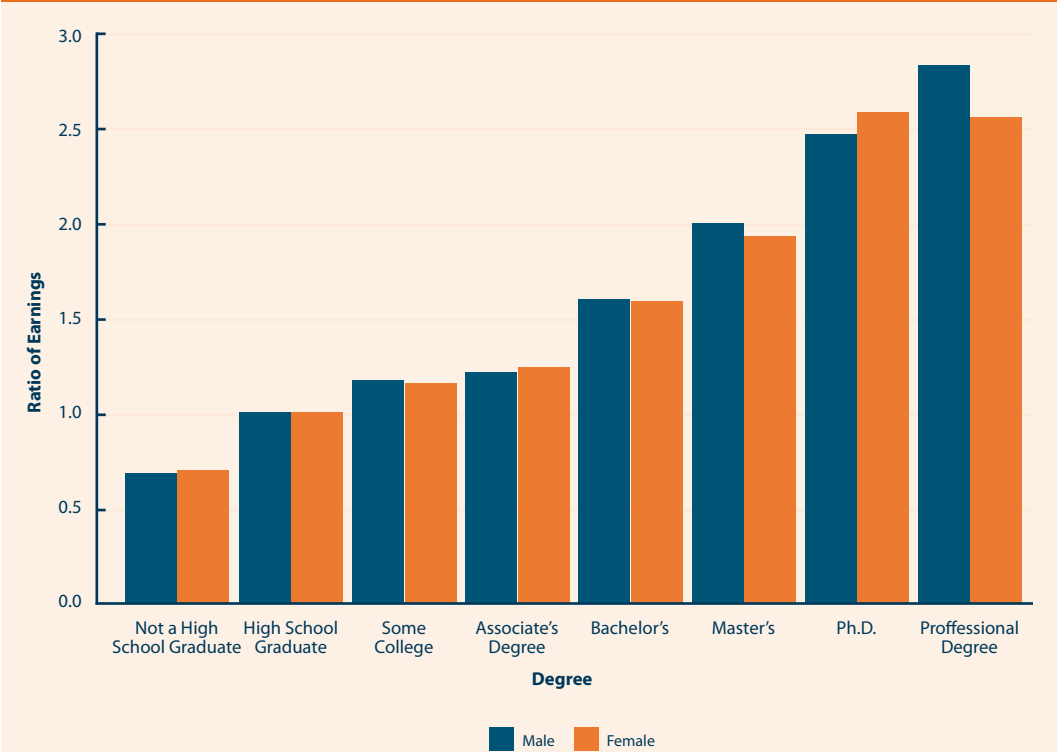
Figure 8 expresses the median incomes of men and women with different levels of education relative to the median incomes of high-school graduates. Individuals with bachelor’s degrees earn about 60

Table 10. Median Annual Earnings in Minnesota, by Gender and Education Level, 2003

Education Level	Male	Female
	<i>(dollars)</i>	
Less than High School	24,121	18,125
High School Graduate	35,412	26,074
Some College	41,348	30,142
Associate Degree	42,871	32,253
Bachelor's	56,502	41,327
Master's	70,640	50,163
Ph.D.	87,131	67,214
Professional Degree	100,000	66,491

Source: U.S. Census Bureau (2004).

Figure 8. Ratio of Median Incomes by Degree (High School Degree Equals 1)



Source: U.S. Census Bureau, 2004, PINC-03; <http://ferret.bls.census.gov/macro/032004/perinc/toc.htm>; calculations by the authors. Note: Includes full-time year-round workers, age 25 and older. Calculations by the authors.

percent more than high-school graduates, and those with graduate degrees earn two to three times as much. These relative differences are surprisingly similar for men and women.

The data in Table 10 and Figure 8 show dramatic differences in annual earnings across education groups for both men and women. However, one should keep in mind that people with different levels of education may differ in other ways, so it is not automatic that an average person with a high-school education would have earned the average income of a person with a college education if he or she had gone to college. It is likely that, on average, college graduates have higher levels of certain types of abilities, broadly defined to include work habits and social skills, that partly explain their higher incomes. The studies summarized by Card, which show an increase in wages of 7 to 9 percent for every year of education, are based on estimates of the impact of education that attempt to hold these other abilities and skills constant and thus give a more accurate estimate of the causal impact of an additional year of education on wages.

Table 10 also shows that men have much higher earnings than women at every level of education, but not all of this is necessarily due to gender discrimination. Many women are likely to work fewer hours per year, and some may choose to take different types of jobs. Altonji and Blank (1999) provide a detailed discussion of the reasons for gender differences in wages and annual earnings.

Better educated people not only earn higher incomes, but they are also less likely to be unemployed. This is seen in Table 11. The unemployment rate for high-school graduates was 4.7 percent in 2004. This rate is not unusually high but it is almost double the rate for college graduates, which was 2.6 percent. The highest rate of all was for individuals

Table 11. Unemployment Rates by Level of Education, 2004

Level of Education	Unemployment Rate (percent)
Less than High School	7.6
High School Graduate	4.7
Some College	4.2
Associate Degree	3.3
Bachelor's	2.6
Master's	2.1
Ph.D.	1.6
Professional Degree	1.1

Source: U.S. Bureau of Labor Statistics (2004).

without a high-school degree; their rate of 7.6 percent was almost three times higher than the rate for college graduates. Individuals with some college or an associate degree had unemployment rates that fell between those of high school and college graduates, while individuals with graduate degrees had particularly low unemployment rates, ranging from 1.1 percent to 2.1 percent.

As with wage differences, one could argue that differences in unemployment rates by level of education primarily reflect differences in individuals' skills, again broadly defined, and that those skills determine both education levels and unemployment rates, so that Table 11 does not necessarily represent the *causal* effect of education on unemployment rates. Yet studies by prominent labor economists show that increases in education do lead to lower unemployment rates. Ashenfelter and Ham (1979) find that an additional year of schooling reduces unemployment among white males by 0.5 to 0.8 percentage points. In a more recent study, Mincer (1991) finds that the probability of unemployment among white males is reduced by 0.8 percentage points for each additional year of schooling. These causal effects are similar to the differences seen in Table 11. For example, assuming an increase in the unemployment rate of 0.7 percentage points per year of schooling, a high school graduate would reduce his or her unemployment rate by

2.8 percentage points by obtaining a bachelor's degree, which is similar to the difference of 2.1 percentage points in the unemployment rates for these two degrees seen in Table 11.

3.2 NON-INCOME BENEFITS

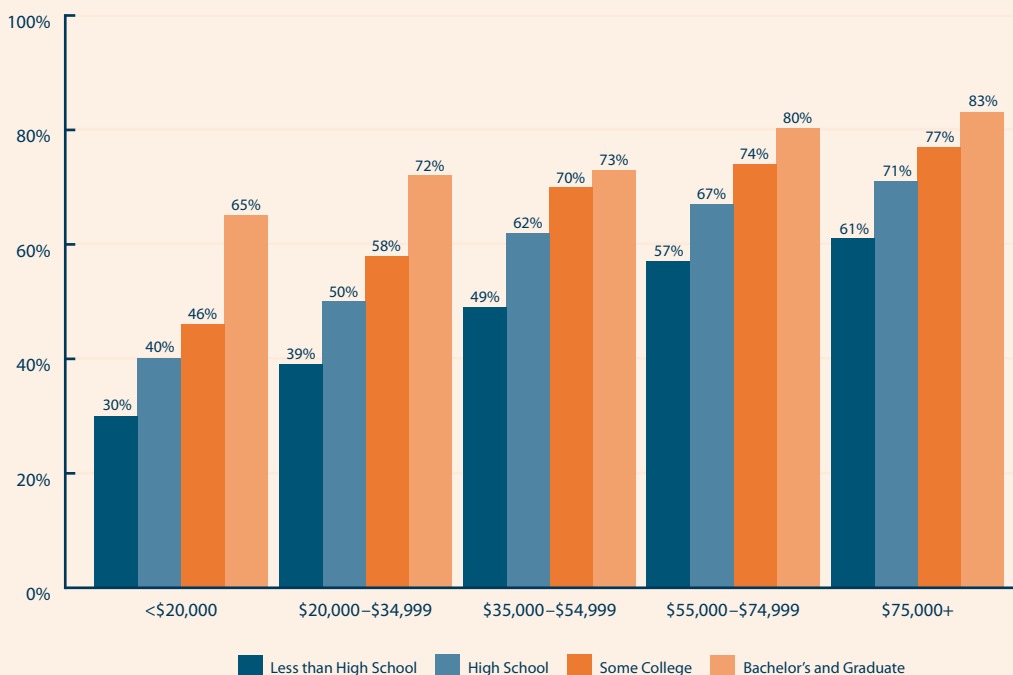
Educated people also enjoy non-income benefits. Two of the most important are that they tend to be healthier and they also derive direct satisfaction from being educated. Considering the health benefits, a comprehensive review by Grossman (2006) documents that more educated people are less likely to smoke or to be obese, and more generally they are healthier, even after controlling for their higher income. The children of better educated people are also more likely to be healthy than the children of less educated people.

An example of this is seen in Figure 9, which displays self-reported health status of Americans

by income and educational attainment. Even among individuals with similar incomes, better educated people are more likely to report that their overall health status is excellent or very good. Of course, these positive associations between educational attainment and health status are correlations, not necessarily causal relationships. Yet careful analysis by Deaton and Paxson (2001) shows that increased education reduces adult mortality.

Finally, most people with an undergraduate or graduate education would agree that their education has improved their quality of life, in addition to the income and health benefits just discussed. Many people enjoy learning and using the skills they acquired in college and graduate studies for non-income earning activities such as reading, going to plays and concerts, and civic and social engagement.

Figure 9. Reported Excellent or Very Good Health by Income and Education, 2001



Source: NCES (2004), based on National Health Interview Survey responses reported in National Center for Health Statistics (2001).

4. PUBLIC BENEFITS OF UNIVERSITY EDUCATION—CONCEPTUAL AND PRACTICAL ISSUES

The introduction to this report posed the question: Why should a resident of Minnesota who did not attend the University of Minnesota or one of the MnSCU state universities subsidize the tuition of individuals who do attend? The answer to this question is that persons who never attend a publicly funded college or university may benefit in at least two ways when other people attend those institutions. First, people who enroll in those institutions generate public benefits that accrue to all members of society. Second, government tax and transfer programs redistribute private benefits obtained by those people to other members of society. This chapter describes in detail the public benefits generated by a college or university education, while the next chapter discusses the redistribution of private benefits. For convenience, both the public and private benefits are summarized in Table 12.

Public benefits from higher education are defined as any benefits caused by that education that accrue to *any* members of society *in addition to the private benefits enjoyed by the individuals who graduate from colleges or universities*. (Some economists call public benefits *external* benefits.) The sum of private and public benefits are the *social* (total) benefits from education. Note that this definition of public benefits allows for the possibility that individuals who graduated from institutions of higher education not only generate public

benefits for the general population but can also receive them; this would occur if one person who graduated from a college or university enjoys benefits because another person graduated from a college or university.

As with private benefits of higher education, public benefits can be divided into two broad types, income benefits and non-income benefits. The remainder of this chapter describes both types of public benefits in more detail, and reviews studies that have attempted to measure them.

4.1 HIGHER EARNINGS FROM OTHERS’ EDUCATION

The wage that individuals receive may depend not only on their characteristics but also on the characteristics of other persons with whom they work. For example, in a given workplace an increase in the number of college- or university-educated employees is likely to make their less educated co-workers more productive. The intuition behind this positive (within firm) spillover effect is that each of the less-educated workers now has more educated co-workers with whom to work, thus becoming more productive and in turn receiving higher wages. This spillover effect on wages can be shown mathematically using standard (neoclassical) economic theory if the production process has constant returns to scale and educated and uneducated workers are not perfect substitutes in production, and recent studies of U.S. labor markets have shown that those two types of

Table 12. Public and Private Benefits of Education

	Public Benefits	Private Benefits
Income Benefits	1. Higher incomes due to diffusion of income generating skills from educated individuals to others via social interactions off the job.	1. Higher wages due to skills acquired from schooling. 2. Lower rate of unemployment.
Non-Income Benefits	1. Increased civic participation. 2. Reduced crime. 3. Learning from, and more pleasant social engagement with, better educated individuals.	1. Better health. 2. Direct enjoyment from learning and use of skills acquired from schooling.

labor are indeed imperfect substitutes (Freeman 1986; Katz and Murphy 1992).⁸

Yet these relative labor supply effects are *not* public benefits because firms presumably take these effects into account when hiring different types of labor and setting their wages. That is, each firm should understand that when it hires educated labor the firm's production will increase not only because the additional educated labor directly raises the firm's production but also because educated labor makes the firm's less educated labor more productive. In a well-functioning, competitive labor market, workers will be paid their full contribution to firm productivity (that is, the full value of their marginal product) and thus, in effect, they will be rewarded for both types of benefits. This implies that there is no public benefit, as defined above, because workers with high levels of education are fully compensated for the impact of their education on the productivity of other workers; that is, all of the productivity effects of better educated workers accrue to them as private benefits via their wages.

Yet there is also a second, and for the purposes of this report very important, pathway by which persons who do not obtain a degree from a college or university receive higher wages because others do obtain such degrees. This effect is known as an *external wage spillover effect*. There are many versions of these effects, but the basic idea is that the existence of well educated citizens makes other workers, especially less-educated workers, more productive in ways that do not depend on the relative scarcity of these two types of workers in their place of employment. All theories of wage spillover effects are based on social interactions *off the job*. For example, a worker's civic and social interactions with well-educated people from other places of employment may directly increase the productivity of that worker because

he or she can learn useful skills from those interactions. As explained above, this pathway does not apply to social interactions within firms, because employers should be aware that the intermingling of workers will raise their overall productivity, which employers in competitive labor market will need to reward.

There are two key aspects of external (between firm) wage spillovers that have important implications for this analysis. First, these wage effects imply a "market failure" (also called a "market inefficiency") because less educated workers who benefit from off-the-job interactions with more-educated individuals do not pay their benefactors for these benefits. Thus the private value of higher education (the value from the perspective of the workers who obtain such as education) is lower than the social value (the sum of this private value and the wage spillovers received by the less educated workers via off-the-job social interactions). This leads to an inefficiently low proportion of workers in society with college or university degrees. The second aspect is that even educated workers could receive wage spillover benefits from other educated laborers, although wage spillover benefits are probably higher for less educated workers since they have more to learn from educated workers than do other educated workers.

A recent paper by Moretti (2004) examined the size of the impacts of college educated labor on the wages of individuals with different levels of education, using 16 years of household survey data and 1980 and 1990 U.S. Census data from over 200 cities in the United States. He estimated that a one percentage point increase in the proportion of the labor force in a city who are college graduates (i.e., those with bachelor's degrees) increases the wages of high-school dropouts by 1.2 percent, the wages of high-school graduates and those with some college by 1.4 percent, and the wages of college graduates and of those with graduate degrees (master, professional and doctoral degrees) by 1.2 percent. Regarding graduate degrees, Moretti estimated that a one percentage point

⁸ If both types of workers are perfect substitutes there is, in effect, only one type of labor and so an increase in supply of either educated or uneducated labor lowers the marginal product of both.

increase in the proportion of the labor force with master, professional or doctoral degrees would increase the wages of high-school dropouts by 2.7 percent, the wages of high-school graduates by 2.2 percent, the wages of those with some college by 1.9 percent, the wages of college graduates by 1.1 percent, and the wages of those with graduate degrees by 0.8 percent. These effects are summarized in Table 13.

Table 13. Estimated Impacts of Increase in Educated Population on the Wages of Other Workers

Percentage Change in Wages for Population With:	One Percentage Point Increase in Population With:	
	Bachelor's Degree	Graduate Degree
Less than High School Education	1.2	2.7
High School Degree	1.4	2.2
Some College	1.4	1.9
Bachelor's	1.2	1.1
Graduate Degree	1.2	0.8

Source: Moretti (2004).

Moretti's estimates reflect two distinct effects: labor composition effects and wage spillover effects. He was unable to disaggregate his estimates of overall impacts, which are shown in Table 13, into the impacts from these two effects. Yet his results for college graduates suggest a spillover effect that raises the wages of college educated workers by at least 1.2 percent for every one percentage point increase in the proportion of the labor force that are college graduates, and presumably more on the wages of less educated individuals (since they probably have more to learn from college graduates than do other college graduates).⁹ This is the case because labor composition effects should be negative (an increase in the supply of that labor should reduce the wages for that labor), so if the sum of the two effects is 1.2 percent, and the labor composition effect is negative, then the spillover effect must be at least 1.2 percent. Similarly, the results for graduate degrees suggest a spillover effect that raises the wages of holders of graduate degrees by at least 0.8 percent for every one percentage point increase in the proportion of the labor force with such degrees, and presumably more on the wages of less educated individuals (for the same reason given above).

However, this interpretation of Moretti's results assumes that all holders of bachelor's degrees

are identical units of labor; this assumption underpins the negative substitution effect, by which an increase in the supply of college graduates reduces the wages of those graduates. Yet this assumption is doubtful. If college graduates are not perfect substitutes for each other (i.e. are not exactly the same type of labor), then it is possible that, even in the absence of wage spillover effects, an increase in the number of workers with a bachelor's degree could *increase* the average wage of workers with bachelor's degrees. This is reasonable if one considers workers with different types of bachelor's degrees to be different kinds of labor; by the same reasoning above regarding the relative scarcity of different types of labor the overall impact of an increase in the supply of one or more types of college graduates is ambiguous.¹⁰ If this were the case, then the spillover effect of the increased supply of workers with bachelor's degrees on the wages of workers with a bachelor's degree could be less than 1.2 percent.

Indeed, suppose that the true spillover effect were, say, 1.3 percent or higher (which follows

⁹ Moretti's estimates focus on changes in wages from 1979 to 1994. This relatively short period of time, and Moretti's use of a specification that allows for different returns to education for each year in his data, should control for technology-education interaction effects.

¹⁰ The reasoning here can be seen in a simple example. Suppose there are three different kinds of college graduate workers: engineers and scientists, economics and business majors, and literature majors. Suppose that the supply of one of these types (it does not matter which one) increases, which implies that the overall supply of college graduates increases. Assuming that these three types of labor are (imperfect) substitutes, the wages of the type that increased will decline while the wages of the other two types will increase, and the overall effect on the average wage of college graduates could be either positive or negative.

from the assumption of perfect substitution among different types of bachelor's degrees and Moretti's finding that a one percent increase in the proportion of the population with a bachelor's degree increases the wages of holders of bachelor's degrees by 1.2 percent). It is reasonable to assume even larger spillover effects from college educated labor to high school graduates and high school dropouts, in which case the total (spillover plus imperfect substitution) effect of a one percent increase in the percent of the labor force with a bachelor's degree on the wages of high school graduates and high school dropouts would be higher than 1.3 percent, but Moretti finds effects of only 1.4 percent and 1.2 percent, respectively. This suggests that the true spillover effects of the impact of an increase in workers with bachelor's degrees on the wages of holders of bachelor's degrees are unlikely to be over 1.0 percent. Summing up, it is likely that individuals within education groups are not perfect substitutes, and so some of the apparent spillover effects may be due to imperfect substitution within these groups.

Finally, there is another reason to think that Moretti overestimates the size of the income spillover effect. Lange and Topel (2006) argue that Moretti's estimates are too high to be plausible, since they imply larger impacts of education on other people's wages than on the wages of the person receiving the education. They discuss several econometric problems that could lead to biased estimates, but unfortunately the estimation problems they raise preclude them from offering a more accurate alternative estimate given the available data.

4.2 NON-INCOME BENEFITS

The other public benefits are those that affect outcomes other than individuals' incomes. We now describe several different pathways by which one individual's education may benefit others, including a review of the empirical evidence on the magnitude of these effects (many of which are hard to quantify in dollar terms).

4.2.1 Effects on Civic Participation and Voting

Higher education has been found to increase the amount and quality of civic and political participation. Dee (2004) found that educational attainment increases voter participation, membership in civic and social groups, and newspaper readership. It also generates more supportive attitudes toward free speech. It is difficult to assign a monetary value to these improvements in civic behavior, given the wide variety of "civic engagement" activities that could be considered. However, it is conceivable that one could place a value on the benefit of additional voter participation induced by higher education by calculating the cost required to realize an equivalent increase in voter participation via existing voter mobilization and education campaigns. This is still likely to underestimate the benefits from improved democratic processes attributable to subsidized higher education because it is almost impossible to place a value on the social benefits of increased group membership, newspaper readership, and attitudes toward free speech.

What might be an appropriate social value to assign to increased voter participation? There is no useful information on this for Minnesota, but Gerber and Green (1999) ran a randomized field experiment in the city of New Haven to test the effectiveness of voter turn out as well as the cost. Making a number of assumptions, based on their experiment with regard to contact time and canvassing wages, they determine that it costs \$16 to induce each additional voter to vote through canvassing.

4.2.2 Impact on Crime

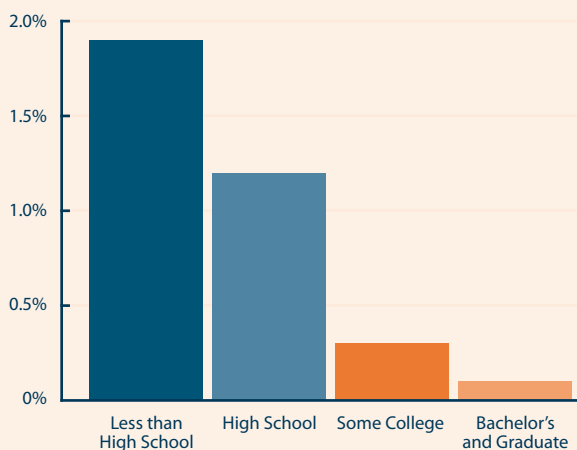
Education also reduces the likelihood that an individual will engage in criminal activities. Lochner and Moretti (2004) offer three reasons why education may reduce crime. First, increased education raises wages and thus raises the opportunity cost of engaging in crime since committing a crime greatly increases one's

chances of incarceration (although one could argue that education also reduces the probability of apprehension and conviction). Second, schooling may make people more risk averse. Lastly, schooling may alter the “psychic cost” of crime in that more educated people are socialized in a manner that increases feelings of guilt and shame associated with committing a crime.

The reduction in crime attributed to education provides a social benefit that primarily accrues to the community where the individual lives. Lochner and Moretti (2004) estimate that completing high school reduces the probability of being incarcerated by 0.8 percentage points for whites and 3.4 percentage points for blacks. They also find that negative effect of high-school graduation on crime rates is strongest for murder, assault, and car theft.

While studies indicate that crime is reduced by completion of high school, little work has been done relating crime to higher education. Yet, as seen in Figure 10, incarceration rates are much lower for college graduates than for high-school graduates. Figure 10 also shows that high-school graduates have lower incarceration rates than people who do not graduate from high school. The 0.7 percentage point difference in the incarceration rates of high school dropouts and high school graduates in Figure 10, is almost identical to the causal impact that Lochner and Moretti found for whites, and lower than the average for whites and blacks. This suggests, but does not prove, that the difference in incarceration rates in Figure 10 between high school graduates and college graduates, about 1 percent, may also accurately reflect a causal effect. Thus increasing the proportion of the population that completes some college or obtains a degree would reduce crime rates. It costs about \$20,000 to incarcerate a person for one year (Administrative Office of the U.S.

Figure 10. Incarceration Rates by Education Level



Source: Baum and Payea (2005).

Courts, 2004). This figure suggests that a policy that induces a high-school graduate to obtain some college or a bachelor or graduate degree saves society about \$200 per year per high-school graduate (since that person's probability of being incarcerated in a given year is reduced by one percentage point).

Of course, reducing crime has other benefits as well, such as reduced spending on police and on the court system, and (perhaps most important) a decline in the direct harm suffered by crime victims. Yet it is difficult to assign a value to these costs, and this report does not attempt to do so.

4.2.3 Learning and Enhanced Social Interactions

Another public benefit attributable to higher education is intuitive, yet hard to measure; most people would agree that they gain new insights and learn interesting things from highly educated individuals. (Though some may argue that economists are an exception to this general rule.) Yet it is difficult to assign a monetary value to these benefits, and to our knowledge no one has tried. The main point is that these are genuine benefits, so the

overall social benefit will be underestimated if one examines only the benefits that are more amenable to quantification.

5. DISTRIBUTION OF PRIVATE AND PUBLIC BENEFITS

Chapters 3 and 4 described the public and private benefits that are generated by increases in the population with higher education, but they did not consider in detail how these benefits are distributed. Yet only a little reflection is needed to realize that these benefits are not equally distributed across the general population. Indeed, complaints from taxpayers who do not attend publicly funded institutions of higher education that they should not have to pay taxes to support those institutions are, in essence, complaints about the distribution of those benefits (and the distribution of the tax obligations that finance those benefits). This section describes how the benefits generated by increased public funding to higher education are distributed across the population, as well as who pays for that increased public funding.

Before discussing distributional issues in detail, an important distinction must be made between two kinds of students who currently attend public institutions of higher education. If state funding were withdrawn from public institutions of higher education, those institutions would be forced to charge tuition levels comparable to those charged by private institutions. Even so, many of the people who currently attend those public institutions would still attend them if they charged that higher tuition, or would switch to attending private institutions. We call these individuals “non-marginal” students; they, by definition, will not change their education levels (although some may switch to a private educational institution) in response to the removal of state government subsidies to higher education. Note that this implies that the provision of subsidies does not generate any additional public benefits from these students. In contrast, there are also individuals who choose to obtain more education because of state

government subsidies to higher education. We call these individuals “marginal” students. The redistributive impacts (and the public and private benefits) of state funding for higher education are quite different for marginal and non-marginal students. With this distinction in mind, we now present four pathways by which state funding for higher education redistributes income and other resources among different groups in the general population.

The first pathway is that state funding for higher education involves a large redistribution of income from the general public (that is, from taxpayers) to *non-marginal* students who attend state institutions of higher education. As explained above, these students would still attend those institutions, or would switch to private institutions, if state funding for higher education disappeared. Thus their education levels do not change and so there is no change in the public (or private) benefits provided by their education. The only change is that they (or their parents) pay much less tuition for their education, so a portion of the funds used to support public higher education is simply redistributed from taxpayers to non-marginal students.

There is also a redistributive element for *marginal* students. State subsidies induce them to obtain more education, which must be financed by someone. In fact, the financial burden is split between these marginal students and taxpayers. Marginal students use their own resources to pay the tuition charged by public universities, while the difference between these tuition rates and the rates that would prevail if state government subsidies did not exist is paid by taxpayers. More abstractly, increases in the number of individuals obtaining higher education requires increases in “academic resources” (professors, administrators, classrooms, etc.). These resources are diverted from some other (perhaps much less academic) activities for which they would have been used in the absence of subsidies, which is a real resource cost to the economy. The decline in

these other activities is a cost that is, in effect, paid for by marginal students and taxpayers.¹¹

Turn next to the second pathway. Reversing directions, some of the private benefits enjoyed by marginal students are redistributed to taxpayers. More specifically, recall the four main private benefits of higher education: increased wages, lower rates of unemployment, better health, and direct enjoyment from being educated. The last two accrue solely to the person being educated (or to their children, in the case of health). The benefits from the first two are income benefits, and while most of these benefits accrue to the individual being educated, part of the increase in income will be paid in taxes and so will be used to benefit the general population (via either increased government services or reduced tax rates that maintain the current amount of government spending and services). Thus, part of the private income benefits accruing to marginal students is redistributed to the general population. Note that this redistribution from individuals who obtained degrees from public institutions of higher education affects only *marginal* students; non-marginal students, by definition, do not change their education levels in response to the elimination of state support to higher education and thus there is no change in the income they earn or the taxes they pay.

Of course, some taxpayers are graduates of Minnesota's public institutions of higher education, so part of the above two avenues of redistribution (from taxpayers to both marginal and non-marginal students and from marginal students to taxpayers) is not really redistribution at all. Yet only about 8.7 percent of the adult population in Minnesota have a degree from the University of Minnesota, and only another 5.7 percent have a 4-year or graduate degree from one of the seven MnSCU state universities, thus 85.6 percent of Minnesota's adult population

did not obtain such degrees from either institution and so most of the redistribution to or away from taxpayers in Minnesota involves individuals who did not obtain a bachelor or graduate degree from Minnesota's public institutions of higher education.

A third redistributive pathway exists because people with college and university degrees are less likely to draw upon government services, such as unemployment benefits, welfare programs and medical assistance. The available evidence suggests that individuals with a bachelor (4-year) degree are much less likely to be unemployed (see Chapter 3). This will reduce state government expenditures on unemployment benefits, freeing up resources that can be used for other state government programs or returned to taxpayers.¹² In either case most of the benefits will accrue to individuals who did not obtain a degree from the University of Minnesota or from one of the seven MnSCU state universities. There is also evidence that education reduces individuals' participation in welfare programs and medical assistance. Yet the TANF (Temporary Assistance to Needy Families), Food Stamp and Medicaid programs are primarily financed with federal, not state, funds and thus there is very little benefit to Minnesotans from this impact of education (most of the benefits, whether in terms of lower tax rates or increased federal spending on other programs, will be shared by the 50 states), and so this report does not investigate this effect.

Finally, apart from government tax and spending decisions, voluntary actions such as charitable giving or volunteer activities can also have consequences for the redistribution of income. This is the fourth pathway. More specifically, higher education increases both monetary giving to charitable causes and hours of volunteer work. Andreoni et al. (2003)

11 In general, raising taxes to (partially) finance the increased education of marginal students also leads to a "dead-weight loss" to the economy as a whole. Strictly speaking, this is not a distributional effect since no one gains from such an efficiency loss. This is explained further in Chapter 6.

12 Strictly speaking, taxes that pay for unemployment benefits are paid for by employers, not individual taxpayers. Yet, in general, employers will raise prices to cover these costs so they are paid for by the general public, almost all of whom are taxpayers.

examined individual and family characteristics that influence both the probability and the total amount of charitable contributions. They found that education has a positive and significant effect on such contributions. They estimate that, for single males, obtaining a bachelors degree increases total charitable contributions by about 120%, relative to single males who only complete high school. The analogous figure for single females was 230%.¹³

Educated people not only donate more money to charitable causes, they also volunteer more of their time. Vaillancourt (1987) studied the characteristics of volunteers in Canada and found that the overall effect of education on volunteer time is positive. Unfortunately, it is not clear how to value the increased hours of volunteer work, so we will not attempt to do so. Yet such work can have substantial social value, which will be omitted from any assessment of the social returns to higher education that includes only income effects (as we have done here).

In summary, state government funding for public institutions of higher education not only generates private and public benefits but also redistributes income and other resources from some members of society to others. This chapter has explained the four main pathways through which such redistribution occurs. The following chapter will present estimates of the size (in dollars) of each of these four pathways, after first presenting estimates of the overall private and public benefits generated by public funding for higher education in Minnesota.

6. AN ASSESSMENT OF THE PRIVATE AND PUBLIC BENEFITS OF SUBSIDIES TO HIGHER EDUCATION IN MINNESOTA

In this chapter we use the methodological framework presented above to estimate the private and public benefits accruing to Minnesota from the educational services offered by the University of Minnesota and the seven MnSCU state universities. More specifically, we quantify the private and public benefits generated by individuals who obtained bachelor or graduate degrees from the University of Minnesota or from one of the seven MnSCU state universities (hereafter referred to as “Minnesota’s public universities”). We begin by using Card and Lemieux’s (2001) estimates to calculate the impact of state government subsidies provided to Minnesota’s public universities on the proportion of Minnesotans with undergraduate (bachelor’s) and graduate (master, professional and doctoral) degrees.¹⁴ These results are then used to assess the consequent private and public benefits. The sum of these estimated benefits is then juxtaposed against Minnesota’s state government spending to support these universities, after which we compare the overall economic costs to the overall benefits (both private and public) of this support. We also present estimates of the distributional impacts of state government subsidies to Minnesota’s public universities. For reference, Box 2 summarizes the steps used to calculate the social benefits of state government subsidies to higher education.

13 More specifically, Andreoni et al. found that, for single males, acquiring a bachelors degree increased the log of total charitable contributions by 0.8, relative to single males who only complete high school. The analogous figure for single females was 1.2.

14 Ideally, we would like to estimate the impact of increasing tuition at the University of Minnesota while not changing the tuition of the MnSCU system, since the main audience for this paper is the University of Minnesota, but we know of no estimates that can be used to simulate this scenario. In contrast, we do have estimates of what happens when there is an overall increase in tuition at public institutions of higher education, so we estimate this more general scenario. In fact, it is probably impossible to estimate separately the impacts of raising tuition at the University of Minnesota and raising tuition at the MnSCU system, since the correlation coefficient of those tuition rates over time (from 1986 to 2007) is 0.99.

Box 2. Steps in Calculating the Social Benefits of Higher Education

1. Calculate how increases in tuition due to withdrawal of state subsidies for the University of Minnesota and the seven MnSCU state universities reduce the proportion of the population in Minnesota with higher education degrees.
2. Estimate the reduction in private benefits in the form of lower wages and higher unemployment rates for those individuals whose education declines in response to the withdrawal of state government subsidies.
3. Estimate the reduction in wage spillovers due to the decrease in the population with bachelor's and graduate degrees.
4. Estimate the decrease in voter participation, and the cost of that decrease, due to the decrease in the population with higher education degrees.
5. Estimate the increase in the incarceration rate, and the cost of that increase, due to the decrease in the population with higher education degrees.

6.1 IMPACT OF REMOVING SUBSIDIES TO HIGHER EDUCATION ON EDUCATION LEVELS

As explained above, the public benefits of the educational services provided by Minnesota's public universities result from the increase in the proportion of the adult population with undergraduate (bachelor's) and graduate (master, professional and doctoral) degrees. At first, one may think that the increase in adults with undergraduate and graduate degrees is equal to the adult population in Minnesota with bachelor and graduate degrees from Minnesota's public universities. Yet, as explained above, in the absence of state government subsidies to public universities in Minnesota at least some—and perhaps most—of these people would still have sought degrees from the “newly privatized” University of Minnesota and the MnSCU state universities, or from private colleges and universities. Thus estimating the “effective” or “net” effect of Minnesota's public universities on the number of people in Minnesota with bachelor or graduate degrees must take this behavior into account.

Card and Lemieux (2001) estimated the impact of a state-funded university system on undergraduate enrollment rates.¹⁵ They found that a one unit increase in the log of annual tuition (about \$1500 in 1988 dollars) charged by public colleges and universities decreases the college/university enrollment rate of men between 19 and 21 years of age by about 1.1 percentage points, and of women in the same age group by about 3.8 percentage points. Averaging over men and women leads to a drop in college enrollment of about 2.5 percentage points for every one unit increase in the (log of) tuition charged by public universities.¹⁶

We use the Card and Lemieux estimates to simulate the impact of withdrawing state government subsidies to Minnesota's public universities on the proportion of the population in Minnesota with bachelor or graduate degrees. More specifically, we assume that the removal of those subsidies causes Minnesota's public universities to raise their tuition rates to the levels charged by Minnesota's private colleges and universities, which would approximately raise enough money to replace the subsidies currently paid by the state to these public institutions of higher education. As explained above, the average tuition and fees (not including room and board) for one year at private colleges and universities in Minnesota

15 We are aware of one other paper that also attempted such estimates, using variation within states over time: Kane (1994). However, Kane focused on black students, and his estimates for white students varied widely over different estimation methods. More recently, Fortin (2006) estimated the impact of the tuition rate at public colleges and universities on enrollment rates at those same institutions, as opposed to overall enrollment (which includes enrollment at private institutions). She found effects that were stronger than those of Card and Lemieux, which is consistent with the latter's results because one would expect some students to transfer for private colleges and universities if tuition is increased at public institutions.

16 One reason for averaging is that these estimates by sex are not very precise, e.g. the estimate for men was statistically insignificant; unfortunately, Card and Lemieux do not report regression results that aggregate over men and women.

is about \$25,000 (see Chapter 2). Yet a large proportion of these students receive financial aid, substantially reducing the actual average cost incurred by the student. We estimate that the average amount of financial aid received by students at private colleges in Minnesota (averaging over both those receiving and not receiving financial assistance) is about \$5,700 per year; so the annual tuition actually paid is, on average, about \$19,300.¹⁷ This compares with the total tuition and fees for full-time undergraduate students of about \$9,400 per year at the University of Minnesota and about \$5,650 per year for undergraduate students at the MnSCU state universities.

In general, the University of Minnesota is more selective than the seven MnSCU state universities, and charges a higher tuition. The tuition (and presumably the quality) of private 4-year colleges in Minnesota also varies, ranging from a low of around \$20,000 to a high of over \$30,000 per year. To simulate the impact of raising tuition at Minnesota's public institutions of higher education we examine the scenario of: a) increasing tuition at the University of Minnesota to \$22,500 per year (assuming that it competes with private institutions that charge from \$25,000 to over \$30,000 but on average also would give about \$6,000 in tuition reductions); and b) increasing tuition at the MnSCU state universities to about \$14,000 per year (assuming that it competes with private institutions that charge from less than \$20,000 to about \$25,000 but on average give about \$6,000 in tuition reductions).¹⁸

This exercise is plausible because increasing University of Minnesota tuition to \$22,500 would generate revenue for the university that is roughly equal to the annual subsidies

for educational expenditures provided by the Minnesota state government. Assuming that enrollment rates are unaffected by a tuition hike of \$13,100 per year (from \$9,400 to \$22,500), this hike would generate \$655 million per year.¹⁹ Similarly, a \$8,350 increase in annual tuition for 4-year students at the MnSCU state universities (from \$5,650 to \$14,000) would generate about \$418 million in additional revenues.²⁰ The \$655 million of additional revenue generated for the University of Minnesota by this tuition increase is somewhat larger than the 2006-07 state subsidy to that institution of \$591 million, and the additional revenue generated for the MnSCU system, \$418 million, is also larger than the 2005-06 state subsidy to that institution of \$241 million (see Tables 7 and 9 for these appropriation numbers). Assuming some reduction in enrollment from these increases in tuition—indeed this is what Card and Lemieux found and, more importantly, is the basis of the simulations presented below—the actual amount of revenue generated by these tuition hikes may be closer to the current appropriations provided by the state government.

An increase in annual tuition from \$9,400 to \$22,500 at the University of Minnesota is equivalent to an increase in the log of tuition from 9.15 to 10.02, an increase of 0.87. Similarly, an increase in annual tuition from \$5,650 to \$14,000 at the MnSCU system is equivalent to an increase in the log of tuition from 8.64 to 9.55, an increase of 0.91. Averaging across these two sets of figures gives an average increase in the log of annual tuition of about 0.89. Using Card and Lemieux's results, and assuming that changes in college enrollment rates are synonymous with changes in the adult population with a college degree, an increase of 0.89 in the log of annual tuition implies that the

17 There are approximately 50,000 students enrolled in bachelor's degree programs at private colleges and universities in Minnesota, and institutionally funded grants and tuition discounts for all of these private schools were about \$284 million in 2004 (see Table A.3), which implies a per student amount (including students who received no assistance) of \$5,680.

18 Grants and tuition reductions at the University of Minnesota are rather small, on average only \$1,000, and they are even smaller at the MnSCU system (about \$200), so they are ignored in this simulation.

19 Recall that the University of Minnesota raised tuition by about 66 percent from 2000 to 2006 with no appreciable drop in student enrollment (indeed, enrollment continued to increase), and the same thing occurred for the MnSCU system. Note also that the University of Minnesota has over 60,000 students, but since some are part-time they are equivalent to about 50,000 full-time students.

20 There are about 65,000 4-year students in the MnSCU state universities, and they are also equivalent to about 50,000 full-time students.

population with a college degree will drop by 2.2 percentage points (0.89×2.5).

What do these results imply for the impact of eliminating state government subsidies for higher education on the distribution of degrees holders in Minnesota? Because Card and Lemieux examined the effect of tuition rate changes on college enrollment, not on any particular college degree, it applies both to people in the “some college” category and to people with bachelor’s degrees in Table 3 (but not to people with graduate degrees). The “some college” category combines people who have 2-year (associate) degrees and people who attended college without obtaining any degree. Allocating the inferred 2.2 percentage point drop in college enrollment equally among those identified in Table 3 as having “some college” and those with a bachelors degree, these tuition increases reduce the percentage of the population with “some college” from 32.8 percent to 31.7 percent, and the percentage of the population with a bachelor’s degree from 23.7 percent to 22.6 percent. These individuals are assumed to be high school graduates, so this reduction in the population with “some college” or a bachelors degree implies a 2.2 percentage point increase in the population with only a high school degree, from 26.8 percent to 29.0 percent. These changes are shown in the second column of Table 14.

There is one important additional complication—these tuition increases are also likely to reduce the number of people in Minnesota who obtain graduate or professional degrees. Card and Lemieux (2001) did not address this issue. We account for this by assuming that the impact would be proportionate to the impact on college enrollment. That is, the decrease in college graduates from 23.7 percent to 22.6

Table 14. Estimated Effect of Large Tuition Increases on the Distribution of University Degrees among the Working Age Population in Minnesota

	Current Distribution of Degrees	Distribution after Large Tuition Increases	
		Bachelor's Programs Only	Adding Graduate Programs
		(percent)	
Less than High School	5.1	5.1	5.1
High School Diploma	26.8	29.0	29.0
Some College	32.8	31.7	31.7
Bachelor's	23.7	22.6	23.2
Master's	8.0	8.0	7.6
Professional Degree	2.2	2.2	2.1
Doctorate	1.4	1.4	1.3
Working Age Population	100.0	100.0	100.0

Source: Current Population Survey, 2006, and Authors’ calculations.
 Notes: Column 2 divides 2.2 percentage point reduction in college enrollment equally across the working age population in the bachelor’s and some college categories, and assumes that these reductions lead to a 2.2 percentage point increase in the population with a high school diploma. Column 3 adds the assumption that the decline in graduate degrees is proportionate to the decline in undergraduate degrees, and assumes that all those who no longer obtain a graduate degree instead obtain a bachelor’s degree.

percent due to the above increases in tuition at the University of Minnesota and the MnSCU state universities is a 5 percent drop. We assume the same percentage drop in the number of adults in Minnesota with masters, professional and doctoral degrees. For example, we assume that the percentage of the population with masters’ degrees will drop from 8.0 percent to 7.6 percent. For simplicity we assume that all of these people will end up with bachelors’ degrees. These final numbers for the impact of raising tuition are given in the third column of Table 14.

The rest of this chapter will use these changes in the distribution of education across the working age population in Table 14 to estimate the private and public benefits generated by state subsidies to support Minnesota’s public universities.

6.2 PRIVATE BENEFITS

Chapter 3 presented two types of income benefits and two types of non-income benefits that accrue to individuals who obtain undergraduate or graduate degrees. It is difficult to assign a dollar value to the non-income benefits, especially to the general enjoyment individuals obtain from being educated. Better health is also difficult to evaluate.

Yet economists have a long history of estimating the impact of education on wages, and some economists have also estimated their impact on the probability of being unemployed. These estimates were discussed in Chapter 3. Table 14 shows the estimated decreases in the education levels of Minnesota's population if state subsidies were eliminated. These are the changes in the education levels of the marginal students. Recall that, on average, economists estimate that an additional year of schooling increases wages by about 8 percent. Applying this impact to the differences between columns 1 and 3 of Table 14, and recalling that there are 2.57 million people of working age in Minnesota (see Table 3), the sum of the loss in private wage benefits to marginal students is \$1,042 million per year (before taxes).

Finally, turn to reductions in unemployment, which were also discussed in Chapter 3. As explained below, we estimate that the drop in education levels shown in Table 14 will lead to an increase of 819 more unemployed people in Minnesota at any given point in time. Applying the wage rates to the change in the unemployment in Minnesota implies that these people would lose about \$16 million in income every year.

Overall, lower levels of education will reduce the (before tax) incomes of marginal students, that is of individuals who would obtain less education if state government subsidies to Minnesota's public universities are withdrawn, by \$1,058 million per year. Almost all of this (\$1,042 million) is due to lower wages. While interesting, these private benefits do not by

themselves provide an argument for public subsidies to higher education; it is the *public* benefits alone that justify these subsidies. The next two sections of this chapter calculate those public benefits.

6.3 PUBLIC BENEFITS: HIGHER EARNINGS FROM OTHERS' EDUCATION

Recall that workers who have not graduated from public colleges and universities benefit from those who have because of spillover effects, such as acquiring skills from graduates of these institutions through social interactions outside of work, which raise their wages. Moretti (2004) estimated this effect, but unfortunately his estimates did not distinguish between these spillover effects and wage effects that operate through changes in the composition of labor (via "imperfect substitution"). In principle, if there were no spillover effects and all types of college graduates are perfect substitutes, an increase in the supply of college graduates would have a negative impact on the wages of college graduates. If instead a positive effect is estimated, the spillover effect must be at least as large as that estimated positive effect (because without the spillover effect the expected impact of an increase in the supply of college graduates on their wages would be negative, again assuming that all college graduates are perfect substitutes for each other).

Moretti found that a one percentage point increase in the share of the labor force with a bachelor's degree raised the wages of workers with that degree by 1.2 percent. Assuming perfect substitution across different types of workers with bachelor's degrees, this suggests that the spillover effect from a one percentage point increase in the share of the labor force with a bachelor's degree is more than 1.2 percent. Yet, as explained above, this is likely to be an overestimate because it is unlikely that all workers with bachelor's degrees are perfect substitutes for each other. Moreover, Lange and Topel (2006) argue that Moretti's estimates are implausibly high. In this study we present two scenarios, both of which make conservative

Table 15. Assumptions Used for Wage Spillover Effects

<i>Percentage Change in Wages for Labor Force With:</i>	<i>One Percentage Point Increase in Labor Force With:</i>			
	Bachelor's Degree		Graduate Degree	
	Moderately Conservative Assumption	Very Conservative Assumption	Moderately Conservative Assumption	Very Conservative Assumption
Less than High School Education	0.75	0.5	1.0	0.75
High School Degree	0.75	0.5	1.0	0.75
Some College	0.5	0.3	0.75	0.5
Bachelor's	0.5	0.3	0.75	0.5
Graduate Degree	0.0	0.0	0.5	0.3

Source: Authors' assumptions based on Moretti (2004) and Lange and Topel (2006).

assumptions (one more so than the other) about the size of the spillover effects.

For the “moderately conservative” estimate we assume that a one percentage point increase in the share of the labor force with a bachelor's degree increases the wages of individuals with that degree by only 0.5 percent. We also assume the same impact on the wages of those individuals with a “some college” education; for those with a high-school diploma or less we set the spillover effect on wages at 0.75 percent (and assume no increase in wages for those with graduate school degrees). For spillovers from people with graduate degrees, we again conservatively estimate the spillover effects from a one percentage point increase in the share of the labor force with such degrees to be 0.5 percent to holders of graduate school degrees, 0.75 percent to people with bachelor degrees or “some college”, and 1.0 percent to high-school graduates and high school dropouts. These various assumptions are summarized in columns 1 and 3 in Table 15. Similarly, our very conservative assumptions involve a set of even more muted spillover effects, again shown in Table 15 (columns 2 and 4).

Table 16 presents estimates, based on our “moderately conservative” assumptions, of the decline in the total value of wage spillovers resulting from the elimination of public subsidies to Minnesota's public universities (which results in tuition increases to \$22,500 for the University of Minnesota and to \$14,000

for the MnSCU system). The table shows the estimated losses in wages for each education group. To understand how each row in the table is calculated, consider individuals in the labor force with a high-school degree, which currently number about 690,000. Their current annual earnings are, on average, about \$31,000. The tuition increase induced by a withdrawal of public subsidies is estimated to increase by about 56,000 the number of individuals with only a high-school degree (about 2.2 percent of the working age population), to a total of about 746,000.

Columns (4), (5) and (6) in Table 16 shows how the wages of these high-school graduates will change due to a reduction in the number of workers with bachelor and graduate degrees. The reduction in the number of workers with bachelor's degrees from 23.7 percent to 23.2 percent (see Table 14) will reduce the wages of high-school graduates by about 0.38 percent (0.5×0.75). Reducing the number of individuals with graduate degrees from 11.6 percent to 11.0 percent (Table 14) will reduce the wages of high school graduates by 0.6 percent (0.6×1.0). Combining these two effects gives a total annual earnings reduction of 1.0 percent, or \$310 ($30,766 \times 0.0101$) per year. Summing over all 746,000 high school graduates gives a total

Table 16. Moderately Conservative Estimate of Reduction in Wage Spillovers from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Current Number	Annual Wages	Estimated Number after Tuition Increase	Percent Change in Wages due to Fewer Bachelor's and Graduate Degrees	Drop in Wages	Drop in Wages
	(thousands)	(dollars)	(thousands)		(dollars per worker)	(total, in million of dollars)
	(1)	(2)	(3)	(4)	(5)	(6)
Less than High School	132,028	\$21,645	132,028	-1.01	-\$218	-\$28.8
High School Diploma	689,709	\$30,766	746,463	-1.01	-\$310	-\$231.5
Some College	843,394	\$35,714	814,926	-0.72	-\$258	-\$209.9
Bachelor's	609,633	\$49,889	595,202	-0.72	-\$360	-\$214.1
Master's	204,601	\$59,508	196,203	-0.30	-\$176	-\$34.5
Professional Degree	57,072	\$95,699	53,803	-0.30	-\$283	-\$15.2
Doctorate	35,333	\$79,403	33,143	-0.30	-\$235	-\$7.8
Total	2,571,770	—	2,571,770	—	—	-\$741.8

Sources: Median Earnings by Education level, 2003 are from the US Census Bureau. Wage change assumptions are from Table 15; see text for details.

spillover loss of about \$232 million per year.²¹ Repeating these calculations for all education groups yields our “moderately conservative” estimate of the loss of spillover effects caused by the withdrawal of state subsidies of about \$742 million per year.

The estimated spillover effects in Table 16 are conservative in the sense that they are based on parameter estimates that are much smaller than those reported by Moretti (2004). Given Lange and Topel's (2006) arguments that Moretti's estimates are far too high, we recalculated the spillover effects using the “very conservative” parameter estimates given in Table 15. These results, presented in Table 17, show a total loss in wage spillover effects of about \$493 million per year.

6.4 PUBLIC BENEFITS: NON-INCOME EFFECTS

Non-income benefits of government subsidies to Minnesota's public universities are the most difficult to value, and this study presents estimates only for the value of increased voter participation and for reductions in crime. Table 18 shows our estimates of the increase in voter participation in Minnesota, and the value of that increased participation. The latter is based on the results of a program evaluation conducted by Gerber and Green (1999). The first column shows the approximate change in the education levels of the population, based on the figures in columns 1 and 3 in Tables 16 and 17. The second column shows the associated reduction in the number of votes in a given election, based on the assumption that an additional year of post-secondary education increases voter participation by 6.8 percent (as reported by Dee 2004), combined with the current voter participation rate of about 60 percent in Minnesota. Using the cost per additional voter of \$16 reported by Gerber and Green, the total value of the increased voter participation (which assumes participation in

21 The total figure in the lower right of Table 16 changes very little if one uses the distribution of the population after the tuition change (as done here) or before the tuition change, since differences due to some groups increasing are offset by differences due to other groups decreasing.

Table 17. Very Conservative Estimate of Reduction in Wage Spillovers from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Current Number	Annual Wages	Estimated Number after Tuition Increase	Percent Change in Wages due to Fewer Bachelor's and Graduate Degrees	Drop in Wages	Drop in Wages
	(thousands)	(dollars)	(thousands)		(dollars per worker)	(total, in million of dollars)
	(1)	(2)	(3)	(4)	(5)	(6)
Less than High School	132,028	\$21,645	132,028	-0.72	\$156	-\$20.6
High School Diploma	689,709	\$30,766	746,463	-0.72	\$222	-\$165.6
Some College	843,394	\$35,714	814,926	-0.46	\$165	-\$134.5
Bachelor's	609,633	\$49,889	595,202	-0.46	\$231	-\$137.3
Master's	204,601	\$59,508	196,203	-0.18	\$105	-\$20.7
Professional Degree	57,072	\$95,699	53,803	-0.18	\$170	-\$9.1
Doctorate	35,333	\$79,403	33,143	-0.18	\$141	-\$4.7
Total	2,751,770	—	2,751,770	—	—	-\$492.5

Sources: Median Earnings by Education level, 2003 are from the US Census Bureau. Wage change assumptions are shown in Table 15; see text for details.

Table 18. Cost of Reduced Voter Participation from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Change in Population, by Degree	Decrease in Number of Voters	Estimated Cost of Lower Education Levels
			(thousands)
High School Graduates	+56,754		
Some College	-28,468	-2,323	-\$1,115
Bachelor's	-14,431	-2,355	-\$1,130
Master's	-8,398	-685	-\$329
Professional Degree	-3,269	-400	-\$192
Doctorate	-2,189	-357	-\$171
Total		-6,120	-\$2,938

Source: Dee (2004), and authors' calculations.

Note: The decrease in voting assumes an average 60% rate of voter participation, and each vote is valued at \$16.

someone that has completed some college or obtained a higher degree will save society an estimated \$200 per year due to a lower probability of incarceration. Thus the cost to society in terms of higher incarceration rates from removing state government subsidies to Minnesota's public universities is \$11.4 million, as shown in Table 19.

6.5 DISTRIBUTIONAL IMPACTS: TAXES, BENEFITS AND CHARITABLE CONTRIBUTIONS

The discussion thus far in this chapter has focused on evaluating the private and public benefits of state government subsidies to Minnesota's public universities. This

is the correct object of attention for deciding whether those subsidies are a wise public policy in economic terms. But there are also several income distribution consequences that have important public policy and political implications. This section discusses three effects

30 elections over the person's lifetime) is still quite small—only about \$2.9 million in total.

Turn next to the impact of changing the distribution of education on crime rates. As explained in Chapter 4, moving a member of the population from high-school graduate to

Table 19. Cost of Increased Incarceration Rates from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Change in Population, by Degree	Cost of Increased Incarceration (\$200 per person)
High School Graduates	+56,754	
Some College	-28,468	-\$5,693,556
Bachelor's	-14,431	-\$2,886,139
Master's	-8,398	-\$1,679,501
Professional Degree	-3,269	-\$653,800
Doctorate	-2,189	-\$437,830
Total		-\$11,350,826

Source: Authors' calculations.

of removing Minnesota's state government subsidies to its public universities: 1. Lower state taxes paid by marginal and non-marginal students due to their lower wages;²² 2. Increased use of state unemployment benefits; and 3. Reduced charitable contributions.

6.5.1 State Taxes

Minnesota's state government collects the following types of taxes: income tax, sales tax, property tax, and excise taxes. Except for individuals in the bottom 30 percent of the income distribution, the typical Minnesota household pays about 8.8% of its income in state taxes (Minnesota Department of Revenue, 2007).²³ The lower incomes of both marginal and non-marginal students caused by the disappearance of State Government support for higher education will reduce state tax revenues.

22 These individuals also pay higher federal taxes, but very little of the benefits generated by the consequent higher federal spending benefits Minnesotans, so those impacts are ignored in this discussion.

23 Total state tax payments for households in deciles 4-10 range from 7.3 to 9.4 percent of their incomes, so assuming 8.8% (the average figure over all deciles) for these deciles is a reasonable approximation. Individuals who obtain a bachelor's or graduate degree almost certainly are found in these deciles, since households in the first three deciles have total incomes of \$23,135 or less, which is much lower than the average annual incomes for holders of college and graduate degrees reported in Table 10.

Consider first the marginal students. The change in the distribution of degrees seen in Table 14 has implications for total income tax collected; this is shown in the first column of Table 20. The second column of Table 20 shows how much wage incomes decline for marginal students due to the elimination of state subsidies for Minnesota's public universities—individuals who opt not to get graduate degrees are assumed to obtain a bachelor's degree, and individuals who opt not to get a bachelor's degree or "some college" are assumed to obtain a high-school degree—

based on the assumption that each additional year of schooling raises earnings by 8 percent. Assuming that everyone whose education level decreases pays 8.8% of their gross income in state taxes, the third column shows the decline in state tax revenue per person due to these lower wages, and the fourth column calculates the total drop in tax revenues (multiplying the figures in columns 1 and 3), and sums the total. Overall, removing Minnesota's state government subsidies to its public universities will eventually reduce state tax revenues paid by marginal students by \$89.7 million per year. This decrease will not occur immediately, but will gradually take place over about 40 years as the new, lower rate of enrollment leads to a gradual reduction in the education level of the general population. This drop in state tax revenues that is generated from the lower incomes (due to the lower education levels) of marginal students is a loss to the general population of Minnesota.

Next, consider non-marginal students. The decrease in wages of the general population due to reduced spillover effects (from social interactions off the job), as discussed in Section 6.3, will also reduce tax revenues. In particular, the reduced taxes due to lower wages earned by the general population (a wage loss estimated to be \$741.8 million per year under the moderately conservative scenario and

Table 20. Loss of State Tax Revenues from Marginal Students Due to Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Change in Population with Education Level	Estimated Wage Premium <i>(assuming 8% increase in earnings per year of schooling)</i>	Decline in Tax Revenue <i>(per capita)</i>	Total Decline in Tax Receipts <i>(millions of dollars)</i>
High School Diploma	+56,754	\$0	0	0
Some College	-28,468	\$12,153	-1,069	-30.4
Bachelor's	-14,431	\$20,400	-1,795	-25.9
Master's	-8,398	\$24,042	-2,116	-17.8
Professional Degree	-3,269	\$36,532	-3,215	-10.5
Doctorate	-2,189	\$36,532	-3,215	-5.1
Total	0	—	—	-89.7

Source: Authors' calculations.

Note: Column 2 increases for some college and bachelor's are relative to a high school degree, while increases for graduate degrees are relative to a bachelor's degree.

\$492.5 million under the very conservative scenario) will result in a loss of tax revenues of either \$65.3 million (moderately conservative scenario) or \$43.3 million (very conservative estimate) per year.

6.5.2 Unemployment Benefit Payments

A decrease in the population with bachelor and graduate degrees will raise unemployment rates and thus increase the payments the state government makes in unemployment benefits, as explained in Chapter 3. Table 21 shows that reducing state subsidies to Minnesota's public universities will increase the number of unemployed people at any point in time by 819.²⁴ In Minnesota in 2005, the average annual unemployment insurance payment to an unemployed person was \$11,245, implying that the annual cost to the state of 819 additional unemployed persons is about \$9.2 million.

24 This number is based by applying current unemployment rates (by education levels) to changes in the education levels of the population; similar results are obtained if the causal impact of education on unemployment, as reviewed in Section III, is used to calculate changes in unemployment rates due to changes in the distribution of education in the population.

6.5.3 Charitable Giving

Table 22 shows the estimated impact on charitable giving from the estimated change in the distribution of education levels in Minnesota due to a withdrawal of state government subsidies for Minnesota's public universities. For persons who move from having a bachelor's degree or "some college" to having only a high school diploma, an average of the estimates for males and females from Andreoni, Brown and Rischall (2003) is used. This average implies that charitable donations drop by about 63% for such persons (more precisely, the log of charitable donations drops by 1.0). Note that this is very similar to the figures in column 2 of Table 22, which are from the University of Minnesota alumni survey. In particular, \$1,134 (the average charitable contributions of high school graduates) is about 65% lower than \$3,238 (the average charitable contribution of college graduates). Andreoni et al. did not estimate impacts for persons who move from a graduate degree to a bachelor degree, but since the average figures in Table 22 for bachelor and high school degrees are very similar to the causal estimates in that paper that compare those degrees, we simply assume that the differences for higher degrees in Table 22 can be given a causal interpretation. Overall, these impacts are quite large, implying that

Table 21. Impact on State Unemployment Insurance Payments from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Change in Population with Education Level	Unemployment Rate	Change in Number of Unemployed	Change in State Unemployment Insurance Payments <i>(million of dollars)</i>
High School Diploma	+56,754	0.05	2,838	31.9
Some College	-28,468	0.045	-1,281	-14.4
Bachelor's	-14,431	0.03	-433	-4.9
Master's	-8,398	0.025	-210	-2.4
Professional Degree	-3,269	0.017	-56	-0.6
Doctorate	-2,189	0.018	-39	-0.4
Total	0	—	819	9.2

Source: Source: U.S Dept. of Labor, Bureau of Labor Statistics and authors' calculations.

Table 22. Impact on Charitable Contributions from Withdrawal of Public Subsidies to Minnesota's Public Universities

Education Level	Change in Population with Education Level	Average Charitable Donations <i>(dollars)</i>	Change in Charitable Donations <i>(millions of dollars)</i>
High School Diploma	57,010	1134	64.6
Some College	-28,468	2938	-83.6
Bachelor's	-14,431	3238	-46.7
Master's	-9,146	2902	-26.5
Professional Degree	-3,065	6528	-20.0
Doctorate	-1,899	3664	-7.0
Total	0	—	-119.2

Source: UMN Alumni Database, and authors' calculations.

the reduction in the population with bachelor and graduate degrees from removing state government subsidies to Minnesota's public universities will reduce charitable giving by \$119.2 million per year.

The overall impact of the three redistributive phenomena discussed in this section that redirect resources from marginal students to the rest of the population (state taxes on marginal students, unemployment benefits and charitable donations) imply that \$218.1 million per year of the private benefits to these students of the state subsidies to education are

made available to the general public via increased state tax revenues, decreased costs of government programs and increases in charitable giving. This redistribution of resources would not end immediately if State Government subsidies were withdrawn; instead it would gradually shrink as the working age population slowly became less educated (relative to the case where subsidies were maintained) over about four decades. Note also that this \$218.1 million figure is almost certainly an underestimate since it excludes (due the difficulties in calculation) reduced use of other government programs (e.g. public assistance to needy families) and other likely benefits (more educated people smoke less, are less likely to be involved in automobile accidents, and devote more hours to volunteer work) that have impacts on government expenditures and charitable activities.

Recall that about 85 percent of the working age population in Minnesota does not have a bachelor's or graduate degree from one of Minnesota's public universities (Chapter 3). There is no presumption that charitable contributions or uses of government tax revenues will accrue disproportionately to either this 85 percent of

the population or the 15 percent that do have such degrees from the University of Minnesota or the MnSCU system, so roughly 85 percent of these benefits, with a value of about \$184.4 million, are redistributed from the private benefits of graduates of the Minnesota's public universities to the rest of the population.²⁵

6.6 SUMMARY, WITH DISCOUNTING

This section brings together the calculations of the three previous sections to draw conclusions about the merits of state government subsidies to Minnesota's public universities. It also presents findings regarding the distribution of both the costs and the benefits of those subsidies. Yet before doing so, the benefits need to be adjusted to make them comparable to the costs, and the "deadweight loss" of raising funds via taxes needs to be considered. We first explain both of these considerations and then pull together all the findings into a set of summary tables.

When comparing the costs and benefits of state government subsidies to higher education one must account for differences in the timing of the costs incurred and the benefits attributable to those costs. The costs of subsidizing any person's education occur when he or she is attending the educational institution that receives the subsidy, but the benefits accrue over the lifetime of that individual. Standard cost-benefit analysis applies discount rates to compare future revenues to today's costs. (The value in today's dollars of future benefits is called the "present discounted value" of those benefits.) The intuition here is that a dollar spent today is worth more than a dollar some year in the future because a dollar today can be invested or deposited in a bank to earn interest, yielding more than one dollar at any future date. There is some uncertainty about the appropriate discount rate to use, so below we apply two different discount rates,

3 percent and 5 percent, to the future stream of public benefits. We assume that a typical person who obtains higher education works for 40 years before retiring; extending that time period beyond 40 years has little effect because discounting greatly diminishes the present discounted value of benefits that far into the future.

A final important issue, which follows from the economic theory of public finance, is the deadweight cost of taxation; increased taxes needed to finance state subsidies to higher education generate economic inefficiencies because they distort the behavior of economic agents. As explained by Auerbach and Hines (2002), it is very difficult to estimate the likely deadweight loss (inefficiency cost) to society as a whole from tax increases imposed to pay for subsidies to higher education, and we know of no attempts to calculate the deadweight loss of state taxes in Minnesota. However, estimates for U.S. taxes indicate that deadweight losses range from 7% to 25% of the revenue raised by those taxes, depending on the assumptions made in the estimation (Fullerton, 1991). In our analysis below we use a 15% discount rate, which is in the middle of the range given by Fullerton.

Table 23 presents two sets of estimates of the costs and benefits of subsidies to higher education in Minnesota, assuming a 3 percent discount rate (similar results using a 5 percent discount rate are presented in Table 24). The left half of the table presents an "intuitive perspective", while the right half presents an "economic perspective". Both perspectives arrive at the same estimate of the difference between the costs and the benefits; they differ only in the way they interpret reduced tuition to non-marginal students. The "intuitive perspective" treats those tuition reductions as a cost, but this is canceled out as a benefit in the lower half of the table. The "economic perspective", which in our opinion is a clearer perspective, treats this as transfer from one group (taxpayers) to another (non-marginal students) and thus not as a cost or a benefit to society as a whole.

²⁵ We are aware of no comprehensive study of who benefits from state government spending in Minnesota, so it is not possible to determine whether either group gets a disproportionate share of the benefits of total state spending.

Table 23. Costs and Benefits of Subsidies to Higher Education: Two Perspectives
(3 percent discount rate)

Intuitive ("Common Sense") Perspective		Economic Perspective	
Costs	(millions of US \$)	Costs	(millions of US \$)
State government appropriations	791		
Of which: Transfers to non-marginal students	765	NOT an economic cost (just a transfer)	—
Payments to marginal students	26	} More academic resources for marginal students	58
Tuition payments of marginal students	32		
Deadweight cost of taxation (15% of revenue)	119	Deadweight cost of taxation (15% of revenue)	119
Opportunity cost of marginal students	107	Opportunity cost of marginal students	107
Total Cost	1,050	Total Cost	284
Benefits	(millions of US \$)	Benefits	(millions of US \$)
Lower tuition for non-marginal students (private)	765	NOT an economic benefit (just a transfer)	—
Higher wages for marginal students (private)	476	Higher wages for marginal students (private)	476
Of which: Increased state tax revenue	42	NOT an economic benefit (just a transfer)	—
Increased charitable giving	71	NOT an economic benefit (just a transfer)	—
Wage spillovers of marginal students (public)	441/293	Wage spillovers of marginal students (public)	441/293
Of which: Increased state tax revenue	39/26	NOT an economic benefit (just a transfer)	—
Lower unemployment of marginal students (private)	7	Lower unemployment of marginal students (private)	7
Of which: Compensated by unemployment benefits	5	NOT an economic benefit (just transfer)	—
Reduced crime/incarceration costs (public)	7	Reduced crime/incarceration costs (public)	7
Increased civic engagement (public)	2	Increased civic engagement (public)	2
Benefits of additional research (public)	*	Benefits of additional research (public)	*
Total Benefit (conservative/very conservative)	1,697/1,549	Total Benefit (conservative/very conservative)	932/784

Notes: Non-marginal students are students whose education levels would not be affected if tuition rates at public universities were increased, and marginal students are students who would obtain less education if those tuition rates were increased.

* For more information on the benefits of research see Pardey, et al. (2007).

Beginning with the intuitive perspective on the left half of Table 23, in 2004-05 Minnesota's state government provided \$791 million to the University of Minnesota (\$550 million) and the seven MnSCU state universities (\$241 million) for educational purposes. The overall effect of this subsidy is to lower tuition for all the students attending these institutions, both marginal students and non-marginal students. For non-marginal students, that is students whose eventual level of completed education would be unchanged if tuition rates were

dramatically increased due to a withdrawal of state support, this amounts to a savings of \$765 million per year.²⁶ Marginal students also benefit in that part of their "full" tuition costs (\$22,500 at the University of Minnesota and \$14,000 at the MnSCU institutions) are paid for by the state government subsidy; this amount is much smaller, \$26 million per year, because marginal students are only 3.2 percent of all students attending Minnesota's public universities.

²⁶ The analysis of Section 6.1 (summarized in Table 14) shows only small changes in the distribution of education from a withdrawal of state government subsidies to higher education. These results imply that 96.8 percent of students at Minnesota's public universities are non-marginal students, and so they receive 96.8 percent of the \$791 million in annual tuition subsidies.

There are three other costs of state subsidies to higher education. First, the marginal students who are induced to attend by those subsidies do pay tuition, although at a subsidized rate; these payments amount to \$32 million per year. Second, as discussed above the higher tax rates to generate the \$791 million in state subsidies results in a 15 percent deadweight loss (efficiency cost) of \$119 million per year. Third, the marginal students would be working if they were not enrolled, and so they lose about \$107 million in wages every year from forgoing full-time work, which economists call an opportunity cost. Adding these three costs to the cost of the state subsidy generates a total cost to Minnesota of \$1,050 million per year.

The bottom half of the left side of Table 23 shows the benefits generated by state subsidies to Minnesota's public universities. First, non-marginal students save \$765 million per year by having their tuition costs subsidized. Second, marginal students enjoy higher wages throughout their lifetimes due to their higher levels of education induced by state subsidies, which reflects the differences in wages shown in Table 10.²⁷ They will earn these higher wages for about the next 40 years, so we apply a discount rate of 3% to make them comparable to today's costs. The (present discounted) value of these wages is \$476 million in today's dollars. Note that 8.8 percent of this increase in wages, about \$42 million in present discounted dollars, will be paid in state taxes and thus is returned to the general taxpaying population, and another \$71 million will be donated to charitable causes.

The higher wages for marginal students are private benefits. They benefit only those students, not the general population, except for the 8.8% paid in state taxes and the income donated to charities. Note that the cost borne by these students from attaining higher education is much smaller, about \$139 million (the sum of

their tuition payments and the opportunity cost of their forgone wages). If the higher wages to marginal students were the only benefit of state subsidies to higher education, it would be hard to argue that the general taxpaying public should subsidize their education, since the public would receive no benefit (other than the state taxes paid and the money donated to charities). Yet there are other benefits, which will be presented below.

A related point is that it seems that marginal students have little need of subsidies to induce them to obtain higher education because the benefits (\$476 million, using a 3% discount rate) appear to be 3-4 times higher than the costs those students bear (\$139 million). Even if subsidies were withdrawn, so that marginal students also had to pay the additional \$26 million in tuition payments that is currently paid by the state, their total costs would be only about one third of the total benefits. However, recall that the benefits come for the next 40 years and have been discounted by a 3% discount rate. We will see below, when discussing Table 24, that higher discount rates greatly reduce today's value of those benefits. It is quite possible that marginal students face relatively high rates of interest, which will make enrollment in higher education less attractive. Finally, it is also possible that their returns to an additional year of schooling are lower than the average return of 8 percent, which would lead to lower private benefits and thus reduce the value to them of higher education.

Most of the remaining benefits in the left half of Table 23 are *public* benefits, that is benefits that accrue to members of society *other* than the marginal students. The first, and by far the largest, are the wage spillovers induced by social interactions outside of the workplace. Recall from Tables 16 and 17 that a moderately conservative estimate is that the higher levels of education induced by state subsidies lead to an annual increase in wages over the whole population of \$742 million per year, while a more conservative estimate yields an increase of \$493 per year. Both estimates must be

27 The difference in wages in Table 10 may in part reflect differences in the abilities of people with different levels of education. As explained in Chapter 3, we assume that each additional year of schooling raises wages by 8 percent; this, not the figures in Table 10, is used to estimate the higher wages of marginal students due to higher levels of education.

discounted because they occur over the entire working life of the marginal students, and a 3 percent discount rate reduces the present value of these estimates to \$441 million and \$293 million per year, respectively, as shown in Table 23. That table also shows the amounts of these figures that are channeled each year into increased tax revenues: \$39 million and \$26 million, respectively.

Table 23 presents one other private benefit and two other public benefits from state subsidies to Minnesota's public universities. Lower unemployment rates for marginal students lead to an increase in the (present discounted value) of wage income of about \$7 million per year (the undiscounted value was \$9.2 million per year). This is a private benefit, although in fact most of this benefit (about \$5 million) is redistributed to the general public via a reduction in unemployment benefits paid to marginal students. The two public benefits are a reduction in incarceration costs, the discounted value of which is \$7 million per year, and increased civic engagement (voter participation), which has a discounted value of \$2 million per year.

Adding up all benefits, public and private, using a 3 percent discount rate, leads to a total benefit of \$1,697 million per year when the moderately conservative estimate of wage spillovers is used, or \$1,549 million per year when the very conservative estimate is used. Subtracting the total costs immediately above implies that the net benefit of state government subsidies to higher education in Minnesota is between \$499 million and \$647 million per year, depending on the assumptions made about wage spillover effects, if a 3 percent discount rate is used (results using a 5 percent discount rate are lower, as seen below).

Economists would change the presentation of these calculations in one important way, which is that they would not consider the \$765 million in reduced payments by non-marginal students to be a cost. Rather, it is a transfer of income (or, more generally, resources) from one group

in society to another. This is shown in the right half of Table 23. For economists, the only costs that matter for evaluating a proposed policy are the resource costs to society as a whole.

There are three such costs of state subsidies to higher education. The first is that more "academic resources" (instructors, classrooms, equipment, administrative staff, etc.) are needed to accommodate the marginal students who are induced to obtain more education. These resources would be used elsewhere in the economy if this additional demand for education services did not exist, and so that demand reduces the goods and services that would have been produced by these resources elsewhere in the economy. Roughly speaking, the value of these resources is their market value. This can be approximated by the cost of obtaining these education services from private colleges and universities, which is the sum of the payments to marginal students by the state (the difference between public and private tuition) and the tuition paid by marginal students at public institutions. As seen in Table 23, this sum equals \$58 million per year.

The second economic cost of state subsidies to higher education is the deadweight loss to the economy of raising \$791 million in tax revenues every year, which is \$119 million per year. Finally, society loses the productive employment of the marginal students who are induced to leave work by those subsidies, which is equal to about \$107 million. Summing these three costs, the total economic (resource) cost of state subsidies to Minnesota's public universities is \$284 million per year. The only difference between this and the "intuitive" cost of \$1,050 million in the left half of Table 23 is due to (correctly) classifying the \$765 million per year of transfers from taxpayers to non-marginal students as a redistribution of resources, not a resource cost to society as a whole.

What do economists see as the benefits of state subsidies to public universities? This is seen in the bottom half of the right side of Table 23. Lower tuition for non-marginal students is not a new

benefit (not an increase in goods and services to society); it is just a transfer of resources from one group (taxpayers) to another (non-marginal students). The higher wages of marginal students are an additional benefit—these individuals have become more productive and their wages reflect their increased contribution to the goods and services available to society. Yet the taxes they pay on these wages is not a new contribution to society, it is just a redistribution of the contribution coming from their increased productivity. Similarly, wage spillovers are also an additional benefit, but the additional tax obligations they entail are just a redistribution of that benefit. The same holds for reduced unemployment (reduced unemployment is a genuine benefit, but reduction in unemployment payments is solely a redistribution of existing benefits). Finally, reduced crime and increased civic engagement are additional benefits to society, since building and staffing more prisons diverts economic resources from other uses, and increased voter participation is a new service provided to society.

Comparing the costs to the benefits using the economic approach generates the same net benefit to society, between \$499 and \$647 million per year (depending on the assumptions made regarding wage spillovers), since the only difference with the intuitive approach is that the \$765 million transfer each year from taxpayers to non-marginal students was subtracted from both the costs and the benefits. It is also worth noting that the two main economic benefits are the increased wages of marginal students and the wage spillover benefits from marginal students to other members of society. The value of the benefits in terms of reduced unemployment, reduced crime and increased civic engagement is much smaller.

The discount rate of 3 percent assumed in Table 23 is on the conservative side. If instead the discount rate were 5 percent, the difference between the costs and the benefits would be smaller. This is shown in Table 24. Focusing on the right half of the table, that is taking the

economic perspective, the present discounted value of benefits falls from a range of \$784 to \$932 million per year (using the very conservative and moderately conservative estimates of the wage spillover effect, respectively) to a range of \$562 to \$672 million per year. These estimates still exceed the costs (by \$278 million and \$388 million, respectively). The more extreme assumption of a 10% discount rate (not shown in either table) generates benefits of \$291 to \$353 million per year (using the very conservative and moderately conservative estimates of the wage spillover effect, respectively), which is still somewhat higher than the costs (although only slightly so for the very conservative estimate of the spillover effect), so we can still conclude that the benefits of public subsidies to higher education outweigh the costs.

Finally, it is worthwhile to look in more detail at the distributional effects alone, to get an idea of how the benefits, and costs, of these subsidies are distributed across the population. This is done in Table 25 for the 3 percent discount rate (and the moderately conservative estimate of the spillover effects). The biggest effect is a pure redistribution effect, the transfer each year of \$765 million from taxpayers to non-marginal students. This redistribution is “pure” in that it does not involve any changes in educational outcomes and thus neither “consumes” any economic resources (other than the deadweight cost of raising the funds from taxpayers) nor generates any economic benefits.

There is only one economic cost of state government support to Minnesota’s public universities that transfers economic resources from one group of Minnesotans to another. This is the \$26 million that is transferred from taxpayers to marginal students to provide greater academic resources for those students. In effect, economic resources that had been consumed by those taxpayers are diverted to provide academic services to those students. One may also think that the \$32 million in (subsidized) tuition paid by marginal students should also be considered, yet even though this involves a real diversion of economic

**Table 24. Costs and Benefits of Subsidies to Higher Education: Two Perspectives
(5 percent discount rate)**

Intuitive ("Common Sense") Perspective		Economic Perspective	
Costs	<i>(millions of US \$)</i>	Costs	<i>(millions of US \$)</i>
State government appropriations	791		
Of which: Transfers to non-marginal students	765	NOT an economic cost (just a transfer)	—
Payments to marginal students	26	} More academic resources for marginal students	58
Tuition payments of marginal students	32		
Deadweight cost of taxation (15% of revenue)	119	Deadweight cost of taxation (15% of revenue)	119
Opportunity cost of marginal students	107	Opportunity cost of marginal students	107
Total Cost	1,050	Total Cost	284
Benefits	<i>(millions of US \$)</i>	Benefits	<i>(millions of US \$)</i>
Lower tuition for non-marginal students (private)	765	NOT an economic benefit (just a transfer)	—
Higher wages for marginal students (private)	336	Higher wages for marginal students (private)	336
Of which: Increased state tax revenue	30	NOT an economic benefit (just a transfer)	—
Increased charitable giving	53	NOT an economic benefit (just a transfer)	—
Wage spillovers of marginal students (public)	326/216	Wage spillovers of marginal students (public)	326/216
Of which: Increased state tax revenue	29/22	NOT an economic benefit (just a transfer)	—
Lower unemployment of marginal students (private)	5	Lower unemployment of marginal students (private)	5
Of which: Compensated by unemployment benefits	4	NOT an economic benefit (just transfer)	—
Reduced crime/incarceration costs (public)	5	Reduced crime/incarceration costs (public)	5
Increased civic engagement (public)	1	Increased civic engagement (public)	1
Benefits of additional research (public)	*	Benefits of additional research (public)	*
Total Benefit (conservative/very conservative)	1,438/1,328	Total Benefit (conservative/very conservative)	672/562

Notes: Non-marginal students are students whose education levels would not be affected if tuition rates at public universities were increased, and marginal students are students who would obtain less education if those tuition rates were increased.

* For more information on the benefits of research see Pardey, et al. (2007).

Table 25. Distributional Consequences of State Subsidies to Higher Education (millions of dollars per year)

Distributional or Redistributive Effect	From	To	Amount
A. Pure Redistributive Effects			
Reduced tuition for non-marginal students	Taxpayers	Non-marginal students	765
B. Redistribution via Economic Costs			
More academic resources for marginal students	Taxpayers	Marginal students	26
C. Distribution of Economic Benefits			
Higher (before tax) wages of marginal students	—	Marginal students	476
Additional taxes paid by marginal students	Marginal students	General public	42
Additional charitable contributions of marginal students	Marginal students	Beneficiaries	71
Reduced unemployment of marginal students	—	Marginal students	7
Reduced unemployment benefits to marginal students	Marginal students	Taxpayers	5
Wage spillover effects	—	General public	441
Additional taxes paid from wage spillovers	General public	General public	39
Reduced crime/incarceration costs	—	General public	7
Increased civic engagement	Marginal students	General public	2

resources it does not involve redistribution of any resources since marginal students pay this cost and also receive the benefit.

As explained above, state government support to Minnesota's public universities also generates new benefits for Minnesotans, but these benefits are not evenly distributed across the population. The first benefit is the higher (before tax) wages of the marginal students, the value of which is \$476 million per year (using a 3 percent discount rate). This is not a transfer from one group to another; it is a new benefit that is generated by the costs discussed in the previous paragraphs. Yet some of this benefit to marginal students is passed on to other Minnesotans; \$42 million per year is paid in additional state taxes, and thus benefits the general public, and an additional \$71 million per year is given to charitable organizations, which benefits the beneficiaries of those organizations. The second benefit is the \$7 million per year that marginal students enjoy because they are less likely to be unemployed; this is not just a transfer, it is a real addition to economic activity. Ironically, most (\$5 million) of this benefit is transferred to the general public because of the reduced need to provide unemployment benefits. (In general, the value unemployment benefits is about two thirds of a given recipient's previous wages.) The third benefit is also quite large, the \$441 million in wage spillovers per year (based on the moderately conservative assumption of the size of wage spillovers); this is also a real increase in economic output and it benefits the general public. Again, \$39 million of this is paid in state taxes, which involves a "redistribution" from the general public (or at least taxpayers) back to the general public. A fourth benefit, reduced incarceration costs, is much smaller (\$7 million per year) and is enjoyed by the general public. Finally, one could argue that the small (\$2 million per year) benefit of increased civic participation is a transfer from marginal students to the general population.

To summarize this chapter, these estimates indicate that the social (public + private) benefits of state government subsidies to

higher education in Minnesota are much higher than the costs, for a variety of assumptions about wage spillover effects and discount rates. Nonetheless, these estimates are subject to several caveats, and so must be treated with caution. First, and most importantly, the impact of large increases in tuition levels at Minnesota's public universities on the education levels of the adult population in Minnesota and the impact of others' education on individuals' wages are derived from parameter estimates taken from Card and Lemieux (2001) and Moretti (2004), respectively. Neither set of estimates is very precise, and both sets could suffer from a variety of biases. Indeed, based on the criticisms of Lange and Topel (2006) we used parameters estimates that are substantially lower than Moretti's. Thus our estimates of the benefits of state government subsidies to Minnesota's public universities should be considered as fairly rough approximations. Second, Tables 23 and 24 omit some benefits that are hard to quantify, such as reduced costs of crime other than savings from lower incarceration rates (reduced police and court costs, and a reduction direct costs to borne by crime victims)²⁸, improvements in civic engagement other than increased rates of voter participation (increased newspaper readership, and greater support for free speech), and the personal benefits arising from social interactions with more-educated people. Third, the "research benefits" attributable to the activities of the University of Minnesota are not included. Note that the last two of these three caveats imply that the benefits are underestimated; if one could calculate these hard to quantify benefits the rationale for state government support to Minnesota's public universities would be even stronger (although still not very precisely estimated).

28 We were able to obtain the average cost of a typical criminal trial in Minnesota (about \$5,000), but we were unable to determine how many trials corresponded to an additional 200 incarcerated individuals in any given year. Yet this cost of trials is unlikely to be as high as the cost of incarceration, which is clearly a relatively small public benefit of state government subsidies to higher education.

7. CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

In this report, we have presented estimates of the costs and the private and public benefits attributable to state government subsidies to higher education in Minnesota. Ignoring the purely redistributive effects of these state subsidies (the transfer of money from taxpayers to non-marginal students, who would not change their levels of education if subsidies were withdrawn) we estimate that the economic cost of these subsidies is \$284 million per year. The two largest estimated benefits are the increased (life-cycle) wages of marginal students (students who would obtain less education if subsidies were removed), which is a private benefit, and the increase in the wages of all workers induced by spillover effects (increases in skills due to interactions with more educated individuals off the job), which is a public benefit. After discounting these benefits to account for the fact that the benefits continue to accrue many years after the subsidies are provided, we estimate that the total value of benefits (both public and private) is between \$784 and \$932 million per year when a 3 percent discount rate is used, and between \$562 and \$672 million per year when a 5 percent discount rate is used. With either discount rate, these estimated benefits are much higher than the estimated costs.

The report also estimates some of the distributional consequences arising from state government subsidies to Minnesota's public universities. Non-marginal students at those institutions are the biggest beneficiaries, receiving \$765 million per year from Minnesota's taxpayers. Marginal students, which are a much smaller group, obtain \$26 million per year from those taxpayers. On the other hand, the increase in the education levels of the marginal students generates \$476 million in higher wages for those students and as much as \$441 million per year in higher wages for all Minnesotans, due to spillover effects from social interactions off the job, and those students also pay \$42 million

more per year in taxes and donate \$71 million per year to charitable causes. Benefits to the general public in terms of lower incarceration rates, lower unemployment benefit payments and increased civic participation are much smaller.

While our calculations strongly suggest that state subsidies to Minnesota's public universities are worthwhile investments, the reader should bear in mind that the estimates of benefits in this report are fairly imprecise. In particular, the wage spillover effects are based on estimates from a single paper (Moretti, 2004); those estimates were challenged by Lange and Topel (2006), so we have used much lower parameter estimates. Similarly, the estimates of the change in the proportion of the population with bachelor and graduate degrees are also based on a single paper (Card and Lemieux, 2001), and these estimates are also imprecise.

Moreover, some public benefits could not be calculated, such as costs of crime other than incarceration costs, forms of increased civic participation other than increased voting, safer drivers, reduced state spending on health services, the personal enjoyment of having a higher level of education (for marginal students), and pleasant interactions with more educated individuals (for the rest of the population). Even more important is that the public benefits of research, which are inextricably intertwined with educational aspects of a modern university, have not been calculated in this report. For a research intensive institution like the University of Minnesota, where the annual expenditure on research in 2004 was \$515 million—about 23% of the university's total expenditure—the public benefits attributable to the university's research activities are difficult to determine but could well be substantial.²⁹

The benefit estimates presented in this study are arguably the most comprehensive for any study of this type for a U.S. public university

²⁹ For more information on the research activities of the University of Minnesota, see Pardy, Dehmer and Beddow (2007).

system, but they are still subject to several caveats. Our cautious conclusion that the benefits outweigh the costs can be made more compelling only with much more research. High priority should be given to obtaining more precise estimates of the impact of increased tuition at public university systems on student enrollment and on eventual levels of education obtained. Estimates are needed for graduate students as well as for undergraduates. An equally high priority is better estimates of wage spillover effects, which appear to play a crucial role in determining the public benefits of state subsidies to higher education. Another high priority is estimates of the benefits of research conducted by these institutions.

Once more precise estimates along the lines in the previous paragraph are available, more research is needed on whether education services can be delivered in a way that does not have such high, and potentially unwanted,

distributional implications. In particular, it is an open question whether the redistribution of \$765 million each year from taxpayers to non-marginal students is a desirable outcome. If those students were, on average, poorer than the average taxpayer, such an argument could be made on equity grounds, but it is not clear that this assumption is correct. This future research should also investigate the economic profile of non-marginal students in Minnesota's public universities. If such a redistribution is not considered to be a high priority (or is deemed to be contrary to egalitarian goals), then more analysis is needed on whether it is possible to distinguish between marginal and non-marginal students, with the objective of finding ways to reduce subsidies to the latter. This may be a difficult distinction to make in practice, and the political ramifications of trying to alter subsidies in this way could be quite large. We leave this to future research, not only by economists, but by political scientists and other social scientists.

REFERENCES

- Administrative Office of U.S. Courts. 2004. "Costs of Incarceration and Supervision." *The Third Branch*. 36:(5). <http://www.uscourts.gov/ttb/may04ttb/costs/index.html>.
- Andreoni, James, Eleanor Brown, and Isaac Rischall. 2003. "Charitable Giving by Married Couples: Who Decides and Why Does It Matter?" *The Journal of Human Resources*. 38(1): 111-133.
- Altonji, Joseph, and Rebecca Blank. 1999. "Race and Gender in the Labor Market," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics Volume 3*. North Holland.
- Ashenfelter, Orley, and John Ham. 1979. "Education, Unemployment and Earnings," *Journal of Political Economy*. 87(5): S99-S116.
- Ashenfelter, Orley, and Cecilia Rouse. 1998. "Income, Schooling and Ability: Evidence from a New Sample of Identical Twins," *Quarterly Journal of Economics*. 113(1): 253-285.
- Auerbach, Alan, and James Hines. 2002. "Taxation and Economic Efficiency", in Auerbach and Feldstein, eds., *Handbook of Public Economics, Volume 3*. North Holland.
- Barr, Nicholas. "Higher Education Funding" *Oxford Review of Economic Policy*, Vol. 20, No. 2, 2004.
- Baum and Payea. 2005. "The Benefits of Higher Education for Individuals and Society: Education Pays." College Board, Trends in Higher Education Series.
- Becker, Gary. 1964. *Human Capital*. New York: Columbia University Press (for National Bureau of Economic Research).
- Benabou, Roland. 2002. "Tax and Education Policy in a Heterogeneous-Agent Economy: What Levels of Redistribution Maximize Growth and Efficiency?" *Econometrica* 70(2): 481-517.
- Bound John, Jeffrey Groen, Gabor Kezdi, Sara Turner. "Trade in university training: cross state variation in the production of stock of college-educated labor." *Journal of Econometrics* 121 (2004) 175-212.
- Bynner, John, and Muriel Egerton. 2001. "The Wider Benefits of Higher Education" Report by the Institute of Education, University of London.
- Cameron, Stephen, and James Heckman. 1998. "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males," *Journal of Political Economy*. 106(2): 262-333.
- Card, David. 1999. "The Causal Effect of Education on Earnings," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics Volume 3*. North Holland.
- Card, David. 2001. "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems," *Econometrica*. 69(5):1127-1160.
- Card, David, and Thomas Lemieux. 2001. "Dropout and Enrollment Trends in the Post-War Period: What Went Wrong in the 1970s?," in J. Gruber, ed., *Risky Behavior among Youths: An Economic Analysis*. University of Chicago Press.
- Deaton, Angus, and Christina Paxson. 2001. "Mortality, Education, Income and Inequality Among American Cohorts," in D. Wise, ed., *Themes in the Economics of Aging*. University of Chicago Press.

- Dee, Thomas. 2004. "Are There Civic Returns to Education?" *Journal of Public Economics* 88(9-10): 1697–1720.
- Fortin, Nicole. 2006. "Higher-Education Policies and the College Wage Premium: Cross-State Evidence from the 1990s." *American Economic Review* 96(4):959-987.
- Freeman, Richard. 1986. "The Demand for Education," in O. Ashenfelter and R. Layard, eds., *Handbook of Labor Economics*. Amsterdam: North Holland.
- Fullerton, Donald. 1991. "Reconciling Recent Estimates of the Marginal Welfare of Taxation." *American Economic Review* 81(1):302-208.
- Gerber, Alan S., and Donald P. Green. 1999. "Does Canvassing Increase Voter Turnout? A Field Experiment" *Proceedings of the National Academy of Sciences*. Vol. 96, pp.10,939-10,942.
- Grimes, Tricia and Shefali Mehta. 2006. "Minnesota Undergraduate Demographics: Characteristics of Post-Secondary Students". Minnesota Office of Higher Education Publication. May.
- Groen, Jeffrey A. 2004. "The effect of college location on migration of college-educated labor." *Journal of Econometrics* 121: 175-212.
- Grossman, Michael. 2005. "Education and Nonmarket Outcomes". Working Paper 11,582. National Bureau of Economic Research. Cambridge, MA.
- Heaton, Christopher. "The Equity Implications of Public Subsidisation of Higher Education: a study of the Fijian case." *Education Economics*, Vol. 7, No. 2, 1999.
- Kane, Thomas. 1994. "College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education." *Journal of Political Economy* 102(5):878-911.
- Kane, Thomas. 1999. *The Price of Admission: Rethinking How Americans Pay for College*. Washington, D.C.: Brookings Institution Press.
- Kane, Thomas. 2005. "Public Intervention in Post-Secondary Education" Mimeo. Graduate School of Education. Harvard University.
- Katz, Lawrence, and Kevin Murphy. 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors." *Quarterly Journal of Economics* 107(1):35-78.
- Lange, Fabian, and Robert Topel. 2006. "The Social Value of Education and Human Capital," in E. Hanushek and F. Welch, eds., *Handbook of the Economics of Education, Volume 1*. North Holland.
- Lochner Lance, Enrico Moretti. 2004. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self Reports." *American Economic Review* 94(1): 155-189.
- Mincer, Jacob. 1974. *Schooling, Experience and Earnings*. New York: Columbia University Press (for National Bureau of Economic Research).
- Mincer, Jacob. 1991. "Education and Unemployment". Working Paper No. 3838. National Bureau of Economic Research. Cambridge, MA.

Minnesota Department of Revenue. 2007. "2007 Minnesota Tax Incidence Study." Tax Research Division. St. Paul, Minnesota. http://www.taxes.state.mn.us/legal_policy/other_supporting_content/07_incidence_report.pdf

Minnesota State Colleges and Universities (MnSCU). 2006. "Amazing Facts". www.mnscu.edu. January.

Moretti, Enrico. 2003. "Human Capital Externalities in Cities." Working Paper No. 9641. National Bureau of Economic Research. Cambridge, MA.

Moretti, Enrico. 2004. "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data". *Journal of Econometrics* 121(2):175-212.

Owens, Julie. "A Review of the Social and Non-Market Returns to Education" Welsh Assembly Government Report, 2004.

Pardey, Philip, Steven Dehmer and Jason Beddow. 2007. "Long Gone Lake Wobegon? The State of Investments in University of Minnesota Research. Center for International Science & Technology Practice and Policy. University of Minnesota.

Sorensen, Stephen, Dominic J. Brewer, Stephen J. Carroll, and Eugene Bryton. 1995. "Increasing Hispanic Participation in Higher Education: A Desirable Public Investment." Rand Corporation, Issue Paper 152.

Vaillancourt, Francois. 1994 "To volunteer or not: Canada, 1987" *Canadian Journal of Economics*, XXVII No. 4.

Table A.1. Enrollment at University of Minnesota in 2006, by Campus and College/School

	Undergraduate	Professional	Graduate	Total
UMN–Crookston				
UMNCR	1,208	0	0	1,208
UMN–Duluth				
Duluth Pharmacy	4	178	0	182
Duluth School of Medicine	11	239	10	260
UMD–Achievement Center	52	0	0	52
UMD–Business & Economics, School of	1,177	0	30	1,207
UMD–Continuing Education	630	0	43	673
UMD–Education & Human Service Professions, College of	1,646	0	176	1,822
UMD–Fine Arts, School of	819	0	10	829
UMD–Liberal Arts, College of	2,364	0	62	2,427
UMD–Science & Engineering, College of	2,125	0	135	2,260
UMNDL	8,826	417	467	9,711
UMN–Morris				
UMM–Academic Affairs	235	0	0	235
UMM–Chancellor’s Office	1	0	0	1
UMM–Elementary & Secondary Education, Division of	131	0	0	131
UMM–Humanities, Division of	438	0	0	438
UMM–Science & Math, Division of	400	0	0	400
UMM–Social Sciences, Division of	469	0	0	469
UMNMO	1,673	0	0	1,673
UMN–Twin Cities				
TSYA	196	0	7	202
Academic Health Center Shared	5	0	1	7
Agriculture, Food, & Environmental Science, College of	1,141	0	308	1,449
Architecture & Landscape Architecture, College of	501	0	293	794
Bell Museum	1	0	3	4
Biological Sciences, College of	1,260	112	299	1,671
Continuing Education, College of	1,947	0	77	2,024
Dentistry, School of	96	747	100	943
Education & Human Development, College of	1,639	0	2,188	3,828
Executive Vice President	44	0	0	44
General College	960	0	0	960
Graduate School	0	0	59	59
Health Sciences, Sr VP	31	1	36	68
Human Ecology, College of	773	0	342	1,115
Humphrey Institute of Public Affairs	29	3	374	406
Law School	0	822	13	834
Liberal Arts, College of	14,070	2	1,731	15,802
Medical School	489	2,160	623	3,272
Management, Carlson School of	1,753	13	2,067	3,833
Natural Resources, College of	242	0	136	378
Nursing, School of	313	0	303	617
Pharmacy, College of	123	481	66	670
Public Health, School of	99	19	840	957
Rochester	3	0	2	5
Technology, Institute of	5,807	0	1,649	7,457
Veterinary Medicine, College of	64	639	61	764
UMNTC	31,585	4,998	11,577	48,160
Grand Total	43,291	5,415	12,044	60,751

Table A.2. Graduate Degrees Awarded in Minnesota in 1966 and 2004

	1966	2004
Alfred Adler Institute of Minnesota	—	26
Augsburg College	—	64
Bemidji State University	36	71
Bethel College and Seminary, All Campuses	16	255
College of St Catherine	—	350
College of St Scholastica	—	232
Concordia College-St Paul	—	151
Crown College	—	5
Hamline University	—	493
Luther Seminary	118	129
Macalester College	5	—
Mankato State University	141	412
Mayo Graduate School	—	141
Medical Institute of Minnesota	—	84
Metropolitan State University	—	141
Minneapolis College of Art and Design	—	15
Moorhead State University	33	73
Northwestern College of Chiropractic	—	185
Northwestern Lutheran Theological Sem	19	—
Southwest State University	—	98
St Cloud State University	105	305
St John's University (Collegeville, MN)	14	36
St Mary's University of Minnesota	41	1,418
United Theological Seminary (New Brighton, MN)	20	29
University of Minnesota – Duluth	—	185
University of Minnesota – Twin Cities	—	3,984
University of Minnesota, All Campuses	2,167	—
University of St Thomas (Saint Paul, MN)	115	1,470
William Mitchell College of Law	66	309
Winona State University	69	164
Total	2,965	10,825

Note: This table excludes Walden University, an on-line institution, which granted no graduate degrees in 1966 but granted 2,097 in 2004. It is excluded because most of its degrees are granted to people who are not residents of Minnesota.

Table A.3. Financial Aid by Institution Type

	University of Minnesota			MNSCU Four-Year Universities			Private For-Profit Institutions			Private Not-For-Profit Institutions		
	FY 2005 Amount	Number of Undergrad Recipients		FY 2005 Amount	Number of Undergrad Recipients		FY 2005 Amount	Number of Undergrad Recipients		FY 2005 Amount	Number of Undergrad Recipients	
Grant & Scholarship Programs												
MN State Grant Program	\$27,147,000	9,692		\$19,700,000	12,381		\$18,324,000	11,066		\$37,251,000	12,784	
MN Post-Secondary Child Care	\$161,978	102		\$473,721	250		\$232,302	140		\$320,811	198	
MN Safety Officer Survivor	\$24,795	3		\$5,294	1		\$10,367	2		\$17,068	2	
MN Advanced Placement/Int'l Baccalaureate	\$35,700	63		\$1,220	2		\$0	0		\$37,060	66	
Federal Pell Grants	\$21,542,390	8,606		\$31,985,990	13,759		\$21,183,671	11,492		\$27,468,418	11,872	
Federal SEOG Awards	\$4,763,429	2,330		\$2,939,350	4,288		\$1,931,508	3,997		\$8,324,335	4,851	
Federal Agency Grants	\$1,678,071			\$827,177			\$206,472			\$2,059,397		
Local and State Agency Grants	\$818,112			\$2,961,622			\$1,286,891			\$1,524,383		
Institution Grants	\$50,032,690			\$10,726,048			\$1,674,097			\$263,001,950		
Institution Tuition Discounts	\$14,306,775	2,821		\$2,150,554	967		\$414,031	149		\$21,217,331	2,072	
Private Grants	\$13,440,608			\$6,666,423			\$620,478			\$18,546,598		
Other Grants	\$0			\$4,984			\$18,748			\$9,925		
Total Grants	\$133,951,548	23,617		\$78,442,383	31,648		\$45,902,565	26,846		\$379,778,276	31,845	
Loan Programs												
MN SELF Loans	\$38,350,006	9,605		\$27,098,613	7,955		\$12,452,388	3,860		\$29,058,678	7,016	
Federal Stafford Loans – Subsidized	\$0	0		\$59,016,172	18,127		\$36,998,531	13,989		\$94,975,921	25,317	
Federal Stafford Loans – Unsubsidized	\$0	0		\$47,568,549	14,616		\$33,445,589	11,002		\$59,216,947	15,022	
Federal Direct Student Loans (FDSL) – Subsidized	\$58,884,452	16,902		\$19,252,821	5,734		\$7,900,577	3,510		\$4,574,010	1,232	
Federal Direct Student Loans (FDSL) – Unsubsidized	\$40,053,681	11,608		\$16,019,067	4,868		\$8,198,541	2,747		\$2,429,914	727	
Federal Perkins Loans	\$5,467,046	2,264		\$5,965,127	3,257		\$205,998	112		\$18,603,821	7,626	
Federal PLUS Loans	\$27,042,113	4,531		\$6,623,252	1,202		\$17,200,539	2,417		\$45,779,656	4,631	
Federal Agency Loans	\$70,756			\$0			\$0			\$700,916		
Institution Awarded Loans	\$770,837			\$0			\$2,110,571			\$543,607		
Private Loans	\$13,333,262			\$20,469,722			\$48,931,276			\$54,995,822		
Other Loans	\$0			\$740,548			\$0			\$0		
Total Loans	\$183,972,153	44,910		\$202,753,871	55,759		\$167,444,010	37,637		\$310,879,292	61,571	
Student Earnings from Work-Study Jobs												
MN State Work-Study Program	\$3,157,923	1,797		\$4,271,642	2,269		\$269,613	103		\$5,824,169	4,159	
Federal State Work-Study Program	\$3,026,663	1,852		\$3,038,241	1,919		\$368,894	216		\$8,835,542	6,765	
Total Work-Study Earnings	\$6,184,586			\$7,309,883			\$638,507			\$14,659,711		
Total Grants, Loans, and Work Study	\$324,108,287	3,649		\$288,506,137	4,188		\$213,985,082	319		\$705,317,279	10,924	

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