New England Public Policy Center
at the Federal Reserve Bank of Boston

Working Paper

07-2

The Fiscal Impacts of College Attainment

by Philip A. Trostel

Abstract

This study quantifies one important part of the economic return to public investment in college education, namely, the fiscal benefits associated with greater college attainment. College graduates generally pay much more in taxes than those not going to college. Government expenditures are also generally much less for college graduates than for those without a college education. Indeed, over an average lifetime, total government spending per college degree is negative. That is, direct savings in post-college government expenditures are greater than government expenditures on higher education. Further, the direct extra tax revenues from college graduates alone are more than six times the gross government cost per college degree. Thus, in addition to the many other benefits from higher education, public financial support of college education pays for itself many times over. On average, government funding for higher education is a sound public investment, even if governments had no other reasons to promote and encourage college education and if the higher-education sector produced nothing but college-educated taxpayers.

Philip A. Trostel is a Professor of Economics & Public Policy, Margaret Chase Smith Policy Center & School of Economics at the University of Maine, Orono and a Faculty Affiliate of the Wisconsin Center for the Advancement of Postsecondary Education at the University of Wisconsin, Madison. The views expressed in this paper are those of the author and do not reflect positions of the Federal Reserve Bank of Boston or the Federal Reserve System. The paper was prepared for while Dr. Trostel was a visiting scholar at the Center. Philip Trostel's e-mail address is philip.trostel@maine.edu.

FEDERAL RESERVE
BANK OF BOSTON™

Executive Summary

This study quantifies one important part of the economic return to public investment in college education, namely, the fiscal benefits associated with greater college attainment. College graduates generally pay much more in taxes than those not going to college. Government expenditures are also generally much less for college graduates than for those without a college education. Indeed, over an average lifetime, total government spending per college degree is negative. That is, direct savings in post-college government expenditures are greater than government expenditures on higher education. Plus, the direct extra tax revenues from college graduates alone are more than six times the gross government cost per college degree. Thus, in addition to the many other benefits from higher education, public financial support of college education pays for itself many times over. On average, government funding for higher education is a sound public investment, even if governments had no other reasons to promote and encourage college education and if the higher-education sector produced nothing but college-educated taxpayers.

The fiscal effects from college attainment are estimated for numerous federal, state, and local taxes and expenditures. Each four-year-equivalent degree (the weighted average of associate's, bachelor's, master's, professional, and doctorate degrees, with associate's and master's degrees counting as two-year degrees) creates the following direct fiscal consequences over an average lifetime:

- State income taxes increase by about $52,500.
- Local property taxes increase by $38,000.
- State and local sales taxes increase by more than $27,000.
- Federal income taxes increase by $238,000.
- Federal payroll taxes increase by $115,500.

- Total tax revenues increase by about $471,000.
  - Various forms of public assistance decrease by more than $10,000.
  - Medicaid benefits decrease by almost $21,000.
  - Medicare benefits decrease by $9,500.

- Social Security benefits decrease by $9,000.
- Supplemental Security Income payments decrease by almost $6,000.
- Unemployment compensation decreases by more than $1,500
- Worker's compensation decreases by $1,500.
- Spending on corrections decreases by more than $21,000.
- Spending on public healthcare decreases by almost $5,000.
- Total government spending on higher education is about $74,500 per degree from public colleges.

- Total government spending decreases by $10,000 per degree from public institutions.

➢ The lifetime net fiscal effect per degree from public institutions is more than $481,000.

The average annual real internal rate of return on government investment in college students is estimated to be 10.3 percent. Moreover, this estimate of the average fiscal rate of return is a conservative lower bound. For numerous reasons, the above fiscal benefits per college degree are estimated conservatively, while the fiscal costs per degree are estimated generously. Thus, although precise estimation of the numerous fiscal effects and fiscal rate of return is not possible, these estimates clearly demonstrate a substantial payoff to public investment in college education.

The lion's share of the fiscal benefits from college attainment accrues to the federal government. Of the estimated total direct fiscal benefits of $556,000 per degree, 72.5 percent goes to the federal government. The vast majority of the investment cost, however, accrues at the state level, with the federal government providing only about 19 percent of the total public support for higher education. Nonetheless, the net fiscal effect per college degree is still positive for individual states. The average net fiscal effect for individual states is, conservatively, almost $82,000 per four-year-equivalent degree. The average annual fiscal rate of return to states is calculated to be 3.1 percent.

I. Introduction

Government support for higher education has, arguably, decreased sharply in recent years.[1] In fiscal year 1984, nationwide net state funding for higher education was 4.1 percent of total state government spending (derived from data from the U.S. Census Bureau's *State and Local Government Finances*). In 1994, this proportion was 2.4 percent and in 2004, it was 1.8 percent. Public investment in higher education is evidently a falling priority.[2] This has fueled an increasing number of studies highlighting the benefits of investment in college education. The private benefits of college attainment (higher earnings, lower unemployment, better health, etc.) have been overwhelmingly demonstrated and widely publicized.[3] The wider social benefits from higher education attainment (higher volunteering and civic participation, lower crime, etc.) are not quite as overwhelmingly demonstrated and known, but have become increasingly publicized in recent years.[4] Prior to this literature, the argument for public support of higher education was based largely on the presumed existence of beneficial externalities that were generally vague, nebulous, and unquantified.

This study complements this growing literature on the wider private and social values of higher education attainment by quantifying the fiscal impacts of college attainment. That is, this report focuses on one specific public benefit of higher education, the greater tax revenues from and reduced government spending on college graduates. The broad issue that this study addresses in part is the fiscal rate of return to public investments in higher education. As noted above, there is a huge literature on the private monetary rate of return to investments in education. These studies have generally found a high real rate of return (about 10 percent), at least in the United States. And a growing literature shows significant non-monetary

[1] For detailed discussion of this issue, see Longanecker (2006) and Trostel and Ronca (2007).
[2] This is at least partly due to increasing fiscal pressures from slow growth in state tax bases and increasing state spending on Medicaid and corrections. See Hovey (1999) and Kane et al. (2005).
[3] A few of the many examples are Card (1999), Mortenson (2001), Harmon et al. (2003), Baum and Payea (2004), Institute for Higher Education Policy (2005), and Barrow and Rouse (2005).
[4] Some examples are Haveman and Wolfe (1984), Wolfe and Haveman (2003), Baum and Payea (2004), Lochner and Moretti (2004), McMahon (2004), Rizzo (2004), Topel (2004), and Institute for Higher Education Policy (2005).

returns to education, both in private and social terms. But there is relatively little work quantifying the returns to government investments in higher education.[5] The fiscal impacts of college attainment are starting to be quantified in some relatively recent studies, but mostly only in a rather piecemeal and superficial way.[6] Given that 2005 National Income and Product Accounts indicate that net federal, state, and local government investment in higher education was $109 billion, i.e., 1.0 percent of national income, this is an important unanswered policy question.

This study addresses a crucial first part of the broader issue of the fiscal rate of return to public investments in higher education. It quantifies the fiscal impacts of higher education attainment. This project is narrower than the broad question for two reasons. The first is that educating students in a state does not necessarily create a corresponding increase in the state's education attainment. Many college graduates migrate to other states, thus creating an interstate fiscal externality.[7] However, because this issue has been quantified in Trostel (2007), it is straightforward to take it into account in this study. The second reason is that changes in public funding for higher education do not necessarily induce proportionate changes in college attainment. The causal effect of state funding for higher education is unclear. Moreover, the marginal and average effects probably differ. However, although this issue has not been tested directly, recent work by Bound and Turner (2006) suggests a strong causal effect of public funding on college attainment, and that the effect is close to proportionate. Direct evidence on the issue of the marginal causal effect of public support on higher education attainment is the subject of current research by the author.

[5] This study is similar to the literature that has quantified the long-term fiscal impacts of government investment in pre-school programs. Some examples of this literature are Currie (2001), Heckman and Masterov (2004), Lynch (2004), and Belfield et al. (2006). This study is also similar the recent literature that has quantified the fiscal effects from high school attainment. See, for example, Krop (1998), Vernez et al. (1999), Goldhaber and Player (2003), Brady et al. (2005), and Levin et al. (2007).
[6] Some of the fiscal benefits from public investment in college education have been highlighted in Mortenson (1994), Trostel (1997 and 2003), Krop (1998), Vernez et al. (1999), Baum and Payea (2004), Institute for Higher Education Policy (2005), and Brady et al. (2005).
[7] This is discussed in Strathman (1994).

While this is not the first study to show the fiscal effects from public investment in college students, it quantifies these effects more completely and carefully than in the limited previous literature. The most in-depth previous work is the RAND study (Krop, 1998 and Vernez et al., 1999), which, unlike most of the rest of the literature, systematically quantifies almost all of the important fiscal benefits of college attainment. Also unlike most of the rest of the literature, it accounts for the important issue of the timing of the fiscal benefits. This work extends the RAND study and the rest of the literature in several ways. For one, it is able to take advantage of a better dataset. Recent data from the U.S. Census Bureau's Current Population Survey (CPS) provide better estimates of effects on tax revenues, as well as effects on Medicare and Medicaid. The CPS also is a much larger sample than the Survey of Income and Program Participation used in the RAND study, thus enabling reasonably precise estimation of fiscal effects in individual states. This study also estimates separate effects from different levels of college attainment (i.e., associate's, masters, etc.), quantifies a few more fiscal effects (on worker's compensation and public health spending due to the lack of health insurance), carefully examines the fiscal cost of public support for higher education, and separates state and local fiscal effects from federal fiscal effects. Finally, this study is the first to estimate a fiscal rate of return to government investments in college education.

Consistent with the small previous literature, public support for higher education is evidently a sound investment of tax dollars. Indeed, the fiscal payoff to public investment in college students appears to be even greater than suggested in earlier work. Greater college attainment has numerous positive fiscal repercussions: increased tax revenues from increased income and reduced low-income tax credits, and decreased expenditures on Medicaid, Medicare, public health care, corrections, supplemental security, unemployment compensation, worker's compensation, public assistance, food stamps, the WIC program, housing subsidies, energy assistance, transportation assistance, child care assistance, and school lunches. Added together, there is a sizable payoff to the government. The average real internal rate of return on government investment in college education appears to be, conservatively, at

least 10 percent. The fiscal rate of return to the federal government is particularly high, conservatively, about 25 percent. The average annual real fiscal rate of return to state and local governments, which provide most of the public funding for higher education, is, conservatively, about 3 percent. Overall, it is difficult to conceive of another investment that can match this average return to public investment in higher education.

Even if the lack of careful targeting of pubic support for college education causes the marginal fiscal rate of return to be only half of the average rate, the fiscal return to additional public investment in higher education appears to be relatively high. Moreover, this project only quantifies the direct government fiscal benefits from college attainment from public colleges. It does not measure indirect effects on tax revenues and government expenditures through higher education's effect on economic growth. The estimated fiscal return also does not include any economic benefits from graduates from private colleges, publicly sponsored university research, university public service and extension activities, or from the effect of public colleges and college education on entrepreneurial activity and job creation. Various social benefits, such as higher civic involvement, lower crime, and greater tolerance, are not quantified either.

II. Methodology

Data

The main data source for this study is the CPS, the source of official statistics on employment and unemployment. More specifically, this study uses the March Annual Social and Economic Supplement (formerly known as the Annual Demographic File), a yearly sample of about 210,000 non-institutionalized individuals.[8] For those 15 and older, it contains economic and demographic information, such as age, state, education attainment, and various sources of income. Because this study focuses on outcomes after high school, only data from those 19

[8] The Public Use Microdata Sample of the American Community Survey is a much larger sample, but has less-detailed information on sources of income, particularly government transfers and taxes.

and older are analyzed. Because age is truncated at age 80, only observations from those 79 and younger are analyzed. The CPS contains about 138,000 observations each year of those between 19 and 79.

For the following national-level results, this study relies on the latest year of data (2006), which applies to calendar year 2005. Because some cell sizes are quite small for individual states (such as the number people with master's degrees in Vermont receiving food stamps), following standard Census Bureau practice, for the state-level results, the latest three years of data (calendar years 2003 – 2005) are pooled to increase the sample size and reduce sampling variation in the results. Data on taxes, however, are only available in the last two years of data. All dollar values reported in this study are adjusted for inflation, using the Consumer Price Index and are expressed in terms of 2005 dollars. All results from CPS data are weighted using CPS sampling weights.

Because the CPS measures college attainment in terms of degrees (except for those who have some college but no degree), this project focuses on the fiscal returns from earning college degrees. It would be preferable to quantify the effects in terms of credit-years of higher education, but the primary data source does not allow it. Holders of professional and doctorate degrees are small percentages of the CPS sample within the 19-79 age range (1.4 and 1.2 percent, respectively). Thus, these degrees are lumped together to reduce the problem of small cell sizes in individual states.

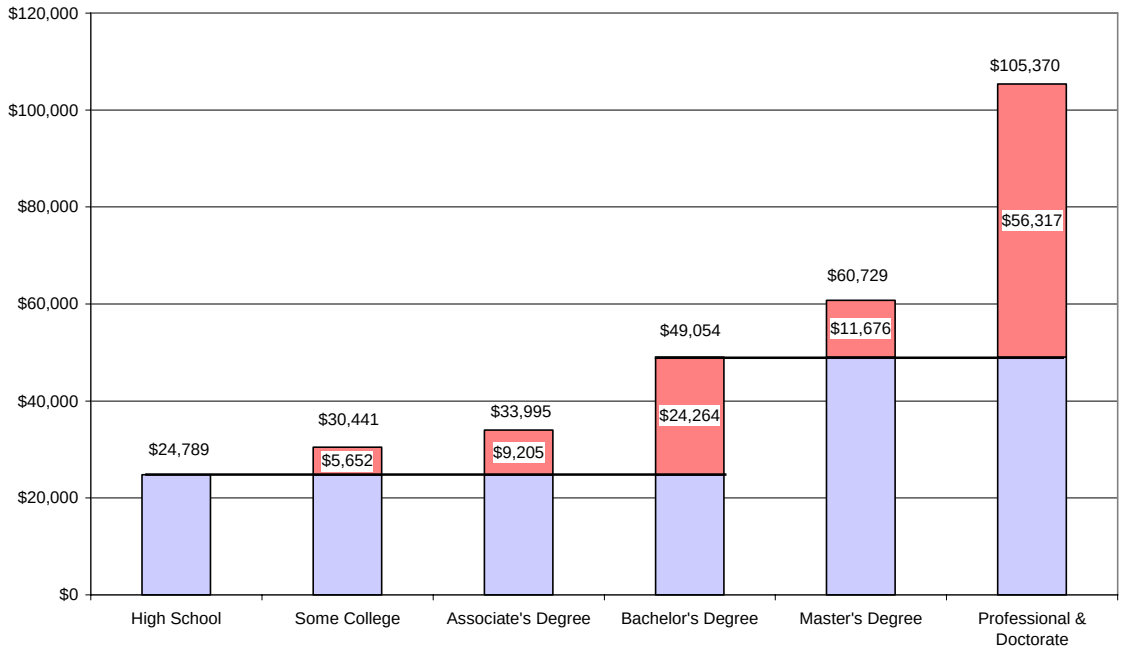
Basic approach

The typical approach in the literature showing the fiscal benefits of education attainment is to calculate average fiscal differentials across education categories. For example, Figure 1 shows average annual labor earnings (including self-employment income) for those between 25 and 64 (i.e., prime working years) across education categories.[9] Average annual earnings across college degrees for each of the New

[9] All results from CPS variables in this report are weighted by the CPS sampling weight.

England states are shown in Appendix Table 1. Nationally, those with a high school diploma and no college had average earnings of $24,789 per year in 2005. Those with some college earn an additional $5,652 on average. The earnings premia of associate's and bachelor's degrees are $9,205 and $24,264, respectively. The average earnings premia are $11,676 for master's degrees and $56,317 for professional and doctorate (these premia for advanced degrees are relative to the prerequisite bachelor's degrees). Nationally, state and local tax revenues are 11.0 percent of personal income in fiscal year 2005 (according to data from the U.S. Census Bureau's *State and Local Government Finances* and National Income and Product Accounts). Thus, first approximations of the annual college premia in state and local tax revenues are: $621 for some college, $1,011 for associate's degrees, $2,665 for bachelor's degrees, $1,282 for master's degrees, and $6,185 for professional and doctorate degrees (the corresponding first-pass premia in state and local tax revenues for each of the New England states are shown in Appendix Table 1). That is, a typical holder of a bachelor's degree (without a graduate degree) pays $2,665 more in state and local taxes than an average high school graduate (with no college), a typical

Figure 1
Average Labor Earnings and Degree Premia in 2005



holder of a master's degree pays $1,282 more in state and local taxes than an average holder of a bachelor's degree (without a graduate degree), etc.

These fiscal benefits in terms of tax revenues add up to a substantial sum over, say, a 40-year work career. This sum is substantially greater than the government contribution per degree. Moreover, this is only one of the fiscal benefits from college attainment.

This, of course, is a simplistic approach to quantifying the fiscal effects of public investment in higher education. Numerous factors that could cause this basic approach to be misleading are now addressed.

Timing

Like practically all other investments, the fiscal benefits of public investment in college students occur after the fiscal cost is incurred. This obvious and important point is frequently neglected in the nascent literature. In present discounted value, the fiscal benefits of college attainment are not nearly as great as suggested by the above simplistic framework. For example, the average differential in state and local tax revenues per bachelor's degree sums to $106,600 over a 40-year work career. In present value, though, this is only about $63,450 when discounted at a 3 percent real interest rate.[10] Moreover, this is the present value when starting work after college graduation. The present value is noticeably less at the time when college attendance starts and the fiscal costs are incurred.

In addition, college students generally earn less and pay less in taxes while they are in college. And because this fiscal opportunity cost occurs up-front, it is relatively high in terms of present discounted value.

Perhaps a more subtle issue concerning the timing of the fiscal costs and benefits is that the college earnings premium is not constant over the lifecycle. The average earnings premium is smallest immediately after graduation and then increases gradually at a decreasing rate. Figure 2 shows average labor earnings in

[10] A net-of-inflation interest rate of 3 percent is typical in applied economics models.

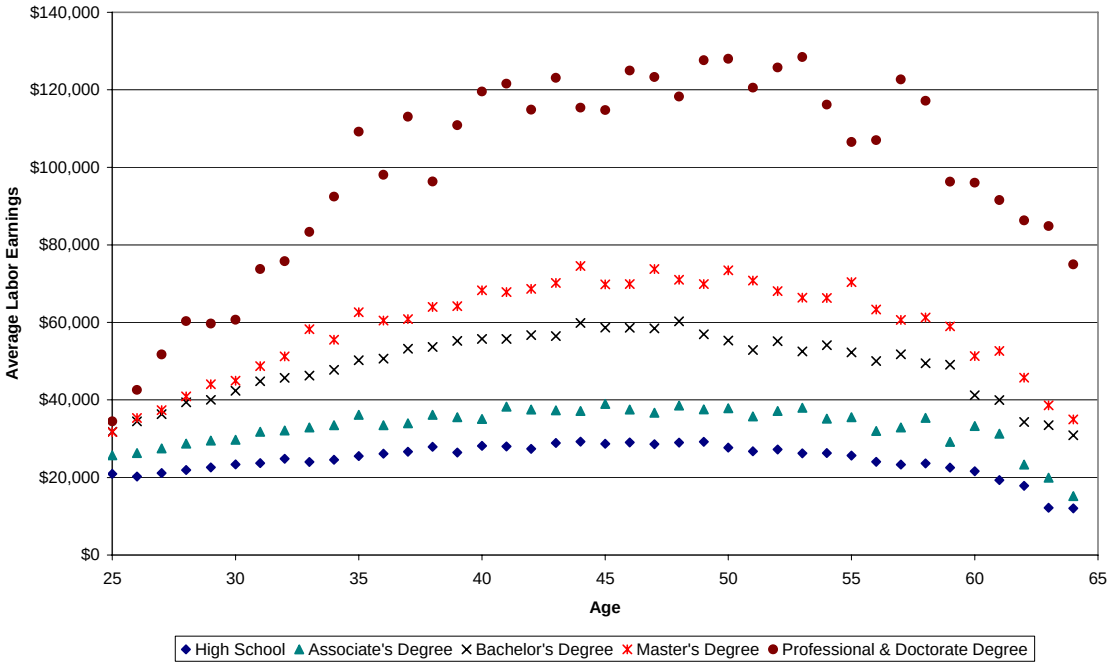
from 2001 to 2005 (in 2005 dollars) for each age, from 25 through 64, for each education qualification. The average life cycle of labor earnings is clearly steeper early in the careers of those with the most education.[11] Although the average bachelor's degree premium for those between 25 and 64 in 2001-05 was $25,122 annually, the premium is clearly much less early in the work lifecycle. In terms of present value, accounting for this noticeably affects the results.

Although discounting future values is simple, the best way to deal with these timing issues is not obvious. Accounting for the timing of the fiscal effects of college attainment requires some assumptions about the average career paths of college graduates and all sets of assumptions are somewhat problematic in some dimensions.

Instead of following the frequent implicit assumption of constant degree premia over the life cycle, this study quantifies the degree premia over the life cycle as the difference in average life-cycle income paths estimated from a fourth-order age polynomial. That is, following Murphy and Welch (1990), life-cycle variation is captured using quartic age function. Although the CPS is a large sample, it is not large enough to prevent some relatively large sampling variation in mean earnings for each year of age. Such sampling variation is seen clearly in Figure 2, particularly for professional and doctorate degrees because they are a relatively small fraction of the sample. Moreover, the problem is more severe when using fewer years of data, especially for individual small states. Thus, an age polynomial is used to capture life-cycle variation, while smoothing the sampling variation. Figure 3 illustrates the estimated life-cycle earnings premia for bachelor's degrees.

[11] Following standard practice, the absence of cohort effects is implicitly assumed in this discussion. That is, average earnings across ages in a given year are implicitly assumed to reflect average earnings over individual's lifecycles. There is little evidence that possible cohort effects create a misleading picture of life-cycle earnings.

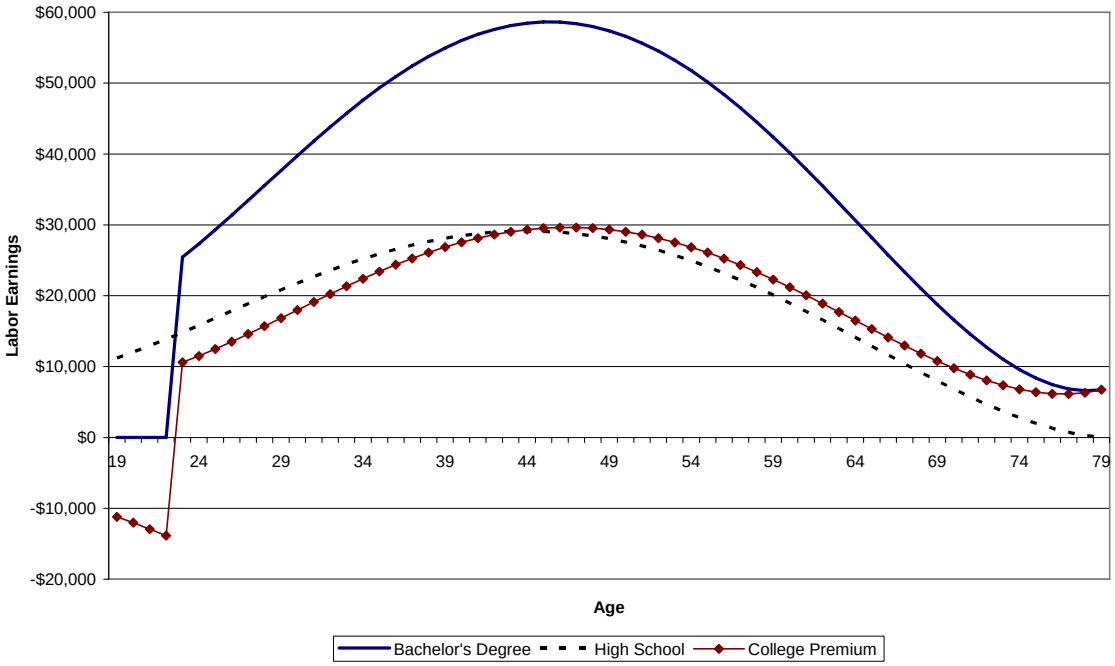
Figure 2
Average Life Cycle of Labor Earnings in 2001-05



This study makes the simple assumption that the average career paths of graduates are those of "traditional" students; that is, students progressing straight from high school to college and from matriculation to graduation in the standard number of years. To be specific, the work career is assumed to begin at 19 for high school graduates, 21 for associate's graduates, 23 for bachelor's graduates, 25 for master's graduates, and 27 for professional and doctorate graduates. Associate's and master's degrees are assumed to take two additional years of education, while bachelor's, professional, and doctorate degrees are assumed to average four additional years of education. This study also makes the simple assumption that students create no fiscal impact while in college, other than the direct public cost of higher education. That is, college students are assumed to pay no taxes, and to receive the average level of social-insurance payments during college as before and after college.[12]

[12] To be specific about assumed social-insurance receipts during college, degree holders are assumed to receive the level of benefits received by average graduates with: high school diplomas at age 19, associate's degrees benefits at age 21, bachelor's degrees at age 23, master's degrees at age 25, and the interpolated values at ages 20, 22, 24, and 26. For example, the imputed social-insurance benefits

Figure 3
Estimated Life-Cycle Profile of Labor Earnings in 2005



Obviously many college (and high school) students take more than the standard numbers of years to graduate and some take less than the usual number of years to graduate. Thus, for many college graduates the benefits of college attainment occur later than assumed above, and the assumption that students are traditional on average overstates the total present value of the fiscal benefits. On the other hand, many students work part-time while in college and/or work full-time while taking time out from college and thus pay at least some taxes before college graduation. Indeed, presumably these are the main reasons many students take longer than usual to graduate. Thus, the assumption that students are traditional on average also understates the total present value of the fiscal benefits. The implicit assumption in this study is that these effects roughly offset each other. To try to quantify these opposing effects would probably add more in complexity and

---

during college for a master's degree is $B^{H}_{19} + (B^{H}_{19}+B^{A}_{21}) + B^{A}_{21} + (B^{A}_{21}+B^{B}_{23}) + B^{B}_{23} + (B^{B}_{23}+B^{M}_{25})$, where B is the average annual level of benefits, the superscripts H, A, B, and M respectively denote high school, associate's degree, bachelor's degree, and master's degree, and the subscripts denote age. Thus, average social-insurance benefits received by college students are assumed to change gradually with college attainment.

uncertainty than in precision. But it should be clearly acknowledged that this study really quantifies the fiscal impact of traditional college students.

For three reasons, the above set of assumptions is quite conservative in showing the fiscal benefits of public investment in college students. The first reason is that it ignores any fiscal benefits from those with some college but no degree. As stated above, this group, compared to high school graduates with no college, earns $5,652 more annually and pays $621 more in state and local taxes per year, on average. The fiscal benefits from some college experience without earning a degree are ignored because of the difficulty in assigning a fiscal cost to this education category. Unlike new college degrees, determining the amount of new "some college" per year is problematic.

The second reason that the subsequent results are conservative in showing fiscal benefits of college education is that the effect on mortality rates is ignored. That is, compared to high school graduates, college graduates generally live longer[13] and hence create greater total fiscal benefits.[14]

The third reason that the following results are conservative is that the intergenerational effects of college education are ignored. Compared to high school graduates, the children of college-educated parents are much more likely to become college graduates[15] and create resulting fiscal benefits.

Tax rates[16]

The basic approach presented earlier assumes that taxes are a constant percentage of income. It is unlikely, however, that average tax rates are constant across education categories. Income taxes are generally progressive, while payroll, property, and sales taxes are generally regressive on an annual basis. But most of

[13] See, for example, Lleras-Muney (2005).
[14] Actually, there is a complicated interaction here. College graduates pay taxes for a longer time period on average. But they also receive Social Security and Medicare benefits for a longer time period, although they are also healthier and hence use Medicare less.
[15] See, for example, Haveman and Wolfe (1995).
[16] With the exception of payroll taxes, the burden of taxes is assumed to fall on the payers. The real burden of employers' share of federal payroll taxes is assumed to be borne by workers.

these are easy to account for using recent CPS data. Beginning in 2005, the CPS has included estimates of individuals' federal income and payroll taxes and state and local income and property taxes.[17]

State and local average sales (and excise) tax rates across education categories can easily be computed using data generated by the Institute on Taxation and Economic Policy's Microsimulation Tax Model (McIntyre et al., 2003). To be specific, McIntyre et al.'s estimates of average sales and excise tax burdens for each income quintile in each state are matched with individual's incomes (excluding transfers) in the CPS. Although the McIntyre et al. estimates are based on 2002 state tax laws and 2000 income data, this method is far superior to simply applying a uniform average sales tax burden across education categories. McIntyre et al. show substantial within-state variation in effective average sales tax rates.

Causation

A potentially important problem facing any effort to quantify the effects of educational attainment is the issue of causality. Correlation is not causation. Although earnings are highly correlated with education attainment, this does not necessarily prove that more education causes earnings to be higher. It is conceivable that higher-ability and/or higher-motivation individuals generally obtain more education and have greater earnings potential independent of their education. Higher education does not necessarily cause higher earnings or the numerous other outcomes correlated with higher education. The observed correlations may be largely the result of omitted-variables bias (also often referred to as endogeneity bias, or ability bias, in this context).

A large literature has developed to try to identify the causal effect of education on earnings.[18] A growing literature has also developed trying to identify

[17] See O'Hara (2004) for information on the CPS procedures used to estimate individuals' tax burdens.
[18] See Card (1999) and Harmon et al. (2003) for recent reviews of this literature.

the causal effect of education on health, mental health, and mortality.[19] A widely publicized recent paper by Lochner and Moretti (2004) attempted to identify the causal effect of education on criminal behavior, arrests, and incarceration. Despite the plausibility of the ability-bias hypothesis, these literatures have generally demonstrated that the observed correlations are indeed causal effects of education. In fact, many, if not most, of the studies in these literatures find slightly larger causal effects of education than the simple correlations. It thus appears that the simple correlations are not misleading; if anything, they appear to be on the conservative side.

This does not mean that the issue of causation can be completely dismissed. This project examines the correlations between higher education and various outcomes, such as unemployment, welfare participation, and incarceration where causation has either not been tested or tested to only a limited extent. Thus, a potentially important limitation of this project is that it does not necessarily demonstrate causal effects of higher education. Unfortunately, the data used in this project are insufficient to allow for causality testing (testing causality requires unusual datasets, such as samples of twins). Previous research on several different outcomes, however, is certainly suggestive that this may not be an important limitation.

College earnings premia

The basic approach outlined earlier implicitly assumes that college premia are constant. That is, the average earnings differentials (and differentials in other outcomes) between education qualifications are independent of the relative numbers of people with different education levels. A simple supply-and-demand framework, however, suggests that this assumption may be problematic. An increase in the relative supply of college-educated labor increases presumably creates downward pressure on the relative earnings of college-educated labor. Moreover, a relative

[19] See Groot and Maassen van den Brink (2004), Cutler and Lleras-Muney (2006), and Chevalier and Feinstein (2006) for recent reviews of this literature.

increase in the supply of college-educated labor presumably implies digging deeper into the talent pool of potential college graduates. Thus, it seems plausible that the college premia are not constant as the proportion of college graduates varies. This is an old concern going back to the 1976 book, *The Overeducated American*, by Richard Freeman.

Contrary to the predictions in the 1970s, the return to higher education did not fall as more and more Americans obtained college degrees. In fact, the economic return to higher education rose in the 1980s and early 1990s and has remained roughly stable since the mid-1990s.[20] Card and Lemieux (2001) and Fortin (2006), however, found that a relative increase in college graduates in a state causes a statistically significant negative effect on the state's college wage premium. On the other hand, using a less-restrictive framework, Trostel (2007) found this effect to be miniscule and not statistically different from zero. Juhn et al. (2005) also found the effect on the college earnings premium to be very small. Although the issue is not yet settled and is the subject of ongoing research by the author, the effect of the relative supply of college-educated labor on the college earnings premium appears to be no larger than a small second-order effect.

Interstate migration

Interstate migration of college graduates can cause some state and local investments in college students to end up creating fiscal benefits in other states (of course, the same can be said for state and local investments in primary and secondary students). A state's production of college graduates does not necessarily have corresponding impact on the state's college attainment. Thus, the fiscal return on a state's investment in higher education is reduced by the extent of the net interstate migration of its college graduates. The national fiscal return is obviously unaffected

[20] For surveys of this literature, see Katz and Autor (1999) and Autor et al. (2005).

by such interstate migration,[21] but this interjurisdictional spillover reduces the fiscal return to individual states.

Recent research by Trostel (2007) estimates the extent of this interstate spillover of college graduates and thus quantifies the extent that fiscal return to individual states needs to be adjusted downward. That study indicates that the average net loss of a state's new bachelor's degrees to other states is about 7 percent. For new associate's degrees, the net interstate leakage is estimated to be about 3 percent. For new master's degrees, the net leakage appears to be about 8 percent. The net leakage of professional and doctorate degrees to other states is roughly 10 percent.

Trostel (2007) also finds that the net interstate leakage of new college graduates is evidently less for the case of public colleges than for private colleges. With the exception of professional and doctorate degrees, there appears to be no net interstate loss of new graduates from public institutions. The net loss of new professional and doctorate graduates to other states is evidently about the same for public and private institutions (10 percent). Because most state support for college students is clearly directed toward those in public institutions, the emphasis in this study is on graduates from public colleges.

Unfortunately, Trostel (2007) did not have sufficient data to identify the net interstate effects for individual states. It is certainly possible that the net interstate spillover of college graduates is larger in some states than in others.[22] But all that can be done is to apply the point estimates mentioned above to all states. Specifically, the net reduction in the fiscal benefits of college attainment for individual states is assumed to be 3.4 percent for associate's degrees, 7.1 percent for bachelor's degrees, 7.9 percent for master's degrees, and 9.6 percent for professional and doctorate

[21] Net international migration is sufficiently small to ignore. Moreover, accounting for it should show slightly greater fiscal benefits, if anything.

[22] Indeed, Trostel (2007) found that the net interstate leakage of new bachelor's degrees is, not surprisingly, greater in the Northeast than in the rest of the nation. But the net leakage of new bachelor's graduates from public institutions in the Northeast is, coincidently, the same as the national-average net leakage of all new bachelor's graduates, 7 percent. The difference in geographically small Northeast states evidently offsets the difference between graduates from public and private institutions.

degrees. Given that that the net interstate out-migration of new college graduates is generally less than these percentages for graduates from public colleges, this is a conservative approach (i.e., it yields a lower fiscal rate of return to college education).

These adjustments to the individual-state fiscal benefits of college attainment are only applied to the end calculations of the overall post-college fiscal effects and the fiscal rate of return. Thus, it should be kept in mind that these adjustments are not in the initial tables showing the various fiscal benefits of college attainment.

The effect of public support

Perhaps the most problematic issue confronting an effort to quantify the fiscal return to public investment in college students is the causal effect of public support on college attainment. Many college graduates do not rely on public support. Undoubtedly, there are also many graduates who take advantage of public financial support but who would have still gotten their college educations without the public support. Indeed, it has been persuasively argued that public subsidies for higher education often benefit those who would have gone to college anyway.[23] Thus, the causal effect of public support on college attainment may be significantly less than suggested by the correlation between public support for higher education and the number of graduates from public colleges. In other words, because public higher education subsidies are generally not well targeted at those on the margin of college attendance, the marginal fiscal effect per public dollar invested in higher education may be substantially less than the average fiscal effect.

Although this issue is not addressed directly in a recent study by Bound and Turner (2006), their results suggest a roughly proportionate marginal causal effect of state support for higher education on bachelor's degree production in the state. In other words, their findings indicate that the average relationship between public support and bachelor's degree attainment is not misleading about the causal effect.

[23] For example, see Hansen and Weisbrod (1969) and Fernandez and Rogerson (1995).

To be specific, they find that exogenous increases in the number of potential college graduates in a state (high school graduates four years earlier) increases state funding for higher education by about only about 60 percent of the increase in the number of potential college students (i.e., funding per student falls by 40 percent) and it also decreases the number of bachelor's degrees awarded relative to the number of potential college graduates in the state by roughly 40 percent. Thus, the "natural experiment" created through changes in cohort size indicates that bachelor's degree attainment in a state changes in inverse proportion to state funding per potential college graduate.

Thus, it tentatively appears that the average correlation between public support and college attainment is not misleading about the causal impact. Current research by the author is attempting to test this tentative conclusion more directly.

III. Tax Revenues

State and local taxes

Table 1 presents estimated lifetime (actually, through age 79) state and local taxes across education categories. Estimates for each New England state are shown in Appendix Tables 2 – 7.[24] These tables also show these lifetime taxes paid in discounted value (at the start of college at age 19), using a 3 percent real interest rate. In addition, they show the total and present-value lifetime degree premia in state and local taxes; that is, the differences in lifetime taxes paid for each degree level relative to those paid by high school graduates (bachelor's graduates in the advanced degree cases). These estimates of lifetime taxes are calculated assuming that no taxes are paid from ages 19 through 20 for associate's degrees, from 19 through 24 for master's degrees, etc. Also as noted earlier, the estimates in Table 1 are from 2005 data (Appendix Tables 2 – 7 are from 2004 and 2005 data, measured in 2005 dollars).

[24] Tax levels and structures (and levels and structures of social-insurance programs) are implicitly assumed to be unaffected by college attainment. Whether fiscal policy depends endogenously on education attainment is an interesting unexplored issue.

Table 1
Estimated Lifetime State and Local Taxes across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$34,044	$50,241	$89,667	$119,138	$168,449
Present Value	$15,898	$23,378	$39,760	$49,146	$70,521
Degree Premium - Sum		$16,197	$55,624	$29,470	$78,782
Degree Premium - PV		$7,480	$23,862	$9,386	$30,761
Property Taxes					
Sum	$88,536	$112,789	$123,078	$147,270	$146,109
Present Value	$37,549	$46,791	$50,256	$58,025	$55,632
Degree Premium - Sum		$24,253	$34,542	$24,192	$23,031
Degree Premium - PV		$9,242	$12,707	$7,768	$5,375
Sales Taxes					
Sum	$57,266	$71,554	$85,307	$93,802	$120,907
Present Value	$29,398	$35,427	$40,431	$42,921	$52,261
Degree Premium - Sum		$14,288	$28,042	$8,494	$35,600
Degree Premium - PV		$6,029	$11,033	$2,490	$11,830
Total State and Local Taxes					
Sum	$179,845	$234,584	$298,053	$360,209	$435,465
Present Value	$82,845	$105,596	$130,448	$150,092	$178,414
Degree Premium - Sum		$54,739	$118,208	$62,157	$137,413
Degree Premium - PV		$22,751	$47,602	$19,645	$47,967

Present values are calculated using a 3 percent real interest rate.

Table 1 shows the effects of college attainment on the three types of state and local tax revenues, as well as their total. As expected, college education creates substantially more state income tax revenues. Each bachelor's degree leads to an additional $55,600 in state income taxes over a lifetime. In present value (at a 3 percent discount rate), bachelor's degree holders pay, on average, 2.5 times as much state income taxes as high school graduates without college. Holders of professional and doctorate degrees pay 4.4 times as much state income taxes in present value as high school graduates not going to college. But college education evidently does not create nearly as much state and local property tax revenues. In present value, the average bachelor's degree holder pays only 34 percent more property taxes as the average high school graduate with no college. Professional and doctorate degree holders pay only 48 percent more property taxes over their lifetimes in present value

than high school graduates with no college. Sales and excise taxes increase with college attainment in similar proportions as property taxes. In present value, bachelor's degree holders pay 38 percent more and professional and doctorate degree holders pay 78 percent more sales and excise taxes as high school graduates.

Lifetime total state and local taxes increase by an average of nearly $55,000 per associate's degree, more than $118,000 per bachelor's degree, more than $62,000 per master's degree, and more than $137,000 for each professional and doctorate. The present values (using a 3 percent discount rate) of these degree premia in state and local tax revenues are, respectively, about $23,000, $48,000, $20,000, and $48,000.

Federal taxes

Estimated lifetime federal taxes across education levels are shown in Table 2. It shows federal income taxes and Social Security payroll taxes (both the employee and employer portions) and their sum.[25] The pattern of degree premia in lifetime federal income taxes across college education categories is more dramatic than it is for state income taxes. More specifically, both the absolute and relative sizes of the degree premia for federal income taxes are larger than they are for state income taxes. Each bachelor's degree leads to an additional $256,000 in federal income taxes over a lifetime (compared to $55,600 in state income taxes). In present value (at a 3 percent discount rate), on average, bachelor's degree holders pay 3.3 times as much federal income taxes as high school graduates (compared to 2.5 for state income taxes). Holders of professional and doctoral degrees pay 6.4 times as much federal income taxes in present value as high school graduates (compared to 4.4 for state income taxes).

[25] Tax levels are implicitly assumed to be constant over time. Persistent federal budget deficits, however, suggest that tax rates will be higher (and/or social-insurance benefit levels will be lower) in the future. To the extent that taxes will be higher (and benefit levels will be lower), these estimates understate the fiscal premia.

Table 2
Estimated Lifetime Federal Taxes across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$111,132	$194,896	$367,132	$466,111	$733,428
Present Value	$47,255	$82,866	$155,699	$190,303	$300,808
Degree Premium - Sum		$83,764	$255,999	$98,980	$366,297
Degree Premium - PV		$35,611	$108,444	$34,604	$145,109
Social Security Payroll Taxes					
Sum	$169,398	$223,516	$289,111	$322,247	$482,088
Present Value	$86,642	$110,896	$138,423	$148,746	$209,136
Degree Premium - Sum		$54,118	$119,713	$33,136	$192,977
Degree Premium - PV		$24,254	$51,781	$10,323	$70,714
Total					
Sum	$280,531	$418,412	$656,243	$788,358	$1,215,517
Present Value	$133,896	$193,761	$294,122	$339,049	$509,945
Degree Premium - Sum		$137,882	$375,712	$132,115	$559,274
Degree Premium - PV		$59,865	$160,225	$44,927	$215,823

Present values are calculated using a 3 percent real interest rate.

Because of the ceiling on income subject to payroll taxation, the degree premia in lifetime Social Security payroll taxes are not as pronounced as for income taxes. In present value, holders of bachelor's degrees pay only 60 percent more payroll taxes as holders of high school diplomas. Professional and doctorate degree holders pay 141 percent more payroll taxes over their lifetimes than high school graduates with no college.

In additional average lifetime total federal taxes, an associate's degree contributes almost $138,000, a bachelor's degree contributes almost $376,000, a master's degree leads to more than $132,000, and each professional and doctorate degree leads to more than $559,000. The present values (using a 3 percent discount rate) of these degree premia in federal taxes are about $60,000, $160,000, $45,000, and $226,000, respectively.

IV. Government expenditures

Welfare

This section quantifies the effects of college attainment on various public assistance programs. For each education category, Table 3 shows estimated lifetime (through age 79) income from five public-assistance programs: food stamps, school lunches,[26] various types of public cash assistance, energy assistance, and housing subsidies. The estimates are for the cash values of these programs in 2005. The sum of these public-assistance programs is shown at the bottom of Table 3. As with tax revenues, this table also reports discounted values (at age 19, using a 3 percent real interest rate) as well as degree premia in public assistance. The estimates reported in Table 3 are somewhat conservative in that they do not include any public costs in administering these programs. That is, they show the value to the recipients rather than the total fiscal cost.

Table 3 shows that, not surprisingly, college attainment generally leads to lower levels of public assistance. The one exception is the puzzling case of average cash assistance for professional and doctorate degrees, which is somewhat higher than for bachelor's and master's degrees (although less than for high school and associate's degrees). Each bachelor's degree reduces lifetime receipts of food stamps by almost $7,100, children's school lunches by more than $2,400, public cash assistance by almost $1,500, energy assistance by almost $400, housing subsidies by almost $300, and total welfare by more than $11,600. Total welfare receipts of the average person with a bachelor's degree but without an advanced degree are 22 percent as much as the average person with a high school diploma and no college. In present discounted value, the average bachelor's degree holder receives 20 percent as much as the average high school graduate.

While the most important types of public assistance are shown in Table 3, they are not the only ones. The CPS contains information on receiving four other forms of welfare: Special Supplemental Nutrition Program for Women, Infants, and

[26] Unlike the other programs, school lunches are for the family rather than the individual. It seems appropriate to include the value of school lunches for children.

Children (WIC), childcare assistance, transportation assistance, and participation in work programs.

Table 3
Estimated Lifetime Welfare Receipts across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Food Stamps					
Sum	$8,601	$4,188	$1,513	$1,458	$1,472
Present Value	$5,401	$2,489	$934	$935	$873
Degree Premium - Sum		-$4,413	-$7,088	-$54	-$40
Degree Premium - PV		-$2,912	-$4,468	$2	-$61
School Lunches					
Sum	$3,645	$2,376	$1,239	$928	$844
Present Value	$2,192	$1,388	$625	$430	$351
Degree Premium - Sum		-$1,269	-$2,406	-$311	-$395
Degree Premium - PV		-$804	-$1,567	-$195	-$274
Cash Assistance					
Sum	$1,714	$1,354	$248	$166	$561
Present Value	$1,130	$758	$173	$141	$373
Degree Premium - Sum		-$360	-$1,466	-$82	$313
Degree Premium - PV		-$372	-$957	-$33	$200
Energy Assistance					
Sum	$506	$273	$117	$126	$86
Present Value	$259	$150	$63	$61	$45
Degree Premium - Sum		-$232	-$388	$9	-$31
Degree Premium - PV		-$109	-$196	-$2	-$18
Housing Subsidy					
Sum	$386	$242	$123	$96	$95
Present Value	$211	$120	$63	$58	$57
Degree Premium - Sum		-$144	-$263	-$27	-$27
Degree Premium - PV		-$91	-$148	-$5	-$7
Total Welfare Receipts					
Sum	$14,852	$8,433	$3,240	$2,774	$3,059
Present Value	$9,193	$4,906	$1,858	$1,625	$1,698
Degree Premium - Sum		-$6,418	-$11,612	-$466	-$180
Degree Premium - PV		-$4,288	-$7,335	-$233	-$160

Present values are calculated using a 3 percent real interest rate.

Unfortunately, it does not contain information on their cash value or fiscal cost. The lifetime incidence of these small, in-kind public-assistance programs across college qualifications is shown in Table 4. The pattern of decreasing participation in these programs as higher education qualification increases is similar to the other welfare programs. Compared to the average person with a high school diploma as the highest education in 2005, the average person with a bachelor's degree is 21 percent as likely to receive WIC, 45 percent as likely to receive childcare assistance, 24 percent as likely to receive transportation assistance, and 30 percent as likely to participate in a work program in order to receive cash assistance. The total welfare estimates reported at the bottom of Table 3 thus understate the total degree premia for yet another reason.

Table 4
Lifetime Average Rates of Receipt of Other Welfare Programs across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
WIC	1.95%	1.09%	0.41%	0.19%	0.05%
Degree Differential		-0.86%	-1.54%	-0.22%	-0.36%
Childcare Assistance	0.40%	0.47%	0.18%	0.06%	0.06%
Degree Differential		0.07%	-0.22%	-0.12%	-0.12%
Transportation Assistance	0.31%	0.26%	0.08%	0.05%	0.07%
Degree Differential		-0.05%	-0.23%	-0.03%	0.00%
Work Program	0.09%	0.08%	0.03%	0.00%	0.00%
Degree Differential		-0.01%	-0.07%	-0.03%	-0.03%

Most, but not all, public assistance is funded by the federal government. Moreover, most federal public-assistance programs are administered through state governments. As a result of the substantial intergovernmental transfers in welfare spending, a precise decomposition of the fiscal premia into federal and state components is not possible. State and local expenditure data are categorized differently than federal spending data (and they use different fiscal years). State-

level data are classified by function, while federal data are classified by agency. Moreover, the state-level data are not disaggregated into programs. Approximate federal/state shares of aggregate welfare spending are constructed by combining the U.S. Census Bureau's *Consolidated Federal Funds Report*, *Federal Aid to States*, and *State and Local Government Finances*.[27] This indicates that about 78.5 percent of total welfare spending was funded at the federal level in fiscal year 2004, the last year for which the federal data are available. This percentage evidently varies considerably across states.

Appendix Tables 8 – 13 report the fiscal effects of college attainment for each New England state. The estimated state and local share of the fiscal premia in welfare spending varies from 13 percent in Massachusetts to 51 percent in New Hampshire (because FY 2003 data are not available, these are averages for FY 2002 and 2004).

Medicaid

Medicaid is, by far, the costliest form of public assistance toward the low-income population. As shown in Table 5, the fiscal college premium in Medicaid dwarfs those for all other welfare programs combined. These estimates are for the family market value[28] of lifetime Medicaid coverage and are derived under the same assumptions as for the other public-assistance programs. The estimates reported in Table 5, like those in Table 3, do not include any public costs in administering Medicaid. In addition, the estimates in Table 5 do not take into account any

[27] To be more specific, federal spending on welfare is derived as the sum of direct payments for food stamps and housing assistance in *Consolidated Federal Funds Report* plus grants to state and local governments from the Department of Agriculture's Food and Nutrition Service (mostly child nutrition, food stamps, WIC) and from the Department of Health and Human Services' Administration for Children and Families (Temporary Assistance to Needy Families, Head Start, and various other programs) in *Federal Aid to States*. State and local welfare spending is derived as public welfare less vendor payments (i.e., Medicaid) in *State and Local Government Finances* less the federal grants above.

[28] Medicaid benefits are for the family rather than the individual because, unlike other forms of public assistance, eligibility rules differ for parents and children, and it seems appropriate (and consistent) to include the Medicaid benefits of children. Also, the CPS measures Medicaid benefits as its insurance market value as opposed to the value of health care bought with Medicaid.

variation in the use of health care paid with Medicaid. Given that health problems vary inversely with education attainment, presumably the public cost of Medicaid across education attainment varies more than the market value of Medicaid across education attainment.[29]

Table 5
Estimated Lifetime Market Value of Medicaid across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$42,227	$30,786	$19,191	$14,462	$14,154
Present Value	$22,912	$15,913	$9,751	$7,565	$6,727
Degree Premium - Sum		-$11,440	-$23,035	-$4,730	-$5,038
Degree Premium - PV		-$6,999	-$13,161	-$2,187	-$3,025

Present values are calculated using a 3 percent real interest rate.

The pattern of Medicaid received across education levels shown in Table 5 is broadly consistent with the other welfare programs. College attainment reduces spending on Medicaid, though the relative amounts that college degrees reduce this type of public assistance are generally somewhat smaller than for the other programs. But since Medicaid is so large relative to the other programs, the absolute amounts of fiscal savings are much larger. The average lifetime market value of Medicare received for bachelor's degrees is 45 percent as much as it is for high school diplomas. The present value (at age 19, using a 3 percent discount rate) of this differential is almost $13,200 per bachelor's degree, which is 1.8 times larger than for the total of the five public assistance programs shown in Table 3.

In fiscal year 2004, the federal government assumed 59.9 percent of the national cost of Medicaid (Kaiser Commission on Medicaid and the Uninsured, 2004), thus about 40 percent of the estimated fiscal premia shown in Table 5 accrue to state governments. This percentage varies among states, though. Estimates of the fiscal premia for the individual New England states apply these different rates

[29] The CPS question about health condition suggests that this could be important. Among recipients of Medicaid aged 27 and older, 38 percent of those with only a high school education report their health to be very good or excellent, compared to 54 percent for those with a bachelor's degree as their highest qualification.

(ranging from 69 percent in Maine to 53 percent in Connecticut, Massachusetts, and New Hampshire). These estimates are shown in Appendix Tables 8 -13.

Medicare

Table 6 reports estimated family market values[30] of lifetime Medicare benefits across education levels. These average benefit levels are calculated under the same assumptions as for public assistance.

Table 6
Estimated Lifetime Market Value of Medicare across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$183,452	$173,941	$179,536	$167,034	$165,884
Present Value	$50,592	$42,617	$42,334	$35,515	$32,816
Degree Premium - Sum		-$9,512	-$3,917	-$12,502	-$13,652
Degree Premium - PV		-$7,976	-$8,259	-$6,818	-$9,517

Present values are calculated using a 3 percent real interest rate.

These estimates for Medicare and the following estimates for Social Security benefits should be interpreted with additional caution. Because those with more education tend to live longer than those with less education, increasing education attainment translates into longer periods of receiving Medicaid and Social Security benefits, and consequently higher fiscal costs, all else being equal. This study does not account for differences in mortality rates, thus this may cause the fiscal costs of these retirement programs to be biased downward as education attainment increases. This may not make much difference, though, in terms of present discounted value at age 19.[31]

Moreover, for two reasons, the approach used in this study might not bias the public costs of retirement programs downward as education attainment increases. As noted in the discussion of Medicaid, the estimates do not take into account any variation in the use of health care paid with Medicare. Given the positive

[30] As with Medicaid, Medicare benefits are for the family rather than for the individual because of the importance of spousal benefits, and Medicare benefits are measured as their insurance market value.
[31] Using a 3 percent real discount rate, the present value at age 19 of $1 at, say, age 75, is $0.19.

relationship between health and education attainment, this may cause the public cost of Medicare to decrease with education attainment more than the market value of Medicaid decreases with education attainment.[32] Also, because retirement age and the start of receiving retirement benefits increase with education attainment, it is not necessarily the case that those with more education receive greater retirement benefits because of their longer life expectancies, particularly in present value. As a result, the net bias of the approach employed in this study is unclear. But the following results for Medicaid and Social Security are more uncertain than the other results in this report.

The estimates in Table 6 reveal relatively small differences in the lifetime market value of Medicare across education levels. The differences are a little more noticeable in terms of present value (at age 19, using a 3 percent discount rate), however. Because average retirement age increases with education attainment, each degree level creates present-value fiscal savings in Medicare that are between about $6,800 and $9,500 per degree.

Social Security

Table 7 reports estimated average lifetime Social Security benefits across education qualifications. As with Medicare, these estimates should be interpreted with caution. The levels and pattern of lifetime and present-value Social Security benefits are similar to those for Medicare. Average total lifetime (through age 79) benefits are roughly stable across education levels. The average present value of these benefits, however, generally decreases slightly with education levels. The present-value fiscal premia in Social Security for each degree is between about $3,800 and $8,400.

[32] The CPS question about health condition again suggests that this could be important. Among recipients of Medicare, 33 percent of those with only a high school education report their health to be very good or excellent, compared to 50 percent for those with a bachelor's degree as their highest qualification.

Table 7
Estimated Lifetime Social Security Benefits across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$180,557	$174,288	$173,404	$161,467	$183,655
Present Value	$44,186	$38,558	$35,763	$30,014	$31,971
Degree Premium - Sum		-$6,269	-$7,153	-$11,937	$10,251
Degree Premium - PV		-$5,628	-$8,423	-$5,749	-$3,792

Present values are calculated using a 3 percent real interest rate.

The sum of the fiscal effects of college attainment on Social Security and Medicare are shown in Table 8. The upper set of estimates shows the sum of the lifetime benefits (i.e., the sum of the estimates in Tables 6 and 7). The lower set of estimates shows the lifetime benefits net of lifetime payroll taxes (i.e., the sum of the estimates in Tables 6 and 7 less the estimates in Table 2). This lower set of estimates reports the negative of the net average fiscal effect of college attainment on the Social Security program. The net college premia in Social Security and Medicare are large. On average, each bachelor's degree creates net fiscal savings in Social Security and Medicare of almost $131,000 over a lifetime.

Table 8
Estimated Lifetime Social Security and Medicare Benefits and Net Benefits across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Total Social Security & Medicare Benefits					
Sum	$364,010	$348,229	$352,940	$328,501	$349,539
Present Value	$94,778	$81,174	$78,096	$65,529	$64,787
Degree Premium - Sum		-$15,781	-$11,070	-$24,439	-$3,401
Degree Premium - PV		-$13,604	-$16,682	-$12,567	-$13,309
Total Benefits Net of Payroll Taxes					
Sum	$194,611	$124,713	$63,829	$6,254	-$132,549
Present Value	$8,137	-$29,721	-$60,326	-$83,217	-$144,349
Degree Premium - Sum		-$69,898	-$130,783	-$57,574	-$196,378
Degree Premium - PV		-$37,858	-$68,463	-$22,891	-$84,023

Present values are calculated using a 3 percent real interest rate.

In present value, this net fiscal savings is about $68,500. Each professional and doctorate degree creates a lifetime net fiscal savings of more than $196,000, and about $84,000 in present discounted value (at age 19).

Supplemental Security Income

Table 9 reports estimated average lifetime receipts of Supplemental Security Income (SSI) across college qualifications.[33] The pattern is similar to that for the various public-assistance programs shown in Table 3 and 4. The fiscal burden of this federal program falls as college attainment increases. As is the case for most of the public-assistance programs, most of the impact of college education in SSI payments is for the undergraduate degrees. Average lifetime SSI for holders of bachelor's degrees is 35 percent as much as the average lifetime benefits for holders of high school diplomas and no college. In present value, bachelor's degrees holders receive only 26 percent as much SSI as recipients of high school diplomas. In present value, each associate's degree reduces SSI payments by about $2,400 and each bachelor's degree reduces SSI by approximately $3,300.

Table 9
Estimated Lifetime Supplemental Security Income across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$9,386	$5,141	$3,330	$3,116	$1,724
Present Value	$4,433	$2,077	$1,137	$1,038	$677
Degree Premium - Sum		-$4,245	-$6,056	-$214	-$1,606
Degree Premium - PV		-$2,355	-$3,296	-$98	-$460

Present values are calculated using a 3 percent real interest rate.

Master's degrees, however, reduce the present value of SSI by only an additional $100, and professional and doctorate degrees reduce the present value of SSI payments by an additional $500.

[33] The relationship between college education and work disabilities is similar to the relationship between college education and heath. CPS data indicate that for those aged 27 and older, 24 percent of those with only a high school education report a disability or health problem that limits their ability to work, compared to 15 percent of those with a bachelor's degree as their highest qualification.

Unemployment Compensation

The incidence of unemployment decreases dramatically with college attainment. The unemployment rate in 2005 among those with a high school education and no college was 4.55 percent, while it was 3.21 percent for those with an associate's degree as their highest education qualification. The unemployment rate of those with a bachelor's degree and no advanced degree was 2.64 percent; for master's degrees holders, it was 2.03 percent; and for professional and doctorate degrees, it was 1.55 percent.[34] Thus, college attainment creates fiscal savings in unemployment insurance (UI). The relative magnitude of the fiscal savings is not as great as suggested by the differences in unemployment rates, however, because unemployment compensation is partially tied to pre-unemployment earnings, and earnings are clearly related to college attainment.

Table 10 reports average lifetime unemployment compensation across education categories. Corresponding estimates for each New England state (using data from 2003 – 2005, expressed in 2005 dollars) are reported in Appendix Tables 8 - 13.[35] [36] These estimates are derived under the assumption that no UI compensation is received while in college.

Table 10
Estimated Lifetime Unemployment Compensation across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$6,689	$6,690	$4,846	$3,508	$880
Present Value	$3,443	$3,355	$2,262	$1,616	$417
Degree Premium - Sum		$1	-$1,842	-$1,338	-$3,967
Degree Premium - PV		-$88	-$1,182	-$646	-$1,845

Present values are calculated using a 3 percent real interest rate.

[34] These unemployment rates across education categories are calculated for those within the ages of 27 and 79 using the CPS Historic Earner Study (formerly known as the Outgoing Rotation Groups).
[35] To keep things simple, the fact that some unemployment compensation is paid by the federal government is ignored. In most years the federal proportion is relatively small.
[36] Unemployment taxes are ignored in the calculations because employers bear the statutory liability. However, the real incidence of the tax may fall on employees to some extent.

Given the underlying simplifying assumption that degrees are earned by traditional full-time students, it would be inconsistent to assume that some students receive unemployment benefits by actively seeking employment after losing a job while in college. Unlike the fiscal degree premia in SSI, the estimated fiscal degree premia in UI is small for associate's degrees, but relatively large for advanced degrees. The present value of average lifetime UI compensation for those with bachelor's degrees as their highest education qualification is 66 percent as much as that for those with high school as their highest qualification. The present value of average UI compensation for those with professional and doctorate degrees is 12 percent as much as that for those with high school diplomas only. The present value of the lifetime fiscal premium in UI is almost $1,200 per bachelor's degree and more than $1,800 per professional and doctorate degree.

Worker's Compensation

Fiscal savings from college attainment are also seen in worker's-compensation programs. In many states, however, worker's compensation is an off-budget item. That is, some states operate worker's compensation through private insurance companies dealing directly with employers. The effects, however, are the same whether on- or off-budget. Thus, this study treats worker's compensation as an implicit fiscal item in all states.

Average lifetime worker's compensation across education categories is reported in Table 11 and estimates for each New England state are in Appendix Tables 8 - 13. These estimates are derived under the same assumption as for UI compensation; that is, no worker's compensation is received while in college (it would be inconsistent to assume that some traditional full-time students qualify for worker's compensation while in college).

Table 11
Estimated Lifetime Worker's Compensation across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Sum	$4,226	$3,472	$2,591	$2,654	$781
Present Value	$1,671	$1,527	$1,073	$997	$300
Degree Premium - Sum		-$754	-$1,635	$63	-$1,810
Degree Premium - PV		-$144	-$599	-$76	-$772

Present values are calculated using a 3 percent real interest rate.

The estimated fiscal degree premia in worker's compensation are relatively the largest for bachelor's degrees and professional and doctorate degrees. The present value of the lifetime fiscal premium in worker's compensation is about $600 per bachelor's degree, and almost $800 per professional and doctorate degree.

Corrections

Combining data from the Bureau of Justice Statistics' *Prisoners in 2005* (Harrison and Beck, 2006b), the Census Bureau's *State and Local Government Finances: 2004-05*, and the Office of Management and Budget's *Budget of the United States Government* (Table 3.2), indicates that average correctional expenditure per inmate was $29,877 in fiscal year 2005.[37] Cost per federal prisoner was $35,203 and cost per state and local prisoner was $29,538.[38] A Bureau of Justice Statistics report (Harlow, 2003) using 1996 and 1997 data indicates that 0.115 percent of the adult population with a bachelor's degree or higher was incarcerated in federal, state, and local prisons and jails. Among those with some college experience or with associate's degrees, the incarceration proportion was 0.317 percent. For those with a high school diploma, the proportion was 1.191 percent, which is 10.4 times higher than the

[37] This cost per prisoner is calculated using all corrections costs, including probation. Thus, the resulting estimates of fiscal premia are for corrections costs rather than just prison costs. This interpretation imposes the implicit assumption that the probabilities of being on probation are roughly proportional to the probabilities of being incarcerated.
[38] Persons held in juvenile facilities were last estimated for fiscal year 2004. All persons in juvenile facilities are assumed to be under state and local jurisdiction.

proportion for bachelor's graduates. Thus, the differential in corrections costs is $321 annually per bachelor's degree [$29,877 × (0.0191 – 0.0115)].[39]

Table 12 reports estimates of average lifetime corrections cost across education categories. These estimates are derived under the same assumptions as for public-assistance programs. The estimates for associate's degrees use the incarceration probability for some college and associate's degrees, which should understate its estimated fiscal premium somewhat (presumably, holders of associate's degrees have a lower probability of being in prison than those with some college, but no degree). Estimates for bachelor's and advanced degrees are lumped together. Given the magnitude of the average incarceration cost for this group, this probably makes little difference.

Estimates for the New England states are shown in Appendix Tables 8 - 13. Because the data do not allow estimation of college differentials in incarceration rates for individual states, the individual-state estimates are derived by applying state-specific per-inmate costs[40] to national-average differentials in incarceration rates.[41] Unlike most of the other fiscal effects which accrue more at the federal level, the large majority of the fiscal benefits from college education accrue to state and local governments. Direct federal corrections expenditure is only 9.0 percent of the national total in 2005.

The estimates of the fiscal premia in Table 12 and Appendix Tables 8 – 13 err to the conservative to the extent that inmates with more education are less expensive to imprison. Among those in prison, those with at least some college experience are less likely to be there for violent crime. Thus, college-educated

[39] Moreover, prisoners (and homeless persons) are not included in the CPS. Sample selection in the CPS is not entirely independent of college attainment. Thus, the average high school graduate pays disproportionately less tax revenues than shown earlier. As a result, the preceding estimates of fiscal premia in tax revenues are understated to the extent that the CPS sample is not completely random with respect to college education.

[40] Estimates of incarceration cost per inmate for individual states in 2005 are derived using data from the Bureau of Justice Statistics' *Prison and Jail Inmates at Midyear 2005* (Harrison and Beck, 2006a), Office of Justice Programs' *Juvenile Offenders and Victims: 2006 National Report* (Snyder and Sickmund, 2006), and the Census Bureau's *State and Local Government Finances: 2004-05.*

[41] Adult population proportions in state and local prisons and jails (i.e., not in federal prisons) are 1.122 percent, 0.289 percent, and 0.098 percent for high school diploma, college below a bachelor's degree, and bachelor's degree or higher, respectively.

prisoners are probably somewhat less expensive. In addition, college educated prisoners are probably healthier, and hence create less prison healthcare costs (according to Stephan, 2004, the costs of inmate medical care are 12 percent of total operating cost of prisons).

Table 12
Estimated Lifetime Corrections Costs across Education Categories

	High School	Associate's Degree	Bachelor's Degree or More
Sum	$21,702	$6,166	$2,697
Present Value	$10,202	$3,102	$1,576
Degree Premium - Sum		-$15,536	-$19,004
Degree Premium - PV		-$7,100	-$8,626

Present values are calculated using a 3 percent real interest rate.

On the other hand, the issue of causation may be more problematic for corrections than for the other college differentials. That is, those in prison may be disproportionately less educated because they were incarcerated and/or the underlying reasons for imprisonment and low education are the same. Most of those in prison started there at college age or younger. Lochner and Moretti (2004), however, present convincing evidence that the effect of education on the incidence of incarceration (and criminal behavior) is indeed causal. Moreover, Harlow (2003) reports that many prisoners take advantage of college and vocational courses offered in prisons, so it is possible that the simple correlation between education attainment and incarceration understates the causal effect.

Public health care

In addition to Medicaid, being negatively correlated with college attainment, the lack of any health insurance is also negatively correlated with college attainment. Moreover, the uninsured impose significant costs on governments, although it is difficult, if not impossible, to identify these costs in government finance data. The fiscal costs created by the uninsured are implicitly small fractions of various spending categories (Medicare, Medicaid, hospitals, public health, etc.). Hadley and Holahan

(2003), however, provide an estimate of the governmental costs of the uninsured. They estimate the total government cost per uninsured to be just under $750 per uninsured (in 2001 dollars). In 2005 dollars (using the Consumer Price Index), this is $823 per uninsured. The cost to the federal government is roughly $535 per uninsured and the cost to state and local governments is about $288 per uninsured. Given that healthcare costs have generally risen faster than inflation, these estimates are probably on the conservative side.

The incidence of uninsurance across education categories can be computed using CPS data. These estimates are reported in Table 13. Among those 27 and older in 2005, 16.8 percent of high school graduates with no college reported having no health insurance, more than double the fraction of those with bachelor's degrees without advanced degree. Table 13 also reports estimates of the college premia in public health care costs from the lack of health insurance by assuming a constant average cost of $823 per uninsured. However, given the positive relationship between college attainment and health, these estimates of the fiscal effects of college education are particularly conservative.[42] That is, the estimates do not take into account that it is likely that the cost per uninsured is decreasing in college attainment. Otherwise, the estimates in Table 13 are calculated using the same assumptions about the timing of these costs over the life cycle as for public-assistance programs. Corresponding estimates for each New England state are shown in Appendix Tables 8 - 13. Unfortunately, in the absence of estimates for individual state estimates, the national-average state and local cost of $288 per uninsured must be assumed for all states.

As with most public-assistance programs, most of the estimated fiscal impact on public health care occurs for undergraduate degrees. The results in Table 13 reveal that estimated average lifetime public-healthcare cost for holders of associate's degrees is 60 percent as much as the average for holders of high school diplomas

[42] Among the uninsured aged 27 and older, 52 percent of those with only a high school education report their health to be very good or excellent, compared to 65 percent for those with a bachelor's degree as their highest qualification.

Table 13
Uninsurance Rates and Estimated Lifetime Public-Healthcare Costs across Education Categories

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Uninsured Percentage	16.8%	10.5%	8.3%	5.0%	5.7%
Public Healthcare Costs					
Sum	$9,220	$5,488	$4,548	$3,255	$3,715
Present Value	$5,811	$3,539	$2,892	$2,229	$2,536
Degree Premium - Sum		-$3,733	-$4,673	-$1,293	-$833
Degree Premium - PV		-$2,272	-$2,918	-$664	-$357

Uninsured percentages are for population age 27 and older. Present values are calculated using a 3 percent real interest rate.

and no college. The average for bachelor's degrees is 49 percent as much for high school diplomas. In present value, each associate's degree reduces public health care cost by almost $2,300 and each bachelor's degree reduces it by more than $2,900.

V. Public cost per degree

Government spending on college education

Government spending on higher education is taken from Table 3.16 of the National Income and Product Accounts (NIPA). Arguably better data for state and local appropriations for higher education are available from the State Higher Education Executive Officers' *State Higher Education Finance* (SHEF) project. Moreover, most total government spending on higher education is at the state and local level.[43] Nonetheless, this study relies on the NIPA data for two reasons. First, the NIPA data include federal spending on higher education and use a consistent methodology to measure both federal and state and local spending on higher education. Second, the NIPA measure of state and local government spending on higher education is 15.9 percent greater than the SHEF measure, thus producing a more generous estimate of the public cost per degree and a more conservative estimate of the fiscal rate of return.

[43] The NIPA data for calendar years 2002 - 2005 indicate that the federal share is about 19 percent.

The main reason for the discrepancy between the NIPA and SHEF measures of states and local funding for higher education is that the NIPA measure implicitly includes expenditures financed through revenues from public college endowments. The SHEF measure only includes state and local government appropriations for higher education. In terms of tax appropriations, the NIPA measure overstates the fiscal cost of college degrees (evidently, by about 16 percent). Rather than evaluate the relative merits of the different underlying concepts of public opportunity cost, this study simply chooses the more generous measure (i.e., a more conservative measure in showing the fiscal return).[44]

The NIPA (as well as the SHEF) measure of the fiscal cost of college degrees is certainly generous in that it includes the costs of university research and service activities. Given that this study only attempts to quantify the fiscal payoffs from college attainment (rather than the fiscal payoffs from the higher education sector), the costs of research and service should be not be included. Data from the National Center for Education Statistics for academic year 2001 (the latest available) indicate that research and service accounted for 19.3 percent of total educational and general expenditure. Unfortunately, the percentages for individual states are not available.

On the other hand, the NIPA data are for current expenditures only. The NIPA does not separate capital expenditures in higher education from primary and secondary education. Data from the Census Bureau's *State and Local Government Finances* for fiscal years 2002 through 2005 on public higher education expenditures indicate that at the state and local level, capital outlays are 13.5 percent as large as operating expenditures. Thus, taking the opposing effects of the inclusion of research and service costs and the exclusion of capital costs into account suggests that the measure of government spending on higher education is overstated by roughly 5.8 percent.

Because the NIPA data on government funding for higher education are not available for individual states, when examining individual states, this study uses data

[44] One could reasonably argue that expenditures financed from publicly owned endowments are public contributions. One could also argue that many of these endowments are established through private donations.

from the Census Bureau's *State and Local Government Finances* (SLGF). To be more specific, this study uses its state and local government expenditure on higher education less capital outlay on higher education and net of state and local government current charges in higher education (i.e., tuition, fees, revenues from auxiliary activities, etc.). Conceptually, these data should then be about the same as the NIPA data. Indeed, in fiscal years 2002 through 2005, the SLGF national measure differs from the NIPA measure of national state and local government spending on higher education by -1.57 percent.[45]

Government cost per degree

Data on college degrees for each state are calculated from the National Center for Education Statistics' *Integrated Postsecondary Education Data System*.[46] Although most public funding for higher education is clearly directed toward students in public institutions, significant funding, particularly federal funding, also goes to students in private higher education. Unfortunately, the government cost data cannot be separated into the amounts going to students in public colleges and to students in private colleges. Thus, to err on the conservative side, this study compares public funding for higher education to degrees granted from public institutions only. This imposes the implicit assumption that financial aid to students in private colleges does not lead to any additional college attainment. Results are also presented when comparing government cost to all degrees, both public and private, but these are not generally emphasized.

Calculating cost per degree is also problematic because higher education costs are not assigned by degree level. Moreover, degrees are not earned within a fiscal year. The latter problem is not particularly troublesome, however, since the multi-year nature of degrees should be adequately taken into account by averaging government spending on higher education over the relevant preceding years. This

[45] NIPA calendar-year data are matched to SLGF fiscal-year (ending 6/30) data by averaging the appropriate calendar years' data.

[46] Graduates from U.S. military colleges not counted in the individual states, but are included in the national totals, as are graduates from colleges in Washington, DC.

study matches degrees awarded in academic year 2005 to average government funding for higher education in the preceding four fiscal years, 2002 through 2005 (thus putting the emphasis on four-year rather than two-year degrees).

To deal with the former problem, instead of trying to assign separate costs to the different degree levels, this study makes the simple assumption that each year of college creates the same fiscal cost. As discussed below, this is somewhat conservative in showing the fiscal return to public investment in college students. It is also again assumed that associate's and master's degrees take two additional years of education, while bachelor's, professional, and doctorate degrees average four additional years of education. Associate's and master's degrees thus count as half of a four-year degree. Table 14 shows the resulting estimates of federal, state and local, and total government costs per four-year-equivalent degree from public institutions only and from all institutions. Appendix Tables 14 - 19 show the estimated state and local government costs per degree in the New England states.

Table 14
Estimated Government Cost per Four-Year-Equivalent Degree

	Federal	State & Local	Total
Public Degrees Only			
Sum	$14,007	$60,566	$74,573
Present Value	$13,407	$57,971	$71,378
All Degrees			
Sum	$9,008	$38,948	$47,955
Present Value	$8,622	$37,279	$45,901

Present values are calculated using a 3 percent real interest rate.

Given that these degrees are assumed to take four years of government funding, these tables also report the estimated costs per degree in terms of present discounted value at the beginning of college (or at the beginning of graduate school, in the case of advanced degrees).

The relative importance of the separate degree levels is taken into account by weighting the corresponding fiscal effects. That is, the fiscal weights for the college

premia at each degree level are their proportions of total four-year-equivalent degrees (from public institutions). If, for example, bachelor's degrees are half of all four-year-equivalent degrees awarded in a particular state, then the estimates of the fiscal consequences of bachelor's degrees in that state receive a 50 percent weight in estimating the total fiscal consequences of public investment in higher education.[47]

The above framework does not account for the fact that the fiscal cost of each year of college education is clearly increasing with the level of college education. The yearly fiscal cost (at the state level) of a doctorate degree is clearly greater than for an associate's degree. Not accounting for this is conservative in showing the fiscal return to public investment in college education because this then puts disproportionate fiscal weight on the lowest degree levels and too little weight on highest level of degrees, and the largest fiscal impact per degree year is for professional and doctorate degrees, followed by bachelor's degrees. If the increasing fiscal cost with degree levels were taken into account, greater fiscal weight would be placed on the degrees with the highest fiscal return per degree year.

VI. Average fiscal rate of return

Total Fiscal Effects

Applying the fiscal weights just discussed to the fiscal premia for each degree estimated earlier yields the estimated fiscal impacts per four-year-equivalent degree. These are reported in Table 15. This table shows, for all levels of government, the weighted averages of the various fiscal effects presented in Sections III - V. Table 16 reports these weighted-average effects of college attainment accruing at the federal government level and Table 17 shows these weighted-average effects of college education accruing to state and local governments. Appendix Tables 14 – 19 show the estimated state and local government effects per four-year-equivalent degree in

[47] Specifically, the fiscal weights nationally are 19.7 percent for associate's degrees, 65.3 percent for bachelor's degrees. 10.2 percent for master's degrees, and 4.7 percent for professional and doctorate degrees. The proportions for all degrees (not just those from public institutions) are, respectively, 16.0, 64.7, 12.9, and 6.4 percent.

the New England states.[48] As discussed earlier, the state-level fiscal effects in Table 17 and Appendix Tables 14 – 19 are reduced by 6.6 percent to account for interstate migration of college graduates.[49]

Table 15 shows that the largest fiscal payoff is clearly in the additional tax revenues from the higher incomes associated with college education. Indeed, 85 percent of the $556,000 estimated cumulative fiscal effect over the lifetime of a four-year equivalent degree is from additional tax revenues. In terms of present value using a 3 percent real discount rate, the additional tax revenues are 78 percent of the $253,000 total fiscal effect per degree. Although the effects of college attainment on the various government expenditures are small relative to the effects on tax revenues, they are not small relative to government expenditure on higher education. Indeed, the $84,700 sum of expenditure savings over a lifetime exceeds the government cost of $74,500 reported in Table 14. The net public cost of higher using a 3 percent real discount rate, however, the total expenditure savings are less than the government investment per four-year equivalent degree from public institutions.

Moreover, it should be kept in mind that these fiscal effects are estimated under numerous conservative consumptions. These estimates understate the fiscal effects for several reasons. The estimates ignore all fiscal benefits from college education that does not lead to a degree. Reductions in mortality rates associated with higher education are also ignored, as are all intergenerational effects. Savings in the administration of the various expenditure programs are not included. Some welfare programs are not included in the calculations.

[48] To be consistent with this study's measure of cost per degree, Tables 15 -17 and Appendix Tables 14 -19 show the present values of the fiscal premia for the graduate degrees relative to the assumed beginning of graduate school (i.e., the present values at age 23).

[49] This number is the sum of the estimated net migration rates from Trostel (2007) (3.4 percent for associate's degrees, 7.1 percent for bachelor's degrees, 7.9 percent for master's degrees, and 9.6 percent for professional and doctorate degrees) times their respective weights (19.7 percent, 65.3 percent, 10.2 percent, and 4.7 percent). This number varies slightly in Appendix Tables 14 – 19 because states have different proportions of degrees.

Table 15
Estimated Lifetime Total Fiscal Effects per Four-Year-Equivalent Degree

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
State and Local Taxes			$118,019	$47,144
Federal Income Taxes			$237,819	$100,569
Federal Payroll Taxes			$115,442	$49,528
Welfare	-$10,218	-$6,544		
Medicaid	-$20,763	-$12,021		
Social Security and Medicare	-$18,622	-$19,867		
Supplemental Security Income	-$5,749	-$3,129		
Unemployment Compensation	-$1,665	-$1,054		
Worker's Compensation	-$1,438	-$506		
Corrections	-$21,385	-$9,726		
Public Healthcare	-$4,828	-$2,974		
Totals	-$84,668	-$55,819	$471,281	$197,240

Internal Rate of Return (public degrees only) = 10.3%

Internal Rate of Return (all degrees) = 13.7%

Present values are calculated using a 3 percent real interest rate.

Table 16
Estimated Lifetime Federal Fiscal Effects per Four-Year-Equivalent Degree

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Income Taxes			$237,819	$100,569
Payroll Taxes			$115,442	$49,528
Welfare	-$8,018	-$5,135		
Medicaid	-$12,442	-$7,203		
Medicare	-$9,518	-$10,619		
Social Security	-$9,104	-$9,248		
Supplemental Security Income	-$5,749	-$3,129		
Corrections	-$1,925	-$876		
Public Healthcare	-$3,139	-$1,933		
Totals	-$49,895	-$38,142	$353,262	$150,097

Internal Rate of Return (public degrees only) = 24.8%

Internal Rate of Return (all degrees) = 29.7%

Present values are calculated using a 3 percent real interest rate.

And only the direct fiscal effects from college attainment are captured (as opposed to potential indirect effects from higher education in general, through innovation, job creation, and growth). In addition, the estimates of government cost per degree are very generous. Public costs of college education in private colleges are included, even though those degrees are ignored. Expenditures financed from public college endowment revenues are included, as are expenditures on university research and service activities. Also, the assumption that all years of college impose the same public cost causes too little weight to be placed on the fiscal benefits from degrees (professional and doctorate), which have the largest fiscal effects.

Table 17
Estimated Lifetime State and Local Fiscal Effects per Four-Year-Equivalent Degree

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Income Taxes			$48,741	$20,699
Property Taxes			$35,439	$12,842
Sales Taxes			$25,357	$9,872
Welfare	-$2,073	-$1,331		
Medicaid	-$7,814	-$4,534		
Unemployment Compensation	-$1,552	-$988		
Worker's Compensation	-$1,350	-$476		
Corrections	-$18,322	-$8,351		
Public Healthcare	-$1,593	-$983		
Totals	-$32,704	-$16,663	$109,536	$43,413

Internal Rate of Return (public degrees only) = 3.1%

Internal Rate of Return (all degrees) = 5.1%

Post-college fiscal effects are reduced by 6.6 percent to account for interstate emigration of graduates. Present values are calculated using a 3 percent real interest rate.

On the other hand, two reasons should be kept in mind that might make these fiscal effects not so conservative. The estimates for the effects on Social Security and Medicare spending, which are fairly large relative to the other programs, are particularly uncertain. And the estimates are for traditional college students. The fiscal returns will be less for older college graduates.

The results in Table 15 suggest that the largest fiscal benefits accrue in federal programs. Moreover, the government cost is concentrated at the state and local level. Thus, the fiscal return on investment in college education is much higher

at federal level than at the state level. Tables 16 and 17 show the magnitude of the difference. Comparing Table 16 to Table 15 reveals that 72.5 percent of the total fiscal premium accrues at the federal level.[50] In present value, 74.4 percent of the total fiscal premium is federal, while the federal government picks up only 18.8 percent of the estimated total public cost. In total undiscounted lifetime effects, the federal fiscal benefit of $403,000 per degree is almost 29 times greater than the federal cost of $14,000 per public-college degree and almost 45 times greater than the federal cost for all degrees, public and private.

As seen in Table 17, the average fiscal impact at the state level is not nearly as dramatic, although the net lifetime impact of state and local government investment in college students is still positive. Appendix Tables 14 – 19 report the estimated lifetime fiscal effects per college degree in each New England state. In total undiscounted lifetime effects, the state and local fiscal benefits of $142,000 are 2.35 times greater than the state and local cost of $60,500 per degree from public colleges, and 3.65 times greater than the state and local cost per degree from all institutions. Again, it should be kept in mind that these fiscal effects are conservatively estimated.

Fiscal rates of return

In addition to presenting the estimates of the various weighted fiscal effects of college attainment, the bottom of Tables 15 - 17 and Appendix Tables 14 – 19 reports estimates of the real average fiscal internal rate of return implied by the cumulative fiscal effects shown in these tables, along with the fiscal costs shown in Table 14 (at the top of Appendix Tables 14 - 19). That is, these tables show the real (i.e., above inflation) average rate of return to government investments in college students. The internal rate of return estimates in Table 17 and Appendix Tables 14 – 19 take into account average net interstate migration of college graduates.

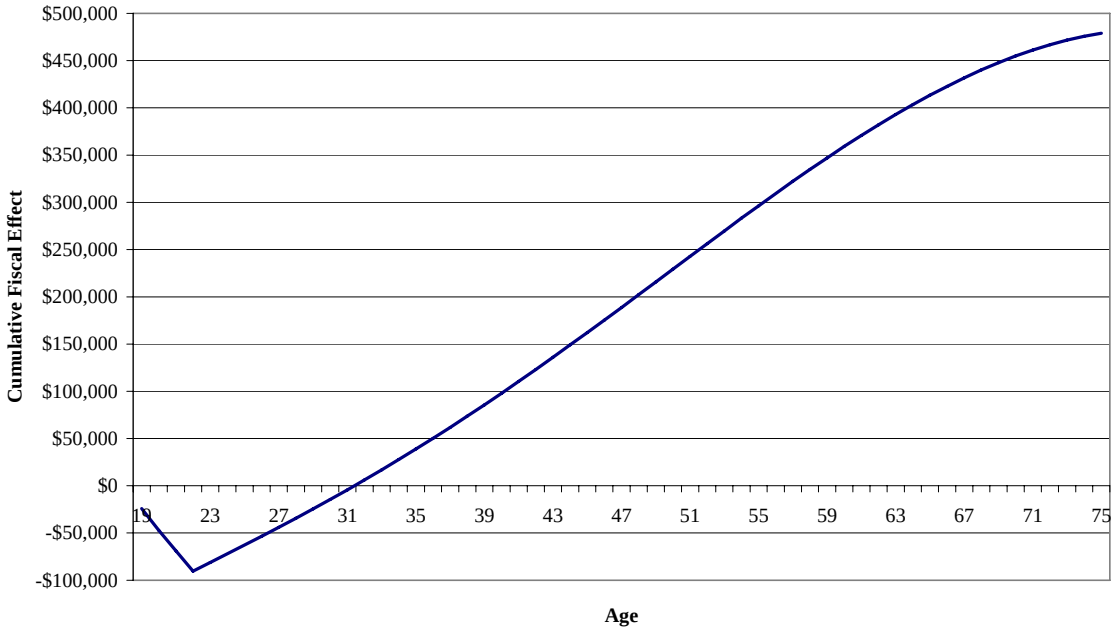
[50] The numbers reported in Tables 16 and 17 do not sum to the totals reported in Table 15 because of the adjustment made for net migration of college graduates.

The estimated overall average fiscal rate of return is, conservatively, 10.3 percent. If degrees from private institutions are included in the public cost per degree, the government rate of return is 13.7 percent. At the individual state level, the average internal rate of return is estimated to be 3.1 percent (5.1 percent when including private degrees). Without the adjustment for interstate migration of college graduates, the average state rate of return per public degree is 3.5 percent (5.5 percent when including degrees from private colleges).

The time required to recoup the public investment in college students is remarkably short. Actually, given the high fiscal payoffs to college attainment shown earlier, perhaps this is to be expected. For all levels of government combined, the public investment is recovered in less than 9.5 years after four-year-equivalent graduation. Public investment in a traditional college student is fully recovered just after age 31. At the state level, however, it takes more than 24 years (age 46) to recover the state and local investment (after taking net migration of college graduates into account).

Figure 4 illustrates the time path of the total fiscal effects per four-year equivalent degree begun at age 19 and completed at age 23. The government investment per degree reaches $90,000 at college graduation (government spending per degree plus the reduced tax revenues while in college). That investment is recovered at age 31.5. The cumulative total fiscal premium per four year-equivalent degree reaches $100,000 at age 40, $200,000 at age 48, $300,000 at age 55, etc.

Figure 4
Cumulative Fiscal Effect per Four-Year Equivalent Degree



VII. Conclusion

College education clearly creates substantial fiscal benefits. This study has quantified these fiscal effects of college attainment more thoroughly than in the limited previous literature. It quantifies more fiscal effects using a more systematic methodology and better data. It also carefully accounts for the timing of the fiscal benefits. Fiscal effects accruing to state and local governments are separated from those accruing to the federal government. Unlike in previous work, this study estimates the separate fiscal effects from different types of college degrees, as well as their overall weighted average. The fiscal cost per degree is also quantified, which allows a fiscal rate of return to be calculated.

Consistent with the previous literature, public support for higher education appears to be a sound use of tax dollars. Although all of the fiscal effects of college education cannot be estimated with great precision due to numerous complicating factors, the return on public investment is evidently substantial. The average fiscal rate of return appears to be at least 10 percent above the rate of inflation). Moreover, this estimate is quite conservative, for numerous reasons. In sum, it is difficult to

imagine another type of investment that can systematically match this average return to public investment in higher education.

Furthermore, the 10-percent estimate measures only the direct fiscal return from college attainment. It does not include the indirect effects on tax revenues and government expenditures through higher education's effect on economic growth. The estimated fiscal return also does not include any benefits from publicly sponsored university research, from university public service and extension activities, or from the effect of public colleges and college education on entrepreneurial activity and job creation. Nor does the return quantified in this study include the value of various other social benefits, such as knowledge creation and dissemination, lower crime, higher civic participation, etc. In addition, the 10-percent estimate is the average rate of return. The marginal fiscal payoff to public support for higher education targeted at those on the margin of college attendance is probably considerably higher.

References

Autor, D. H., Katz, L. F., & Kearney, M.S. (2005). Trends in U.S. wage inequality: Re-assessing the revisionists. National Bureau of Economic Research Working Paper No. 11627.

Barrow, L., & Rouse, C. (2005). Does college still pay? *Economists' Voice*, *2(*4), 3.

Baum, S., & Payea, K. (2004). *Education pays: The benefits of higher education for individuals and society*. Washington, DC: College Board.

Belfield, C. R., Nores, M., Barnett, S., & Schweinhart, L. (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age-40 followup. *Journal of Human Resources*, *41*(1), 162-90.

Bound, J., & Turner, S. (2006). Cohort crowding: How resources affect collegiate attainment. National Bureau of Economic Research Working Paper No. 12424.

Brady, H., Hout, M., & Stiles, J. (2005). *Return on investment: Educational choices and demographic change in California's future*. Berkeley, CA: Survey Research Center.

Card, D. (1999). The causal effect of education on earnings. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 3A). Amsterdam: Elsevier Science.

Card, D., & Lemieux, T. (2001). Can falling supply explain the rising return to college for younger men? A cohort-based analysis. *Quarterly Journal of Economics*, *116*(2), 705-46.

Chevalier, A., & Feinstein, L. (2006). Sheepskin or Prozac: The causal effect of education on mental health. Center for the Economics of Education working paper.

Currie, J. (2001). Early childhood education programs. *Journal of Economic Perspectives*, *15*(2), 213-38.

Cutler, D. M., & Lleras-Muney, A. (2006). Education and health: Evaluating theories and evidence. National Bureau of Economic Research Working Paper No. 12352.

Fernandez, R., & Rogerson, R. (1995). On the political economy of education subsidies. *Review of Economics Studies*, *62*(2), 249-62.

Freeman, R. (1976). *The overeducated American*. New York: Academic Press.

Fortin, N. M. (2006). Higher-education policies and the college wage premium: Cross-state evidence from the 1990s. *American Economic Review*, *96*(4), 959-87.

Goldhaber, D., & Player, D. (2003). *Analytical framework for assessing the potential return on a federal investment in the Alliance for Excellent Education's* Every child a graduate. Washington, DC: Alliance for Excellent Education.

Groot, W., & Maassen van den Brink, H. (2004). The health effects of education: survey and meta-analysis. Unpublished manuscript.

Hadley, J., & Holahan, J. (2003). How much medical care do the uninsured use, and who pays for it? *Health Affairs* - Web Exclusive, 12 February.

Hansen, W. L., & Weisbrod, B. A. (1969). *Benefits, costs and finance of public higher education*. Chicago, IL: Markham.

Harlow, C. W. (2003). *Education and corrections populations*. Washigton, DC: Bureau of Justice Statistics.

Harmon, C., Oosterbeek, H., & Walker, I. (2003). The returns to education: Microeconomics. *Journal of Economic Surveys*, *17*(2), 115-56.

Harrison, P. M., & Beck, A. J. (2006a). *Prison and jail inmates at midyear 2005*. Washington, DC: Bureau of Justice Statistics.

Harrison, P. M., & Beck, A. J. (2006b). *Prisoners in 2005*. Washigton, DC: Bureau of Justice Statistics.

Haveman, R. H., & Wolfe, B. L. (1984). Schooling and economic well-being: The role of nonmarket effects. *Journal of Human Resources, 19*(3), 377-407.

Haveman, R., & Wolfe, B. (1995). The determinants of children's attainments: A review of methods and findings. *Journal of Economic Literature*, *33*(4), 1829-78.

Heckman, J. J., & Masterov, D. V. (2004). The productivity argument for investing in young children. Invest in Kids Working Group Working Paper No. 5.

Hovey, H. A. (1999). *State spending for higher education in the next decade: The battle to sustain current support*. Washington, DC: National Center for Public Policy and Higher Education.

Institute for Higher Education Policy. (2005). *The investment payoff: A 50-state analysis of the private and public benefits of higher education*. Washington, DC: Author.

Juhn, C., Kim, D. I., & Vella, F. (2005). The expansion of college education in the United States: Is there evidence of declining cohort quality? *Economic Inquiry*, *43*(2), 303-15.

Kaiser Commission on Medicaid and the Uninsured. (2004). *Medicaid facts*. Washington, DC: Author.

Kane, T. J., Orszag, P. R., & Apostolov, E. (2005). Higher education appropriations and public universities: Role of Medicaid and the business cycle. *Brookings-Wharton Papers on Urban Affairs*, 99-146.

Katz, L. F., & Autor, D. H. (1999). Changes in the wage structure and earnings inequality. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 3A). Amsterdam: Elsevier Science.

Krop, R. A. (1998). *The social returns to increased investment in education: Measuring the effect of education on the cost of social programs*. Santa Monica, CA: Rand.

Levin, H., Belfield, C., Muennig, P., & Rouse, C. (2007). *The costs and benefits of an excellent education for all of America's children*. New York, NY: Center for Benefit-Cost Studies of Education.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *Review of Economic Studies, 72*(1), 189-211.

Lochner, L., & Moretti, E. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports" *American Economic Review*, 2004.

Longanecker, D. (2006). A tale of two pities. *Change*, *38*(1), 14.

Lynch, R. G. (2004) *Exceptional Returns: Economic, fiscal, and social benefits of investment in early childhood development*. Washington, DC: Economic Policy Institute.

McIntyre, R. S., Denk, R., Francis, N., Gardner, M., Gomaa, W., Hsu, F., & Sims, R. (2003). *Who pays? A distributional analysis of the tax systems in all 50 states* (2nd Ed.). Washington, DC: Institute on Taxation and Economic Policy.

McMahon, W. (2004). The social and external benefits of education. in G Johnes & J Johnes, *International handbook on the economics of education*. Edward Elgar.

Mortenson, T. (1994). Federal income taxes paid by college educated workers 1970 to 1991. *Postsecondary Education Opportunity, 28*.

Mortenson, T. (2001). Individual economic welfare in the human capital economy 1973 to 2000. *Postsecondary Education Opportunity*, *114*.

Murphy, K. M., & Welch, F. (1990). Empirical age-earnings profiles. *Journal of Labor Economics*, *8*(2), 202-29.

O'Hara, A. (2004). New methods for simulating CPS taxes. U.S. Census Bureau Technical Paper.

Rizzo, M. (2004). The public interest in higher education" in Federal Reserve Bank of Cleveland, *Education and economic development*.

Snyder, H. N., & Sickmund, M. (2006). *Juvenile offenders and victims: 2006 national report*. Washington, DC: Office of Justice Programs.

Stephan, J. J. (2004). *State prison expenditures, 2001*. Washington, DC: Bureau of Justice Statistics.

Strathman, J. G. (1994). Migration, benefit spillovers and state support of higher education. *Urban Studies*, *31*(6), 913-20.

Topel, R. (2004). The private and social values of education" in Federal Reserve Bank of Cleveland, *Education and economic development*.

Trostel, P. A. (1997). The incentive effects of tax and educational policies. *Policy Options*, 54-7.

Trostel, P. A. (2003). The long-term economic effects of declining state support for higher education: Are states shooting themselves in the foot? Wisconsin Center for the Advancement of Postsecondary Education.

Trostel, P. A. (2007). The impact of new college graduates on intrastate labor markets. Wisconsin Center for the Advancement of Secondary Education Working Paper No. 11.

Trostel, P. A., & Ronca, J. M. (2007). A simple unifying measure of state support for higher education. Wisconsin Center for the Advancement of Secondary Education Working Paper No. 7.

Wolfe, B. L., & Haveman, R. H. (2003). Social and nonmarket benefits from education in an advanced economy. in Y. Kodrzycki, *Education in the 21st Century: Meeting the Challenges of a Changing World*, 2003.

Vernez, G., Krop, R. A., & Rydell, C. P. (1999). *Closing the education gap: Benefits and costs*. Santa Monica, CA: Rand.

Appendix Table 1
Average Labor Earnings, Degree Premia, and Tax Revenue Differentials in 2003-05

	High School	Some College	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Connecticut						
Average Earnings	$28,330	$34,730	$40,015	$56,179	$67,364	$107,881
Degree Premium		$6,401	$11,685	$27,849	$11,185	$51,702
Tax Revenue Differential (11.6%)		$744	$1,358	$3,237	$1,300	$6,009
Massachusetts						
Average Earnings	$27,961	$32,006	$34,650	$54,233	$64,249	$95,883
Degree Premium		$4,045	$6,688	$26,272	$10,017	$41,650
Tax Revenue Differential (10.5%)		$425	$703	$2,761	$1,053	$4,377
Maine						
Average Earnings	$23,445	$26,803	$32,467	$40,751	$45,374	$88,867
Degree Premium		$3,358	$9,022	$17,306	$4,623	$48,116
Tax Revenue Differential (13.0%)		$438	$1,177	$2,257	$603	$6,275
New Hampshire						
Average Earnings	$29,418	$33,186	$37,237	$51,725	$65,089	$87,372
Degree Premium		$3,769	$7,819	$22,308	$13,364	$35,646
Tax Revenue Differential (8.9%)		$336	$697	$1,990	$1,192	$3,180
Rhode Island						
Average Earnings	$27,972	$31,566	$36,595	$48,147	$55,859	$109,166
Degree Premium		$3,594	$8,623	$20,175	$7,712	$61,020
Tax Revenue Differential (12.1%)		$433	$1,039	$2,431	$930	$7,354
Vermont						
Average Earnings	$28,218	$29,601	$31,452	$41,670	$49,888	$76,356
Degree Premium		$1,383	$3,233	$13,452	$8,218	$34,686
Tax Revenue Differential (12.9%)		$178	$417	$1,734	$1,059	$4,470

Appendix Table 2
Estimated Lifetime State and Local Taxes across Education Categories in Connecticut

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$38,900	$67,085	$125,052	$144,483	$236,118
Present Value	$18,046	$29,860	$55,358	$64,126	$96,367
Degree Premium - Sum		$28,185	$86,152	$19,432	$111,066
Degree Premium - PV		$11,814	$37,313	$8,767	$41,009
Property Taxes					
Sum	$128,354	$157,515	$207,979	$211,806	$169,515
Present Value	$56,639	$68,452	$83,252	$87,536	$64,628
Degree Premium - Sum		$29,161	$79,624	$3,827	-$38,463
Degree Premium - PV		$11,814	$26,614	$4,284	-$18,624
Sales Taxes					
Sum	$55,557	$64,890	$81,038	$85,455	$107,150
Present Value	$27,955	$32,096	$37,931	$38,975	$46,681
Degree Premium - Sum		$9,333	$25,481	$4,417	$26,112
Degree Premium - PV		$4,141	$9,976	$1,045	$8,751
Total State and Local Taxes					
Sum	$222,811	$289,490	$414,068	$441,744	$512,783
Present Value	$102,639	$130,409	$176,541	$190,637	$207,676
Degree Premium - Sum		$66,679	$191,257	$27,676	$98,715
Degree Premium - PV		$27,769	$73,902	$14,096	$31,135

Present values are calculated using a 3 percent real interest rate.

Appendix Table 3
Estimated Lifetime State and Local Taxes across Education Categories in Maine

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$43,880	$65,016	$132,239	$140,321	$179,764
Present Value	$21,416	$31,654	$56,954	$59,582	$74,897
Degree Premium - Sum		$21,136	$88,359	$8,082	$47,525
Degree Premium - PV		$10,239	$35,538	$2,628	$17,943
Property Taxes					
Sum	$100,744	$117,611	$101,210	$111,802	$93,709
Present Value	$44,300	$49,956	$41,649	$43,071	$35,476
Degree Premium - Sum		$16,867	$466	$10,592	-$7,502
Degree Premium - PV		$5,656	-$2,651	$1,421	-$6,174
Sales Taxes					
Sum	$49,240	$59,179	$72,150	$75,524	$87,924
Present Value	$25,482	$29,606	$34,086	$33,912	$40,606
Degree Premium - Sum		$9,939	$22,910	$3,374	$15,774
Degree Premium - PV		$4,123	$8,603	-$173	$6,521
Total State and Local Taxes					
Sum	$193,863	$241,806	$305,600	$327,647	$361,397
Present Value	$91,198	$111,216	$132,689	$136,565	$150,979
Degree Premium - Sum		$47,943	$111,736	$22,048	$55,798
Degree Premium - PV		$20,018	$41,490	$3,876	$18,290

Present values are calculated using a 3 percent real interest rate.

Appendix Table 4
Estimated Lifetime State and Local Taxes across Education Categories in Massachusetts

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$57,834	$80,933	$121,530	$181,703	$168,582
Present Value	$26,529	$37,677	$55,425	$69,603	$70,080
Degree Premium - Sum		$23,099	$63,695	$60,173	$47,053
Degree Premium - PV		$11,148	$28,896	$14,177	$14,655
Property Taxes					
Sum	$111,510	$119,437	$139,585	$135,894	$121,966
Present Value	$49,828	$50,608	$59,006	$53,568	$44,372
Degree Premium - Sum		$7,928	$28,076	-$3,691	-$17,619
Degree Premium - PV		$780	$9,178	-$5,438	-$14,634
Sales Taxes					
Sum	$40,067	$46,522	$61,695	$63,877	$76,474
Present Value	$20,449	$23,178	$28,737	$28,344	$31,831
Degree Premium - Sum		$6,455	$21,628	$2,182	$14,779
Degree Premium - PV		$2,729	$8,287	-$393	$3,094
Total State and Local Taxes					
Sum	$209,411	$246,892	$322,810	$381,475	$367,023
Present Value	$96,807	$111,463	$143,168	$151,515	$146,283
Degree Premium - Sum		$37,482	$113,400	$58,664	$44,213
Degree Premium - PV		$14,656	$46,361	$8,347	$3,115

Present values are calculated using a 3 percent real interest rate.

Appendix Table 5
Estimated Lifetime State and Local Taxes across Education Categories in New Hampshire

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$948	$1,423	$5,033	$3,862	$2,269
Present Value	$288	$427	$1,175	$1,334	$600
Degree Premium - Sum		$475	$4,085	-$1,171	-$2,764
Degree Premium - PV		$139	$887	$159	-$575
Property Taxes					
Sum	$109,947	$138,658	$154,117	$163,042	$188,604
Present Value	$49,630	$60,766	$64,654	$65,070	$75,671
Degree Premium - Sum		$28,712	$44,171	$8,925	$34,487
Degree Premium - PV		$11,136	$15,024	$416	$11,017
Sales Taxes					
Sum	$22,658	$26,959	$28,877	$29,608	$34,964
Present Value	$11,640	$12,940	$13,702	$14,011	$15,254
Degree Premium - Sum		$4,301	$6,219	$731	$6,087
Degree Premium - PV		$1,301	$2,062	$309	$1,552
Total State and Local Taxes					
Sum	$133,553	$167,040	$188,028	$196,513	$225,837
Present Value	$61,558	$74,134	$79,532	$80,416	$91,525
Degree Premium - Sum		$33,488	$54,475	$8,485	$37,810
Degree Premium - PV		$12,576	$17,973	$884	$11,993

Present values are calculated using a 3 percent real interest rate.

Appendix Table 6
Estimated Lifetime State and Local Taxes across Education Categories in Rhode Island

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$41,666	$85,686	$119,006	$155,267	$358,411
Present Value	$18,559	$34,137	$50,650	$61,714	$141,788
Degree Premium - Sum		$44,020	$77,340	$36,262	$239,406
Degree Premium - PV		$15,578	$32,091	$11,063	$91,138
Property Taxes					
Sum	$110,304	$113,193	$137,306	$174,473	$185,394
Present Value	$45,649	$46,638	$54,139	$65,637	$60,952
Degree Premium - Sum		$2,889	$27,002	$37,166	$48,088
Degree Premium - PV		$990	$8,491	$11,497	$6,812
Sales Taxes					
Sum	$56,529	$71,194	$79,385	$80,866	$114,216
Present Value	$29,084	$33,446	$37,106	$37,768	$46,496
Degree Premium - Sum		$14,665	$22,856	$1,481	$34,831
Degree Premium - PV		$4,362	$8,021	$662	$9,390
Total State and Local Taxes					
Sum	$208,499	$270,073	$335,697	$410,606	$658,022
Present Value	$93,292	$114,221	$141,896	$165,118	$249,236
Degree Premium - Sum		$61,574	$127,198	$74,909	$322,325
Degree Premium - PV		$20,929	$48,604	$23,222	$107,340

Present values are calculated using a 3 percent real interest rate.

Appendix Table 7
Estimated Lifetime State and Local Taxes across Education Categories in Vermont

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Income Taxes					
Sum	$44,469	$49,416	$86,437	$123,444	$192,555
Present Value	$19,141	$22,394	$37,850	$53,552	$80,526
Degree Premium - Sum		$4,947	$41,968	$37,007	$106,118
Degree Premium - PV		$3,253	$18,709	$15,702	$42,676
Property Taxes					
Sum	$113,264	$121,997	$134,198	$171,543	$160,611
Present Value	$52,912	$54,424	$54,313	$65,699	$62,388
Degree Premium - Sum		$8,733	$20,934	$37,346	$26,413
Degree Premium - PV		$1,513	$1,401	$11,387	$8,075
Sales Taxes					
Sum	$54,956	$65,306	$64,961	$78,915	$92,426
Present Value	$28,070	$30,877	$32,006	$36,579	$41,264
Degree Premium - Sum		$10,351	$10,005	$13,954	$27,466
Degree Premium - PV		$2,807	$3,936	$4,572	$9,258
Total State and Local Taxes					
Sum	$212,689	$236,719	$285,596	$373,902	$445,593
Present Value	$100,123	$107,696	$124,169	$155,830	$184,178
Degree Premium - Sum		$24,031	$72,907	$88,307	$159,997
Degree Premium - PV		$7,573	$24,046	$31,661	$60,009

Present values are calculated using a 3 percent real interest rate.

Appendix Table 8
Estimated Lifetime State and Local Expenditures across Education Categories in Connecticut

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$3,231	$2,197	$973	$529	$1,037
Present Value	$2,053	$1,070	$578	$373	$567
Degree Premium - Sum		-$1,034	-$2,258	-$445	$63
Degree Premium - PV		-$983	-$1,475	-$206	-$11
Medicaid					
Sum	$22,936	$8,079	$7,463	$5,675	$5,299
Present Value	$11,671	$3,971	$3,544	$2,836	$3,030
Degree Premium - Sum		-$14,857	-$15,473	-$1,788	-$2,164
Degree Premium - PV		-$7,700	-$8,127	-$709	-$515
Unemployment Compensation					
Sum	$12,663	$8,978	$9,261	$5,620	$8,547
Present Value	$6,383	$5,547	$4,470	$3,141	$4,923
Degree Premium - Sum		-$3,685	-$3,401	-$3,642	-$715
Degree Premium - PV		-$836	-$1,913	-$1,329	$453
Worker's Compensation					
Sum	$4,375	$1,051	$2,021	$1,928	$7,755
Present Value	$2,233	$462	$1,182	$1,051	$2,997
Degree Premium - Sum		-$3,324	-$2,354	-$93	$5,734
Degree Premium - PV		-$1,772	-$1,052	-$131	$1,815
Corrections*					
Sum	$20,620	$5,692	$2,378 **		
Present Value	$9,693	$2,871	$1,413		
Degree Premium - Sum		-$14,928	-$18,242		
Degree Premium - PV		-$6,822	-$8,280		
Public Healthcare*					
Sum	$2,598	$1,694	$1,413	$1,216	$1,195
Present Value	$1,689	$1,096	$970	$814	$922
Degree Premium - Sum		-$904	-$1,185	-$197	-$218
Degree Premium - PV		-$592	-$718	-$156	-$48
Total State and Local Expenditures					
Sum	$66,423	$27,691	$23,510	$14,967	$23,832
Present Value	$33,722	$15,018	$12,158	$8,215	$12,439
Degree Premium - Sum		-$38,732	-$42,913	-$8,542	$323
Degree Premium - PV		-$18,704	-$21,564	-$3,943	$281

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 9
Estimated Lifetime State and Local Expenditures across Education Categories in Maine

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$10,913	$5,827	$2,588	$822	$608
Present Value	$6,566	$2,774	$1,348	$503	$384
Degree Premium - Sum		-$5,086	-$8,325	-$1,766	-$1,980
Degree Premium - PV		-$3,792	-$5,218	-$844	-$964
Medicaid					
Sum	$28,674	$21,893	$11,771	$8,328	$7,374
Present Value	$17,289	$11,896	$6,461	$3,888	$4,617
Degree Premium - Sum		-$6,781	-$16,902	-$3,443	-$4,398
Degree Premium - PV		-$5,393	-$10,828	-$2,573	-$1,844
Unemployment Compensation					
Sum	$9,146	$2,171	$2,674	$3,985	$3,667
Present Value	$5,090	$1,031	$1,378	$2,194	$2,907
Degree Premium - Sum		-$6,975	-$6,471	$1,311	$993
Degree Premium - PV		-$4,059	-$3,713	$817	$1,529
Worker's Compensation					
Sum	$4,438	$595	$468	$1,464	$0
Present Value	$1,738	$401	$141	$484	$0
Degree Premium - Sum		-$3,843	-$3,970	$996	-$468
Degree Premium - PV		-$1,337	-$1,597	$343	-$141
Corrections*					
Sum	$32,516	$8,976	$3,750 **		
Present Value	$15,286	$4,528	$2,228		
Degree Premium - Sum		-$23,541	-$28,766		
Degree Premium - PV		-$10,758	-$13,057		
Public Healthcare*					
Sum	$2,170	$1,431	$1,107	$1,233	$857
Present Value	$1,395	$874	$745	$775	$632
Degree Premium - Sum		-$739	-$1,064	$127	-$250
Degree Premium - PV		-$521	-$650	$30	-$113
Total State and Local Expenditures					
Sum	$87,857	$40,892	$22,358	$15,832	$12,505
Present Value	$47,364	$21,504	$12,301	$7,845	$8,541
Degree Premium - Sum		-$46,965	-$65,498	-$6,526	-$9,853
Degree Premium - PV		-$25,859	-$35,063	-$4,456	-$3,760

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 10
Estimated Lifetime State and Local Expenditures across Education Categories in Massachusetts

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$1,439	$961	$360	$148	$392
Present Value	$864	$471	$144	$59	$116
Degree Premium - Sum		-$478	-$1,080	-$212	$33
Degree Premium - PV		-$393	-$721	-$85	-$28
Medicaid					
Sum	$22,114	$16,095	$9,828	$6,855	$4,622
Present Value	$12,262	$9,282	$5,726	$4,133	$3,424
Degree Premium - Sum		-$6,019	-$12,286	-$2,974	-$5,207
Degree Premium - PV		-$2,979	-$6,536	-$1,593	-$2,302
Unemployment Compensation					
Sum	$17,294	$9,204	$12,598	$6,381	$3,555
Present Value	$8,646	$4,603	$5,354	$2,898	$1,910
Degree Premium - Sum		-$8,090	-$4,696	-$6,216	-$9,043
Degree Premium - PV		-$4,043	-$3,292	-$2,456	-$3,444
Worker's Compensation					
Sum	$7,505	$4,326	$4,067	$1,554	$0
Present Value	$3,820	$1,725	$2,473	$436	$0
Degree Premium - Sum		-$3,179	-$3,438	-$2,513	-$4,067
Degree Premium - PV		-$2,096	-$1,347	-$2,036	-$2,473
Corrections*					
Sum	$30,178	$8,330	$3,481 **		
Present Value	$14,187	$4,202	$2,068		
Degree Premium - Sum		-$21,848	-$26,698		
Degree Premium - PV		-$9,984	-$12,118		
Public Healthcare*					
Sum	$2,778	$2,037	$1,714	$1,415	$1,268
Present Value	$1,729	$1,465	$1,202	$1,131	$1,020
Degree Premium - Sum		-$740	-$1,063	-$300	-$446
Degree Premium - PV		-$264	-$527	-$70	-$182
Total State and Local Expenditures					
Sum	$81,309	$40,954	$32,047	$16,353	$9,837
Present Value	$41,508	$21,749	$16,966	$8,657	$6,469
Degree Premium - Sum		-$40,355	-$49,261	-$15,694	-$22,211
Degree Premium - PV		-$19,759	-$24,542	-$8,309	-$10,496

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 11
Estimated Lifetime State and Local Expenditures across Education Categories in New Hampshire

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$3,764	$2,175	$1,303	$651	$396
Present Value	$2,206	$1,313	$633	$311	$194
Degree Premium - Sum		-$1,589	-$2,462	-$652	-$907
Degree Premium - PV		-$893	-$1,573	-$322	-$439
Medicaid					
Sum	$13,738	$9,151	$5,643	$4,668	$4,821
Present Value	$7,509	$4,169	$2,570	$2,853	$2,412
Degree Premium - Sum		-$4,587	-$8,095	-$975	-$822
Degree Premium - PV		-$3,340	-$4,939	$283	-$157
Unemployment Compensation					
Sum	$9,396	$9,179	$8,111	$4,564	$3,399
Present Value	$4,300	$3,802	$3,584	$2,030	$1,335
Degree Premium - Sum		-$217	-$1,285	-$3,547	-$4,712
Degree Premium - PV		-$498	-$716	-$1,554	-$2,249
Worker's Compensation					
Sum	$4,244	$10,802	$171	$2,506	$0
Present Value	$1,962	$3,569	$81	$750	$0
Degree Premium - Sum		$6,558	-$4,072	$2,335	-$171
Degree Premium - PV		$1,607	-$1,881	$670	-$81
Corrections*					
Sum	$24,578	$6,784	$2,835 **		
Present Value	$11,554	$3,423	$1,684		
Degree Premium - Sum		-$17,794	-$21,744		
Degree Premium - PV		-$8,131	-$9,870		
Public Healthcare*					
Sum	$2,459	$1,501	$1,152	$840	$1,286
Present Value	$1,583	$1,026	$759	$569	$643
Degree Premium - Sum		-$958	-$1,307	-$312	$134
Degree Premium - PV		-$557	-$824	-$190	-$116
Total State and Local Expenditures					
Sum	$58,179	$39,592	$19,215	$13,229	$9,902
Present Value	$29,114	$17,301	$9,312	$6,513	$4,584
Degree Premium - Sum		-$18,587	-$38,965	-$5,985	-$9,313
Degree Premium - PV		-$11,813	-$19,802	-$2,798	-$4,727

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 12
Estimated Lifetime State and Local Expenditures across Education Categories in Rhode Island

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$5,650	$3,006	$1,154	$429	$340
Present Value	$3,672	$1,745	$621	$272	$227
Degree Premium - Sum		-$2,644	-$4,496	-$724	-$814
Degree Premium - PV		-$1,926	-$3,051	-$349	-$394
Medicaid					
Sum	$23,671	$15,366	$11,315	$10,663	$7,669
Present Value	$12,473	$8,300	$5,819	$4,193	$3,634
Degree Premium - Sum		-$8,305	-$12,356	-$653	-$3,646
Degree Premium - PV		-$4,172	-$6,654	-$1,626	-$2,186
Unemployment Compensation					
Sum	$12,509	$13,798	$8,520	$12,128	$279
Present Value	$5,982	$6,128	$4,239	$5,496	$139
Degree Premium - Sum		$1,289	-$3,990	$3,608	-$8,241
Degree Premium - PV		$145	-$1,743	$1,257	-$4,099
Worker's Compensation					
Sum	$8,316	$14,489	$11,949	$3,155	$0
Present Value	$4,192	$5,220	$2,632	$1,113	$0
Degree Premium - Sum		$6,173	$3,633	-$8,794	-$11,949
Degree Premium - PV		$1,028	-$1,559	-$1,520	-$2,632
Corrections*					
Sum	$33,310	$9,195	$3,842 **		
Present Value	$15,659	$4,639	$2,283		
Degree Premium - Sum		-$24,115	-$29,468		
Degree Premium - PV		-$11,020	-$13,376		
Public Healthcare*					
Sum	$2,501	$977	$1,453	$1,170	$1,014
Present Value	$1,628	$629	$904	$750	$657
Degree Premium - Sum		-$1,525	-$1,048	-$283	-$439
Degree Premium - PV		-$999	-$723	-$154	-$247
Total State and Local Expenditures					
Sum	$85,957	$56,831	$38,232	$27,545	$9,301
Present Value	$43,605	$26,661	$16,498	$11,823	$4,657
Degree Premium - Sum		-$29,127	-$47,725	-$10,687	-$28,931
Degree Premium - PV		-$16,944	-$27,107	-$4,675	-$11,841

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 13
Estimated Lifetime State and Local Expenditures across Education Categories in Vermont

	High School	Associate's Degree	Bachelor's Degree	Master's Degree	Professional & Doctorate Degree
Welfare					
Sum	$6,825	$2,234	$883	$759	$892
Present Value	$4,212	$1,285	$460	$325	$256
Degree Premium - Sum		-$4,592	-$5,942	-$124	$9
Degree Premium - PV		-$2,927	-$3,753	-$134	-$204
Medicaid					
Sum	$30,238	$20,012	$12,832	$8,860	$12,217
Present Value	$18,153	$11,513	$7,045	$4,291	$4,561
Degree Premium - Sum		-$10,226	-$17,407	-$3,972	-$615
Degree Premium - PV		-$6,639	-$11,108	-$2,753	-$2,484
Unemployment Compensation					
Sum	$10,766	$21,276	$5,669	$6,802	$411
Present Value	$5,133	$9,029	$2,452	$3,577	$236
Degree Premium - Sum		$10,510	-$5,097	$1,133	-$5,258
Degree Premium - PV		$3,896	-$2,681	$1,125	-$2,216
Worker's Compensation					
Sum	$4,572	$5,018	$118	$0	$0
Present Value	$2,219	$2,568	$59	$0	$0
Degree Premium - Sum		$446	-$4,454	-$118	-$118
Degree Premium - PV		$349	-$2,159	-$59	-$59
Corrections*					
Sum	$33,441	$9,231	$3,857 **		
Present Value	$15,720	$4,657	$2,292		
Degree Premium - Sum		-$24,210	-$29,584		
Degree Premium - PV		-$11,063	-$13,428		
Public Healthcare*					
Sum	$2,430	$2,182	$1,399	$1,017	$1,229
Present Value	$1,454	$1,225	$876	$712	$688
Degree Premium - Sum		-$247	-$1,030	-$382	-$170
Degree Premium - PV		-$229	-$579	-$163	-$188
Total State and Local Expenditures					
Sum	$88,272	$59,953	$24,758	$17,438	$14,749
Present Value	$46,892	$30,277	$13,184	$8,907	$5,741
Degree Premium - Sum		-$28,319	-$63,514	-$7,321	-$10,010
Degree Premium - PV		-$16,614	-$33,708	-$4,277	-$7,443

Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages. **Corrections estimates combine Bachelor's and advanced degrees.

Appendix Table 14
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in Connecticut

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$83,814	$80,223		
Cost per (all) Degree	$41,032	$39,274		
Income Taxes			$71,557	$31,099
Property Taxes			$56,765	$19,716
Sales Taxes			$20,659	$7,974
Welfare	-$1,822	-$1,271		
Medicaid	-$14,541	-$7,577		
Unemployment Compensation	-$4,112	-$1,799		
Worker's Compensation	-$2,183	-$1,104		
Corrections*	-$18,766	-$8,551		
Public Healthcare*	-$1,064	-$670		
Post-college Totals	-$42,487	-$20,972	$148,981	$58,790

Internal Rate of Return (public degrees only) = 3.0%

Internal Rate of Return (all degrees) = 6.0%

Post-college fiscal effects are reduced by 6.8 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.

Appendix Table 15
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in Maine

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$ 54,476	$52,142		
Cost per (all) Degree	$ 33,492	$32,057		
Income Taxes			$68,427	$28,003
Property Taxes			$6,943	-$201
Sales Taxes			$19,314	$7,069
Welfare	-$7,618	-$4,958		
Medicaid	-$14,275	-$9,601		
Unemployment Compensation	-$6,455	-$3,680		
Worker's Compensation	-$3,799	-$1,462		
Corrections*	-$30,003	-$13,673		
Public Healthcare*	-$947	-$608		
Post-college Totals	-$63,096	-$33,982	$94,684	$34,872

Internal Rate of Return (public degrees only) = 4.2%

Internal Rate of Return (all degrees) = 6.7%

Post-college fiscal effects are reduced by 6.6 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.

Appendix Table 16
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in Massachusetts

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$62,876	$60,182		
Cost per (all) Degree	$17,994	$17,223		
Income Taxes			$61,360	$25,572
Property Taxes			$18,735	$3,889
Sales Taxes			$16,401	$5,986
Welfare	-$898	-$622		
Medicaid	-$10,598	-$5,575		
Unemployment Compensation	-$7,624	-$4,322		
Worker's Compensation	-$3,998	-$2,214		
Corrections*	-$28,461	-$12,973		
Public Healthcare*	-$1,007	-$439		
Post-college Totals	-$52,586	-$26,146	$96,497	$35,447

Internal Rate of Return (public degrees only) = 3.1%

Internal Rate of Return (all degrees) = 8.2%

Post-college fiscal effects are reduced by 6.5 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.

Appendix Table 17
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in New Hampshire

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$28,410	$27,192		
Cost per (all) Degree	$13,945	$13,348		
Income Taxes			$2,794	$683
Property Taxes			$40,750	$13,649
Sales Taxes			$5,712	$1,816
Welfare	-$2,314	-$1,436		
Medicaid	-$7,230	-$4,445		
Unemployment Compensation	-$1,558	-$949		
Worker's Compensation	-$549	-$734		
Corrections*	-$22,438	-$10,225		
Public Healthcare*	-$1,253	-$783		
Post-college Totals	-$35,342	-$18,572	$49,256	$16,148

Internal Rate of Return (public degrees only) = 4.0%**

Internal Rate of Return (all degrees) = 7.4%**

Post-college fiscal effects are reduced by 6.6 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.

Appendix Table 18
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in Rhode Island

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$50,640	$48,470		
Cost per (all) Degree	$16,775	$16,056		
Income Taxes			$78,304	$31,364
Property Taxes			$27,047	$8,337
Sales Taxes			$20,549	$6,853
Welfare	-$3,929	-$2,687		
Medicaid	-$10,819	-$6,033		
Unemployment Compensation	-$2,027	-$1,079		
Worker's Compensation	$2,120	-$1,193		
Corrections*	-$30,070	-$13,701		
Public Healthcare*	-$1,185	-$801		
Post-college Totals	-$45,908	-$25,493	$125,900	$46,554

Internal Rate of Return (public degrees only) = 4.7%

Internal Rate of Return (all degrees) = 10.8%

Post-college fiscal effects are reduced by 6.8 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.

Appendix Table 19
Estimated Lifetime Fiscal Effects per Four-Year-Equivalent Degree in Vermont

	Costs		Revenues	
	Sum	Present Value	Sum	Present Value
Cost per Public Degree	$47,484	$45,450		
Cost per (all) Degree	$23,329	$22,329		
Income Taxes			$39,878	$18,175
Property Taxes			$22,333	$2,838
Sales Taxes			$12,344	$4,373
Welfare	-$5,328	-$3,398		
Medicaid	-$15,372	-$10,040		
Unemployment Compensation	-$1,100	-$880		
Worker's Compensation	-$3,074	-$1,476		
Corrections*	-$29,976	-$13,657		
Public Healthcare*	-$850	-$503		
Post-college Totals	-$55,700	-$29,953	$74,555	$25,386

Internal Rate of Return (public degrees only) = 3.8%

Internal Rate of Return (all degrees) = 7.1%

Post-college fiscal effects are reduced by 6.8 percent to account for net emigration of graduates. Present values are calculated using a 3 percent real interest rate. *Estimates for Corrections and Public Healthcare are based on national averages.