Economic Impact of Investment in Public Higher Education in Massachusetts:

Short-Run Employment Stimulus, Long-Run Public Returns

Michael Ash, Ph.D.
Professor of Economics and Public Policy
Department of Economics and
Center for Public Policy and Administration
University of Massachusetts Amherst

Shantel Palacio, MPPA
Center for Public Policy and Administration
University of Massachusetts Amherst

April 2012

TABLE OF CONTENTS

Prepared with a grant from

Massachusetts Society of Professors (MSP)

Acknowledgments. We thank Zachary Phillis for excellent research assistance, Ferd Wulkan and John Stifler for editing, and Benjamin Taylor for public relations. We thank the advisory board for the project for guidance and comments: Professor Robert Pollin (Political Economy Research Institute and Department of Economics) and Professor Nancy Folbre (Department of Economics) both of the University of Massachusetts Amherst. We thank Philip Trostel (University of Maine) for comments and methodological contributions.

SUMMARY

Extensive economic evidence makes it clear that increased state spending on public higher education in Massachusetts should be a top priority now and for the foreseeable future. This conclusion follows from an analysis of the economic impact of such spending, based on new research by economists measuring the quantitative relationships between the circulation of money, the overall health of a society, and the position of higher education in that relationship. In this report we examine both the short-run employment impact of additional spending on higher education and the long-run financial impact of investing in a better-educated workforce. The conclusions, which can be summarized in four main categories, are encouraging:

1. Increasing public funding of public higher education in Massachusetts will create an immediate increase in the number of jobs in the state, more than alternative uses of the same funds will create.

2. It will continue to improve employment in the long run, through the increased tax revenue that results from more and better employment across the Commonwealth.

3. The long-run benefits will include a reduction in demand on spending for welfare and other social programs

4. By increasing material benefits to individual citizens and families, increased public funding of public higher education will also create broader social and economic benefits.

Government officials, business leaders, and citizens' groups are all seeking ways to expand the Massachusetts economy. These new findings make it clear that compared to commonly considered alternatives, increased public funding for the state's institutions of higher education is the most robust, efficient and viable, ensuring the greatest short- and long-term benefits. A

systematic analysis of current data indicates that while the present cost of educating someone in a public institution of higher education in Massachusetts is slightly over $49,000, that public college or university graduate will in return, by even the most conservative estimates, contribute a net of more than $98,000 to the state after college. This graduate will pay more taxes, since his or her income will be higher, and will put less of a burden on public services. In other words, for every additional student educated in a public college or university in the state, the Commonwealth of Massachusetts comes out nearly $50,000 ahead. No other use of a comparable outlay of public funds can match this one in terms of how it repays the investment. Thus, at the most basic dollars-and-cents level, increased public funding for public higher education eminently justifies itself and provides increased benefits for the entire Commonwealth.

1. IMMEDIATE JOB-CREATION

In the short run, spending on public higher education will create relatively high-paying jobs, and workers will recirculate the earnings from those jobs. Such a stimulative effect for the state's economy is analogous to what can often be accomplished by private investment, but the differences are significant, especially in terms of how efficiently the public investment can deliver benefits to the largest number of citizens and to the Commonwealth as a whole. In particular right now, increased spending on public higher education in Massachusetts will reinvigorate the Massachusetts economy by creating jobs in sectors that have suffered in the current downturn. One obvious area is construction work; others include service jobs (maintenance, food preparation, security) and professional work (architects, planners, etc.).

Standard economic analysis shows a definite, positive short-run impact on employment in Massachusetts. To make this short-run analysis meaningful, we compare the impact of additional

public spending on higher education with the impact of equivalent public spending on other kinds of economic activity, including casinos, health-care, and tax cuts. We have focused on how these different kinds of additional public spending can boost employment.

- ***Quantitative methods used in analyzing short-term effects***

Our conclusions about the strongly positive short-term job-creation effect of increased public funding for higher education in Massachusetts are based on a method known in economics as Input-Output analysis. Its application is described in a 2009 study by Robert Pollin and Heidi Garrett-Peltier, of the Political Economy Research Institute at the University of Massachusetts (Pollin and Garrett-Peltier 2009). This method makes it possible to compare the short-run effect on employment that results from spending on public higher education to the effects resulting from other kinds of public and private spending. The main data sources for this component of the analysis are the Input-Output tables developed by the U.S. Bureau of Economic Analysis (BEA). These tables show data from surveys of households and firms that generate estimates specific to Massachusetts, thereby enabling policy makers to apply results from the broader literature of economics to the specific context of the Massachusetts economy.

Calculating the employment impact of an expenditure on a given activity means counting three effects of that expenditure: direct, indirect, and induced. The *direct* effect of the expenditure is that it pays for the activity itself, buying goods and services from a range of suppliers. Its *indirect* effect consists of the further economic activity it stimulates among those suppliers, since they in turn require goods and services from other suppliers. For example, an accounting firm, hired as part of the direct effect of the expenditure, requires paper and ink from stationers and electrical energy from power generators. Those purchases by the accounting firm are indirect

effects of the initial expenditure. Finally, the workers and owners of both the directly affected activity and the indirectly affected suppliers now receive additional income, which they spend on a variety of consumer goods and services. This additional expenditure is *induced* by the initial spending on the direct activity, and it too stimulates additional economic activity and employment. The employment generated by the direct, indirect, and induced pathways is the total employment effect of the stimulus.

In economics terminology, the goods and services purchased are inputs; the goods and services produced from these inputs are outputs. For a contractor, a bulldozer is an input, a building's foundation is an output. For a university, buildings and faculty are inputs; educated graduates, whose subsequent work is of value to the economy, are outputs. Input-output analysis that will identify the employment impacts of various spending choices is based on a set of tables for the U.S. economy with data produced by the BEA, as well as on interfaces provided by several private, independent economic analysis firms. In this report, the basis of the employment-impact estimates is IMPLAN, a reliable and widely used commercial product that analyzes dollar-figure expenditures in terms of the value of what those expenditures produce.

In such a short-run analysis, it is useful but incomplete to speak of the employment impact of a particular expenditure. As Siegfried et al. (2006) and Pollin and Garret-Peltier (2009) observe, such an approach fails to consider the alternative effects that would be obtained with a different use of the same resources – people, money, etc. If public higher education funds were put to an alternative use, these funds would still generate employment (output), and the employees and owners of the alternative activity would receive compensation and profits, which they would spend on a range of consumer goods. The crucial question is which kind of expenditure will

produce the greatest gain. The analysis in this report considers the alternatives and so determines the employment impact of expenditure on higher education relative to the effects of other kinds of spending.[1]

- ***Elements of the stimulus***

The employment effect of an economic stimulus depends on three factors: the size of the stimulus; the labor intensiveness (how many people it employs for what it accomplishes) of the activity it funds; and average compensation (wages and benefits). For an analysis in a particular geographic region, especially in a relatively small state such as Massachusetts, a fourth factor bears on the local employment impact, a factor referred to here as leakage. To the extent that the employment effects in distant locations -- literally from New Hampshire to China -- are not of interest to Massachusetts public decision-makers, anyone trying to determine the local employment effect of a policy in Massachusetts needs to adjust the analysis by not counting the portion of the stimulus taking place beyond the state's borders. The input-output method implemented by IMPLAN makes it possible to account for such leakage.

One feature of input-output analysis is that the source of the money to be spent does not matter in assessing its impact on employment. In terms of the immediate employment impact of additional expenditure on public higher education, it makes no difference whether the additional

[1] In 2006, also using an input-output analysis, the Office of the President of the University of Massachusetts reported the annual Massachusetts employment effect for the UMass system to be 29,000 jobs, of which 15,000 were direct employment by UMass and an additional 14,000 jobs were stimulated through the indirect effect on contractors and other suppliers (UMass Office of the President 2006). As noted above, however, this analysis is incomplete since it does not compare employment effects of alternative expenditures.

expenditure comes from public sources -- a higher state budget appropriation for the public college and university systems -- or from private sources, primarily students' or student families' tuition payments. However, we are presuming – and we are convinced that the Commonwealth in general can safely presume – that a still larger share of the cost of higher education cannot efficiently be borne by the average student's family, let alone by poorer households. In 2010, average tuition and fees at Massachusetts's public four-year institutions were 30% above the national average; at public two-year institutions they were 52% above the national average (Chronicle of Higher Education 2010). Even before the recession of 2008-2010, student debt upon graduation had become high enough to compromise the new graduate's options either for employment or for further study, and to maintain an uncomfortably high debt burden on a growing number of Massachusetts families. We return to the issue of high tuition and fees of higher education in the final sections of the study.

In determining the best allocation of new expenditures, three areas are particularly relevant for comparison to higher education: casino construction and operation, health care spending, and income tax reduction. Spending could be directed towards other public priorities, but the three alternatives listed above are the most useful points of comparison because they are currently policy-relevant and because the level of expenditure in each is similar to the level of expenditure on public higher education – in the current state budget, roughly one billion dollars per year.[2]

Policy-makers need to be concerned not only with the number of jobs created but with the type

[2] The 2001 reduction of the Massachusetts personal income tax rate by 0.65 percentage points accounts for approximately 1 billion dollars per year in foregone revenue. Casino gambling is forecast to produce revenue of between $750 million and $1.5 billion per year (Massachusetts Statewide Gaming Report 2010).

and quality of these jobs. In comparing alternative expenditures, this analysis therefore estimates the wage distribution of jobs created by each spending priority, i.e., how many new jobs will there be, how well are they paid, and how much difference will there be between the highest and lowest salaries or wages in these various sectors of employment? In addition, the analysis of public higher education spending in Massachusetts must account for both in-state spending and out-of-state leakage.

- ***Spending/investment choices for the commonwealth***

Before comparing specific spending programs, we consider the broader goal of a spending increase. Each year the State computes a revenue gap for public higher education – the amount by which the revenue available to Massachusetts institutions of public higher education falls short of the amount needed to maintain these institutions' focus, mission, and enrollment, based on their locations and facilities. It establishes dollar values by using national standards, peer comparisons, and fundamental quality targets. The Massachusetts FY2011 budget request by the State Board of Higher Education observes that the revenue gap for the state university and community college system, i.e., not including the UMass system, is now approximately $440 million. Since the UMass system accounts for nearly half of all state expenditure on higher education, a reasonable estimate for the full gap is $800 million.

The state can invest in public higher education in several ways. For example, it might make an extensive capital investment by constructing new buildings, or it could expand faculties and staff while continuing to use existing facilities. Different investment programs will have different impacts on employment depending on the employment profile of the component activities. This report examines two public higher-education spending alternatives, one involving new

construction, the other assuming all the funds are used to expand educational activity in existing facilities. Each involves a single, substantial increase in the public higher-education budget, which will then be maintained at this new, higher level in subsequent years.[3]

In each scenario, we consider the impact of an $800 million increase in the annual higher education budget. In the first scenario, in the initial two years half the money is spent on new construction, half on expansion of existing educational activity; in following years, the full $800-million increase is applied to expanded educational activity. In the second scenario, we consider simply spending the proposed $800 million on the expansion of existing educational activity, without any investment in construction.

- ***What the data show about short-term benefits***

Table 1 displays the employment effect of various uses of an $800 million outlay. The first five rows of the table consider $800 million of additional spending; the other four rows show the effects of four different $800 million income-tax cuts. For higher education, the table shows the numbers for the two scenarios described above: a 50-50 mix of construction/maintenance and operating expenses, or a 100 percent expenditure on operating expenses. For casinos, which have been embraced for their job-creation potential in Massachusetts, similar scenarios are examined: a 50-50 mix of construction and operation, or purely operation. For health care, our analysis considers using the $800 million entirely for expanding ongoing services.

[3] This level will subsequently be adjusted only for inflation and population increase.

Table 1: Jobs created by $800 million expenditure

	Direct Effect	Indirect Effect	Sum: Direct and Induced Effects	Induced Effect	**Total Jobs**
In spending					
Higher Education (construction/operating)	7,252	1,471	8,723	3,042	**11,766**
Higher Education (operating)	8,861	1,420	10,281	3,189	**13,470**
Casino (construction/operation)	5,535	2,338	7,873	2,603	**10,476**
Casino (operation)	6,505	3,062	9,568	2,706	**12,274**
Health	5,774	1,507	7,281	3,309	**10,590**
In Tax Cuts					
Household income >$150K				5,124	**5,124**
Household income> $50K				5,186	**5,186**
Household income>$35K				5,303	**5,303**
All households				5,342	**5,342**

Notes
Source: IMPLAN and author's calculations.

Following these spending scenarios, we consider four different $800 million tax cuts. The first is a tax cut accruing largely to households with incomes in excess of $150,000 per year, the group that benefited most from the reduction in 2001 of the tax rate on dividends and capital gains from 12 percent to 5.3 percent. The second and third scenarios examine $800 million in tax cuts that accrue to households with earnings over $50,000 or $35,000 respectively. The final scenario would distribute the tax cuts on an equal per-household basis, even to households with no existing income-tax liability.

For the spending scenarios, the employment effect is divided into three components: the direct effect of the spending on the sector in which the spending occurs, the indirect effect as the target

sector then purchases inputs from Massachusetts businesses, and the induced effect as the recipients of the new wage and profit income spend some of this income on household consumption. For the tax-cut scenarios, because no industry receives the initial demand stimulus, there is neither a direct effect nor an indirect effect. The tax cut increases the disposable income of households, who choose to spend some of this income on Massachusetts-produced goods and services. The rest of the addition to disposable income is saved or is spent on goods and services from out-of-state; the employment created by the spending on Massachusetts-produced goods and services is the induced effect. In each scenario, the analysis examines the one-year employment effect of a year of spending. If the additional spending continues, i.e., if the $800 million additional spending becomes a permanent part of the budget, then the employment will continue.

In each of years one and two, the expenditure on higher education and construction generates 7,252 jobs through the direct employment effect, an additional 1,471 jobs at in-state suppliers, and a further 3,042 jobs as households spend their new earnings. The total number of jobs created is 11,766. In subsequent years, the direct employment effect increases to 8,861, in large part because higher education is more labor-intensive than construction. The indirect, or supplier, effect contributes an additional 1,420 jobs, and higher household expenditure adds another 3,189. The total number of jobs created is 13,470. The increase in employment for $800 million in casino spending is somewhat lower, ranging from 10,476 to 12,274 jobs; for health expenditure it is lower still, at 10,590.

The employment effect of tax cuts is substantially lower -- between 5,124 and 5,342 new jobs depending on how the tax cut is structured. Because of the spending and, more particularly, the

saving patterns of higher-income households, the tax cuts directed to higher-income households produce less employment than those directed to lower-income households. This variation among the effects of alternative tax cuts, however, is overwhelmed by their substantially less stimulative effect on Massachusetts employment regardless of which approach to tax-cutting is taken. The basic reasons for the low impact of tax cuts are, first, that households spend only part of a tax cut, while saving the rest; second, that household purchases do not necessarily stimulate employment in the state; and, third, that while the induced effect of tax cuts is greater than the induced effect of investment in higher education, casinos, or healthcare, investments in these areas also generate direct and indirect effects, making the total effect in those areas greater than in any of the tax cut scenarios.

Table 2 shows the average wage and the range of wages in the direct employment sectors for each expenditure area -- two figures that are reliable means for assessing the quality of the jobs created. A higher average wage and a low spread from low to high indicate that expenditure in these sectors will create better jobs than an alternative choice would create. The smaller spread between the highest- and lowest-paying jobs indicates that any given job in this area is more likely to be a desirable one, since even the lowest-paying jobs in this sector pay relatively well. At the same time, other things being equal, a higher average wage indicates that fewer jobs may be created per dollar of expenditure. This relationship, however, is not automatic and invariable, because some sectors may be more labor-intensive, employing more workers and less expensive plant equipment. Table 2 also shows the unemployment rate in each direct-expenditure sector under analysis.

Table 2: Quality of employment indicators, direct-effect industries

	Average annual wage	Range of Occupational Average Wages				Unemployment (%)
		low		high		
Higher Education	$39,313	teaching assistants	$22,700	faculty	$61,500	4.1
Construction	$41,214	laborers	$29,490	managers	$81,870	20.6
Casinos	$27,760	dealers	$16,310	managers	$68,290	11.8
Health (non-MD)	$36,160	cleaners	$18,420	RN's	$61,420	4.9

Notes
Average annual wage is the employment-weighted average of the median wage in the BLS sub-occupations for the United States, 2008-2009.
Unemployment is national unemployment rate, 2010.
Source: Bureau of Labor Statistics and author's calculations.

Average annual earnings in higher education are $39,313 per year. In construction, which is part of one of the higher education programs and one of the casino expenditure programs considered here, average annual earnings are $41,214. In casinos, average annual earnings are $27,760 per year; in health care, not including MD's, the average is $36,160 per year. Other relevant features of desirable jobs include health insurance coverage, pension coverage, and other non-wage benefits; the size of these benefits varies substantially across sectors. For example, access to medical coverage is available to 70 percent of workers in construction, 83 percent of workers in installation, maintenance and repair, 90 percent of workers in public education, and only 44 percent of workers in services (Bureau of Labor Statistics)

In higher education, the lowest paid category of employees are teaching assistants, typically graduate students who teach to support their own post-baccalaureate education; their average annual earnings are $22,700 per year. At the high end, faculty earn on average $61,500 per year

across a range of disciplines and levels of institutions. In construction, the range of earnings is significantly wider, from laborers who earn $29,490 per year to managers with average annual earnings of over $80,000. (Again, we keep in mind that while the low end of this range is higher than it is for higher education, the lowest paid people in higher education are graduate students on their way to more lucrative careers, and that the average salary in construction is still lower than it is in education.) The range in the casino industry and in health care is wide, from average earnings well below $20,000 in the lowest paid job categories to earnings for the highest-paid workers in excess of $60,000.

This analysis of the quantity and quality of employment in jobs created by investment in higher education answers the charge of Siegfried et al. (see p. 5) to consider alternative expenditures. The comparison to casino expenditure and to health care expenditure indicates that higher education is a cost-effective way to create additional jobs, with more jobs created per dollar of expenditure than in these other sectors. Furthermore, the jobs created are of generally high quality, with average annual earnings of $40,000 per year, a relatively narrow salary range and low unemployment (4 percent nationally for all persons employed in higher education in 2010); in other words, these are stable middle-class jobs.

While Tables 1 and 2 describe the quality and quantity of jobs created under alternative programs of spending, they do not consider the source of spending. Assuming the new funds for higher education come as a result of a tax increase, we must examine and factor in to what extent a tax increase will reduce household expenditure, in turn reducing demand for some kinds of goods and services. Thus, the employment gain from new investment in higher education (or casinos or health care) must be adjusted to include the *loss* of employment resulting from lower household expenditures caused by a tax increase.

In this analysis, the $800 million increase in spending on higher education is funded by a tax increase that would affect only households earnings more than $50,000 per year. As shown in Table 3, these higher taxes correspond to a decrease in employment of 5,186 jobs -- less than half the number of new jobs simultaneously created. The net employment effect from increased public spending on public higher education is therefore overwhelmingly positive. As indicated in the last row, Net Employment Effect, the higher education investment program creates 6,580 net new jobs in Massachusetts, increasing to 8,284 in subsequent years. Furthermore, in the first two years of the program a significant share of the employment will be in construction, an area that has been highly depressed, with a national unemployment rate of more than 20 percent (see last column of Table 2). These high-quality jobs are fully paid for, and they put people in the Commonwealth to work by using existing resources.

Table 3: Balanced Budget Higher Education Investment Program
Massachusetts employment effect of increasing taxes and higher education investment by $800 million

	Employment Effect (Change in Jobs)	
	Years 1-2	Year 3 and beyond
Direct Employment (Higher Education)	7,252	8,861
Indirect Employment (Suppliers)	1,471	1,420
Induced Employment (Earnings)	3,042	3,189
H.E. Total Employment Effect	**11,766**	**13,470**
Taxes	**-5,186**	**-5,186**
Net Employment Effect	**6,580**	**8,284**

Notes
Higher Education Investment Program
Years 1-2 assume higher education investment split between the expansion of activity at existing facilities and new public construction.
Year 3 and beyond assumes the full higher education investment in expansion of activity at existing and new facilities
Tax Program
Investment in higher education is financed by an income-tax increase affecting only households with income greater than $50,000
Source: IMPLAN and author's calculations

As of December 2011, the unemployment rate in Massachusetts was 6.8 percent; during the decade that ended with the December 2007 business cycle peak, it had averaged 4.5 percent. The difference represents a shortfall of some 80,000 new jobs. That is, the Commonwealth of Massachusetts needs approximately 80,000 new jobs to return the unemployment rate to 4.5 percent. The net increase of approximately 8,000 new jobs from a balanced-budget higher-education investment could represent an important share of the needed increase. In technical terms, the net increase in employment is larger than the opportunity cost – i.e., it is larger than it would be in any of the alternative spending or tax-cutting scenarios – and therefore the decision to fund the expansion of higher education with public funds is the right one.

2. LONG-TERM INCREASES IN TAX REVENUES AND OTHER GAINS

As the previous section shows, higher education investment is an excellent job-creator. Moreover, the employment generated by the higher education investment program is far more than any dig-a-hole-and-fill-it-up employment stimulus. Higher education investment builds both human capital -- the health, know-how, and other productive capacity of the population -- and social capital, i.e., the networks and relationships among people that magnify their productivity exponentially. Both kinds of capital will pay long-run economic, fiscal, and social dividends. In plainer terms, both mean more jobs, better jobs, increased tax revenues, a higher quality of life, and a healthier economy. People with more education receive higher incomes, accumulate greater wealth, and therefore generate higher tax revenues.

The following data analysis shows in specific terms how such an investment improves the overall economic outlook for the Commonwealth. All the estimates are based on current, cross-sectional differences between college-educated and high-school-educated workers. Their

usefulness as a guide to policy therefore depends on these differences' remaining constant; if the differences tend to fluctuate over time, policy analysts will need to make appropriate adjustments. For instance, if the unemployment rate among college-educated workers were to increase relative to that of less-educated workers, then the earnings premium and the public-expenditure advantage would understandably be diminished. On the other hand, if the relative labor market performance of college-educated workers increases – i.e., if they become more and more likely to be well employed -- then the net benefits of higher education will prove larger than presented.

Economist Philip Trostel (2007) converts data on the earnings differences among workers with different levels of education into resulting differences in tax payments, which are the public's most visible return on its investment in public higher education. Trostel also examines differences in subsequent public expenditure as a function of the level of education of the recipient of the expenditure. He finds that college graduates are substantially less likely to draw on a variety of public and social insurance programs than are people without college degrees. Welfare, Medicaid and other public health care, Unemployment Compensation, or Worker's Compensation – a college graduate is statistically much less likely to require funds from these sources than is someone with only a high school diploma. College graduates are also less likely to be unemployed or in jail.

Key results for Massachusetts using Trostel's methodology are shown in Tables 4-6, updated with the most current data from the U.S. Current Population Survey. Table 4 shows the higher average earnings for college-educated workers relative to those for workers with only high school diplomas. The first row shows the level of annual wage and salary earnings by the level

of education. The second row shows the earnings differential for people with some college, those with associate's degrees, and those with bachelor's degrees, relative to those who are only high-school educated. As the numbers indicate, this degree premium expands sharply with the completion of the bachelor's degree. People with bachelor's degrees earn, on average, more than $30,000/year above what people with only a high-school diploma earn; more simply, the average four-year college graduate earns twice as much as the average high school graduate.

Table 4. Impact of higher education investment on annual earnings and tax revenue for Massachusetts

Average annual labor earnings and state and local tax revenues, 2010.

	High School	**Some College**	**Associate's Degree**	**Bachelor's Degree**
Wage and Salary Earnings	$26,029	$31,162	$39,546	$55,509
Degree Premium		$5,133	$13,517	$29,480
State Income Tax	$1,063	$1,630	$1,960	$2,961
S.I.T. Premium		$567	$897	$1,899
S.I.T. and Property Tax	$2,639	$3,561	$3,928	$5,309
S.I.T. and Property Tax Premium		$922	$1,289	$2,670

Source: Annual Social and Economic Supplement of Current Population Survey 2009-2011.

Table 4 then shows the annual tax revenue differential between high-school educated workers and those with some higher education or a post-secondary degree. As the table indicates, state income tax and local property taxes paid each year by workers with bachelor's degrees are $2,670 greater than the taxes paid by workers with only high school diplomas. The state sales tax adds modestly to the tax revenue advantage for workers with higher education. The sales tax estimate used in Table 5 is taken directly from Trostel's estimates for 2005 and updated only for inflation.

Table 5 shows the total average tax payment and the tax-revenue differential for the college-

educated over the taxpayer's entire working life after graduation. Numbers in the table distinguish between the Sum, which simply adds the amounts paid in taxes over the course of the worker's career, and the Present Value, a standard financial adjustment that puts more weight on costs incurred and benefits realized today and less weight on costs and benefits realized in the future.

Table 5. Estimated Lifetime State and Local Taxes Across Education Categories in Massachusetts, 2010

	High School	**Associate's Degree**	**Bachelor's Degree**
State Income Tax			
Sum	$42,511	$78,384	$118,451
Present Value	$24,566	$45,296	$68,449
Degree Premium – Sum		$35,873	$75,940
Degree Premium – PV		$20,730	$43,883
S.I.T. and Property Tax			
Sum	$105,552	$157,107	$212,356
Present Value	$60,995	$90,787	$122,714
Degree Premium – Sum		$51,555	$106,805
Degree Premium – PV		$29,792	$61,719
S.I.T., Property Tax, and Sales Tax			
Sum	$151,681	$210,667	$283,386
Present Value	$84,538	$117,472	$155,799
Degree Premium – Sum		**$58,987**	**$131,705**
Degree Premium – PV		**$32,934**	**$71,261**

Present Values are calculated with a 3 percent real interest rate.
Source: Annual Social and Economic Supplement of Current Population Survey 2009-2011 and Trostel (2007).

The logic of Present Value is that people are to some extent impatient and discount the future relative to the present. The Present Value computation allows for this sentiment by means of a

standard formula familiar to accountants.[4] However, a long-lived public entity such as our Commonwealth, which has responsibility to future generations as well as to our own, might well focus on the simple Sum, over time of benefits, minus costs. Both approaches are legitimate for comparing the benefits and costs of college attendance, and so both are presented here.

For an illustration of advantages of investing public funds in higher education, in Row 1 we find that a worker with a high school diploma pays Massachusetts $42,511 in state income tax over the course of a career, while a worker with a bachelor's degree, and therefore on average a much higher income, pays $118,451 in state income tax – an additional $75,940, or almost three times as much -- over the course of a career. However, because workers with the bachelor's degrees usually do their highest earning late in their careers, and because their earnings begin only after four years of college, the Present Value of a college graduate's additional tax payments is $43,883.

The additional rows of the table show the degree premium for tax revenues paid in combined income and property taxes (because college-educated workers own higher-valued homes) and in these taxes plus sales taxes (because college-educated workers purchase more goods on which sales tax is charged in Massachusetts). When income, property, and sales taxes are added, the college-educated Massachusetts resident pays on average $131,705 more in Sum, or $71,261 more in Present Value, in state and local taxes than does someone with only a high school

[4] Each year's term in the Sum is divided by $(1.03)^t$, where .03 is the currently standard assumed discount rate for public sector applications, and t is the number of years in the future that the cost or benefit arrives.

education. The additional tax revenue alone covers the cost per public degree, without any consideration of the effect on public expenditure or the non-monetary social value of a college-educated work force. When these two factors are included in the calculation, the net gain for the Commonwealth is significant.

3. REDUCTION IN OTHER AREAS OF STATE SPENDING

Beyond the fact that some of the benefit created by public investment returns directly to the public coffers in the form of higher tax revenues from those with associate's, bachelor's and advanced degrees, more highly educated people also require less in the way of public expenditures. They receive lower transfer payments (welfare, Medicaid, unemployment compensation, workers compensation, etc.), because they experience less unemployment and less poverty; and they are less likely to be incarcerated. In quantifying such public-sector fiscal impacts of higher education, this report draws heavily on the work of Trostel (2007), who has confirmed that college-educated people pay much more in taxes and use less in public benefits than people who lack such education.

Table 6 displays the lifetime state and local expenditures on various public programs for those with a high school education, those with some college, and those with bachelor's degrees. In every category, the college-educated require smaller average public outlays than do the high-school educated.

Table 6. Lifetime State and Local Expenditures Across Education Categories in Massachusetts

	High School	Associate's Degree	Bachelor's Degree
Welfare			
Sum	$3,003	$761	$255
Present Value	$1,736	$440	$147
Degree Premium – Sum		-$2,242	-$2,748
Degree Premium – PV		-$1,296	-$1,588
Medicaid			
Sum	$22,450	$11,624	$6,833
Present Value	$12,973	$6,717	$3,949
Degree Premium – Sum		-$10,827	-$15,617
Degree Premium – PV		-$6,256	-$9,025
Unemployment Compensation			
Sum	$32,702	$26,891	$20,198
Present Value	$18,897	$15,540	$11,672
Degree Premium – Sum		-$5,810	-$12,504
Degree Premium – PV		-$3,358	-$7,225
Worker's Compensation			
Sum	$4,102	$2,542	$802
Present Value	$2,371	$1,469	$464
Degree Premium – Sum		-$1,560	-$3,300
Degree Premium – PV		-$902	-$1,907
Corrections			
Sum	$34,744	$9,590	$4,008
Present Value	$16,333	$4,838	$2,381
Degree Premium – Sum		-$25,154	-$30,736
Degree Premium – PV		-$11,496	-$13,953
Public Healthcare			
Sum	$3,198	$2,345	$1,973
Present Value	$1,991	$1,687	$1,384
Degree Premium – Sum		-$853	-$1,225
Degree Premium – PV		-$304	-$607
Total State and Local Expenditure			
Sum	$100,200	$53,753	$34,070
Present Value	$54,301	$30,690	$19,996
Degree Premium – Sum		-$46,446	-$66,130
Degree Premium – PV		-$23,611	-$34,304

Present Values are calculated with a 3 percent real interest rate.
Estimates for Corrections and Public Healthcare are from Trostel (2007), based on national averages, and updated with the CPI-U.
Source: Annual Social and Economic Supplement of Current Population Survey 2009-2011 and Trostel (2007).

Moreover, standard statistical analysis, in which it is possible to adjust for any prior advantage held by the typically more affluent people who historically have gone to go to college, confirms that these outcomes are the actual effect of the education, not a mere reflection of the type of people who tend to get college educations. When the reductions in public expenditures across all these categories are added, the college-educated incur lower social costs: $66,130 less in Sum and $34,304 less in Present Value than do the high-school educated. We then add these relative savings to the value already established for the increase in taxes to show the net fiscal impact of four-year equivalent degrees. **A college degree holder pays $131,705 more in taxes and costs $66,130 less in public expenditure than does a high-school graduate, for a net post-college fiscal benefit to Massachusetts of $197,835 ($105,566 in Present Value).** These terms need to be adjusted for migration, which we discuss in more detail below. Migration-adjusted values are presented and do not substantively change the analysis; the fiscal benefit per four-year degree is still a net of $183,986.

The benefits in higher tax revenue and lower public expenditure need to be compared to the public cost to the Commonwealth of producing a college graduate. The total state appropriation for public institutions of higher education was $1.068 billion in 2008-09 (Digest of Education Statistics 2010) and this helped to graduate 15,385 people with bachelor's degrees, 9,073 associate's degrees, 5,286 master's degrees, 99 professional degrees, and 436 doctorates, which we convert to approximately 20,300 four-year equivalent degrees (combining the impact of associates' , bachelors', and advanced degrees). Updated for inflation, the implied cost is $53,392 ($49,616 in present value) per four-year equivalent degree in Massachusetts.

Table 7. Estimated Lifetime Fiscal Effects per Four-Year Equivalent Degree in Massachusetts

Post-College Effects	Sum	Present Value
	Revenue	
State Income Tax	$75,940	$43,883
State and Local Taxes	**$131,705**	**$71,261**
	Cost	
Welfare	-$2,748	-$1,588
Medicaid	-$15,617	-$9,025
Unemployment Compensation	-$12,504	-$7,225
Worker's Compensation	-$3,300	-$1,907
Corrections	-$30,736	-$13,953
Public Healthcare	-$1,225	-$607
Total	**-$66,130**	**-$34,304**
Net Post-College Effect	**$197,835**	**$105,566**
With migration adjustment	**$183,986**	**$98,176**
Public Cost per Public Degree	**$53,392**	**$49,616**
Net Fiscal Effect	**$130,595**	**$48,560**

Present Values are calculated with a 3 percent real interest rate.

Source: Trostel (2007), Annual Social and Economic Supplement of CPS (2009-2011), Digest of Education Statistics (2010)

Updating Trostel's research, Table 7 shows the full lifetime fiscal impact per four-year equivalent degree. The migration-adjusted summed benefits of $183,986 easily cover the $53,392 cost of a public degree. Because the costs are front-loaded while the benefits are realized over a career, standard practice indicate that we need to consider the Present Value of all benefits and costs. The present value of the lifetime benefits is $98,176 and the cost of a four-year equivalent degree is $49,616. The net present value is thus $48,560, the net gain to the Commonwealth of creating a new college graduate. Viewed as an investment, the Commonwealth's expenditure on higher education yields a better return than do many financial assets.

- ***Higher education in the current economy***

This report comes as the United States and the Commonwealth continue to suffer from a deep economic crisis. During the Great Recession, the persistent economic crisis that began in 2007, some commentators have questioned whether a college degree is still worth it. This question, raised in the context of the debate over austerity, is legitimate in that the likelihood of unemployment may have increased or the pay premium (and hence tax premium) may have decreased for college graduates sufficiently to eliminate the fiscal advantages of college education.

In fact that advantage still exists. Recent data on unemployment by level of education from the U.S. Bureau of Labor Statistics show that while the unemployment rate increased for all levels of education, the increase was least severe for the college-educated. From the business-cycle peak in 2007 to the worst of the Great Recession, the unemployment rate for those with a bachelor's degree or more education increased by three percentage points, from two percent to slightly under five percent. For those with only a high-school diploma, however, the increase was more than six percentage points, from slightly over four percent to nearly 11 percent. When we examine the ratio of the unemployment rates, we find that people with college diplomas are now less than half as likely to be unemployed as those with high school diplomas, and this relative advantage increased during the Great Recession. Furthermore, the advantages for college graduates in lower public expenditure, such as on welfare or Medicaid, that Trostel documents (2007) have in general increased between 2005 and 2010.

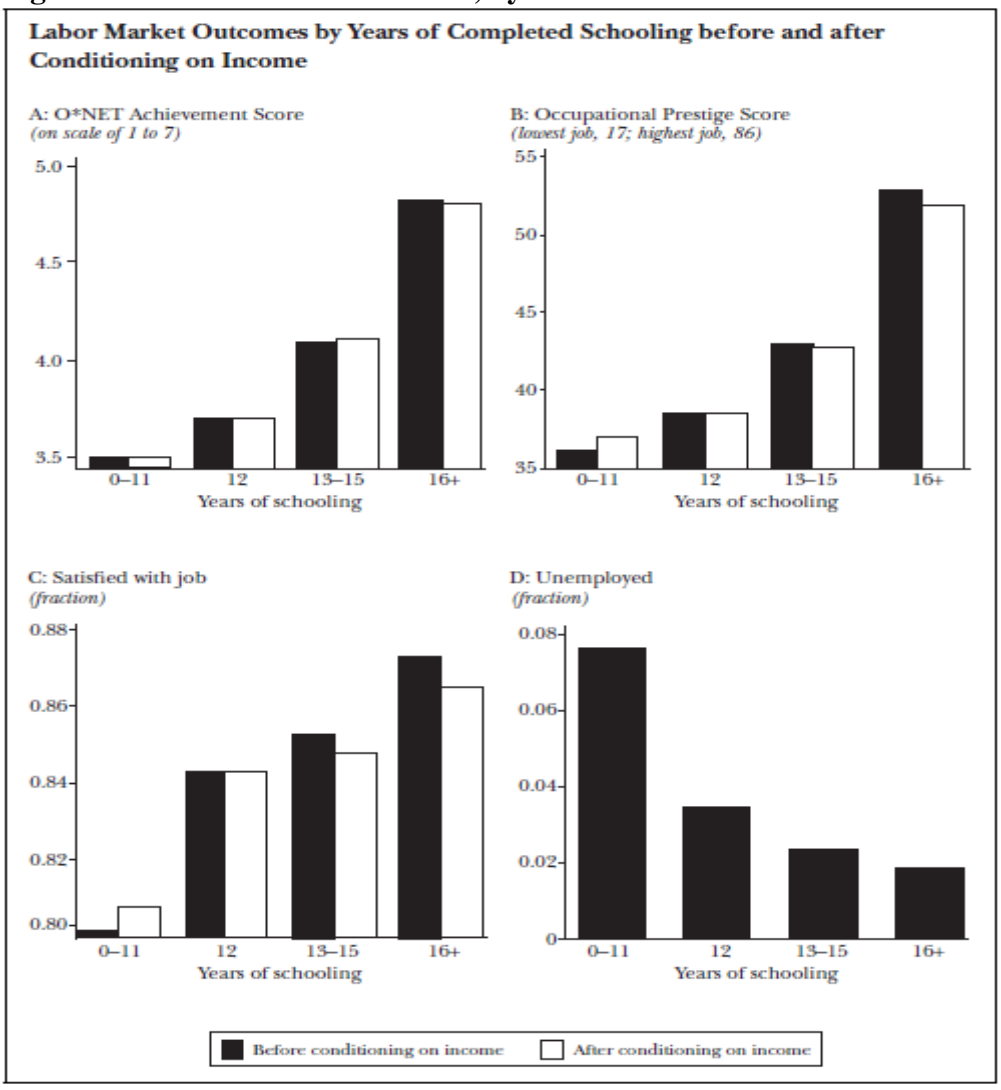
The fiscal benefits of education, including higher state and local tax contributions and less use of transfer programs depend on regular, high-quality employment. The evidence is strong that

especially during the current downturn a college education has retained both private and social economic value.

4. BROADER SOCIAL AND ECONOMIC BENEFITS

These computations, encouraging as they are, become even more so when they include the additional non-pecuniary benefits of higher education. To quantify these benefits, economists Philip Oreopoulos and Kjell Salvanes (2011) examine the ways in which important non-monetary life outcomes vary by level of education.

Figure 1. Labor Market Outcomes, by Education

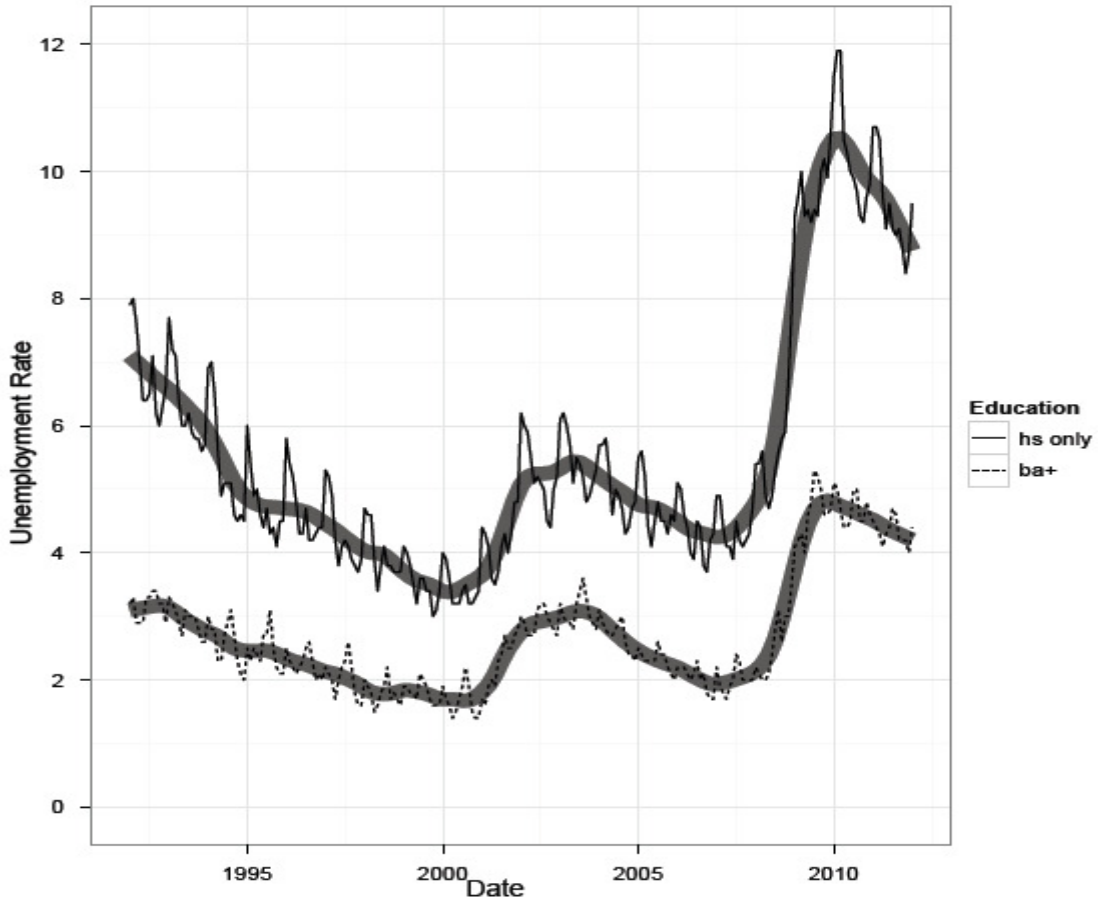


Source: Reprinted from Oreopoulos and Salvanes (2011).

Their study examines happiness and life satisfaction, health, social capital, measures of job quality other than pay, and risky behaviors. Some of the findings are summarized below and are illustrated in Figure 1.

(a) These non-pecuniary outcomes overwhelmingly improve with education. The percentage of people who report being "happy about life" is 5 points higher for college graduates than for those with only a high-school diploma. Compared to high-school graduates, college graduates have higher job satisfaction, find employment in higher-prestige and higher-achievement occupations, and are only about one-fourth as likely to be unemployed (Figure 2). Almost 50 percent of college graduates report very good health, compared to only 30 percent of high-school graduates.

Figure 2. Unemployment during the Crisis, by Education



Source: U.S. Bureau of Labor Statistics, seasonal adjustment by authors.

The rate of smoking for college graduates is almost 20 percentage points lower. Divorce rates among the college-educated are less than half the rates for the high-school educated. Trust, an important component of social capital (Putnam), increases substantially with a college education: in Oreopoulos and Salvanes's survey, almost 60 percent of college graduates answer "trust" to the statement, "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people," compared to only 40 percent of high-school graduates.

College graduates are about one-quarter less likely to have ever been arrested, and a separate study (Lochner and Moretti 2004) shows substantially less criminality among the college educated. Dee (2004) finds important civic returns to education. Educational attainment increases voter participation and the frequency of newspaper readership. These non-pecuniary benefits of investment in human capital are extremely difficult to value in dollar terms, but they need to be considered in public decisions about education.

(b) These non-pecuniary benefits are not merely the result of higher incomes that accompany higher levels of education. If they were – and it might seem reasonable to assume as much -- these benefits would already have been accounted for, simply by recording the higher incomes. That is, they would represent "purchases" of a sort enabled by higher income. However, Oreopoulos and Salvanes's comparison of college graduates and high-school graduates with similar incomes shows that approximately three-quarters of the additional happiness for college graduates, relative to that for high-school graduates, persists over and above the happiness apparently due simply to income. In fact, for most of the non-pecuniary outcomes under examination, very little of the extra benefit for the college educated is attributable to their higher

salaries. These effects must therefore be accounted over and above the increase in income associated with additional education.

(c) The bulk of the improvements come with the completion of a bachelor's degree. However, college education without a degree is also associated with improvements. As most of the figures indicate, those improvements are especially pronounced at 16+ years of education, whether or not those 16 years include a college degree.

(d) Many of the effects are causal. That is, they do not merely reflect the environment and family background of people who are currently likely to receive more schooling. Rather, additional education will improve these outcomes for the average person.

It is worth repeating that while this accounting of non-pecuniary benefits demonstrates substantial private benefits, i.e., benefits to the individuals, their families and employers, many of these benefits have an important public component. For example, lower smoking rates and better overall health are factors that reduce health-care costs; less criminality increases public safety and decreases the cost of the penal system; greater social capital facilitates civic and neighborhood upkeep as well as commerce. These are all important payoffs. Some of these public benefits can be quantified and accounted in higher taxes and lower public expenditures; others are difficult to measure numerically but are no less real.

Another important recent finding is that higher education increases the wages of workers who have not received this higher education themselves. Moretti (2004) finds that increasing the number of college-educated workers makes the work of less educated workers relatively more valuable. For example, more people living in new houses in suburban developments means a

need for more plumbers and electricians. Workers with less education will experience an increase in earnings of between 1.5 and 2 percent for each additional percentage point of the population being college-educated. Put simply, college-educated people are themselves job-creators.

Another spillover effect is that the public higher education of nurses, teachers, doctors, and other care workers in turn increases the human capital stock of the larger population. Public higher education in Massachusetts trains new educators, including teachers in the K-12 system and higher-education faculty, and new health-care workers. The value of this training is not fully captured either by the high private earnings of workers in these fields or by the conventional estimates of the non-pecuniary benefits of higher education. Rather, the additional value that educators and health-care workers bring to the Commonwealth is the social value of the caring labor that these workers perform. Among other things, the people who receive this care are all the more likely to work productively and to go on to pursue higher education themselves. Increasingly, economists are recognizing this social value as integral to the well-being of the economy as a whole.

- ***Advantages of greater access to higher education for all***

Another significant economic return on investment in public higher education is educational accessibility for economically challenged households. The provision of educational opportunities for first-in-family college attendees may overcome significant multi-generational barriers to economic and social mobility. Sociologists Jennie Brand and Yu Xie (2010) found that higher education is negatively selected in the United States. That is, people who are most likely to receive higher education are those who have the least potential economic benefit from

the education, and that higher education has the greatest potential benefit for people who are not currently included in the higher education system. This result is surprising, because many economists expect the opposite, namely, that people will efficiently choose to acquire more education if the benefit is large.

This paradoxical result may be because talented people from low-income households face what in the formal terms of research is called constrained liquidity; in other words, these people don't have the money, now, to fund what would eventually be a valuable education for themselves and a benefit to their society. Conversely, some people from households with high socioeconomic status might have good economic alternatives even in the absence of a higher education -- for example, taking over a family business.

To increase access to higher education where it is needed most, public colleges and universities are indispensable. Economists have repeatedly shown that the productivity increases from higher education are associated specifically with the education available at public institutions (see, for example, Card). Their quantitative findings reflect the widespread understanding that more education means more productivity, and that it is appropriate for the public to provide such support. Two main reasons for this understanding are (1) that poor and working families cannot themselves afford the deferred wages and up-front costs of college attendance, even if the private and public rewards are likely to be large in the medium run; and (2) that, at the same time, the general public benefits substantially from a more educated citizenry.

Many poor households cannot pay tuition and other costs of a college education now, regardless of future benefits of such a worthwhile investment. This lack of liquidity is complemented by lending constraints. Poor households can find it difficult to get loans, even for high-return

investments in education, because they have no way to collateralize the loan or to pledge binding loan repayment from future income streams. Risk aversion may also contribute to the unwillingness of poor households to take out loans to pursue higher education; even though the average effect on earnings may be high, the possibility that a given student's higher education will not yield high returns may be daunting to low-income families.

- ***Public spending is key to attracting students***

The causal relationship between higher education and social and economic benefits provides strong evidence in favor of policies that encourage additional college attendance. A substantial investment in public higher education can lower the effective price for current and possible future students and result in higher rates of attendance and completion. A key question is how much of these benefits from public higher education can be realized specifically through public spending.

To answer that question we need to review what higher education really costs. Trostel's estimates are given in terms of the public cost of a public four-year equivalent degree, a computation that makes it possible to evaluate all the various benefits of higher education by combining figures for community college education, partially completed degrees, and completed four-year degrees. Given an estimated cost per public four-year equivalent degree of $53,000, an annual expenditure of $800 million will cover the cost of educating approximately 60,000 students per year. In Massachusetts approximately 150,000 full-time-equivalent students are enrolled in public higher education now (National Center for Education Statistics 2010), so $800 million is equivalent to more than one third of this enrollment. The exact number of additional students and graduates will depend on the particular structure of the policy and the

responsiveness of the population to the opportunities this policy is intended to create.

Common sense dictates, and econometric studies (e.g., Kane, Dynarski) confirm, that when the price is lower, more people attend institutions of higher education and more people complete degrees at these institutions. Households are responsive to the price of college, both for initial enrollment and for continuing toward a degree. This relationship is especially clear among poorer households, where recent studies find that the price elasticity of demand for this education is negative with respect to both enrollment and retention of students. In other words, the likelihood of someone's enrolling in college in the first place and then of staying in college long enough to graduate is strongly related to that college's tuition, fees and other related expenses. A full exploration of the price response is beyond the scope of this report, but we provide some indicators to predict possible responses.

Net tuition and fees paid by students at public institutions in Massachusetts are roughly $930 million (National Center for Education Statistics), and the state currently spends approximately $1 billion to cover the balance of the real cost of these students' education. Except for UMass Amherst, the tuition and fee payments are collected almost entirely from in-state households. If the entire proposed $800 million program were applied to making tuition and fees free for current students, then the expansion in public expenditure would replace nearly all the private spending – i.e., the state would pay more for current students, and those students themselves would pay less. In such a case, there would be little expansion of revenue, hence of employment or human capital.

On the other hand, if the expansion could be perfectly targeted to make college possible for exactly those people who would not otherwise have attended, and if public and private

contributions (i.e., state funding and individual students' share of college costs) continue to be split roughly 50-50, then an $800 million public expansion matched by an increase of approximately $1 billion in private outlay in the form of tuition and fees would roughly double enrollment. In this case both the short-run employment impact and the human capital impact of the stimulus would be doubled.

The most politically and economically feasible arrangement probably is somewhere between these two options. Using half of the proposed $800 million for a substantial tuition reduction -- 30 percent -- for current enrollees and the remaining half to expand new enrollment would provide a substantial employment stimulus in the short run. Some of the reduced cost for families would turn into new expenditure in other parts of the Commonwealth economy with modest stimulative effects. The stimulus would be the size of the forecast explained on pp. 14-16 above, both because the capital expenditure would support entirely new employment and because the public investment would be partly matched by new tuition revenue from the new enrollees themselves. The program would also increase overall enrollment by approximately 40 percent. The details of the impact of the investment program on enrollment, tuition, and expenditure are shown in Table 8.

Table 8. Estimated enrollment, expenditure, and tuition impact of $800 million public higher education investment program (PHEIP)

	Current	PHEIP	Change
State appropriation	$1,068,344,000	$1,868,344,000	75%
Tuition and fees	$927,714,000	$926,194,653	0%
Core expenditure (sum)	$1,996,058,000	$2,794,538,653	40%
Cost per student	$13,446	$13,446	0%
Tuition per student	$6,249	$4,456	-29%
FTE public enrollment	148,453	207,834	40%

Sources: National Center for Education Statistics and author's calculations.
http://nces.ed.gov/programs/digest/d10/tables/dt10_228.asp?referrer=list
http://nces.ed.gov/programs/digest/d10/tables/dt10_364.asp?referrer=list

- ***Higher education and long-term commitment to Massachusetts residents***

A final important issue for states considering greater investment in higher education is the potential out-of-state migration of graduates, i.e., brain drain to other states. This is a classic economic problem, namely, that an investor's inability to capture the full benefit of an investment leads to underinvestment. The problem that out-of-state migration poses for capturing the public's return on its investment in public higher education has usually been addressed empirically. One approach has been to use alumni records to count the number of state college and university alumni who remain in the state. The findings from this study were somewhat reassuring: 85 percent of public higher education students remained in Massachusetts several decades after graduating (Public Higher Ed Task Force 2005).

However, the question can be posed differently: To what extent will investment in public higher education raise or lower the number of college-educated workers in the state? The college-educated workers ultimately employed within the state do not actually have to be those who were educated in the state. For example, college-educated people may be attracted to locations with high concentrations of other college-educated people (or they could be repelled, if for example, competition for specific jobs is higher). In other words, if Massachusetts colleges and universities are educating a greater portion of the state's population, a larger number of more college-educated people from elsewhere may be attracted to jobs and communities here.

Trostel (2010) examined the net impact on the college-educated population of producing an additional college graduate. In much of the country, Trostel finds a nearly one-for-one correspondence: 100 additional college graduates in one state increases the college-educated population in that state by 93 people. Even in New England, where the relatively small sizes of

states facilitate inter-state migration, 100 additional public college graduates raise the college-educated population by that national average of 93. (The net implied leakage for private college graduates is substantially higher.) This means that the state captures roughly 93 percent of its investment in public higher education, a figure higher than the 85 percent figure commonly used to measure the retention. Again, the 93 percent estimate does not necessarily mean that 93 percent of state college graduates remain in state but that, when migration into Massachusetts by college-educated new residents is considered along with the out-of-state migration of some who have received their higher education within Massachusetts, the investment in public higher education effectively raises the college-education rate among the population. The analysis in Table 7 has been adjusted to account for the 93 percent capture rate. Given that most of the Massachusetts residents being educated in the state's university system stay here, and most of those who move out of the state are compensated for by others who move here, then the Commonwealth will realize a large benefit by spending more on higher education.

Homegrown graduates may thus be important both for their direct contribution to the state and for creating a climate that attracts and retains larger numbers of college graduates both from Massachusetts and from elsewhere. Massachusetts has long benefited from its reputation as an intellectually and professionally stimulating environment in which to work. Further investment in public higher education here will continue to enhance that reputation.

CONCLUSIONS

All these considerations make it clearer than ever that higher education is the foundation for reliable economic growth in Massachusetts, and that increased funding for it makes sense. Although such a focus may at first glance appear to be out of concert with the current

environment of recession and austerity, in fact public spending on higher education can provide both a short-run stimulus to ease the burden of unemployment and a long-run investment in an educated populace that will pay for itself in terms of higher wages, higher tax revenue, and lower public expenditures. The immediate benefits will reach many areas of the state's workforce, and the long-term benefits will continue to renew themselves.

The proposed new revenue and investment structure would provide the entire employment stimulus described in Section 1 of this report. It would also increase enrollment by 40 percent, leading to roughly 11,200 additional graduates per year. Based on the fiscal balance estimates explained above, the implied steady-state additional income tax revenue alone is a roughly $740 million-per-year gain for the Commonwealth. This amount by itself would cover the state investment. When the cost of the education, the increase in other state and local tax revenue, and the decreased demands on public expenditure are included in the calculation, the overall fiscal benefit would be on the order of $540 million per year -- that is, 11,200 new graduates with a public fiscal benefit of $48,560 each.

In other words, a dramatic increase in the state's investment in public higher education is an exceptionally good deal for the entire Commonwealth and should be vigorously pursued by policy makers.

Bibliography

The Adams Group. 2007. The Impact of Public Higher Education on the State of Colorado. Prepared for Colorado Department of Higher Education. December 2007

Brand, Jennie E. and Yu Xie. 2010. Who Benefits Most from College? : Evidence for Negative Selection in Heterogeneous Economic Returns to Higher Education. American Sociological Review 75: 273.

Bureau of Labor Statistics. (http://www.bls.gov/ncs/ebs/sp/ebnr0016.txt

Card, David. 2001. Estimating The Return To Schooling: Progress On Some Persistent Econometric Problems. Econometrica 69(5), Sep, 1127-1160

Chronicle of Higher Education, http://chronicle.com/article/Massachusetts-Almanac-2010/124037/

Coelen, Stephen P., Joseph B. Berger, Rebecca L. Forest, and Elaine Smith. 2002. Massachusetts Public Higher Education: A Shrewd Investment with Significant Returns. Massachusetts Institute for Social and Economic Research (MISER) and the Center for Education Policy (CEP) at the University of Massachusetts, Amherst.

Courant, Paul N., Michael McPherson, and Alexandra M. Resch. 2006. The Public Role in Higher Education, National Tax Journal, LVIV(2), June.

Dee, Thomas S. 2004. Are there civic returns to education? Journal of Public Economics 88 pp. 1697 – 1720

Ronald G. Ehrenberg. 2004. Econometric studies of higher education. Journal of Econometrics 121 (2004) 19 – 37

Folbre, Nancy. 2010. Saving State U: Why We Must Fix Public Higher Education. The New Press.

Gerald, Danette and Kati Haycock. 2006. Engines of Inequality: Diminishing Equity in the Nation's Premier Public Universities. Washington, DC: The Education Trust.

Groen, Jeffrey A. 2004. The effect of college location on migration of college-educated labor. Journal of Econometrics, 121: pp. 125-142.

Groen, Jeffrey A. and White, Michelle J., In-State versus Out-of-State Students: The Divergence of Interest between Public Universities and State Governments (2003). Working Papers. Paper 33. http://digitalcommons.ilr.cornell.edu/workingpapers/33

Milligan, Kevin, Enrico Moretti, and Philip Oreopoulos. 2004. "Does education improve citizenship? Evidence from the United States and the United Kingdom," Journal of Public Economics, Elsevier, vol. 88(9-10), pages 1667-1695, August.

Moretti, Enrico. 2004. "Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data," Journal of Econometrics, Elsevier, vol. 121(1-2), pages 175-212.

National Center for Education Statistics

(http://nces.ed.gov/programs/digest/d10/tables/dt10_364.asp?referrer=list),

Oreopoulos, Philip and Kjell G. Salvanes, 2011. "Priceless: The Nonpecuniary Benefits of Schooling," Journal of Economic Perspectives, American Economic Association, vol. 25(1), pages 159-84, Winter.

Paulsen, Michael B. 1998. Recent Research on the Economics of Attending College: Returns on Investment and Responsiveness to Price. Research in Higher Education 39 (4): 471-489.

Pollin, Robert and Heidi Garrett-Peltier. 2007. The U.S. Employment Effects of Military and Domestic Spending Priorities. Institute for Policy Studies, Political Economy Research Institute, and Women's Action for New Directions.

Pollin, Robert and Heidi Garrett-Peltier. 2009. The U.S. Employment Effects of Military and Domestic Spending Priorities: An Updated Analysis. Political Economy Research Institute.

Public Higher Education Coalition. 2006. Advancing Public Higher Education in Massachusetts: A Roadmap for Governor-Elect Patrick.

Rizzo, M. J. (2004). The public interest in higher education (CHERI Working Paper #55). Cornell University, ILR School site: http://digitalcommons.ilr.cornell.edu/student/10/.

Siegfried, John J., Allen R. Sanderson, and Peter McHenry. 2006. The Economic Impact of Colleges and Universities. Vanderbilt University Department of Economics, Working Paper No. 06-W12, May.

Topel Robert. 2005. The Private and Social Values of Education. Federal Reserve Bank of Cleveland.

Philip A. Trostel. 2007. The Fiscal Impacts of College Attainment. New England Public Policy Center, Working Paper 07-2

Philip A. Trostel. 2010. The Impact of New College Graduates on Intrastate Labor Markets. Journal of Education Finance 36(2): 186-213.

University of Massachusetts. 2006. UMass: A Strategic Investment. A Critical Asset for the Commonwealth's Economic Future.

U.S. Department of Commerce. 2009. Concepts and Methods of the U.S. Input-Output Accounts.