DOCUMENT RESUME

ED 356 733 HE 026 389

AUTHOR	Bluestone, Barry
TITLE	UMASS/Boston: An Economic Impact Analysis.
INSTITUTION	Massachusetts Univ., Boston.
PUB DATE	Jan 93
NOTE	86p.
AVAILABLE FROM	University of Massachusetts, Chancellor's Office, Boston, MA 02125 (free).
PUB TYPE	Information Analyses (070) -- Reports - General (140)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	College Graduates; *Cost Effectiveness; *Economic Impact; Economic Progress; Federal Aid; Fees; Higher Education; Income; Productivity; *School Community Relationship; State Aid; State Universities; Taxes; Tuition
IDENTIFIERS	*Massachusetts; *University of Massachusetts Boston

ABSTRACT

This report assesses the economic impact of the University of Massachusetts at Boston (UMass/Boston) on the Commonwealth of Massachusetts with attention to three major economic contributions: (1) the additional income that UMass/Boston students generate within the state as a result of their university education; (2) the added state income and sales tax revenue generated for the state government as a result of the additional income earned by these students; and (3) the export base income and tax revenue generated from non-resident tuition, fees, and living expenses, gifts and unrestricted funds from non-Massachusetts sources, student federal grants-in-aid, non-Massachusetts sponsored grants and contracts, and federal endowment income. Despite reliance on conservative assumptions throughout the model, it may be concluded that in economic terms UMass/Boston has been a lucrative investment for the Commonwealth even if one merely considers the beneficiary to be the state government itself. Among the findings it was estimated that the UMass/Boston entering class of Fall 1991, involving 2,572 students, will generate over their working lives, an added $1.05 billion to the overall income stream in Massachusetts, an amount of revenue that greatly exceeds the $34.1 million that students cost the state during their training at UMass/Boston. (GLR)

UMASS/BOSTON

AN ECONOMIC IMPACT ANALYSIS

Barry Bluestone
Frank L. Boyden Professor of Political Economy and
Senior Fellow, John W. McCormack Institute
of Public Affairs
University of Massachusetts at Boston

January 1993

UMASS/BOSTON:
AN ECONOMIC IMPACT ANALYSIS

Executive Summary

Using an innovative method for analyzing the impact of a public university on a regional economy, this study measures the three major economic contributions of the University of Massachusetts at Boston to the Commonwealth: (1) the additional income that UMass/Boston students generate within the state as a result of their university education (2) the added state income and sales tax revenue generated for the state government as a result of the additional income earned by these students, and (3) the "export base" income and tax revenue generated from non-resident tuition, fees, and living expenses; gifts and unrestricted funds from non-Massachusetts sources; student federal grants-in-aid; non-Massachusetts sponsored grants and contracts; and federal endowment income.

The principal conclusion of this study is that, despite the reliance on conservative assumptions throughout the model, in economic terms UMass/Boston has been an extraordinarily lucrative investment for the Commonwealth even if one merely considers the beneficiary to be the state government itself. At the same time that UMass/Boston provides a substantial contribution to the professional skill base of the state's economy -- and particularly the Greater Boston area, it also turns out to be a net revenue producer for state government. Because of the projected future income of its students and because of the "export base" income it generates -- UMass/Boston returns each year to state coffers substantially more in personal and sales tax revenue than it receives in state support.

The data for this study are for FY1992 and use the Fall 1991 entering class as the unit of analysis. The following are the key findings of this new study:

(1) As a result of the education received at UMass/Boston, the Fall 1991 entering class of 2,572 students can be expected over their working lifetimes to add $1.05 billion to the overall income stream in Massachusetts. Each entering class can be expected to contribute a comparable amount. Translated into "present discounted value" (PDV) terms, using a 7 percent interest rate, the current asset value of this aggregate lifetime income stream is $471 million. Adding a modest multiplier effect to these estimates in order to account for additional consumption generated in Massachusetts resulting from the added income of UMB students yields an income flow of $1.4 billion and a PDV in excess of $630 million. These figures represent the added value to the Commonwealth of the greater workforce skill base provided by UMB training to a single entering class. That 89 percent of undergraduates and 82 percent of graduate students remain in Massachusetts after leaving UMB is largely responsible for these sizable in-state income flows.

(2) From the state government's perspective, the additional income and sales tax revenue generated by UMB students over their lifetimes exceeds the value of the state subsidy to UMB for the training of these students. In dollar terms, the Fall 1991 class will cost the state $34.1 million during the years these students are registered for classes at UMB. However, the future income stream for this entering class is projected to yield $53.5 million dollars in additional state tax revenue (in PDV terms). Hence, **for every $1 spent by the Commonwealth on UMB students, it can expect to receive in return an added $1.57 in personal income and sales taxes.** Measuring this ratio in investment terms yields a rate of return to the state government of 8.9 percent -- significantly more than the state could earn if it were allowed to invest in long-term U.S. Treasury Bonds, corporate bonds, or even the typical mutual fund.

(3) A related analysis demonstrates that even in the most extreme case -- the "No UMB Scenario" -- the net cost to the state government is essentially zero. If the university did not exist at all and therefore received no subsidy from the state government (and assuming there were no comparable state-supported public colleges or universities in the

Commonwealth where UMB students could enroll) the net savings to the Massachusetts treasury would be trivial. The loss in tax revenue due to the foregone education of only those students who could not afford private college or university is virtually equal to the size of the UMB state subsidy. The estimated loss in tax revenue from the Fall 1991 entering class under the "No UMB" scenario is $30.6 million compared to the $34.1 million state subsidy to these students. Thus, under the "No UMB" scenario, the state "saves" a grand total of $3.5 million on the Fall 1991 class -- a small fraction of the annual current and capital budget subsidy to the university and a miniscule fraction of the state's $15 billion annual budget.

(4) Even this $3.5 million figure overstates the net cost to the state government of maintaining its subsidy of UMB students. In FY1992, UMB brought in $25.6 million in non-Massachusetts "export base" income. Given the state multiplier, this produces a total income flow of $34.3 million. This additional income generates $2.7 million in additional state income and sales taxes. Deducting this revenue from the $3.5 million net subsidy to the Fall 1991 entering UMB class yields a total annual net gain to the state government under the "No UMB" scenario of less than $1 million.

Based on this analysis, it should be clear that UMass/Boston has been, and continues to be, an extremely valuable investment property in the state government's portfolio. One suspects that very little state tax revenue is spent more prudently or profitably than the dollars spent on UMB.

Preface

This research report is the culmination of a study suggested to me by the Chancellor of the University of Massachusetts at Boston, Dr. Sherry Penney. When I first began to design this research, I was struck by the inadequacy of traditional economic approaches to analyzing the value of higher education institutions to the states where they reside. This was particularly true of public colleges and universities.

In the course of my research, I came to recognize the need for an entirely new approach to measuring the net impact of UMB to the Commonwealth. The new approach would take into account the value of the increment in the income stream of UMB students as a result of their education at the university. It would also measure the net value of income that came into the state as a result of activities at the school.

From the very beginning of my efforts, I was assured by the Chancellor that my research would be free from any influence by the university administration and all others associated directly with UMB. This assurance has been assiduously observed. I take full responsibility for the research methodology and for the results that ensue. I have attempted at every stage of the analysis to use conservative assumptions rather than ones that might inflate the apparent value of UMB to the Commonwealth and its citizens. I have included an extensive methodological appendix to this report in order to make my research methods as transparent as humanly possible and to assist those who would like the chance to review and criticize the analysis. As the methodology is quite innovative, I wholeheartedly invite constructive criticism.

In the preparation of this report, I received enormous assistance from a number of individuals at the University and elsewhere. I owe them a great deal of gratitude for the prodigious effort they made to provide me with raw data for the analysis. These individuals include Mark Schlesinger and Ed Twoomy in the Chancellor's Office; Jean MacCormack, Vice-Chancellor for Administration and Finance; Jennifer Wilton, the director of the Office of Policy Research and Planning; Byron Drinkwater, the director of the UMB Budget Office; Peter Tofuri, Jr. and Patty Bell of the Alumni Affairs Office; Frank Fletcher, Director of the UMB Development Office; Corine Williams Byrd, Director of Student Financial Management; and Peter Langer, Director of the University Advising Center. In addition, John Havens of the Social Welfare Research Institute (SWRI) at Boston College provided estimates of several important model parameters using the Multi-Regional Policy Impact Simulation model (MRPIS) housed at SWRI. Without their generous assistance, this project could not have been completed.

UMASS/BOSTON:
AN ECONOMIC IMPACT ANALYSIS

Barry Bluestone
Frank L. Boyden Professor of Political Economy
University of Massachusetts at Boston

Introduction

Since the passage of the Morrill Act of 1862, which established the original land grant colleges, the United States government has been committed to extending the opportunity for higher education to all of its citizens who can benefit from it. Less than a year after the passage of this historic Civil War era legislation, the Commonwealth established the University of Massachusetts with the goal of using state institutions of higher education to expand individual horizons, raise the level of public discourse, and improve the skills of the state's workforce.

In the present age, with the dramatic growth in global competition, American policymakers have turned to higher education as the preeminent option for maintaining a strong U.S. economy and boosting the nation's standard of living. While all levels of education, from pre-school to graduate school, have received increased attention as part and parcel of an overall economic strategy, universities and colleges have been singled out as the premier institutions for generating and maintaining the nation's professional labor force. In an era in which "brainwork" has largely replaced "backwork", institutions of higher education provide the critical training ground for an ever larger share of the labor force.

Historically, public higher education has made a special contribution to the skill base of the nation. It has provided post-secondary educational opportunities to those who could not afford private higher education and made it possible for other students to receive advanced schooling without the risk of taking on enormous amounts of debt. Public colleges and universities have often been treated as "loss leaders" -- costly institutions which spend public tax dollars to provide private business with skilled labor which presumably in the end serves the public good.

In the realm of state economic development, the University of Massachusetts at Boston is responsible for three types of contributions to the Commonwealth. The first -- and by far the most important -- is that the university provides a substantial portion of the college educated labor force needed by private businesses as well as by local, state, and federal government agencies operating in the state. Without a large college-trained labor force, Massachusetts would have great difficulty attracting and retaining its economic base in light of global and inter-state challenges. In the decade between 1981 and 1991, UMass/Boston was home to nearly 102,000 individual students. Since 1972, it has awarded over 25,000 undergraduate degrees and nearly 2,900 Master's degrees.[1] With nearly 90 percent of its undergraduates and almost 82 percent of its graduate students remaining in Massachusetts after leaving UMB, the urban university itself is responsible for training a significant proportion of the college educated labor force in Massachusetts. In the Greater Boston area, nearly one in twelve adults with education beyond high school has attended UMass/Boston.[2]

---

[1] According to the UMB Office of Institutional Research and Planning, between 1981 and 1991, 101,897 students attended UMB. From academic year 1972-73 through June 1992, the school awarded 25,120 undergraduate degrees and 2,870 Master's degrees.

[2] According to data from the 1990 U.S. Census, there were 1,061,979 individuals (age 25 and above) living in the Greater Boston area who had more than a high school education. Data on UMass/Boston graduates suggest that about 80 percent remain in the Greater Boston area years after leaving the university. Given these data, our best estimate is that nearly 8 percent

The second major contribution -- and one of two that we focus attention on in this analysis -- takes the form of additional state tax revenues generated by reason of the higher incomes earned by UMB students who remain in-state. Without questioning the basic proposition that higher education is good for the economy, this study asks a much narrower, but no less relevant, question: **Does the public investment in public higher education -- specifically the state government of Massachusetts' investment in the University of Massachusetts at Boston -- have a satisfactory "rate of return" for the state government itself and the taxpayers who supply the government with the financial wherewithal for investing in the university?**

The answer, based on this study, is a surprisingly powerful "Yes". That is, if you treat the state government as though it were a private bank, one finds that investments in UMB have not only been economically prudent, but indeed highly profitable in a strict business sense. Our best estimate suggests that for every $1 spent by the Commonwealth on UMB (including both current and capital spending), UMB students will earn additional income over their lifetimes which will generate for the state $1.57 in personal income and sales taxes (in present discounted value terms.) This is equivalent to an investment that pays an 8.9 percent nominal rate of return. If the state government were a private bank or industrial concern, it could hardly make a better investment than

---

(continued)

of the higher educated population in Boston gained their college experience at UMass/Boston.

in the students it implicitly subsidizes. Investing in long-term bank certificates of deposit or U.S. government treasury bonds would not be anywhere near as lucrative. Only if it could invest in higher risk growth funds such as Fidelity Magellan could the state revenue department hope to make a higher return, and then only in the long run.[3]

The third major contribution -- and the other for which we prepare an actual dollar estimate -- is the additional income generated in the state by reason of UMB being an "export base" industry. As we shall demonstrate, the university brought into the Commonwealth in FY 1992 nearly $26 million from external sources in the form of non-resident student tuition, fees and living expenses; gifts and unrestricted funds from non-Massachusetts sources; student federal grants-in-aid; non-Massachusetts sponsored grants and contracts; and federal endowment income. If UMB did not exist, this amount would very likely not have been added to the Massachusetts income stream. The $26 million, after accounting for an estimated "multiplier effect", was sufficient to provide $35 million in additional state income. Even using a very low jobs to income ratio, this added revenue is responsible for between 500 and 600 Massachusetts jobs -- jobs not paid for by Massachusetts tax dollars.[4]

---

[3] According to Fidelity Investments, the Magellan Fund has returned 6.22 percent over the twelve month period ending November 1992. Over the past 3 years, the average annual return (assuming full investment of dividends and capital gains) has been 9.58 percent. For the past 5 years, the return has averaged 10.56 percent. Over longer periods of time, taking into account the extraordinary run-up in stock values during the mid-1980s, the return has been considerably higher: 21.94 percent during the past 10 years and 22.60% during the full lifetime of the fund.

[4] This employment estimate is based on an analysis of the relationship between total output generated in Massachusetts industry and associated employment requirements. According to the Social Welfare Research Institute at Boston College, an increase in total output of $61,850 is necessary to support one job in Massachusetts. This estimate comes from background research prepared for the Association of Independent Colleges and Universities of Massachusetts, "Economic Impact of Massachusetts Higher Education, 1989-1990 Academic Year," September 1991.

These results follow from a conservative analysis of the state costs of subsidizing UMass/Boston, an equally conservative analysis of the tax revenue benefits generated from the additional wage and salary earnings of UMB students once they leave the university, plus a reasonably restrictive estimate of the additional state income generated as a consequence of UMB "export" activities.

The basic analysis behind these findings is found in the body of this report. Greater analytic detail and additional information about the assumptions used in this study are provided in an attached Appendix.

Analyzing the Impact of Higher Education on the Economy

As far as we can tell, the nature of the analysis to follow is innovative in at least three ways.

First, it treats the university as an investment instrument, not merely as an export base.

Second, it attempts to measure not the total value of the university, but the increment in dollar value to the state as a result of UMB activities -- that is, the value that would be lost if UMass/Boston did not exist.

Third, it measures the net impact of the university on state government revenue by comparing the dollar value of public subsidy with the additional state tax revenue resulting from the added income that we project will be earned by students as a direct consequence of their post-secondary education.

The unique methodology utilized in this analysis produces a much lower estimate of the value of the university to the state and its citizens than traditional models -- but we believe a much more reasonable and credible one.

In brief, the traditional model for estimating the impact of a college or university on a regional economy works in the following, relatively simple, way.[5] Total institutional expenditures by the college or university and the total direct spending of its employees, students, and campus visitors are estimated for a given year. This total is then incremented by a local "multiplier" which takes into account the additional (indirect) business volume generated as a result of the direct spending of the school, its employees, students, and visitors. The resulting dollar value is referred to as the "Total Economic Impact" of the college or university on the regional economy. The challenging part of such an analysis involves generating reasonable estimates of employee, student, and visitor spending and calculating a trustworthy estimate for the "multiplier."

There is nothing implicitly wrong with this approach. But it is important to recognize what the final dollar value from this methodology represents and what assumptions are built into its calculations.

** **As the name of this methodology implies, the final dollar value generated by this type of analysis relates to total economic impact, not the increment in total value due to the operation of the college or university.** It does not provide any clue as to how much lower would be the total income of the surrounding region if the college or university did not exist.

---

5 The "total value" methodology discussed here follows from the work of J. Caffrey and H. Isaacs, Estimating the Impact of a College or University on the Local Economy (Washington, D.C.: American Council on Education, 1971). It is also the basic model followed by D.S. Elliot, S.L. Levin, and J.B. Meisel, "Measuring the Economic Impact of Institutions of Higher Education," Research in Higher Education, Vol. 28, 1988, pp. 17-33; G.J. Ryan, "The Economic Impact of the Community Colleges on the State of New Jersey," Brookdale Community College, Lincroft, New Jersey, 1983; and Jeff Seybert, "The Economic Impact of Higher Education on the Kansas City Metropolitan Area 1988-1989," A Report prepared for the Kansas City Regional Council for Higher Education, April 1991.

By way of example, the standard method counts as university-generated funds any money students from the local community spend on housing, food, and incidentals even if they would have spent the same money if they were not students at the university. Moreover, in the case of a publicly supported college, this method does not take into account that the tax dollars that make up institutional spending would have either been spent on other government programs in the region or spent by local taxpayers if their taxes were lower by reason of not having to subsidize the college or university.

** **The traditional methodology treats the college or university simply as an "export" base or "tourist" industry, not as an investment instrument.** Accordingly, dollars spent by employees, students, and visitors are handled as dollars that come into the local community as though the university were selling exports or receiving tourists who stay for a short period of time, spend money, and then depart. This, indeed, is a fair representation of many schools -- particularly those in the private sector -- which bring students from outside the local community, educate them, and then see them return to their place of origin or a new location. However, for schools that educate a local labor force that largely remains in the community after schooling is completed, this method seriously underestimates the full economic impact associated with the university or college.

Hence, the traditional methodology has two potentially serious problems. First, it overstates the net impact of a college or university on the regional economy by reason of counting every dollar spent by the institution and by its employees, students, and visitors as though these were all "new" dollars to the regional economic base. Second, it underestimates the net impact of schools by failing to measure the potential future income flow from the added earning power of the students who benefit from having been educated by reason of the college or university.

In general, the traditional methodology tends to provide a very much inflated estimate of the current "export-base" income generated in a region by a college or university -- while at the same time completely disregarding the long-term additional "investment" income (and related tax revenue) produced by their students over the course of their lifetimes. Moreover, whatever its merit for analyzing private institutions of higher education, the Total Economic Impact analysis is generally unsuited for studies of public sector colleges and universities given the potential alternative use of state tax dollars allocated to support these schools.

The "Net Impact Investment/Export Base" Model

The methodology used here to identify and estimate the value of the University of Massachusetts at Boston to the Commonwealth departs markedly from the traditional analysis. We call it a "Net Impact Investment/Export Base" model -- "Net Impact Model" for short. The model has the following fundamental characteristics:

** It measures the "present discounted" lifetime increment in state income and sales taxes generated as a result of the additional earning power of UMB students who remain in-state after leaving the university.

** It estimates the net difference between the value of the state subsidy to UMB and the present discounted value of the tax revenue generated by reason of the additional earning power of UMB students.

** It measures the increment in export base income to the state generated by UMB as a consequence of non-Massachusetts income brought to the Commonwealth through the university.

The first two of these characteristics can be regarded as the "investment" element in the overall model. The third incorporates the export base component of the net annual value of UMB to Massachusetts.

A Primer on the Methodology for the "Net Impact" Model

As noted above, the appendix to this report provides detail on the precise methodology used to estimate both the investment and export base contributions to the Commonwealth. In this section, the basic structure of the methodology is presented as a backdrop to the actual estimates reported in the next section.

Measuring the "Investment" Value of UMB

Step 1 The first step in measuring the net income stream to the state from UMB involves estimating the increment in lifetime earnings to UMB students as a consequence of the additional education they receive at the university. This was done by preparing a regression analysis of "age-earnings" profiles for four types of students residing in New England.[6] Individual regressions (as presented in the appendix) were run on reported personal wage and salary income for (1) high school graduates (2) those who complete 1-3 years of post-secondary school (3) college or university graduates, and (4) graduate students. Separate regressions were run for men and women. The actual regressions and graphs of age-earnings profiles can be found in the appendix.

Step 2 The regression parameters were inserted into a spreadsheet and the predicted annual incomes for these four types of students (for men and women separately) were calculated for ages 20 through 65.[7] Within the spreadsheet, four differences were calculated for each year: College Grad vs. High School Grad; Some College vs. High School Grad; College Grad vs. Some College; and Graduate School vs. College Grad. Each of these corresponds to

---

[6] The data set used for this analysis is the Annual Demographic File of the March 1988 Current Population Survey prepared each year by the U.S. Bureau of Labor Statistics in cooperation with the Bureau of the Census. In order to maintain large sample size , we relied on a subsample of the national CPS for the six New England states.

[7] To account for projected increases in real wage rate levels over time, the age-earnings profiles were augmented by annual growth rates based on an analysis of wage growth by education category for the 1979-1989 decade. The appendix to this report provides details on these calculations.

a type of student at UMass/Boston. The first corresponds to a new Freshman (or Freshman Transfer) who completes a UMB undergraduate degree; the second corresponds to a student who leaves UMB before completing an undergraduate degree; the third corresponds to a student who transfers into UMB and graduates after completing some post-secondary training elsewhere; and the fourth corresponds to those who take post-graduate training at UMB. (These differences are visually depicted by the areas between age-earning profiles shown in the appendix.)

Step 3 To measure the total increment in earnings streams for each of these student types, we added the income increments for ages 25 through 65.[8] Thus, for example, we find that a New England male who completes his entire undergraduate training at UMB can be expected to earn approximately $990,000 more over his lifetime (age 25-65) than a male who completed the high school degree, but did not go to college.

Table 1 indicates the increments in lifetime income for each of these types of students.

Table 1

Increments in Lifetime Income due to Post-Secondary Education (by Sex)

	College Grad vs. H.S. Graduate	Some College vs. H.S. Graduate	College Grad vs. Some College	Grad School vs. College Grad
MEN	$989,150	$247,176	$741,973	$1,039,815
WOMEN	$687,784	$300,512	$387,272	$ 389,421

Source: Analysis of March 1988 Current Population Survey

[8] This age range is used to reflect the typical period in the labor market for UMass/Boston students who tend to be older than the average college student. The mean age of UMB students is approximately 28; the median 25. See UMass/Boston Office of Policy Research and Planning, "Facts in Brief, Fall 1992."

The dollar values are quite impressive, but we should note for the record that these estimates are fully consistent with the results from other studies.[9] Moreover, they demonstrate several well-known facts about the impact of education on earnings. For one, persistent differences in the occupational attachment of men and women result in strikingly different earnings "success" in the market. For another, there is evidence of a very strong "diploma effect". Among men, one to three years of college beyond high school yields only about one-quarter as much additional income as completion of the undergraduate degree; among women, about 45 percent. Hence, reducing the dropout rate among college students would increase lifetime income significantly. Finally, graduate school pays off quite favorably, especially for men.[10]

Step 4 To be able to compare lifetime streams of income with the current cost to the state of subsidizing public university education, it is necessary to calculate the "present discounted value" (PDV) of each income stream. The PDV is the value today of a dollar earned at some time in the future. For example, if interest rates are 5 percent, $105 a year from now is worth $100 today.

---

9 See, for example, background work done by Alan Matthews and John Havens for Association of Independent Colleges and Universities of Massachusetts, "Economic Impact of Massachusetts Higher Education: 1989-1990 Academic Year," September 1991.

10 The pattern and levels of income gain shown in Table 1 accord well with current thinking about wage differences between men and women. Continuing occupational "segregation" along gender lines can explain, for example, the much higher return to postgraduate education for men. While occupational barriers are breaking down, it is still true that women are disproportionately found in such fields as teaching, social work, and nursing -- relatively lower wage fields for postgraduate students -- while men are found in greater numbers in law, medicine, and business.

For the purpose at hand, we assumed a 3 percent discount rate -- consistent with a 7 percent nominal interest rate matched with 4 percent inflation. Such a discount factor is consistent with current medium to long-term interest rates and expected inflation rates. Once this discount is applied to the incremental earnings streams in Table 1, we obtain the present discounted values shown in Table 2.

Table 2

Present Discounted Value of Income Increments due to Post-Secondary Education (by Sex)

	College Grad vs. H.S. Graduate	Some College vs. H.S. Graduate	College Grad vs. Some College	Grad School vs. College Grad
MEN	$442,502	$101,173	$341,329	$431,767
WOMEN	$322,654	$128,129	$194,525	$160,546

Source: Analysis of March 1988 Current Population Survey

This completes the first stage of the "Net Impact" analysis of investment in higher education. Table 2 provides the "investment values" associated with completing various amounts of post-secondary education in New England.

Measuring the Tax Revenue Increment from these Income Streams

The next stage in the analysis is to convert the PDV results shown in Table 2 to PDV estimates of additional taxes paid by college educated students over their lifetimes. This is necessary in order to be able to compare the state cost of subsidizing public university students with the increment in state taxes paid by those students from the added income they will enjoy as a result of that education.

Additional Massachusetts state income tax is calculated by multiplying the PDV earnings increments in Table 2 by 5.95% -- the current state tax rate on wage earnings. In addition, added sales tax payments are calculated by assuming that consumers will spend 90 percent of their after-income tax increment in earnings (i.e. they will save 10 percent) and that approximately half of the additional spending will be subject to the Massachusetts 5% sales tax -- a tax which does not apply to housing and the cost of most food and clothing.[11] Both of these assumptions appear to be quite reasonable -- the latter being on the conservative side.

The results are shown in Table 3.

Thus, we see that in present discounted value terms, the typical male UMB undergraduate (who completes his entire degree at UMB and who remains in the state after graduation) will pay almost $35,000 in additional taxes over his lifetime.[12] The typical female UMB graduate who completes the same amount of education will return about three-quarters this amount to the state, given her lower market earnings.

---

[11] The precise method for determining projected sales tax revenue is detailed in the appendix. Essentially, the sales tax estimates are based on multiplying the PDV estimates of income growth by (1-.28-.0595) to yield the change in disposable income (i.e. income after the payment of federal and state personal income taxes); this figure is then multiplied by .9 to reflect the marginal propensity to consume, by .5 as an estimate of consumption that is subject to the limited state sales tax, and by .05 to reflect the current sales tax rate. In addition, two small corrections are made to these final estimates in order to adjust predicted to actual sales tax revenues using this formula and data from the Massachusetts Department of Revenue.

[12] The actual total amount of added state taxes paid by this typical student is $77,514. In PDV terms, this amounts to the $34,676 figure shown in Table 3. One can calculate the total as opposed to PDV taxes paid by applying the tax assumptions in Table 3 to the total income increments shown in Table 1.

Table 3

The PDV Value of Increments in Massachusetts State Income and Sales Tax Revenue Paid on Incremental Income due to Post-Secondary Education (by Sex)

	College Grad vs. H.S. Graduate	Some College vs. H.S. Graduate	College Grad vs. Some College	Grad School vs. College Grad
			MEN	
Income Tax	$26,329	$6,020	$20,309	$25,690
Sales Tax	8,428	1,927	6,501	8,224
Total Tax	$34,757	$7,947	$26,810	$33,914
			WOMEN	
Income Tax	$19,198	$ 7,624	$11,574	$9,552
Sales Tax	6,146	2,440	3,705	3,058
Total Tax	$25,344	$10,064	$15,279	$12,610

Source: See Table 2
Note: Based on Massachusetts State Income Tax rate on earnings of 5.95% and Massachusetts State Sales Tax rate of 5.00%.

These incremental tax revenue estimates provide us with half the data we need to compare the dollar benefits directly flowing to the state government from UMB students with the public costs of training those students. In the next section, we estimate the per student state cost of subsidizing UMB.

Measuring the State Cost of Educating UMB Students

There are two elements in the measurement of average per student costs at UMB born by the state government. The first involves determining the number of years students spend at school; the second involves estimating the per year cost paid by the state government.

Average Years at UMB per Student

Given the varied tenure experiences of UMB students, it is necessary to calculate average years in attendance for five different types of students. These are:

(1) HS GRAD --- UMB GRAD

Students who enrolled as high school graduates and completed their undergraduate degrees at UMB. (Includes Freshman Year transfer students)

(2) HS GRAD --- SOME UMB (NO UMB GRAD)

Students who enrolled as high school graduates but did not complete their undergraduate degrees at UMB. (Includes Freshman Year transfer students)

(3) TRANSFER IN --- SOME UMB (NO UMB GRAD)

Students who transferred to UMB from a community college or another university or college but did not complete their undergraduate degrees at UMB. (Includes Sophomore, Junior, and Senior transfer students)

(4) TRANSFER IN --- UMB GRAD

Students who transferred to UMB from a community college or another university or college and completed their undergraduate degrees at UMB. (Includes Sophomore, Junior, and Senior transfer students)

(5) GRADUATE STUDENTS

Students who enrolled in graduate programs and either completed or did not complete advanced degrees.

Measurement of average tenure at UMB for each of these types of students (separately for men and women) is made possible by reason of detailed retention data compiled by the University's Office of Institutional Research and Planning (OIRP).[13]

The specific methodology was as follows. For both undergraduates and graduate students, the semester-by-semester retention and graduation rates for the Fall 1984 student cohort were applied to the Fall 1991 enrollment cohort. The Fall 1984 cohort provides sufficient data to avoid serious truncation bias in the estimation of number of semesters enrolled at UMB.[14]

This procedure produces the "average years at UMB" data for each type of student identified above (see Table 4).

According to these calculations, the typical male undergraduate who enters UMB from high school and completes his undergraduate degree takes five years to do so. The typical women takes a slightly shorter time. The typical male student who does not graduate from UMB having entered after high school spends about 2.5 years on campus; the typical female student a bit more. Transfers in who ultimately graduate from UMB spend a little more than 3 1/3 years at the school.[15]

---

[13] The data for undergraduates come from unpublished computer runs completed during the summer of 1992. Retention and graduation data for graduate students is contained in UMB Office of Institutional Research and Planning, "Trends in Graduate Enrollment, 1981-1988," OIRP Research Brief 1.89, January 1989, Table 5, p. 8.

[14] Variation in retention and graduation rates for classes entering in different years appears to be small, permitting the use of 1984 as a proxy for other classes.

[15] Note that these estimates are the equivalent of "headcount" numbers, not full-time-equivalents (FTEs). Thus, when it comes to estimating state costs per student, we shall retain a headcount approach as opposed to an FTE approach.

Table 4

Projected Average Years at UMB for Students Entering in Fall 1991

	Men	Women
HS GRAD - UMB GRAD	5.01	4.72
HS GRAD - SOME UMB	2.50	2.77
TRANSFER IN - SOME UMB	2.28	2.55
TRANSFER IN - UMB GRAD	3.37	3.36
GRADUATE STUDENTS	2.63	2.63

Source: Compiled from retention and graduation data provided by the UMB Office of Institutional Research and Planning.

When we finally measure the overall average state subsidy per student, we shall estimate costs for each of these types of students separately and take a weighted average to obtain an overall cost valuation. The weights represent the percentage of students (by sex) in each of the tenure categories noted above.

Estimating State Spending per UMB Student (FY1992)

The chief components of state spending on UMB include:[16]

(1) Annual State Appropriation

(2) State Paid UMB Employee Fringe Benefits

(3) Capital Use Estimates

[16] Total state spending per student was estimated from the IPEDS Reports provided by Byron Drinkwater, Director of the UMB Budget Office.

The annual state appropriation includes the general appropriation plus special appropriations for student financial aid, library expenses, and "other" non-specific uses.

State paid UMB employee fringe benefits represent the fringe benefit costs that are covered directly by the state and which do not appear in the UMB budget.

Total state spending is reduced by the amount of student tuition funds returned to the State General Fund by the university under FY1992 budget policy.

Capital use is calculated on a "cost basis" with physical structure investment charged at 2% per year of estimated capital cost. This is equivalent to a straight-line 50-year depreciation schedule. The "cost basis" charge for equipment is 6.67% -- the equivalent of a 15-year useful life. Since an unknown amount of equipment is provided under sponsored research, we have assumed that the state government has paid for two-thirds of total equipment purchases at the university.

Finally, to calculate per student state spending, the total (current + capital use) FY1992 state spending estimate for UMB ($50,264,676) was divided by the total number of students attending UMB in Fall 1991 (11,606). This yielded a per student state spending estimate of $4,331. This figure is used in all calculations of annual per student state costs. (For comparability with other university data, this figure can be translated onto a "full-time-equivalent" student basis; the resulting amount comes to $6,056 per year.)

Table 5 presents the basic data for these calculations. (The appendix includes a more detailed budgetary accounting.)

Table 5

State Spending per UMB Student (FY1992)

State General Appropriation	$41,727,100
State Special Appropriations	967,785
State Paid UMB Employee Fringe Benefits	11,185,159
(LESS Tuition Returned to State General Fund)	(7,895,557)
TOTAL CURRENT STATE EXPENDITURES	$45,984,487
Capital Use Estimates:	
Buildings	$3,317,586
Equipment	962,603
TOTAL CAPITAL USE STATE EXPENDITURES	$ 4,280,189
TOTAL STATE SPENDING (CURRENT+ CAPITAL)	**$50,264,676**
Per Student Spending per Year Enrolled (Fall 1991 Student Headcount: 11,606)	**$4,331**

Source: UMB Budget Office, IPEDS Reports

Additional Information Needed to Calculate "Net Impact" Analysis

At this point, we have three of the key ingredients necessary for measuring the net impact of UMB on state government finances: (1) the basic income increment attached to post-secondary education (2) the average number of years a student attends UMass/Boston, and (3) the average annual state cost of subsidizing UMB.

Still, there are three additional elements necessary to obtain a full net impact analysis. The first of these is the "option value" of attending UMB. The second is an estimate of continued in-state residence of UMB student alumni. The third is an estimate of the "multiplier" that can be applied to income increments to measure the total in-state income generated as a result of the higher earnings of UMB students. We shall look at each of these briefly.

Estimating the "Option Value" of a UMB Education

Students who transfer from UMB to attend another (private) higher education institution and those undergrad graduates who attend (private) universities for graduate or professional training presumably augment their future income streams in part because UMB provided them with the opportunity to pursue further education elsewhere. As a consequence, part of the added increment to earnings is properly attributed to UMB.

The method of estimating the number of UMB students who dropped out and then transferred to private universities and colleges is as follows:[17]

---

[17] To estimate the "option value" of a UMB education, we relied on two data sources for estimates of the number of UMB students who likely pursued further higher education at private (non-state supported) institutions after leaving UMB. These two sources were: UMB Center for Survey Research, "Report from the Survey of UMass/Boston Juniors," March 1986; and UMB Office of Institutional Research and Planning, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," Report 3.89, April 1989. In addition, estimates of the percentage of UMB dropouts transferring to other schools was provided in private correpondence from Peter Langer, Director of the UMB University Advising Center, August 13, 1992.

(1) The dropout percentage for Freshman, Sophomore, Junior, and Senior students from the Fall 1984 class was estimated from the unpublished OIRP retention data. This dropout rate was applied to the Fall 1991 student cohorts.

(2) It was assumed that the graduation rate of transfer students at other institutions was equal to the rate prevailing at UMB.

(3) Based on UMB student dropout survey data, it was estimated that 61% of transfers to other universities and colleges attend private schools.

(4) Separate estimates were prepared for Freshman, Sophomore, and Junior/Senior dropouts for men and women separately.

This overall procedure yielded small, but not insignificant, numbers of UMB transfer students who attend private schools and complete undergraduate degrees. By way of example, of the 384 male Freshman who entered UMB in the Fall 1991, we calculate 12 completed an undergraduate degree at a private university or college after leaving UMB and transferring to another school.[18] Similar calculations were made for men and women who are Freshman Transfer Dropouts, Sophomore Transfer Dropouts, and Junior/Senior Transfer Dropouts. We also estimated a corresponding option value for UMB undergraduates who went to private graduate or professional school after undergraduate training at UMB. According to OIRP research, 22% of UMB graduates pursue university credit beyond the undergraduate degree.[19]

---

[18] The method of calculation is as follows. Of the 384, we estimate a dropout rate of 45.4%. This yields 174 who could transfer to another school. Of this number, we estimate that 50.3% went to college elsewhere and 22.5% of these graduated. This yields 20 students. Of this number, we estimate 61% went to private as opposed to other public Massachusetts universities and colleges. Hence, the final number of Fall 1991 male Freshman who end up transferring from UMB to a private school and completing an undergraduate degree there is 12 students.

[19] See UMB Office of Institutional Research and Planning, "The Graduates of 1987: What They Are Doing and What They Think About the University," Report 3.88, June 1988.

In all option value calculations, we assume that 1/2 of the increment in earnings due to the higher level of education completed after a student leaves UMass/Boston can be attributed to UMB. Admittedly, this is an arbitrary assumption, but the impact on the overall estimate of net value is small even if this assumed value is raised or lowered substantially.

The last step involving the option value is to multiply the option value income by the state income tax and sales tax rate percentages and add these dollar values to the appropriate tax revenue increments for each group of students in the overall analysis.

Estimating In-State Residence of Alumni

Obviously, the state government receives future tax revenue from UMB students only if they remain residents of the Commonwealth. Therefore, it is necessary to calculate what share of UMB students remain in-state after leaving the university. Unfortunately, UMass/Boston does not have comprehensive survey information regarding the location of its alumni. However, during the summer of 1992 the Alumni/Development Office conducted a survey of the UMB College of Management alumni for those who graduated between 1984 and 1991. This survey included both undergraduates and Master's level students.[20] We used this survey to obtain estimates of in-state residency for all UMB students, seeing no reason why management students would have a significantly different outstate-migration rate any higher or lower than UMB students in other units of the university.

---

[20] A summary of the results of this survey was communicated to the author in a letter from Patty Bell in Alumni/Development Records on August 20, 1992.

For most years, the Alumni Office was able to locate current addresses for 85% or more of the alumni. Separate records were kept for men and women. To estimate an average long-term in-state residence ratio, we chose the years 1984-1987 for analysis. As it turned out, the in-state ratio was nearly constant over these four years -- with a gender weighted average of 89% for undergraduates and 82% for graduate students. The ratios did not vary by more than two percentage points between men and women.[21] These two percentages were used in the overall net impact analysis.

Measuring the "Multiplier Effect"

An extra dollar spent in a regional economy has a "multiplied" effect on total income as that dollar moves from one consumer to the next through the economy. Because of "leakages" in the system, the dollar does not continue to multiply forever. Dollars leak out of the spending stream of a particular region (or state) in a large number of ways: spending on "imports" (anything produced out-of-state); taxes; and savings are the three most important leakages.

The state multiplier used in this analysis is the one calculated for Massachusetts in the Multi-Regional Policy Impact Simulation (MRPIS) model housed at Boston College and used to analyze the impact of private universities and colleges in the Commonwealth for the Association of Independent Colleges and Universities of Massachusetts (AICUM).[22] The MRPIS

---

[21] While not used in the formal analysis, it is worth noting that a high proportion of the alumni not only continue to reside in Massachusetts, but nearly 80% reside in the Greater Boston area. Again, there is little trend over time in this percentage.

[22] Estimates of the Massachusetts multiplier were supplied by John Havens, Director of the MRPIS Model at Boston College.

multiplier has a value of 1.341 -- a conservative estimate by most standards due to the large number of simulated leakages incorporated in the model.[23] This multiplier was applied to the net impact analysis.

With these last three pieces of data in hand, we have all the information necessary to perform the net impact investment income analysis that comprises the first half (and most important component) of our overall study of the economic impact of UMB on the Commonwealth. Before presenting these results, however, we need to briefly explain the methodology used to compute the second component of the overall analysis -- the export base income estimates.

A Brief Primer on the Methodology for the Export Base Model

As we noted in the introduction to this study, UMass/Boston also makes an economic contribution to the Commonwealth by reason of funds it brings into the state in the form of non-resident student spending, non-Massachusetts grants and gifts, federal student grants-in-aid, and federal endowment income. To ascertain the total export base provided by UMB, this study measured five income flows into the Commonwealth via the university.

---

[23] The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce uses the "Regional Input-Output Modeling System" (RIMS II) for calculating "official" state multipliers for each state. Those for Massachusetts generally run from 1.5 to over 2.0 depending on the nature of the initial economic stimulus. Only two of the more than two dozen multipliers calculated for the Commonwealth using RIMS II are below 1.5 and both of these are above the MRPIS multiplier used here. See U.S. Department of Commerce, Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II) (Washington D.C.: Government Printing Office, May 1986).

(1) Non-resident student tuition, fees, and living expenses.

The size of the non-resident student population as of Fall 1991 is taken from OIRP records. At 495 students out of 11,606, they represent only 4.3% of the entire student body. Tuition and fees paid by non-resident students amounted to $9,766.[24] An estimate of living expenses per non-resident student was derived from a private university study undertaken by the Association of Independent Colleges and Universities of Massachusetts.[25] The AICUM estimate for total average per student living expenses is $10,327.

(2) Non-Massachusetts-based sponsored research contracts and grants.

Total non-Massachusetts-based sponsored research and activity funds for the period July 1, 1992 - June 30, 1992 was obtained from the UMB Office of the Vice Chancellor for Administration and Finance.[26] Of a grand total of awards equal to approximately $12.3 million during that period, $8.7 million came from government agencies and private foundations outside of the Commonwealth. To be on the conservative side, we assumed that any funds from in-state agencies or foundations would have gone to other in-state institutions if they had not been awarded to UMB -- thus not increasing the total income in the state.

---

[24] See University of Massachusetts 1991-92 Facts (April 22, 1992).

[25] See "Economic Impact of Massachusetts Higher Education, 1989-1990 Academic Year" published by the Association of Independent Colleges and Universities of Massachusetts, September 1991.

[26] These statistics will appear later this year in Office of the Vice Chancellor for Adminstration and Finance, "Annual Report of Sponsored Activities, Fiscal Year 1992."

(3) Student federal grant-in-aid.

Dollar figures for all federal grant-in-aid provided UMB students includes funds from Pell Grants, Supplemental Educational Opportunity Grants (SEOGs), the federal subsidy to Work Study, McNair student grants, and federal aid for administering federal grants on campus.[27] Only federal aid was included in the analysis. The large amount of federal loans to students was not included because presumably students will have to repay these funds to the federal government and therefore these dollars plus interest charges will leave the state over the student's lifetime.

(4) Non-Massachusetts-based gifts and unrestricted contributions.

The total value of non-Massachusetts-based gifts and other private contributions to UMB in FY1992.[28] The figure used here includes only those gifts from non-state resident corporations and individuals under the assumption that if UMB did not receive these funds, they would be awarded to another in-state institution.

(5) Income from federal endowments.

The final export base income source is income from federal endowments. In this small category, the largest item is income from the federal endowment to the John W. McCormack Institute. The total McCormack endowment in FY1992 was $3 million. At an estimated 6% interest rate, this endowment was worth $180,000 per year.[29] Assorted other endowments yielded an additional $14,000 of income.

---

[27] These data are compiled from UMass/Boston Student Financial Aid Office,"Financial Aid Services 1991-92 Annual Report Initial Analysis," Summer 1992.

[28] Data for this part of the analysis was obtained from unpublished reports of the UMB Development Office.

[29] In calendar 1992, the federal government provided an additional $3 million to the McCormack Institute endowment. The income flow from this endowment increment did not begin until FY1993 and has been excluded from this analysis.

Adding up the five categories of the "export base" provides the basic export value generated by UMass/Boston used in this analysis.

The Impact of UMB on the Economy of Massachusetts

We now have all the ingredients necessary to estimate the impact of UMass/Boston activities on the economy of Massachusetts. In presenting our results, we look at the three contributions that UMB can make to the Commonwealth

(1) Its contribution to the value of the labor force base of the state.

(2) Its net impact on state government finances measured as the value of the state subsidy to UMass/Boston vs. the increment in state income and sales taxes generated by UMB students.

(3) Its contribution to the "Export Base" of the state.

In doing this, we have chosen to focus on the class of students who entered UMass/Boston in the Fall semester 1991. This class of 2,572 students has the following composition:

Table 6

Gender and Status of Fall 1991 Entering Student Body - UMass/Boston

	Men	Women
Undergraduate Students	966	1,127
Graduate Students	191	288
Total	1,157	1,415

Source: Office of Institutional Research and Planning

We predict student tenure at UMB and the increment in income each group of students can expect to earn as a result of the education it obtains from the university. As noted above, we study different groups of students based on their likely tenure and then take a weighted average of these students to provide estimates for the entire Fall 1991 entering class. This type of analysis could be repeated for each entering class so as to yield the total benefit to the Commonwealth from the existence of UMB. By studying just one class, however, we can yield a rough estimate of the state benefit-to-cost ratio for virtually any class of UMB students. This analysis is therefore generalizable to all students at the university.

MAJOR FINDINGS

The Additional Earnings of UMB Students

One way to assess the overall contribution of UMB students to the economy of the Commonwealth is to measure the additional income generated in the state by reason of the education they received at UMass/Boston. This incremental earnings stream presumably represents the added value of these workers to the state's business community.

To produce this analysis for the Fall 1991 entering class, we use the data on the incremental earnings streams for each type of student, the number of students of each type, and the in-state alumni residence ratios. Table 7 presents these results.

According to this analysis, 89 percent of the 2,093 undergraduates and 82 percent of the 479 graduate students of the Fall 1991 entering UMass/Boston class can be expected to remain in Massachusetts after leaving the university. Over their lifetimes (Age 25-65), this class will earn an estimated $1.05 billion dollars more in Massachusetts than if they had not completed as much education as they did at UMB. In present discounted value terms, this amounts to over $471 million. Such a large increment in earnings is an obvious sign that the university contributes mightily to the overall economy of the state. Adding the multiplier effect (=1.341) as this income stream is spent and circulates throughout the state economy yields a total income increment of $1.4 billion and a full multiplied PDV of more than $630 million. It is important to note that this represents the increment in earnings of a single UMB entering class. Each year's class can be expected to contribute an incremental income stream of similar magnitude.

Table 7

Estimated Total and Present Discounted Value of Incremental Income Strea
Fall 1991 UMass/Boston Entering Class

UNDERGRADUATES

HS GRAD - UMB GRAD	Female	Male
Total Income Increment	$129,924,117	$143,616,598
PDV of Income Increment	$62,839,172	$64,247,719
Number in Fall 1991 Class	212	163

HS GRAD - SOME UMB (NO UMB GRAD)	Female	Male
Total Income Increment	$105,587,491	$95,446,703
PDV of Income Increment	$45,019,232	$39,057,827
Number in Fall 1991 Class	395	434

TRANSFER IN - SOME UMB (NO UMB GRAD)	Female	Male
Total Income Increment	$35,602,903	$64,178,676
PDV of Income Increment	$17,883,179	$29,524,044
Number in Fall 1991 Class	207	194

TRANSFER IN - UMB GRAD	Female	Male
Total Income Increment	$107,784,129	$115,368,810
PDV of Income Increment	$54,139,488	$53,072,983
Number in Fall 1991 Class	313	175

ALL UNDERGRADUATE STUDENTS	Female	Male	Total
Total Income Increment	$378,898,640	$418,610,787	$797,509,427
PDV of Income Increment	$179,881,072	$185,912,574	$365,793,646
Number in Fall 1991 Class	1127	966	2093

ALL GRADUATE STUDENTS	Female	Male	Total
Total Income Increment	$91,965,663	$162,855,825	$254,821,489
PDV of Income Increment	$37,914,543	$67,623,348	$105,537,891
Number in Fall 1991 Class	288	191	479

ALL STUDENTS UNDERGRAD & GRADUATE	Female	Male	Total
Total Income Increment	$470,864,303	$581,466,613	$1,052,330,916
PDV of Income Increment	$217,795,815	$253,535,922	$471,331,537
Number in Fall 1991 Class	1415	1157	2572

Note: Assumes in-state alumni residence ratios of .89 for undergraduates and .82 for graduate students

The Net Impact on State Revenues from UMB Students

While the aggregate additional earnings of UMB students reflects a significant contribution to the overall state economy, the central analysis of this study is devoted to a comparison of state subsidies to UMass/Boston with the increment in state revenues resulting from the increase in income generated by UMB students. For pedagogic purposes, we present these results in four stages.

> Stage 1 includes unadjusted estimates of the per student state subsidy to UMB and estimates of the increment in state tax revenue from students assuming no multiplier effect, no option value, and 100 percent in-state residence among UMB alumni.
>
> Stage 2 modifies the results from Stage 1 by adding the multiplier effect.
>
> Stage 3 modifies the results from Stage 1 by adding the multiplier effect and option value.
>
> Stage 4 modifies the results from Stage 1 by adding the multiplier effect, the option value, and restricts the tax revenue estimates to only those alumni who remain in-state after leaving UMass/Boston.

Thus, Stage 4 represents the best and most complete measure of the net impact of UMB on state government costs and revenues.

Table 8 presents the Stage 1 results. Note that among undergraduate men, the estimated increment in tax revenue (in PDV terms) amounts to $16,998. Comparing this with the estimated $13,159 spent by the state on each such undergraduate provides a Revenue/Cost ratio of 1.29. That is, before adjusting for the multiplier, any option value, and in-state alumni residence status, undergraduate men in the Fall 1991 UMB entering class could be expected to return to the state in added taxes 29 percent more than they are subsidized.

Table 8
Stage 1 Results

UNDERGRADUATES

HS GRAD - UMB GRAD

	Female	Male
Ave.Yrs at UMB	4.72	5.01
State Cost	$20,442	$21,698
Est.Inc.in Tax Revenue	$25,344	$34,757
Ratio (Tax Rev/State Cost)	1.24	1.60
% Fall 1991 Class (by Sex) (Incl. Grad Students)	0.150	0.141

HS GRAD - SOME UMB (NO UMB GRAD)

	Female	Male
Ave.Yrs at UMB	2.77	2.5
State Cost	$11,997	$10,828
Est.Inc.in Tax Revenue	$10,064	$7,947
Ratio (Tax Rev/State Cost)	0.84	0.73
% Fall 1991 Class (by Sex)	0.279	0.375

TRANSFER IN - SOME UMB (NO UMB GRAD)

	Female	Male
Ave.Yrs at UMB	2.55	2.28
State Cost	$11,044	$9,875
Est.Inc.In Tax Revenue	$7,640	$13,405
Ratio (Tax Rev/State Cost)	0.69	1.36
% Fall 1991 Class (by Sex)	0.146	0.168

TRANSFER IN - UMB GRAD

	Female	Male
Ave.Yrs at UMB	3.36	3.37
State Cost	$14,552	$14,595
Est.Inc.In Tax Revenue	$15,279	$26,810
Ratio (Tax Rev/State Cost)	1.05	1.84
% Fall 1991 Class (by Sex)	0.221	0.151

Table 8 (Con't)

ALL UNDERGRADUATE STUDENTS

	Female	Male	Weighted Total
Ave.Yrs at UMB	3.26	3.04	3.16
State Cost	$14,125	$13,159	$13,679
Est.Inc.in Tax Revenue	$13,951	$16,998	$15,359
Ratio (Tax Rev/State Cost)	0.99	1.29	1.12
% Fall 1991 Class (by Sex) (Incl. Grad Students)	0.80	0.63	

ALL GRADUATE STUDENTS

	Female	Male	Weighted Total
Ave.Yrs at UMB	2.63	2.63	2.63
State Cost	$11,391	$11,391	$11,391
Est.Inc. in Tax Revenue	$12,610	$33,914	$21,110
Ratio (Tax Rev/State Cost)	1.11	2.98	1.85
% Fall 1991 Class (by Sex) (Incl Undergrad Students)	0.20	0.17	

ALL STUDENTS (UNDERGRAD & GRADUATE)

	Female	Male	Weighted Total
Ave.Yrs at UMB	3.13	2.97	3.06
State Cost	$13,568	$12,867	$13,253
Est.Inc.in Tax Revenue	$13,678	$19,790	$16,430
Ratio (Tax Rev/State Cost)	1.01	1.54	1.24
% Fall 1991 Class (by Sex) (Incl. Grad Students)	1.00	1.00	

	Female	Male	Total
TOTAL STATE COST	$19,199,407	$14,886,900	$34,086,308
TOTAL EST. TAX INC.	$19,354,246	$22,897,577	$42,251,823
Ratio (Tax Rev/State Cost) (Fall 1991 Class)	1.01	1.54	1.24

For undergraduate women, the ratio is lower (0.99) reflecting the lower earnings streams women can expect over their lifetimes. For them, added tax revenue amounts to only $13,951 vs. a state cost of $14,125. Overall, counting undergraduate men and women together produces a Revenue/Cost ratio of 1.12 -- indicating that before any adjustments the state makes a total return of 12 percent on its UMB subsidy to undergraduates.

Graduate education at UMB has an even better payoff for state government. The unadjusted Revenue/Cost ratio for men is 2.98; the comparable ratio for women is 1.11. Overall, while the state spends an average of $11,391 per UMB graduate student, it would make back $21,110 excluding the multiplier effect and option values, but assuming every UMB alumni remained in-state. Under these assumptions, the state earns $1.85 for every dollar it invests in graduate education at UMass/Boston.

For the entire Fall 1991 UMB class, the overall Revenue/Cost ratio estimate at the end of Stage 1 is 1.24. According to these unadjusted numbers, the state will spend $34.1 million on this class during their stay at UMB. However, it will stand to gain more than $42 million in additional tax revenue as a result of this subsidy -- excluding any multiplier effect or option value.

Table 9 presents the Stage 2 results. Here the estimated tax revenue estimates in the previous table are increased by the multiplier effect (while we continue to exclude any option value and still assume 100 percent in-state alumni residency). This table provides a fuller accounting of the total increment in tax revenues flowing from the added income and the expected added spending of UMB students in Massachusetts. The result is that the overall un-

Table 9
Stage 2 Results

UNDERGRADUATES

HS GRAD - UMB GRAD

	Inclusive of Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$20,442	$21,698
Est.Inc.in Tax Revenue	$33,986	$46,609
Ratio (Tax Rev/State Cost)	1.66	2.15
% Fall 1991 Class (by Sex) (Incl. Grad Students)		

HS GRAD - SOME UMB (NO UMB GRAD)

	Inclusive of Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$11,997	$10,828
Est.Inc.in Tax Revenue	$13,496	$10,657
Ratio (Tax Rev/State Cost)	1.12	0.98
% Fall 1991 Class (by Sex)		

TRANSFER IN - SOME UMB (NO UMB GRAD)

	Inclusive of Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$11,044	$9,875
Est.Inc.in Tax Revenue	$10,245	$17,976
Ratio (Tax Rev/State Cost)	0.93	1.82
% Fall 1991 Class (by Sex)		

TRANSFER IN - UMB GRAD

	Inclusive of Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$14,552	$14,595
Est.Inc.in Tax Revenue	$20,489	$35,952
Ratio (Tax Rev/State Cost)	1.41	2.46
% Fall 1991 Class (by Sex)		

Table 9 (Con't)

ALL UNDERGRADUATE STUDENTS

Inclusive of Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$14,125	$13,159	$13,679
Est.Inc.in Tax Revenue	$18,708	$22,794	$20,596
Ratio (Tax Rev/State Cost)	1.32	1.73	1.51
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

ALL GRADUATE STUDENTS

Inclusive of Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$11,391	$11,391	$11,391
Est.Inc. in Tax Revenue	$16,910	$45,479	$28,309
Ratio (Tax Rev/State Cost)	1.48	3.99	2.49
% Fall 1991 Class (by Sex)			
(Incl Undergrad Students)			

ALL STUDENTS (UNDERGRAD & GRADUATE)

Inclusive of Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$13,568	$12,867	$13,253
Est.Inc.In Tax Revenue	$18,342	$26,539	$22,032
Ratio (Tax Rev/State Cost)	1.35	2.06	1.66
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

Inclusive of Multiplier Effect (=1.341)

	Female	Male	Total
TOTAL STATE COST	$19,199,407	$14,886,900	$34,086,308
TOTAL EST. TAX INC.	$25,954,044	$30,705,651	$56,667,131
Ratio (Tax Rev/State Cost)	1.35	2.06	1.66
(Fall 1991 Class)			

dergraduate Revenue/Cost ratio increases from 1.12 to 1.51; the graduate ratio rises to 2.49 from 1.85; and the total Fall 1991 entering class ratio increases to 1.66 from 1.24. With the multiplier effect in the analysis, the $34.1 million state investment returns more than $56.6 million in additional tax revenue.

Table 10 adds the option value as well as the multiplier effect. This raises the overall undergraduate Revenue/Cost ratio to 1.67; it maintains the graduate ratio at 2.49 (since we assume no option value for graduate students); and places the overall Fall 1991 class ratio at 1.81. Now the $34.1 million state investment in the Fall 1991 class produces added tax revenue of over $61 million.

Finally, Table 11 provides the final and best estimates of the Revenue/Cost implications of the state subsidy to UMass/Boston. Here the estimates in Table 10 are reduced by the in-state alumni residency ratios of .89 for undergraduates and .82 for graduates. Nonetheless, as shown in the table, the results continue to demonstrate a high payoff for the state subsidy to UMB. The payoff ranges from 27 percent among undergraduate women to 227 percent among graduate men. Overall, the Revenue/Cost ratio is 1.57. In dollar terms, the $34.1 million dollar state investment returns $53.6 million in added state revenue. On net, then, the state gains in PDV terms nearly $20 million for each annual entering class at UMass/Boston. As such, UMass/Boston students more than pay for their own university educations through the added Massachusetts taxes they will contribute throughout their lifetimes.

Finally, from the state government's point of view, we can translate these results into an "internal rate of return" -- that is, what interest rate would the state have to earn on a treasury bond, a corporate bond, or mutual fund to receive a return equivalent to what it earns on its investment in UMass/Boston. The answer is 8.9 percent. This is significantly higher than

Table 10
Stage 3 Results

UNDERGRADUATES

HS GRAD - UMB GRAD

	Inclusive of Option Value & Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$20,442	$21,698
Est.Inc.in Tax Revenue	$35,846	$51,612
Ratio (Tax Rev/State Cost)	1.75	2.38
% Fall 1991 Class (by Sex) (Incl. Grad Students)		

HS GRAD - SOME UMB (NO UMB GRAD)

	Inclusive of Option Value & Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$11,997	$10,828
Est.Inc.in Tax Revenue	$14,628	$12,644
Ratio (Tax Rev/State Cost)	1.22	1.17
% Fall 1991 Class (by Sex)		

TRANSFER IN - SOME UMB (NO UMB GRAD)

	Inclusive of Option Value & Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$11,044	$9,875
Est.Inc.In Tax Revenue	$11,377	$19,963
Ratio (Tax Rev/State Cost)	1.03	2.02
% Fall 1991 Class (by Sex)		

TRANSFER IN - UMB GRAD

	Inclusive of Option Value & Multiplier Effect (=1.341)	
	Female	Male
Ave.Yrs at UMB		
State Cost	$14,552	$14,595
Est.Inc.In Tax Revenue	$22,349	$40,955
Ratio (Tax Rev/State Cost)	1.54	2.81
% Fall 1991 Class (by Sex)		

Table 10 (Con't)

ALL UNDERGRADUATE STUDENTS

Inclusive of Option Value & Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$14,125	$13,159	$13,679
Est.Inc.In Tax Revenue	$20,180	$25,638	$22,794
Ratio (Tax Rev/State Cost)	1.43	1.96	1.67
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

ALL GRADUATE STUDENTS

Inclusive of Option Value & Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$11,391	$11,391	$11,391
Est.Inc. in Tax Revenue	$16,910	$45,479	$28,309
Ratio (Tax Rev/State Cost)	1.48	3.99	2.49
% Fall 1991 Class (by Sex)			
(Incl Undergrad Students)			

ALL STUDENTS
(UNDERGRAD & GRADUATE)

Inclusive of Option Value & Multiplier Effect (=1.341)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$13,568	$12,867	$13,253
Est.Inc.In Tax Revenue	$19,514	$29,080	$23,934
Ratio (Tax Rev/State Cost)	1.44	2.26	1.81
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

Inclusive of Option Value & Multiplier Effect (=1.341)

	Female	Male	Total
TOTAL STATE COST	$19,199,407	$14,886,900	$34,086,308
TOTAL EST. TAX INC.	$27,612,579	$33,645,990	$61,557,646
Ratio (Tax Rev/State Cost)	1.44	2.26	1.81
(Fall 1991 Class)			

Table 11
Stage 4 Results

UNDERGRADUATES

HS GRAD - UMB GRAD

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.89)

	Female	Male
Ave.Yrs at UMB		
State Cost	$20,442	$21,698
Est.Inc.in Tax Revenue	$31,903	$45,934
Ratio (Tax Rev/State Cost)	1.56	2.12
% Fall 1991 Class (by Sex) (Incl. Grad Students)		

HS GRAD - SOME UMB (NO UMB GRAD)

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.89)

	Female	Male
Ave.Yrs at UMB		
State Cost	$11,997	$10,828
Est.Inc.in Tax Revenue	$13,019	$11,253
Ratio (Tax Rev/State Cost)	1.09	1.04
% Fall 1991 Class (by Sex)		

TRANSFER IN - SOME UMB (NO UMB GRAD)

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.89)

	Female	Male
Ave.Yrs at UMB		
State Cost	$11,044	$9,875
Est.Inc.in Tax Revenue	$10,126	$17,767
Ratio (Tax Rev/State Cost)	0.92	1.80
% Fall 1991 Class (by Sex)		

TRANSFER IN - UMB GRAD

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.89)

	Female	Male
Ave.Yrs at UMB		
State Cost	$14,552	$14,595
Est.Inc.in Tax Revenue	$19,891	$36,450
Ratio (Tax Rev/State Cost)	1.37	2.50
% Fall 1991 Class (by Sex)		

Table 11 (Con't)

ALL UNDERGRADUATE STUDENTS

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.89)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$14,125	$13,159	$13,679
Est.Inc.in Tax Revenue	$17,960	$22,996	$20,287
Ratio (Tax Rev/State Cost)	1.27	1.75	1.48
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

ALL GRADUATE STUDENTS

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State (=.82)

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$11,391	$11,391	$11,391
Est.Inc. in Tax Revenue	$13,866	$37,293	$23,213
Ratio (Tax Rev/State Cost)	1.22	3.27	2.04
% Fall 1991 Class (by Sex)			
(Incl Undergrad Students)			

ALL STUDENTS (UNDERGRAD & GRADUATE)

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State

	Female	Male	Total
Ave.Yrs at UMB			
State Cost	$13,568	$12,867	$13,253
Est.Inc.in Tax Revenue	$17,127	$25,356	$20,832
Ratio (Tax Rev/State Cost)	1.26	1.97	1.57
% Fall 1991 Class (by Sex)			
(Incl. Grad Students)			

Inclusive of Option Value & Multiplier Effect (=1.341) Remain-in-State

	Female	Male	Total
TOTAL STATE COST	$19,199,407	$14,886,900	$34,086,308
TOTAL EST. TAX INC.	$24,234,498	$29,336,806	$53,579,003
Ratio (Tax Rev/State Cost)	1.26	1.97	1.57
(Fall 1991 Class)			

the Lehman Brothers current long-term treasury bond rate (7.4%) or the Merrill Lynch average corporate bond rate (7.7%).[30] It is three times the yield on short-term certificates of deposit and approaches the annual average return on the Fidelity Magellan fund over the past three years. Virtually any private business or bank would be satisfied with such a return on its investment.

Alternative Scenarios

Obviously, any analysis of this type is sensitive to the assumptions used in preparing the actual estimates. To test for this sensitivity, two alternative scenarios were generated. One of these uses a more conservative estimate of overall wage growth; the other a more liberal assumption about the size of the multiplier.

Alternative #1 -- Under the more conservative scenario, the projected wage growth for each level of education was set equal to the rates experienced in the United States from 1979 through 1989, a period during which overall real average hourly wages were essentially stagnant -- they actually declined by 2.7 percent.[31] Under this scenario, then, we expect no real growth in wages on average during the next forty years, although wage growth is greater for those with more years of schooling.

---

[30] As quoted in Wall Street Journal, December 23, 1992, p. C1.

[31] During the 1979-1989 period, overall real average hourly earnings declined by 5.1% among men while they grew by 6.7% among women. The appendix to this report provides detail on the real wage growth rates by education level for both men and women. For more detail, see Lawerence Mishel and Jared Bernstein, The State of Working America, op.cit.

Alternative #2 -- Under the more liberal scenario, we set the multiplier at 1.5 rather than the 1.341 used above. This multiplier is more in line with those estimated by the U.S. Bureau of Economic Analysis (BEA) for Massachusetts. Even then, 1.5 is at the low end of the BEA estimates.

Table 12 compares the results for the original scenario with these two alternatives.

Table 12

The Return to Massachusetts of Investing in UMass/Boston Students
(Alternative Scenarios)

	Revenue/ Subsidy Ratio	Internal Rate of Return	PDV of Revenue Stream (in millions)
Alternative #1 (Lower Estimate)	1.39	8.4%	$47.2
"Official" Estimate	1.57	8.9%	$53.6
Alternative #2 (Higher Estimate)	1.75	9.4%	$59.8

As Table 12 demonstrates, the results of this analysis are relatively "robust". That is, alternative assumptions do not appreciably change the overall conclusion that the state government's investment in UMass/Boston students provides a solid rate of return. Even assuming no overall growth in real average wages, the revenue/subsidy ratio remains above 1.0 yielding an 8.4 percent investment return. With a higher multiplier, the revenue/subsidy ratio rises to 1.75, providing a 9.4 percent return. In the aggregate, depending on the scenario

chosen, the present discounted value of the additional state tax revenue stream due the added education of the Fall 1991 UMass/Boston class ranges from $47 to $60 million. This compares with the $34 million cost to the state government associated with subsidizing these students.

What if UMass/Boston Did Not Exist?

We can take this part of the analysis one step further. One could ask the question what would be the revenue implications if UMass/Boston did not exist at all -- and there was no equivalent public institution serving the Greater Boston area? In this case, the direct cost to the state would presumably be zero. What would happen to state revenues?

The answer to this question depends on what UMB students would have done if there were no UMass/Boston. While we do not have any conclusive survey data that indicate what percentage of UMB students would have gone to private colleges and universities if UMB did not exist, we have a few shreds of evidence that help us generate some conclusions about this counterfactual. We know, for example, that 46 percent of enrolling students in the Fall of 1988 indicated that UMB was the only school to which they applied. Fully 71 percent of those enrolling at UMB rated UMass/Boston as their first choice. UMB was not the first choice of 29 percent of UMB enrollees. Furthermore we know that 26 percent of admitted students who did not enroll at UMB did not attend any institution of higher education.[32] Of the remaining non-enrollees, 29 percent went to another Massachusetts public institution, 28 percent decided to attend a private college or university in Massachusetts, and another 17 percent went to an out-of-state school.

---

32 These statistics are found in UMB Office of Institutional Research and Planning, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," OIRP 3.89, April 1989.

Massaging these statistics can produce a rough estimate of what percentage of UMB students would not have gone to a private college or university if UMB did not exist. Assume the following:

(1) Three-fourths of the students who enrolled at UMB without applying to any other school would not have gone to a private college or university if such a public higher education option did not exist in Massachusetts.

(2) Half of the students who reported UMB was their first but not only choice would not have gone to a private college or university if a public higher education option did not exist in Massachusetts.

(3) One-third of the students who reported UMB was not their first choice but went to UMB anyway would not have gone to a private college or university if a public higher education option did not exist in Massachusetts.

Under these assumptions, we conclude that approximately 57 percent of the Fall 1991 entering class at UMB would not have gone to college if an equivalent public higher education option did not exist in Massachusetts.[33] Given the mean income of UMB students and the high cost of private school, this is probably a conservative estimate.

Applying this 57 percent non-enrollment estimate to the final figures in Table 11 suggests that 57 percent of the nearly $53.6 million in added tax revenue from the Fall 1991 entering UMB class would not materialize if UMB or its equivalent did not exist in Massachusetts. This amounts to $30.6 million -- only $3.5 million less than the estimated amount ac-

---

[33] This estimate is based on the following calculation: ((.75 X. 46 X 2572)+(.5 X .25 X 2572)+(.33 X .29 X 2572))/2572.

tually spent on the Fall 1991 class. Hence, a counterfactual state budget without UMass/Boston (and no equivalent public higher education institution in its place) "saves" the state only a trivial amount -- $3.5 million a year on a $15 billion state budget.[34]

What does this $3.5 million buy the Commonwealth? Consider the loss in total income to Massachusetts citizens if 57 percent of the Fall 1991 UMB entering class did not pursue the higher education they actually receive at the university. We can do this by applying the 57 percent figure to the total income increment and PDV estimates in Table 7. The result suggests that the total income loss would be $600 million (.57 X $1,052,330,916). The PDV of this foregone income stream is $269 million (.57 X $471,331,537). Hence in PDV terms, a $3.5 million net expenditure by state government on UMB yields a boost in total PDV state income 75 times greater. Put another way, Massachusetts residents receive $75 dollars in added income for every $1 they pay in Massachusetts taxes used for funding UMB.

---

[34] Note, this assumes that the 43 percent of students who would have gone to private school would have completed as much school as they will at UMB, that the in-state alumni residency ratios would have remained at .89 for undergraduates and .82 for graduates, and that the income streams and tax revenue PDV amounts would have been the same as for UMB students. Obviously, if students would have left Massachusetts for school elsewhere, it is likely that a larger number would have left the state permanently reducing the tax revenue flow to the Commonwealth. Moreover, it is likely that if students had to pay private tuition and fees, the average amount of education completed would be lower. Both of these factors could easily lead to a negative impact on state revenues from the elimination of public higher education in Massachusetts.

The "Export Base" Contribution of UMB to the State

Our study is not quite complete, however. It is necessary to add the findings of our "export base" analysis to the overall economic contribution of UMass/Boston to the state government. Figure 1 provides the basic data for the five non-Massachusetts sources of revenue that flow into UMB. In FY 1992, the breakdown is as shown in Table 13:

Table 13

Sources of Non-Massachusetts Funds to UMB FY 1992

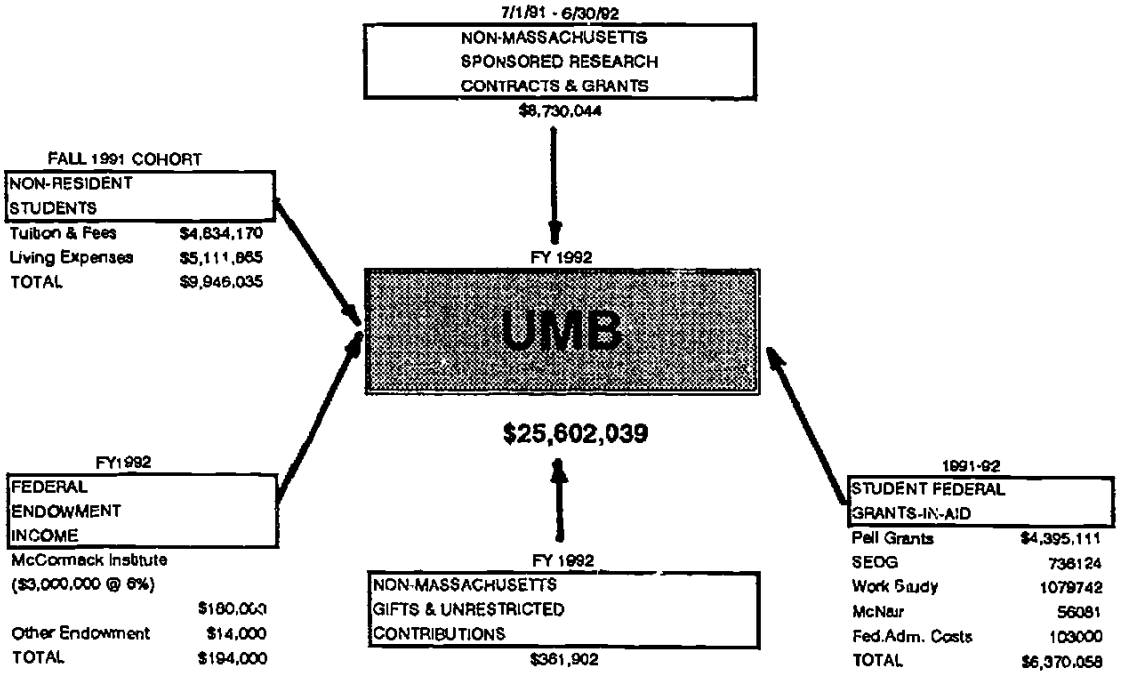
Non-Resident Student Tuition, Fees, and Living Expenses	$9,946,035
Non-Massachusetts Sponsored Research	8,730,044
Student Federal Grants-in-Aid	6,370,058
Endowment Income	194,000
Non-Massachusetts Gifts & Contributions	361,902
TOTAL	$25,602,039

Sources: UMB Development Office; UMB Financial Aid Office; AICUM Study of Economic Impact of Private Schools on Massachusetts Economy

To obtain a full estimate of the impact of these dollar flows, we must apply the state multiplier. This yields a total increment to Massachusetts income of $34,332,334 for FY 1992. This is income that Massachusetts would forego if UMB did not exist. Note that the state tax revenue generated by this income flow amounts to approximately $2.7 million a year

FIGURE 1

UMASS/BOSTON EXPORT BASE



-- $2.04 million in personal income tax; $647 million in sales tax revenue.[35] Note for the record that this $2.7 million revenue stream offsets most of the $3.6 million net cost noted in the previous section of this study. Hence, the overall cost of UMass/Boston to the state budget for the Fall 1991 class is less than $1 million. Essentially, then, the entire array of gains from having UMass/Boston in the Commonwealth accrue at almost no net monetary cost to state government.

Conclusion and Summary

The overall conclusion from this analysis of the economic impact of UMB is that the university not only makes a significant contribution to the competitiveness and standard of living in the Commonwealth through the provision of a highly trained labor force, but that UMB students actually return to state coffers substantially more than they take in state subsidies. Our best estimate is that for every $1 spent by the state on the Fall 1991 entering UMB class, the state will receive $1.57 back in taxes (on a present discounted value basis). This is equivalent to an 8.9 percent rate of return on the state's investment in the university.

Even under the assumption of a counterfactual where as many as 43 percent of UMass/Boston students would attend private school if UMB did not exist at all, the overall analysis suggests that the university is virtually costless to the state government. The combination of additional tax revenue generated by the 57 percent of students who would not attend higher education if UMB did not exist plus the taxes generated as a result of the "export base" earnings of the university practically offset the full state subsidy to the school.

---

[35] This is computed by applying the same tax rates and spending assumptions as used in the tax revenue estimates for UMB student income flows.

This makes UMB a prudent and profitable investment from the point of view of state government even if the state had no other interest but to earn a direct return on its investment of tax dollars in the university. Indeed, it is difficult to think of a private sector investment that is as lucrative and risk-free as this one.

In summary, the three major economic contributions UMass/Boston makes to the citizens of the Commonwealth -- the provision of an educated labor force for the private and public sector, a large increment in state tax revenues from the additional earnings of UMB in-state resident alumni, and the boost to state income and revenue from UMB as an "export base" all suggest that Massachusett's urban public university is a magnificent jewel in the Commonwealth's crown.

APPENDIX

METHODOLOGY

I. Measuring the Increment in Future Taxes Paid by UMB Students

The methodology for measuring the increment in future taxes paid by UMB students requires four steps.

Step 1 relies on ordinary least squares regression analysis to estimate standard "age-earnings profiles" for individuals with given amounts of schooling at a given point in time. In particular, we ran regressions of the following type:

$$\text{Annual Earnings} = a_0 + ß_1 * \text{AGE} + ß_2 * \text{AGE}^2 + e$$

for individuals who had completed twelve years of schooling (High School Graduates); 13-15 years of schooling (Some College); 16 years of schooling (College Grads); and 17 or more years of schools (Graduate or Professional education). Separate regressions were run for men and women given annual earnings differences for equal amounts of schooling.

The data for this analysis were drawn from the March 1988 Current Population Survey conducted by the U.S. Bureau of Labor Statistics in cooperation with the U.S. Census Bureau. To restrict the sample to those living within a labor market most like that of Massachusetts but wishing to maintain an adequate sample size, all those residing in Census Division 1 (the six New England states) were included in the sample. The sample was restricted to those age 16 and above (and those with wage and salary income greater than zero).

The dependent variable used was personal wage and salary earnings for the previous year (1987). This variable excludes income from sources other than paid employment or self-employment -- notably interest, dividend, rent, and capital gains income and transfer income from social security, welfare, unemployment insurance benefits, etc. As the results indicate in Table A1, all of the coefficients were of the expected sign and virtually all of the relevant t-statistics were statistically significant at least at the .01 level.

Step 2 involved fitting separately for men and women age-earnings profiles for each schooling group using the regression parameters estimated in Step 1 and projected wage growth rates for individuals with each level of schooling.

This was done by inserting the regression equations into a Lotus Worksheet, calculating the earnings for each schooling level for ages 20 through 65, and then augmenting these results by adjusting these profiles for nominal wage growth between 1987 and 1991 and then for projected wage growth rates after 1991.

AGE-EARNINGS PROFILE REGRESSIONS

ANNUAL EARNINGS = a0 + b1*AGE + b2*AGE SQUARED

DEP.VAR. Personal Wage & Salary Earnings (1987) - NEW ENGLAND REGION

MEN

	H.S. GRAD	1-3 YRS COLLEGE	COLLEGE GRAD	GRAD/PROF SCHOOL
AGE	2248.9	3127.6	3732.7	4227.5
	(13.79)	(15.90)	(8.19)	(6.89)
AGESQ	-24.8	-32.7	-39.2	-42.3
	(-13.10)	(-13.41)	(-7.55)	(-6.30)
CONSTANT	-22116	-41670	-47149	-55918
	(-6.91)	(-11.50)	(-5.05)	(-4.19)
ADJ. R-SQ	0.145	0.335	0.136	0.108
N	1155	769	486	471

WOMEN

	H.S. GRAD	1-3 YRS COLLEGE	COLLEGE GRAD	GRAD/PROF SCHOOL
AGE	698.9	1195.4	811.3	1421.6
	(7.15)	(7.52)	(2.80)	(3.32)
AGESQ	-7.5	-12.2	-10	-14.9
	(-6.64)	(-6.11)	(-2.90)	(-3.17)
CONSTANT	-1979	-11486	3596	-8315
	(-1.02)	(-3.96)	(.63)	(-.89)
ADJ. R-SQ	0.04	0.123	0.014	0.028
N	1276	767	451	331

(t-statistics in parentheses)

(Note: Sample restricted to those Age 16+ with Wage & Salary Income > 0)

SOURCE: CURRENT POPULATION SURVEY - ANNUAL DEMOGRAPHIC FILE - MARCH 1988

The real wage growth rates used in this study are based on recent research performed by Lawrence Mishel and Jared Bernstein at the Economic Policy Institute in Washington, D.C.[1] Using CPS data, Mishel and Bernstein calculated the total percentage change in real average hourly wages (AHW) by education for the period 1979 through 1989. During this period, real average hourly wages for all U.S. workers actually declined by 2.7 percent. Wage growth varied substantially, however, by education and gender. For male high school graduates, real AHW declined by 12.7 percent over this ten year period. By contrast, real AHW for female college graduates increased by 12.7 percent and those with post-graduate training saw their wages grow by 12.5 percent. Table A1 presents these results. For every level of education, women's wages grew faster than men's -- although, of course, women's wages remain, on average, below those of men having started at a much lower base.

Given the assumption that real wages will not rise as fast as they did during the 1947-1973 period -- when wages grew by almost 3 percent a year -- but that they will begin to increase again as a result of increased productivity, we assumed a modest improvement for this analysis. We annualized the Mishel-Bernstein estimates and added 0.5 percent growth to each of their estimates. Again, see Table A1. This yielded annual real wage growth rates that ranged from -0.849 percent for male high school graduates to 1.703 percent for female college graduates. The weighted average of these growth rates given the education/gender frequencies from the regression equations is +0.6 percent. This is surely a conservative assumption about future wage growth over the next forty years. Graphs for the final age-earnings profiles for men and women are found in Figure A1 and Figure A2.

Dollar differences between the following groups were then calculated:

```
College Grad - High School Grad
Some College - High School Grad
College Grad - Some College
Post Grad    - College Grad
```

The first group corresponds to members of a Freshman Class that succeed in graduating with the equivalent of a B.A. or B.S. degree. The second group includes those who spend one semester or more at UMB, but do not complete the degree. The third group represents those who transfer into college from another school (community college or other four-year college or university) and stay to graduate. The last group represents those who pursue a Masters or Ph.D. degree or professional studies. The results of these calculations are represented in the Appendix Tables.

---

[1] See Lawrence Mishel and Jared Bernstein, The State of Working America (Washington, D.C.: Economic Policy Institute, 1993).

PROJECTED ANNUAL WAGE GROWTH BY YEARS OF EDUCATION
(Based on Lawrence Mischel and Jared Bernstein, EPI Paper)

1979-1989 % Change in Real Average Hourly Wages by Education

	Men	Women
HIGH SCHOOL GRAD	-12.7%	-2.9%
1-3 YEARS COLLEGE	-8.3%	4.3%
4 YEARS COLLEGE	0.3%	12.7%
6 YEARS COLLEGE	9.8%	12.5%

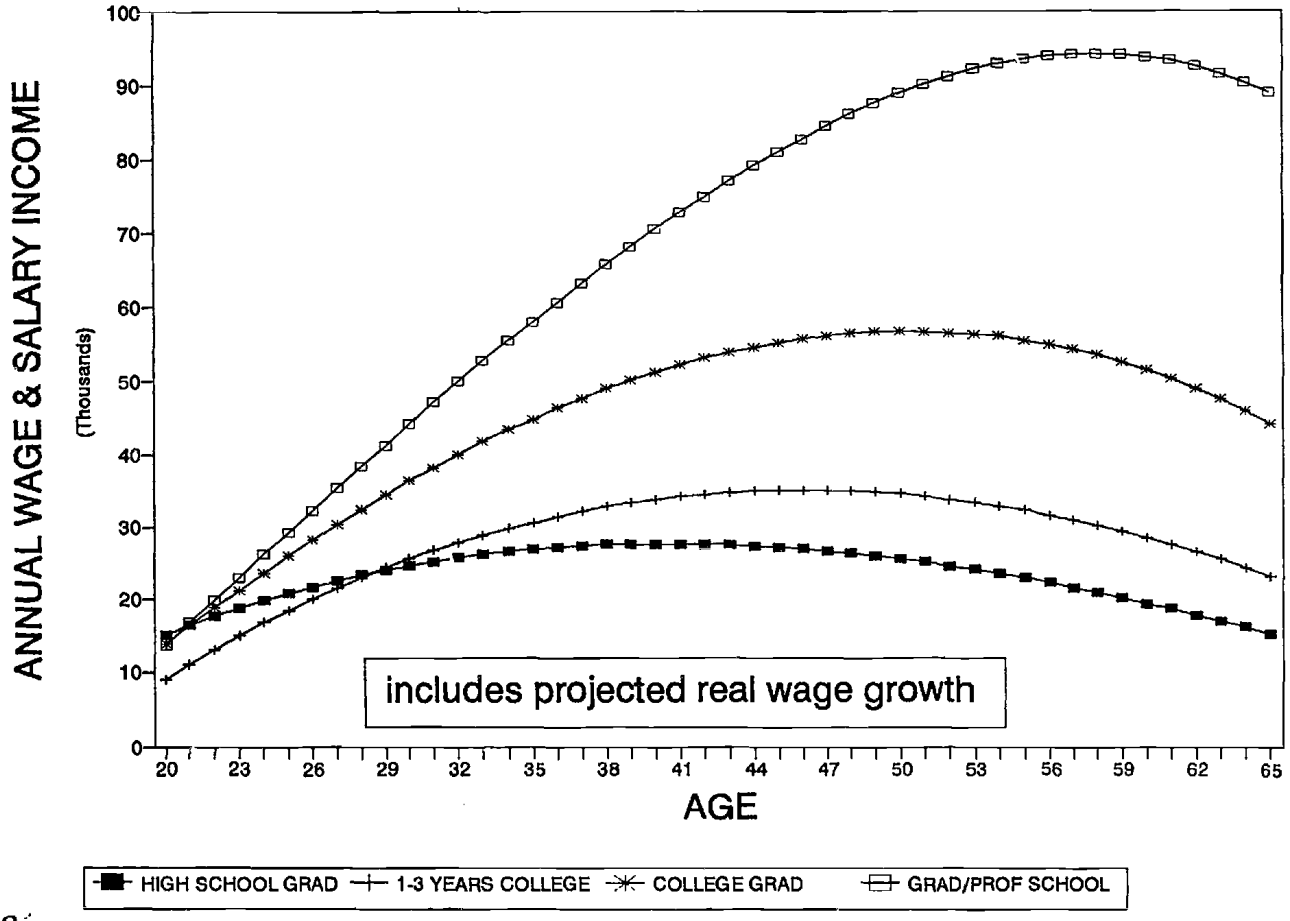
1979-1989 ANNUAL % Change in Real Average Hourly Wages by Education

	Men	Women
HIGH SCHOOL GRAD	-1.349%	-0.294%
1-3 YEARS COLLEGE	-0.863%	0.422%
4 YEARS COLLEGE	0.030%	1.203%
6 YEARS COLLEGE	0.939%	1.185%

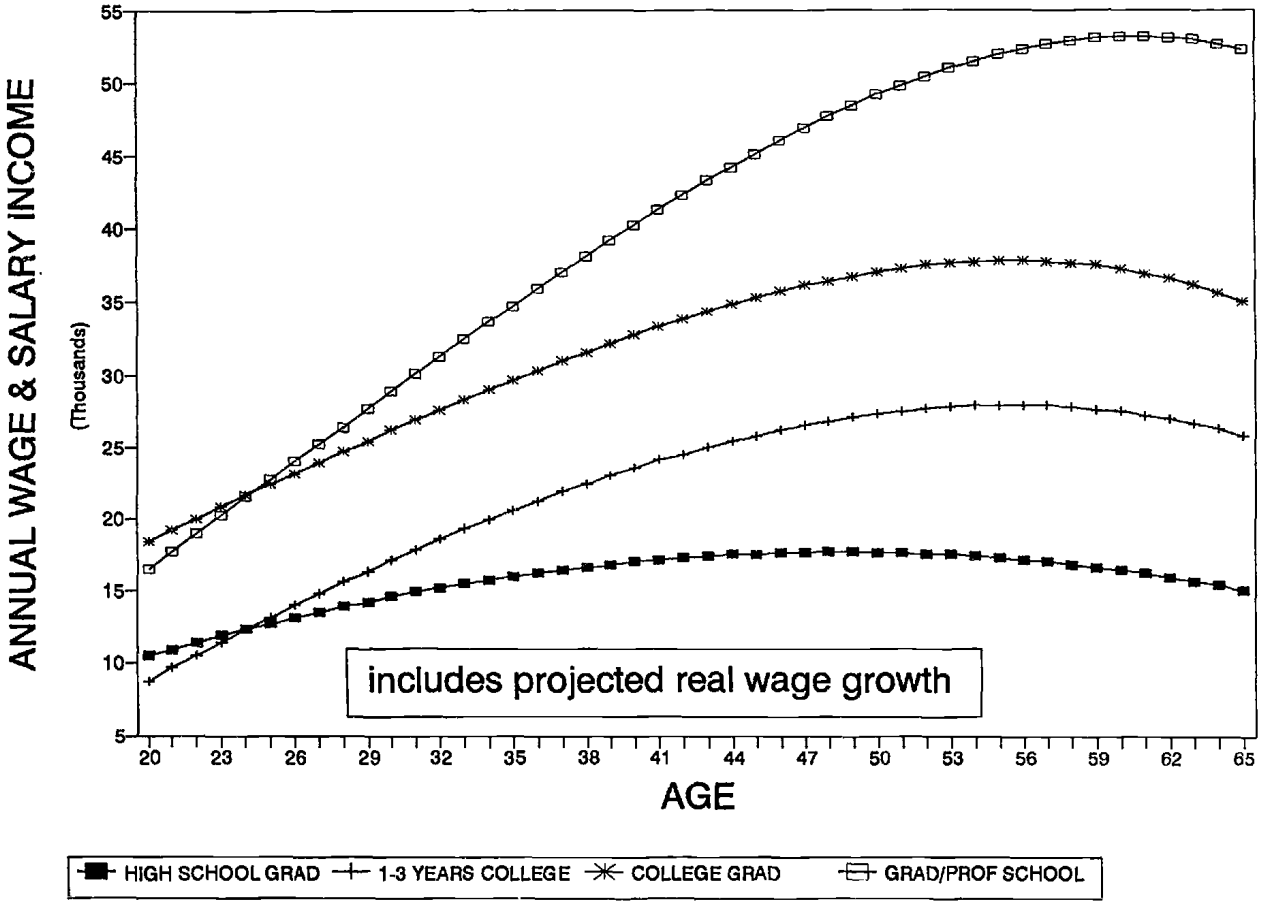
Projected Annual % Change in Real Wages by Education
(= 1979-89 Annual Rate + 0.5%)

	Men	Women
HIGH SCHOOL GRAD	-0.849%	0.206%
1-3 YEARS COLLEGE	-0.363%	0.922%
4 YEARS COLLEGE	0.530%	1.703%
6 YEARS COLLEGE	1.439%	1.685%

AGE EARNINGS PROFILES - MEN
by Education Completed



AGE EARNINGS PROFILES - WOMEN
by Education Completed



Step 3 involved calculating the 'present discounted value' for each age earnings profile and the differences in profiles. We assumed a nominal discount rate of 7 percent corresponding to a real discount rate of 3 percent with 4 percent annual inflation. The 7 percent nominal discount rate is roughly equivalent to the return on long-term U.S. treasury bonds and therefore seems appropriate for this type of long-run analysis. The results of these calculations are represented in the Appendix Tables.

Step 4 involved calculating the total value and present discounted value of the increment in Massachusetts income and sales taxes paid by each group as a result of the increment in earnings due additional schooling. The additional state income tax was calculated by multiplying the PDV earnings increment by 5.95%, the current marginal tax rate on earnings in the Commonwealth.

The calculation of additional sales tax revenue was significantly more complicated. To obtain a reasonable estimate, we relied on data from the Massachusetts Department of Revenue and used the following multi-step method:

(1) A preliminary estimate of the relationship between an increment in personal income and sales tax paid was obtained by using the formula:

```
STX = PY * (1-MFPITR-MSPITR) * MPC * %TX * STR

where:  STX      = Sales tax paid
        PY       = Increment in personal income (or
                   PDV of increment in personal
                   income)
        MFPITR   = Marginal federal personal income
                   tax rate
        MSPITR   = Marginal state personal income tax
                   rate
        MPC      = Marginal propensity to consume
        %TX      = Estimated percentage of increment
                   in consumption subject to state
                   sales tax
        STR      = Statuatory state sale tax rate
```

The values used in this formula are:

```
STX = PY * (1-.28-.0595) * .9 * .50 * .05
```

(2) Using data from the Massachusetts Department of Revenue for each year between 1985 and 1991, estimate total state sales tax revenue based on the formula in (1) above.

(3) Calculate the 1985-1991 average ratio of actual sales tax revenue to estimated sales tax in order to correct for errors in either the assumed MPC or estimated percentage of consumption subject to state sales tax. This ratio is 1.042.

(4) Calculate the ratio of the sales tax revenue growth rate relative to the personal income tax revenue growth rate for the period 1985 through 1989 (the state's most rapid economic growth period) to estimate the marginal growth in sales tax revenue relative to personal income growth in the state. This ratio is 1.232.

(5) Multiply the formula in (1) by the two "correction" ratios found in (3) and (4) to arrive at a final estimate of sales taxes paid per dollar of added personal income.

(6) Adding together the estimate of added income taxes and the estimate of added sales taxes paid by individuals in each education/gender group was the last step in calculating additional total taxes paid.

It should be noted that the results so generated exclude certain increased revenues due to added schooling. To the extent that individuals with higher earnings have greater savings and therefore acquire more interest, dividend, and capital gains income, this methodology ignores the added tax revenue generated through these income streams. It also ignores any increased property tax revenue as this revenue accrues to local governments, not the state.

AGE-EARNINGS TRAJECTORIES [WAGE GROWTH RATES = EPI RATES + 0.50%] (Revised Sales Tax Rates)
$1992 – March 1988 CPS Personal Annual Wages adjusted by May 1992/1987 Nominal Average Weekly Earnings
MALES Projected Real Annual Wage Growth = HS GRADS: -0.85% SOME COLLEGE: -0.36% COLLEGE GRAD: +0.53% POSTGRAD: +1.44%
Projected Real Interest Rate = 3.0% (NOMINAL INTEREST RATE = 7.0%; INFLATION RATE = 4.0%)

AGE	r	WAGE INC HS GRAD	WAGE INC SOME CO	WAGE INC COLLEGE	WAGE INC POSTGRA	MEN HS	MEN 1-3	MEN COLL	MEN GS	MENC-HS	MENSC-H	MENC-SC	MENGS-C
20	1.000	1.000	1.000	1.000	1.000	15090	9104	13792	13642	-1298	-5987	4688	-149
21	1.030	0.992	0.996	1.005	1.014	15909	10822	15860	16296	-30	-5087	5058	416
22	1.061	0.983	0.993	1.011	1.029	16592	12347	17773	18774	1180	-4245	5425	1001
23	1.093	0.975	0.989	1.016	1.044	17151	13692	19481	21077	2330	-3458	5788	1596
24	1.126	0.966	0.986	1.021	1.059	17594	14870	21014	23213	3420	-2725	6144	2199
25	1.159	0.958	0.982	1.027	1.074	17933	15891	22381	25188	4448	-2042	6490	2807
26	1.194	0.950	0.978	1.032	1.090	18178	16787	23592	27008	5416	-1409	6825	3416
27	1.230	0.942	0.975	1.038	1.105	18331	17509	24654	28678	6323	-823	7148	4024
28	1.267	0.934	0.971	1.043	1.121	18407	18125	25577	30204	7170	-282	7452	4627
29	1.305	0.926	0.968	1.049	1.137	18411	18627	26368	31592	7958	216	7741	5224
30	1.344	0.918	0.964	1.054	1.154	18349	19021	27035	32845	8686	673	8014	5811
31	1.384	0.910	0.961	1.060	1.170	18227	19317	27584	33971	9357	1090	8267	6386
32	1.426	0.903	0.957	1.065	1.187	18053	19522	28023	34972	9970	1469	8501	6949
33	1.469	0.895	0.954	1.071	1.204	17831	19644	28359	35854	10526	1813	8715	7495
34	1.513	0.887	0.950	1.077	1.221	17567	19689	28597	36622	11031	2123	8908	8025
35	1.558	0.880	0.947	1.083	1.239	17264	19664	28744	37280	11480	2400	9081	8536
36	1.605	0.872	0.943	1.088	1.257	16929	19575	28806	37833	11878	2648	9232	9026
37	1.653	0.865	0.940	1.094	1.275	16564	19427	28788	38283	12224	2863	9361	9496
38	1.702	0.858	0.937	1.100	1.293	16173	19226	28695	38637	12522	3053	9469	9943
39	1.754	0.850	0.933	1.106	1.312	15761	18977	28532	38898	12771	3218	9555	10366
40	1.806	0.843	0.930	1.112	1.331	15329	18684	28304	39069	12975	3354	9620	10764
41	1.860	0.836	0.926	1.117	1.350	14882	18352	28016	39154	13134	3470	9664	11138
42	1.916	0.829	0.923	1.123	1.369	14422	17985	27672	39157	13249	3563	9686	11485
43	1.974	0.822	0.920	1.129	1.389	13952	17587	27276	39082	13324	3636	9688	11806
44	2.033	0.815	0.916	1.135	1.409	13473	17162	26832	38931	13358	3689	9670	12100
45	2.094	0.808	0.913	1.141	1.429	12989	16712	26343	38709	13355	3724	9631	12366
46	2.157	0.801	0.910	1.147	1.450	12500	16242	25814	38419	13315	3742	9573	12604
47	2.221	0.794	0.906	1.153	1.471	12009	15753	25248	38063	13240	3744	9496	12814
48	2.288	0.788	0.903	1.160	1.492	11517	15248	24648	37644	13131	3731	9400	12996
49	2.357	0.781	0.900	1.166	1.513	11026	14731	24017	37167	12991	3705	9286	13150
50	2.427	0.774	0.897	1.172	1.535	10537	14203	23358	36632	12820	3665	9155	13274
51	2.500	0.768	0.893	1.178	1.557	10052	13666	22674	36044	12621	3614	9007	13371
52	2.575	0.761	0.890	1.184	1.580	9571	13123	21967	35405	12395	3552	8843	13439
53	2.652	0.755	0.887	1.191	1.602	9096	12578	21239	34717	12144	3480	8664	13478
54	2.732	0.748	0.884	1.197	1.625	8627	12025	20494	33984	11868	3399	8469	13489
55	2.814	0.742	0.880	1.203	1.649	8165	11473	19734	33207	11569	3309	8260	13473
56	2.898	0.736	0.877	1.210	1.673	7711	10922	18960	32388	11249	3211	8038	13429
57	2.985	0.729	0.874	1.216	1.697	7265	10372	18174	31531	10910	3107	7803	13357
58	3.075	0.723	0.871	1.222	1.721	6826	9824	17379	30637	10551	2996	7555	13258
59	3.167	0.717	0.868	1.229	1.748	6400	9280	16578	29709	10176	2880	7296	13133
60	3.262	0.711	0.865	1.235	1.771	5983	8742	15767	28748	9785	2759	7026	12981
61	3.360	0.705	0.861	1.242	1.796	5575	8208	14954	27757	9379	2633	6748	12803
62	3.461	0.699	0.858	1.249	1.822	5178	7682	14137	26737	8959	2504	6456	12600
63	3.565	0.693	0.855	1.255	1.848	4792	7163	13319	25691	8527	2371	6157	12371
64	3.671	0.687	0.852	1.262	1.875	4416	6651	12501	24620	8085	2235	5849	12119
65	3.782	0.681	0.849	1.269	1.902	4052	6149	11683	23525	7632	2097	5535	11842

		MEN HS	MEN 1-3	MEN COLL	MEN GS	MENC-HS	MENSC-H	MENC-SC	MENGS-C
PRESENT DISCOUNTED VALUE STREAM AGE 25-65						TOTAL $442,502	TOTAL $101,173	TOTAL $341,329	TOTAL $431,767
						TAX	TAX	TAX	TAX
	INCOME					$26,329	$6,020	$20,309	$25,690
	SALES					$8,426	$1,927	$6,501	$8,224
	TOTAL					$34,757	$7,947	$26,810	$33,914

TOTAL REAL DOLLAR INCOME (NOT PDV)

AGE	r	WAGE INC HS GRAD	WAGE INC SOME CO	WAGE INC COLLEGE	WAGE INC PDSTGRA	MEN HS	MEN 1-3	MEN COLL	MEN GS	MENC-HS	MENSC-H	MENC-SC	MENGS-C
20	1.000	1.000	1.000	1.000	1.000	15090	9104	13792	13642	-1299	-5987	4688	-149
21	1.030	0.992	0.996	1.005	1.014	16387	11147	16356	16787	-30	-5240	5209	430
22	1.061	0.983	0.993	1.011	1.029	17603	13099	18855	19917	1252	-4504	5756	1062
23	1.093	0.975	0.989	1.018	1.044	18741	14962	21287	23031	2546	-3779	6325	1744
24	1.126	0.966	0.986	1.021	1.059	19803	16736	23651	26126	3849	-3067	6915	2475
25	1.159	0.958	0.982	1.027	1.074	20789	18422	25946	29200	5157	-2368	7524	3254
26	1.194	0.950	0.978	1.032	1.090	21703	20021	28170	32249	6467	-1682	8149	4079
27	1.230	0.942	0.975	1.038	1.105	22545	21533	30322	35270	7777	-1012	8789	4949
28	1.267	0.934	0.971	1.043	1.121	23318	22961	32401	38262	9083	-357	9440	5861
29	1.305	0.926	0.968	1.049	1.137	24022	24304	34404	41220	10383	282	10101	6816
30	1.344	0.918	0.964	1.054	1.154	24659	25563	36332	44142	11674	904	10769	7809
31	1.384	0.910	0.961	1.060	1.170	25231	26740	38183	47023	12952	1509	11443	8840
32	1.426	0.903	0.957	1.065	1.187	25739	27834	39955	49862	14215	2095	12120	9907
33	1.469	0.895	0.954	1.071	1.204	26186	28648	41646	52653	15461	2663	12798	11007
34	1.513	0.887	0.950	1.077	1.221	26571	29782	43256	55394	16685	3211	13475	12138
35	1.558	0.880	0.947	1.083	1.239	26897	30636	44783	58081	17886	3739	14147	13298
36	1.605	0.872	0.943	1.088	1.257	27165	31411	46225	60710	19060	4246	14814	14485
37	1.653	0.865	0.940	1.094	1.275	27377	32109	47582	63277	20205	4732	15472	15695
38	1.702	0.858	0.937	1.100	1.293	27534	32730	48851	65777	21317	5197	16120	16926
39	1.754	0.850	0.933	1.106	1.312	27636	33275	50031	68207	22394	5639	16755	18176
40	1.806	0.843	0.930	1.112	1.331	27687	33745	51120	70562	23434	6059	17375	19442
41	1.860	0.836	0.926	1.117	1.350	27686	34140	52118	72838	24432	6455	17978	20720
42	1.916	0.829	0.923	1.123	1.369	27635	34462	53022	75029	25387	6827	18560	22007
43	1.974	0.822	0.920	1.129	1.389	27535	34710	53831	77131	26296	7175	19120	23300
44	2.033	0.815	0.916	1.135	1.409	27388	34887	54543	79140	27155	7499	19656	24596
45	2.094	0.808	0.913	1.141	1.429	27195	34992	55157	81049	27962	7797	20165	25892
46	2.157	0.801	0.910	1.147	1.450	26957	35027	55671	82853	28714	8069	20645	27182
47	2.221	0.794	0.906	1.153	1.471	26675	34991	56084	84548	29409	8316	21093	28464
48	2.288	0.788	0.903	1.160	1.492	26350	34887	56393	86128	30043	8537	21506	29734
49	2.357	0.781	0.900	1.166	1.513	25984	34714	56598	87585	30614	8730	21884	30988
50	2.427	0.774	0.897	1.172	1.535	25577	34474	56696	88918	31119	8897	22222	32220
51	2.500	0.768	0.893	1.178	1.557	25131	34167	56688	90113	31555	9036	22519	33426
52	2.575	0.761	0.890	1.184	1.580	24647	33794	56566	91171	31918	9147	22772	34605
53	2.652	0.755	0.887	1.191	1.603	24125	33355	56334	92082	32209	9230	22979	35748
54	2.732	0.748	0.884	1.197	1.625	23567	32852	55989	92840	32421	9284	23137	36852
55	2.814	0.742	0.880	1.203	1.649	22974	32285	55526	93439	32554	9310	23243	37911
56	2.898	0.736	0.877	1.210	1.673	22347	31654	54951	93870	32603	9307	23296	38920
57	2.985	0.729	0.874	1.216	1.697	21687	30962	54254	94126	32567	9275	23293	39873
58	3.075	0.723	0.871	1.222	1.721	20994	30207	53437	94203	32443	9213	23230	40766
59	3.167	0.717	0.868	1.229	1.746	20270	29391	52498	94088	32227	9121	23107	41591
60	3.262	0.711	0.865	1.235	1.771	19518	28515	51434	93777	31918	8999	22919	42343
61	3.360	0.705	0.861	1.242	1.796	18739	27579	50244	93260	31511	8847	22664	43016
62	3.461	0.699	0.858	1.249	1.822	17921	26585	48926	92529	31005	8664	22341	43603
63	3.565	0.693	0.855	1.255	1.848	17081	25531	47477	91575	30396	8451	21946	44098
64	3.671	0.687	0.852	1.262	1.875	16214	24421	45897	90390	29682	8206	21478	44493
65	3.782	0.681	0.849	1.269	1.902	15322	23253	44182	88963	28860	7931	20929	44781

	MEN HS	MEN 1-3	MEN COLL	MEN GS	MENC-HS	MENSC-H	MENC-SC	MENGS-C
TOTAL REAL DOLLAR INCOME STREAM AGE 25-65					TOTAL $989,150	TOTAL $247,176	TOTAL $741,973	TOTAL $1,039,815
					TAX	TAX	TAX	TAX
				INCOME	$58,854	$14,707	$44,147	$61,869
				SALES	$18,840	$4,708	$14,132	$19,805
				TOTAL	$77,695	$19,415	$58,280	$81,674

AGE-EARNINGS TRAJECTORIES [WAGE GROWTH RATES = EPI RATES + 0.50%]

$1992 – March 1988 CPS Personal Annual Wages adjusted by May 1992/1987 Nominal Average Weekly Earnings

FEMALES Projected Real Annual Wage Growth = HS GRAD: +0.21% SOME COLLEGE: +0.92% COLLEGE GRAD: +1.70% POSTGRAD: +1.69%

Projected Real Interest Rate = 3.0% (NOMINAL INTEREST RATE = 7.0%; INFLATION RATE = 4.0%)

FEMALES

AGE	r	WAGE INC HS GRAD	WAGE INC SOME CO	WAGE INC COLLEGE	WAGE INC POSTGRA	FEM HS	FEM 1-3	FEM COLL	FEM GS	FEMC-HS	FEMSC-H	FEMC-SC	FEMGS-C
20	1.000	1.000	1.000	1.000	1.000	10494	8783	18442	16513	7949	-1710	9659	-1929
21	1.030	1.002	1.009	1.017	1.017	10653	9400	18672	17230	8019	-1253	9272	-1442
22	1.061	1.004	1.019	1.034	1.034	10779	9961	18869	17897	8090	-819	8909	-973
23	1.093	1.006	1.028	1.052	1.051	10875	10468	19037	18511	8162	-407	8569	-526
24	1.126	1.008	1.037	1.070	1.069	10942	10925	19175	19074	8233	-17	8250	-101
25	1.159	1.010	1.047	1.088	1.087	10982	11333	19285	19586	8303	351	7952	301
26	1.194	1.012	1.057	1.107	1.105	10997	11695	19367	20051	8370	698	7672	683
27	1.230	1.015	1.066	1.125	1.124	10989	12014	19423	20468	8435	1025	7410	1045
28	1.267	1.017	1.076	1.145	1.143	10958	12290	19454	20841	8495	1332	7163	1387
29	1.305	1.019	1.086	1.164	1.162	10908	12527	19459	21169	8551	1619	6932	1710
30	1.344	1.021	1.096	1 184	1.181	10840	12728	19441	21455	8602	1887	6715	2014
31	1.384	1.023	1.106	1.204	1.201	10754	12890	19400	21700	8647	2136	6511	2300
32	1.426	1.025	1.116	1.225	1.222	10652	13019	19337	21906	8686	2367	6318	2569
33	1.469	1.027	1.127	1.245	1.242	10535	13116	19253	22074	8718	2580	6137	2821
34	1.513	1.029	1.137	1.267	1.263	10405	13182	19148	22204	8743	2777	5966	3056
35	1.558	1.031	1.148	1.288	1.284	10263	13219	19024	22299	8761	2956	5804	3276
36	1.605	1.033	1.158	1.310	1.306	10110	13229	18880	22360	8771	3120	5651	3480
37	1.653	1.036	1.169	1.333	1.328	9946	13213	18719	22388	8772	3267	5505	3669
38	1.702	1.038	1.180	1.355	1.350	9773	13173	18540	22384	8766	3400	5367	3844
39	1.754	1.040	1.191	1.378	1.373	9592	13110	18344	22349	8751	3517	5234	4005
40	1.806	1.042	1.201	1.402	1.396	9404	13024	18132	22284	8728	3621	5107	4152
41	1.860	1.044	1.213	1.426	1.420	9209	12919	17904	22191	8696	3710	4985	4287
42	1.913	1.046	1.224	1.450	1.444	9007	12794	17662	22070	8655	3787	4868	4408
43	1.974	1.048	1.235	1.475	1.468	8801	12651	17406	21924	8605	3850	4755	4518
44	2.033	1.051	1.246	1.500	1.493	8590	12491	17136	21751	8545	3901	4644	4615
45	2.094	1.053	1.258	1.525	1.516	8376	12316	16853	21555	8477	3940	4537	4702
46	2.157	1.055	1.269	1.551	1.544	8158	12126	16558	21335	8400	3968	4432	4777
47	2.221	1.057	1.281	1.578	1.570	7938	11922	16251	21092	8313	3984	4329	4841
48	2.288	1.059	1.293	1.605	1.596	7715	11705	15932	20828	8217	3990	4228	4896
49	2.357	1.061	1.305	1.632	1.623	7491	11476	15603	20544	8113	3985	4127	4940
50	2.427	1.064	1.317	1.660	1.650	7265	11237	15264	20239	7999	3971	4026	4975
51	2.500	1.066	1.329	1.688	1.676	7039	10987	14915	19916	7876	3948	3929	5000
52	2.575	1.068	1.341	1.717	1.706	6813	10728	14557	19575	7745	3915	3830	5017
53	2.652	1.070	1.354	1 746	1.735	6586	10460	14191	19216	7604	3874	3731	5025
54	2.732	1.072	1.366	1.776	1.764	6360	10185	13816	18841	7455	3824	3631	5025
55	2.814	1.075	1.379	1.806	1.794	6135	9902	13433	18450	7298	3767	3531	5017
56	2.898	1.077	1.392	1.837	1.824	5911	9613	13043	18044	7132	3703	3430	5001
57	2 985	1.079	1.404	1.868	1.855	5688	9319	126'	17624	6958	3631	3327	4978
58	3.075	1.081	1.417	1.900	1.886	5466	9019	12243	17191	6776	3552	3224	4948
59	3.167	1.084	1.430	1.932	1.918	5247	8715	11833	16745	6586	3468	3118	4912
60	3.262	1.086	1.444	1.965	1.950	5030	8406	11416	16286	6388	3377	3012	4868
61	3.360	1.088	1.457	1.998	1.983	4814	8095	10996	15816	6183	3280	2903	4819
62	3.461	1.090	1.470	2.032	2.017	4602	7780	10572	15335	5970	3178	2792	4763
63	3.565	1.093	1.484	2.067	2.051	4392	7463	10142	14844	5751	3071	2679	4702
64	3.671	1.095	1.498	2.102	2.085	4184	7144	9708	14343	5524	2959	2564	4635
65	3.782	1.097	1.511	2.138	2.120	3980	6823	9270	13833	5290	2843	2447	4563

		FEM HS	FEM 1-3	FEM COLL	FEM GS	FEMC-HS	FEMSC-H	FEMC-SC	FEMGS-C
PRESENT DISCOUNTED VALUE STREAM						TOTAL	TOTAL	TOTAL	TOTAL
AGE 25-65						$322,654	$126,129	$194,525	$160,546
						TAX	TAX	TAX	TAX
	INCOME					$19,198	$7,624	$11,674	$9,552
	SALES					$6,146	$2,440	$3,705	$3,058
	TOTAL					$25,344	$10,064	$15,279	$12,610

TOTAL REAL DOLLAR INCOME (NOT PDV)

AGE	r	WAGE INC HS GRAD	WAGE INC SOME CO	WAGE INC COLLEGE	WAGE INC POSTGRA	FEM HS	FEM 1-3	FEM COLL	FEM GS	FEMC-HS	FEMSC-H	FEMC-SC	FEMGS-C
20	1.000	1.000	1.000	1.000	1.000	10494	8783	18442	16513	7949	-1710	9659	-1929
21	1.030	1.002	1.009	1.017	1.017	10973	9682	19232	17746	8259	-1291	9550	-1485
22	1.061	1.004	1.019	1.034	1.034	11436	10567	20019	18987	8583	-869	9452	-1032
23	1.093	1.006	1.028	1.052	1.051	11884	11439	20802	20228	8919	-445	9364	-575
24	1.126	1.008	1.037	1.070	1.069	12315	12296	21582	21468	9267	-19	9286	-114
25	1.159	1.010	1.047	1.088	1.087	12731	13138	22357	22706	9625	407	9218	349
26	1.194	1.012	1.057	1.107	1.105	13131	13965	23126	23942	9995	834	9161	816
27	1.230	1.015	1.066	1.125	1.124	13515	14775	23888	25173	10374	1261	9113	1285
28	1.267	1.017	1.076	1.145	1.143	13882	15569	24643	26400	10761	1687	9074	1757
29	1.305	1.019	1.086	1.164	1.162	14233	16345	25390	27621	11157	2112	9045	2231
30	1.344	1.021	1.096	1.184	1.181	14566	17103	26128	28834	11560	2536	9024	2706
31	1.384	1.023	1.106	1.204	1.201	14886	17842	26855	30038	11969	2957	9012	3184
32	1.426	1.025	1.116	1.225	1.222	15187	18562	27570	31233	12383	3375	9009	3663
33	1.469	1.027	1.127	1.245	1.242	15471	19261	28274	32416	12802	3790	9013	4142
34	1.513	1.029	1.137	1.267	1.263	15739	19939	28963	33586	13224	4200	9024	4623
35	1.558	1.031	1.148	1.288	1.284	15990	20595	29638	34742	13649	4606	9043	5103
36	1.605	1.033	1.158	1.310	1.306	16223	21229	30297	35882	14074	5006	9068	5584
37	1.653	1.036	1.169	1.333	1.328	16440	21840	30939	37004	14500	5400	9099	6065
38	1.702	1.038	1.180	1.355	1.350	16639	22426	31562	38107	14924	5788	9136	6544
39	1.754	1.040	1.191	1.378	1.373	16820	22988	32168	39189	15346	6168	9178	7023
40	1.806	1.042	1.201	1.402	1.396	16984	23524	32748	40248	15764	6539	9224	7500
41	1.860	1.044	1.213	1.426	1.420	17131	24033	33307	41282	16177	6902	9274	7975
42	1.916	1.046	1.224	1.450	1.444	17259	24515	33842	42289	16583	7255	9326	8447
43	1.974	1.048	1.235	1.475	1.468	17370	24968	34352	43268	16982	7598	9384	8916
44	2.033	1.051	1.246	1.500	1.493	17463	25393	34834	44216	17371	7930	9441	9382
45	2.094	1.053	1.256	1.525	1.518	17537	25787	35286	45131	17749	8249	9500	9844
46	2.157	1.055	1.269	1.551	1.544	17594	26150	35708	46010	18114	8556	9558	10302
47	2.221	1.057	1.281	1.578	1.570	17632	26481	36097	46852	18466	8850	9616	10754
48	2.288	1.059	1.293	1.605	1.596	17651	26780	36452	47653	18801	9128	9672	11201
49	2.357	1.061	1.305	1.632	1.623	17653	27044	36770	48412	19116	9392	9726	11642
50	2.427	1.064	1.317	1.660	1.650	17635	27274	37050	49126	19415	9639	9778	12075
51	2.500	1.066	1.329	1.688	1.678	17599	27468	37290	49791	19691	9869	9822	12502
52	2.575	1.069	1.341	1.717	1.706	17543	27625	37486	50406	19943	10081	9862	12920
53	2.652	1.070	1.354	1.746	1.735	17469	27744	37638	50967	20169	10275	9895	13329
54	2.732	1.072	1.366	1.776	1.764	17378	27824	37743	51472	20368	10448	9920	13728
55	2.814	1.075	1.379	1.806	1.794	17269	27864	37799	51916	20536	10601	9935	14118
56	2.898	1.077	1.392	1.837	1.824	17131	27862	37802	52298	20671	10731	9940	14496
57	2.985	1.079	1.404	1.868	1.855	16979	27818	37751	52613	20772	10839	9933	14862
58	3.075	1.081	1.417	1.900	1.886	16808	27731	37643	52859	20835	10923	9912	15215
59	3.167	1.084	1.430	1.932	1.918	16617	27599	37476	53031	20858	10982	9876	15555
60	3.262	1.086	1.444	1.965	1.950	16407	27422	37246	53126	20839	11015	9824	15880
61	3.360	1.088	1.457	1.998	1.983	16176	27197	36951	53140	20775	11021	9754	16190
62	3.461	1.090	1.470	2.032	2.017	15925	26924	36587	53070	20662	10999	9663	16483
63	3.565	1.093	1.484	2.067	2.051	15654	26601	36152	52911	20498	10947	9551	16759
64	3.671	1.095	1.498	2.102	2.085	15363	26226	35643	52660	20280	10865	9415	17017
65	3.782	1.097	1.511	2.138	2.120	15051	25802	35056	52311	20005	10751	9254	17255

	FEM HS	FEM 1-3	FEM COLL	FEM GS	FEMC-HS	FEMSC-H	FEMC-SC	FEMGS-C
TOTAL REAL DOLLAR INCOME STREAM AGE 25-65					TOTAL $667,784	TOTAL $300,512	TOTAL $387,272	TOTAL $389,421
					TAX	TAX	TAX	TAX
INCOME					$40,923	$17,880	$23,043	$23,171
SALES					$13,100	$5,724	$7,378	$7,417
TOTAL					$54,023	$23,604	$30,419	$30,588

II. Estimating the Number of Years at UMB per Student

The cost and revenue estimates prepared for this report are based on the cohort of students who first enrolled at UMB in the Fall 1991 semester.

Using retention data compiled by the UMB Office of Institutional Research and Planning, estimates of length of stay at the university are compiled for five different types of students:

HS GRAD - UMB GRAD

Students who enrolled as high school graduates and completed their undergraduate degrees at UMB.
(Includes Freshman Year transfer students)

HS GRAD - SOME UMB (NO UMB GRAD)

Students who enrolled as high school graduates but did not complete their undergraduate degrees at UMB.
(Includes Freshman Year transfer students)

TRANSFER IN - SOME UMB (NO UMB GRAD)

Students who transferred to UMB from a community college or another university or college but did not complete their undergraduate degrees at UMB.
(Includes Sophomore, Junior, and Senior transfer students)

TRANSFER IN - UMB GRAD

Students who transferred to UMB from a community college or another university or college and completed their undergraduate degrees at UMB.
(Includes Sophomore, Junior, and Senior transfer students)

GRADUATE STUDENTS

Students who enrolled in graduate programs and either completed or did not complete advanced degrees.

The retention data for undergraduates is from unpublished computer runs prepared by the OIRP and provided by Jennifer Wilton. Retention and graduation data on graduate students is based on UMB Office of Institutional Research and Planning, "Trends in Graduate Enrollment, 1981-1988," OIRP Research Brief 1.89, Table 5, p. 8.

For both undergraduates and graduate students, the semester-by-semester retention and graduation rates for the Fall 1984 student cohort was applied to the Fall 1991 enrollment cohort. Independent estimates for men and women were calculated. The Fall 1984 cohort provides sufficient data to avoid serious truncation bias in the estimation of number of semesters enrolled at UMB.

This procedure produced the following "average years at UMB" data for each type of student identified above:

	Men	Women
HS GRAD - UMB GRAD	5.01	4.72
HS GRAD - SOME UMB	2.50	2.77
TRANSFER IN - SOME UMB	2.28	2.55
TRANSFER IN - UMB GRAD	3.37	3.36
GRADUATE STUDENTS	2.63	2.63

These enrollment year estimates were multiplied by the estimate of FY1992 annual per student state spending ($4,373) to obtain estimates of the average state spending per student during the entire period the student was enrolled at UMB. These estimates ranged from $9,970 for male transfer students who did not complete a UMB degree to $21,909 for male high school graduates who completed all of their undergraduate work at UMB.

RETENTION AND GRADUATION OF UMB UNDERGRAD CLASSES BEGINNING IN FALL 1991
(Retention rates based on Fall 1984 entering class) (Excludes Engineering)
Source: OIRP Retention Tables

FEMALES

		Freshman		Fr.Trans		So.Trans		Jr.Sr.Tr	TOTAL	
Cohort		367		241		351		168	1127	
Graduate	0.331	121	0.378	91	0.54	190	0.733	123	525	0.466
Dropouts	0.669	246	0.622	150	0.46	161	0.267	45	602	0.534

MALES

		Freshman		Fr.Trans		So.Trans		Jr.Sr.Tr	TOTAL	
Cohort		384		213		239		130	966	
Graduate	0.301	116	0.225	46	0.465	111	0.491	64	338	0.350
Dropouts	0.699	268	0.775	165	0.535	128	0.509	66	628	0.650

BOTH SEXES

		Freshman		Fr.Trans		So.Trans		Jr.Sr.Tr	TOTAL	
Cohort		751		454		590		298	2093	
Graduate	0.316	237	0.306	139	0.510	301	0.627	187	864	0.413
Dropouts	0.684	514	0.694	315	0.490	289	0.373	111	1229	0.587

SEMESTERS TO COMPLETION – CLASS OF FALL 1991
(BASED ON FALL 1984 COMPLETION RATES)
Source: Jennifer Wilton

HS GRAD - UMB GRAD (FR./FR.TRANS)

FEMALE

FRESHMN (Cohort:367)
(Grad Rate=33.1%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	0.4	0.4	1.468	2.936
2.5	0.6	0.2	0.734	1.835
3	1.7	1.1	4.037	12.111
3.5	2.3	0.6	2.202	7.707
4	10.9	8.6	31.562	126.248
4.5	14.2	3.3	12.111	54.4995
5	23.6	9.4	34.498	172.49
5.5	26.4	2.8	10.276	56.518
6	29.3	2.9	10.643	63.858
6.5	29.7	0.4	1.468	9.542
7	31.2	1.5	5.505	38.535
7.5	32	0.8	2.936	22.02
8	33.1	1.1	4.037	32.296
			SUM	SUM
			121.477	600.5955

AVE. YEARS TO COMPLETION 4.94

FR.TRANS (Cohort:241)
(Grad Rate=37.6%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	0	0	0	0
2.5	0	0	0	0
3	5.6	5.6	13.496	40.488
3.5	9.4	3.8	9.158	32.053
4	23.6	14.2	34.222	136.888
4.5	27	3.4	8.194	36.873
5	30.7	3.7	8.917	44.585
5.5	32.2	1.5	3.615	19.8825
6	35.2	3	7.23	43.38
6.5	36	0.8	1.928	12.532
7	36.7	0.7	1.687	11.809
7.5	37.1	0.4	0.964	7.23
8	37.6	0.7	1.687	13.496
			SUM	SUM
			91.096	399.2165

AVE. YEARS TO COMPLETION 4.38

AVERAGE YEARS TO COMPLETION (weighted ave: Freshman and Freshman Transfers) 4.718028

MALE

FRESHMN (Cohort:384)
(Grad Rate=30.1%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	0.5	0.5	1.92	3.84
2.5	0.5	0	0	0
3	1.4	0.9	3.456	10.368
3.5	1.4	0	0	0
4	6.2	4.8	18.432	73.728
4.5	7.5	1.3	4.992	22.464
5	16.4	8.9	34.176	170.88
5.5	20.1	3.7	14.208	78.144
6	26	5.9	22.656	135.936
6.5	26.5	0.5	1.92	12.48
7	29	2.5	9.6	67.2
7.5	29.7	0.7	2.688	20.16
8	30.1	0.4	1.536	12.288
			SUM	SUM
			115.584	607.488

AVE. YEARS TO COMPLETION 5.26

FR.TRANS (Cohort:213)
(Grad Rate=22.5%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	0.5	0.5	1.065	2.13
2.5	0.5	0	0	0
3	2.4	1.9	4.047	12.141
3.5	2.9	0.5	1.065	3.7275
4	12.9	10	21.3	85.2
4.5	14.4	1.5	3.195	14.3775
5	17.7	3.3	7.029	35.145
5.5	18.7	1	2.13	11.715
6	19.6	0.9	1.917	11.502
6.5	20.1	0.5	1.065	6.9225
7	22	1.8	4.047	28.329
7.5	22.5	0.5	1.065	7.9875
8	22.5	0	0	0
			SUM	SUM
			47.925	219.177

AVE. YEARS TO COMPLETION 4.57

AVERAGE YEARS TO COMPLETION (weighted ave: Freshman and Freshman Transfers) 5.01

HS GRAD - UMB NO GRAD (FR./FR.TRANS/SO.TRANS/JR-SR.TRANS

FEMALE

FRESHMN (Cohort:367)
(Dropout Rate=66.9%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	17.2	17.2	42.226	21.113
1	33.7	16.5	40.5075	40.5075
1.5	42.5	8.8	21.604	32.406
2	51	8.5	20.8675	41.735
2.5	56.5	5.5	13.5025	33.75625
3	60.5	4	9.82	29.46
3.5	64	3.5	8.5925	30.07375
4	73.6	9.6	23.568	94.272
4.5	76.4	2.8	6.874	30.933
5	86.6	10.2	25.041	125.205
5.5	91.2	4.6	11.293	62.1115
6	93.3	2.1	5.1555	30.933
6.5	94.1	0.8	1.964	12.766
7	95.8	1.7	4.1735	29.2145
7.5	95.8	0	0	0
8	100	4.2	10.311	82.488
			SUM	SUM
			245.5	696.9745

AVERAGE YEARS AT UMB 2.84

FR.TRANS (Cohort:241)
(Dropout Rate=62.2%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	20.2	20.2	30.2796	15.1398
1	36.7	16.5	24.7335	24.7335
1.5	41.2	4.5	6.7455	10.11825
2	51.3	10.1	15.1399	30.2798
2.5	53.9	2.6	3.8974	9.7435
3	61.4	7.5	11.2425	33.7275
3.5	67	5.6	8.3944	29.3804
4	83.9	16.9	25.3331	101.3324
4.5	86.9	3	4.497	20.2365
5	90.6	3.7	5.5463	27.7315
5.5	92.1	1.5	2.2495	12.36725
6	94.8	2.7	4.0473	24.2838
6.5	96.6	1.8	2.6982	17.5383
7	97.4	0.8	1.1992	8.3944
7.5	96.6	-0.8	-1.1992	-8.994
8	100	3.4	5.0998	40.7728
			SUM	SUM
			149.9	396.7853

AVERAGE YEARS AT UMB 2.65

AVERAGE YEARS AT UMB (FR DROPOUTS/FR TRANS DROPOUTS) 2.767969
AVERAGE YEARS AT UMB (SO DROPUTS/JR-SR DROPOUTS) 2.554283

MALE

FRESHMN (Cohort:384)
(Dropout Rate=69.9%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	21.7	21.7	58.2426	29.1214
1	45.4	23.7	63.6108	63.6108
1.5	51.4	6	16.104	24.156
2	57.3	5.9	15.8356	31.6712
2.5	61.6	4.3	11.5412	28.853
3	64.2	2.6	6.9784	20.9352
3.5	65.8	1.6	4.2944	15.0304
4	72.6	6.8	18.2512	73.0048
4.5	74.4	1.8	4.8312	21.7404
5	86.1	11.7	31.4028	157.014
5.5	87.2	1.1	2.9524	16.2382
6	92.9	5.7	15.2988	91.7928
6.5	94.3	1.4	3.7576	24.4244
7	96.1	1.8	4.8312	33.8184
7.5	96.8	0.7	1.8788	14.091
8	100	3.2	8.5888	68.7104
			SUM	SUM
			288.4	714.2124

AVERAGE YEARS AT UMB 2.96

FR.TRANS (Cohort:213)
(Dropout Rate=77.5%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	24.9	24.9	41.1099	20.55495
1	45.5	20.6	34.0108	34.0108
1.5	54.5	9	14.859	22.2885
2	62.2	7.7	12.7127	25.4254
2.5	65.1	2.9	4.7879	11.96975
3	72.7	7.6	12.5478	37.6428
3.5	78.6	3.9	6.4389	22.53615
4	90.4	13.8	22.7838	91.1352
4.5	90.4	0	0	0
5	92.8	2.4	3.9624	19.812
5.5	92.8	0	0	0
6	95.7	2.9	4.7879	28.7274
6.5	96.2	0.5	0.8255	5.36575
7	96.2	0	0	0
7.5	96.2	0	0	0
8	100	3.8	6.2738	50.1904
			SUM	SUM
			165.1	369.6589

AVERAGE YEARS AT UMB 2.24

AVERAGE YEARS AT UMB (FR DROPOUTS/FR TRANS DROPOUTS) 2.500042
AVERAGE YEARS AT UMB (SO DROPUTS/JR-SR DROPOUTS) 2.279469

TRANSFER IN - UMB GRAD (SO. TRANSFER/JR-SR TRANSFER)

FEMALE

SOPHOM (Cohort:351)
(Grad Rate=54.0%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	4.6	4.6	16.146	32.292
2.5	8.4	3.8	13.338	33.345
3	29.5	21.1	74.061	222.183
3.5	35.2	5.7	20.007	70.0245
4	45.6	10.4	36.504	146.016
4.5	46.4	0.8	2.808	12.636
5	48.3	1.9	6.669	33.345
5.5	49	0.7	2.457	13.5135
6	51	2	7.02	42.12
6.5	51.3	0.3	1.053	6.8445
7	52.9	1.6	5.616	39.312
7.5	52.9	0	0	0
8	54	1.1	3.861	30.888
			SUM	SUM
			189.54	682.5195

JR/SR (Cohort:168)
(Grad Rate=73.3%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	5.2	5.2	8.736	8.736
1.5	8.1	2.9	4.872	7.308
2	26.7	18.6	31.248	62.496
2.5	35.5	8.8	14.784	36.96
3	54.1	18.6	31.248	93.744
3.5	58.3	5.2	8.736	30.576
4	67.4	8.1	13.608	54.432
4.5	68	0.6	1.008	4.536
5	69.2	1.2	2.016	10.08
5.5	69.8	0.6	1.008	5.544
6	72.1	2.3	3.864	23.184
6.5	72.7	0.6	1.008	6.552
7	73.3	0.6	1.008	7.056
7.5	73.3	0	0	0
8	73.3	0	0	0
			SUM	SUM
			123.144	351.204

AVE. YEARS TO COMPLETION 3.60
AVERAGE YEARS TO COMPLETI 2.85
AVERAGE YEARS TO COMPLETION (weighted ave: Freshman and Freshman Transfers) 3.36

MALE

SOPHOM (Cohort:239)
(Grad Rate=46.5%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	0	0	0	0
1.5	0	0	0	0
2	3.2	3.2	7.648	15.296
2.5	7.5	4.3	10.277	25.6925
3	24.6	17.1	40.869	122.607
3.5	26.7	2.1	5.019	17.5665
4	34.2	7.5	17.925	71.7
4.5	35.8	1.6	3.824	17.208
5	39	3.2	7.648	38.24
5.5	40.1	1.1	2.629	14.4595
6	41.2	1.1	2.629	15.774
6.5	43.9	2.7	6.453	41.9445
7	46	2.1	5.019	35.133
7.5	46	0	0	0
8	46.5	0.5	1.195	9.56
			SUM	SUM
			111.135	425.181

JR/SR (Cohort:130)
(Grad Rate=49.1%)

YEARS	CUM.%	YEAR%	NUMBER	
0.5	0	0	0	0
1	2.7	2.7	3.51	3.51
1.5	9.8	7.1	9.23	13.845
2	22.3	12.5	16.25	32.5
2.5	29.5	7.2	9.36	23.4
3	42	12.5	16.25	48.75
3.5	42.9	0.9	1.17	4.095
4	47.3	4.4	5.72	22.88
4.5	47.3	0	0	0
5	49.1	1.8	2.34	11.7
5.5	49.1	0	0	0
6	49.1	0	0	0
6.5	49.1	0	0	0
7	49.1	0	0	0
7.5	49.1	0	0	0
8	49.1	0	0	0
			SUM	SUM
			63.63	160.68

AVERAGE YEARS TO COMPLETI 3.83
AVERAGE YEARS TO COMPLETI 2.52
AVERAGE YEARS TO COMPLETION (weighted ave: Freshman and Freshman Transfers) 3.37

III. Estimating State Spending per UMB Student (FY1992)

Total state spending per student was estimated from the IPEDS Reports provided by Byron Drinkwater, Director of the UMB Budget Office.

The key components of state spending include:

(1) Annual State Appropriation
(2) State Paid UMB Employee Fringe Benefits
(3) Capital Use Estimates

Estimated annual total state spending on UMB includes both current and capital account items.

The annual state appropriation includes the general appropriation plus special appropriations for student financial aid, library expenses, and "other" non-specific uses.

State paid UMB employee fringe benefits represent the fringe benefit costs that are covered directly by the state and do not appear in the UMB budget. The total amount of state paid fringe benefit equals 29.26% of UMB's "maintenance budget" less fringe benefits paid by UMB on sponsored contract and grant research.

Total state spending is reduced by the amount of student tuition funds returned to the State General Fund by the university under FY 1992 budget policy.

Capital use is calculated on a "cost basis" with physical structure investment charged at 2% per year of estimated capital cost. This is equivalent to a straight-line 50-year depreciation schedule. The "cost basis" percent charged for equipment is 6.67% -- the equivalent of 15-year useful life. Since an unknown amount of equipment is provided under sponsored research, we have assumed that the state government has paid for two-thirds of total equipment purchases at the university.

Finally, to calculate per student state spending, the total (current = capital use) FY1992 state spending estimate for UMB ($50,747,813) was divided by the total number of students attending UMB in Fall 1991 (11,606). This yielded a per student state spending estimate of $4,373. This figure is used in all calculations of annual per student state costs. (For comparability with other university data, this figure can be translated onto a "full-time-equivalent" student basis; the resulting amount comes to $6,114 per year.)

STATE SPENDING PER UMB STUDENT (FY1992)
FALL 1991 STUDENT HEADCOUNT = 11,606
Source: IPEDS Report; Byron Drinkwater

State Appropriation			$41,727,100
State Special Appropriations			
	Financial Aid	$357,742	
	Library	$331,851	
	Other	$278,192	
			$967,785
Fringe Benefits			
	29.26% of Maintenance Budget		
	29.26%*($41,268,777+$3,626,822)		
		$13,194,972	
	LESS Fringes paid from Contracts & Grants (Reimbursed to the State)		
		$1,757,633	
			$11,437,339
LESS Tuition Returned to State General Fund			
			($7,895,557)
TOTAL CURRENT STATE EXPENDITURES			$46,236,667
	Per Student	$3,984	
CAPITAL USE ESTIMATES			
	Buildings (Cost Basis)	$165,642,021	
	2% of Cost Basis		$3,312,840
	Equipment (Cost Basis)	$26,814,332	
	% attributed to State = 2/3	$17,965,602	
	6.67% of Cost Basis		$1,198,306
TOTAL CAPITAL USE			$4,511,146
TOTAL STATE SPENDING (CURRENT + CAPITAL USE)			$50,747,813
	Per Student	$4,373	
	Per FTE Student	$6,114	

IV. Estimating the "Option Value" of a UMB Education

Students who transfer from UMB to attend another (private) higher education institution and those undergrad graduates who attend (private) universities for graduate or professional training presumably augment their future income streams in part because UMB provided them with the opportunity to pursue further education elsewhere. As a consequence, part of the added increment to earnings is rightly attributed to UMB.

To estimate this "option value" of a UMB education, we relied on two data sources for estimates of the number of UMB students who likely pursued further higher education at private (non-state supported) institutions after leaving UMB. These two sources were: UMB Center for Survey Research, "Report from the Survey of UMass/Boston Juniors," March 1986; and UMB Office of Institutional Research and Planning, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," Report 3.89, April 1989. In addition, estimates of the percentage of UMB dropouts transferring to other schools was provided in private correpondence dated 8/13/92 from Peter Langer, Director of the UMB University Advising Center.

The method of estimating the number of UMB students who dropped out and then transferred to private universities and colleges is as follows:

(1) The dropout percentage for Freshman, Sophomore, Junior, and Senior students from the Fall 1984 class was estimated from the unpublished retention data. This dropout rate was applied to the Fall 1991 student cohorts.

(2) It was assumed that the graduation rate of transfer students at other institutions was equal to the rate prevailing at UMB.

(3) Based on UMB student dropout survey data, it was estimated that 61% of transfers to other universities and colleges attend private schools.

(4) Separate estimates were prepared for Freshman, Sophomore, and Junior/Senior dropouts for men and women separately.

This overall procedure yielded small, but not insignificant, numbers of UMB transfer students who attend private schools and complete undergraduate degrees.

By way of example, of the 384 male Freshman who entered UMB in the Fall 1991, we calculate 12 completed an undergraduate degree at a private university or college after dropping out of UMB and transferring to another school. Of the 384, we estimate a dropout rate of 45.4%. This yields 174 who could transfer to another school. Of this number, we estimate that 50.3% went to college elsewhere and 22.5% of these graduated. This yields 20 students. Of this number, we estimate 61% went to private as opposed to other

public Massachusetts universities and colleges. Hence, the final number of Fall 1991 male Freshman who end up transferring from UMB to a private school and completing an undergraduate degree there is 12 students. This small group is assumed to obtain a measurable option value from having attended UMB without completing a UMB degree.

Similar calculations are made for men and women who are Freshman Transfer Dropouts, Sophomore Transfer Dropouts, and Junior/Senior Transfer Dropouts.

We also calculated an analogous option value for UMB undergraduates who went to graduate or professional school after graduating from UMB. According to OIRP Report 3.88, "The Graduates of 1987: What They Are Doing and What They Think About the University," June 1988, 22% of UMB graduates pursue university training beyond the undergraduate degree.

In all option value calculations, we assume that 1/2 of the increment in earnings due to the higher level of education completed can be attributed to UMB.

Tax revenue estimates from these "option value" students is added into the appropriate tax revenue increments for each group of students in the overall analysis.

OPTION VALUE OF ATTENDING UMB AND TRANSFERRING OUT

Basic Data and Assumptions:

% of Dropouts Attending School Elsewhere	50.3%

Source: CSR "Report from the Survey of UMass/Boston Juniors," March 1988

Assume transfers to other schools graduate from other schools at rate transfers-in graduate from UMB.

FRESHMAN DROPOUTS

% of Dropouts Attending School Elsewhere	50.3%	
	Male	Female
% of Freshman Transfer-Outs Completing College	0.225	0.378
% of Transfer-Outs Going to Non-Mass Public Schools	61.0%	

Source: OPRP Report 3.89, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," April 1989.

Fall 1991	Male	Female
Number in Cohort	384	867
% Dropout	0.454	0.337
% of Dropouts Attending College Elsewhere	0.508	0.508
% of Dropouts Completing College Elsewhere	0.225	0.378
% of Dropouts Completing Non-Mass Public College	0.61	0.61
Number of Students Using Non-Public Option	12	14

FRESHMAN TRANSFER-IN DROPOUTS

% of Dropouts Attending School Elsewhere	50.3%	
	Male	Female
% of Freshman Transfer-Outs Completing College	0.225	0.378
% of Transfer-Outs Going to Non-Mass Public Schools	61.0%	

Source: OPRP Report 3.89, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," April 1989.

Fall 1991	Male	Female
Number in Cohort	218	241
% Dropout	0.455	0.667
% of Dropouts Attending College Elsewhere	0.508	0.508
% of Dropouts Completing College Elsewhere	0.225	0.378
% of Dropouts Completing Non-Mass Public College	0.61	0.61
Number of Students Using Non-Public Option	7	

SOPHOMORE TRANSFER-IN DROPOUTS

% of Dropouts Attending School Elsewhere			50.3%	
			Male	Female
% of Sophomore Transfer-Outs Completing College			0.465	0.54
% of Transfer-Outs Going to Non-Mass Public Schools			61.0%	

Source: OPRP Report 3.89, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," April 1989.

Fall 1991		Male		Female
Number in Cohort		213		241
% Dropout	0.332		0.272	
% of Dropouts Attending College Elsewhere	0.503		0.503	
% of Dropouts Completing College Elsewhere	0.465		0.54	
% of Dropouts Completing Non-Mass Public College	0.61		0.61	
Number of Students Using Non-Public Option		10		11

JR/SR TRANSFER-IN DROPOUTS

% of Dropouts Attending School Elsewhere			50.3%	
			Male	Female
% of Jr/Sr Transfer-Outs Completing College			0.491	0.733
% of Transfer-Outs Going to Non-Mass Public Schools			61.0%	

Source: OPRP Report 3.89, "College Choice and UMass/Boston: Factors Associated with the Enrollment or Non-Enrollment of Admitted Undergraduates," April 1989.

Fall 1991		Male		Female
Number in Cohort		130		166
% Dropout	0.266		0.225	
% of Dropouts Attending College Elsewhere	0.503		0.503	
% of Dropouts Completing College Elsewhere	0.491		0.733	
% of Dropouts Completing Non-Mass Public College	0.61		0.61	
Number of Students Using Non-Public Option		5		9

V. Estimating In-State Residence of Alumni

Unfortunately, UMass/Boston does not have comprehensive survey information regarding the location of its alumni. However, during the summer of 1992 the Alumni/Development Office conducted a survey of the UMB College of Management alumni for the period 1984 through 1991. This survey included both undergraduates and Master's level students. A summary of the results of this survey was communicated to the author in a letter from Patty Bell in Alumni/Development Records on August 20, 1992.

For most years, the office was able to locate current addresses for 85% or more of the alumni. Separate records were kept for men and women. To estimate an average long-term in-state residence ratio, we chose the years 1984-1987 for analysis. As it turned out, the in-state ratio was nearly constant over these four years -- with a gender weighted average of 89% for undergraduates and 82% for graduate students. The ratios did not vary by more than two percentage points between men and women.

While not used in the formal analysis, it is worth noting that a high proportion of the alumni not only continue to reside in Massachusetts, but nearly 80% reside in the Greater Boston area. Again, there is little trend over time in this percentage.

VI. Measuring the "Multiplier Effect"

As is commonly known, an extra dollar spent in an economy has a "multiplied" effect on total income as that dollar moves from one consumer to the next through the economy. Because of "leakages" in the system, the dollar does not continue to multiply forever. Dollars leak out of the spending stream of a particular region (or state) in a large number of ways: spending on "imports" (anything produced out-of-state); taxes; and savings are the three most important leakages.

The state multiplier used in this analysis is the one calculated for Massachusetts in the Multi-Regional Policy Impact Simulation (MRPIS) model housed at Boston College and used to analyze the impact of private universities and colleges in the Commonwealth for the Association of Independent Colleges and Universities of Massachusetts (AICUM). The MRPIS multiplier has a value of 1.341 -- a conservative estimate by most standards due to the large number of simulated leakages incorporated in the model. This was used throughout our analysis.

VII. Estimating the Value of the UMass/Boston Export Base

The UMass/Boston "export base" includes all income flows into UMB from sources **outside the state.** There are five such income flows that were estimated for this analysis:

(1) Non-resident student tuition, fees, and living expenses.

ALUMNI IN-STATE RESIDENCE
Average for Class Year 1984-1987

UNDERGRAD

1984	Female	Male
Total	700	492
In-Mass	625	444
1985		
Total	682	496
In-Mass	613	445
1986		
Total	688	431
In-Mass	607	370
1987		
Total	768	480
In-Mass	696	420
Ave In-State	89.53%	88.41%
Female/Male In-State Ratio	60.21%	39.79%
Weighted In-State Ratio UNDERGRAD	89.09%	
Weighted In-State Ratio Undergrad+Grad	88.46%	

GRADUATE

1984	Female	Male
Total	44	32
In-Mass	37	30
1985		
Total	53	28
In-Mass	47	20
1986		
Total	75	62
In-Mass	57	49
1987		
Total	76	67
In-Mass	64	53
Ave In-State	82.66%	80.42%
Female/Male In-State Ratio	57.42%	42.58%
Weighted In-State Ratio GRADUATE	81.71%	

The size of the non-resident student population in 1991 is taken from OIRP records. At 495 students out of 11,606, they represent only 4.3% of the entire student body. Tuition and fees at $9,766 is taken from University of Massachusetts 1991-92 Facts (April 22, 1992). An estimate of living expenses per non-resident student is taken from the study, "Economic Impact of Massachusetts Higher Education, 1989-1990 Academic Year" published by the Association of Independent Colleges and Universities of Massachusetts, September 1991. The AICUM estimate for total average per student living expenses is $10,327.

(2) Non-Massachusetts-based sponsored research contracts and grants.

Total non-Massachusetts-based sponsored research and activity funds for the period 7/1/91 - 6/30/92 was available from the UMB Office of the Vice Chancellor for Administration and Finance. Of a grand total of awards equal to approximately $12.3 million during that period, $8.7 million came from government agencies and private foundations outside of the Commonwealth. To be on the conservative side, we assumed that any funds from in-state agencies or foundations would have gone to other in-state institutions if they had not been awarded to UMB -- thus not increasing the total income in the state.

(3) Student federal grant-in-aid.

Dollar figures for all federal grant-in-aid provided UMB students is compiled from "Financial Aid Services 1991-92 Annual Report Initial Analysis" produced by the UMB Student Financial Aid Office. Only federal aid was included in the analysis. The large amount of federal loans to students was not included because presumably students will have to repay these funds to the federal government and therefore these dollars plus interest charges will leave the state over the student's lifetime.

(4) Non-Massachusetts-based gifts and unrestricted contributions.

The total value of non-Massachusetts-based gifts and other private contributions to UMB in FY1992 was compiled by the UMB Development Office. The figure used here includes gifts only from non-state resident corporations and individuals.

(5) Income from federal endowments.

The final export base income source is income from federal endowments. In this small category we include only the income from the (initial) federal endowment to the John W. McCormack Institute. The total endowment was $3 million in FY1992. At an estimated 6% interest rate, this endowment was worth $180,000. Miscellaneous endowment income added $14,000 to the total.