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ANDERSON ECONOMIC GROUP

Michigan's University Research Corridor

First Annual Economic Impact Report

Commissioned by Michigan's University Research Corridor

Michigan State University
University of Michigan
Wayne State University

Prepared by:

Anderson Economic Group, LLC
Caroline M. Sallee
Patrick L. Anderson

Anderson Economic Group, LLC
1555 Watertower Place, Suite 100
East Lansing, Michigan 48823
Tel: (517) 333-6984
Fax: (517) 333-7058

http://www.AndersonEconomicGroup.com

Summary of Findings

The University Research Corridor (URC) is an alliance of Michigan's three largest academic institutions: Michigan State University, the University of Michigan, and Wayne State University. The URC universities asked Anderson Economic Group to undertake a comprehensive study that quantifies the economic impact of the URC's activities on Michigan's economy. This report is to be the first in a series of annual reports and is intended to benchmark the contributions of the URC universities to the state's economy. We present the key findings of our analysis below.

URC STUDENTS

The URC had 133,331 students enrolled in the fall of 2005. This is an increase of 3.9% from the fall of 2001. The students at the URC universities are drawn from throughout Michigan and around the world. Students from Michigan accounted for 77% of total enrollment in the fall of 2005, while 14% came from elsewhere in the U.S. and the remaining 9% came from other countries or territories. The URC has students from every county in Michigan, every state, and more than 150 countries. See "URC Student Demographics" on page 4 for our complete analysis.

SCALE OF THE URC

The URC universities collectively spent $6.5 billion on operations in FY 2006. The $6.5 billion was used to pay the salaries of 46,398 full-time-equivalent staff and faculty, purchase supplies and equipment, and maintain buildings. This figure—$6.5 billion—is about 2% of all economic activity in the state, as measured by Michigan's Gross State Product.

In 2006, there were 556,338 alums of a URC university living in Michigan, making up 7.3% of Michigan's population over the age of 18 years. These alums earned an estimated $25 billion in salary and wages in 2006, or 13.4% of all wage and salary income in Michigan. See Table 1 below for the scale of the URC.

TABLE 1. Scale of the URC, FY 2006

Category	Impact
Operational Expenditures (e.g. supplies, payroll, equipment)	$6.5 billion
Full-Time-Equivalent Employees	46,398
Enrolled Students	133,331
Alumni Living in Michigan	556,338
Wage and Salary Earnings of URC Alumni in Michigan	$25 billion

Base Data Sources: National Center for Education Statistics, IPEDS; URC Universities
Analysis: Anderson Economic Group, LLC

ECONOMIC IMPACT

We define *net economic impact* as the additional earnings to state residents caused by the operation of these institutions. In calculating the net economic impact, we follow a careful methodology that counts expenditures only once, takes into account substitution of one activity within the state by another, and uses very conservative multipliers for indirectly-caused activity. Among other conservative

assumptions, we assume most URC students would attend college even if these research institutions were not located in Michigan, and that many employees of the URC would find other jobs in Michigan even if the URC institutions were not located here. We detail our methodology for the economic impact of the operational expenditures by URC universities in "Operational Expenditures Methodology" in Appendix B.

In FY 2006, Michigan's residents were over $12.8 billion richer due to the URC. These new earnings to Michigan residents stem from expenditures by the URC universities on non-payroll items (such as supplies and equipment) and by employees, students, and alumni. We were careful only to include expenditures by URC employees, students, and alumni directly caused by the URC. This net economic impact figure—6.9% of all wage and salary income in Michigan—takes into account the economic activity that would have occurred in Michigan even without the URC. See Table 2 below.

In addition to $12.8 billion in new earnings, the URC generated 68,803 jobs in Michigan. Our complete analysis is in "Impact on Jobs and Income" on page 11.

TABLE 2. Net Economic Impact of URC, FY 2006

Impact Category	New Earnings in Michigan (millions)
Non-payroll Operating (e.g. supplies, equipment)	$2,066.2
University of Michigan Hospital Non-payroll Operating	$824.1
Faculty & Staff	$3,606.5
URC Students	$1,583.8
Alumni	$4,787.7
TOTAL ECONOMIC IMPACT	**$12,868.2**

Source: Anderson Economic Group, LLC

HUMAN CAPITAL BENEFITS

URC universities increase the knowledge and skills of the students who attend. URC alums earn higher wages over their lifetime than their counterparts. We estimate that the lifetime earnings in Michigan of the class of 2006 will be $5.6 billion higher (in 2006 dollars) than they would have had the graduating students not attended a URC university. In making this estimate we again employ the conservative assumption that most URC graduates would have attended college even if these institutions were not located in Michigan. See "Human Capital" on page 15 for our analysis.

FISCAL IMPACT

In 2006, we estimate that $2.25 billion in wages of URC employees and $4 billion of URC alumni in Michigan was caused by the URC. We estimate that the tax revenue the state received because of these earnings, that otherwise would not exist in the state, is $351.6 million. This includes new tax revenue the state receives from personal income, sales and use, property, and gasoline taxes. Our complete analysis can be found in "Impact on State Revenue" on page 27.

URC REVENUE SOURCES

Michigan's URC universities received $7.8 billion in revenue in FY 2006. This is 35% more than the three universities received in FY 2002. Almost every source of revenue increased during the four year time period. State appropriations, however, decreased by 13% during this time period. State appropriations made up 18% of total revenue in FY 2002 but only 12% in FY 2006. See "URC Revenue Sources" on page 21.

COMPARISON WITH PEER UNIVERSITY CLUSTERS

To judge how the URC compares with other university clusters in the nation, we selected a handful of the best-known groups of universities in California (North and South), Illinois, Massachusetts, North Carolina, and Pennsylvania. Each of these clusters has three universities from the same state and are well known for their research and development activities. For example, the Northern California cluster includes UC San Francisco, UC Berkeley, and Stanford University; the North Carolina cluster includes Duke, University of North Carolina at Chapel Hill, and NC State; and the Massachusetts cluster includes MIT, Harvard, and Tufts. See "Comparison with Peer University Clusters" on page 38 for a complete list of the comparison university clusters.

Student Enrollment and Completions. The URC's 133,331 students in the fall of 2005 make it the largest research university cluster, in terms of enrollment, in our analysis. The next highest is the Southern California cluster (UCLA, USC, and UC San Diego) with just over 93,000 students enrolled in the fall of 2005.

The URC universities award a variety of degrees each academic year. In terms of number of degrees granted, the URC ranks #1 in total number of degrees conferred in *Physical Science, Agriculture and Natural Resources* and *Medicine and Biological Science*. The URC is in the top three in total number of degrees awarded in *Engineering* and *Math and Computer Science* and *Business Management and Law.*

R&D Expenditures. In 2005, academic institutions in Michigan spent $1.45 billion on research and development, with the URC universities spending 94% of this amount, or $1.37 billion. Approximately 60% of funding for these R&D expenditures came from federal sources. In other words, the URC universities brought $832 million in federal dollars into the state of Michigan for research.

In 2005, the URC spent less on R&D than the California and North Carolina clusters but more than the other three. The URC universities receive less federal funding than all clusters except North Carolina and Illinois, and rely on institutional funds for a significantly higher proportion of their R&D expenditures than all six comparison clusters. See Table 3 on page iv and "Comparison with Peer University Clusters" on page 38.

TABLE 3. Total Research and Development Expenditures, 2005

University Cluster	Total Expenditures (in millions)	Federally Funded Expenditures	Federal Share of Total Expenditures	Institutional Share of Total Expenditures
Michigan's URC	**$1,369**	**$832**	**61%**	**25%**
Northern California	$2,024	$1,304	64%	15%
Southern California	$1,952	$1,263	65%	19%
Illinois	$1,181	$779	66%	22%
Massachusetts	$1,159	$951	82%	2%
North Carolina	$1,374	$806	59%	16%
Pennsylvania	$1,337	$953	71%	12%
All U.S. Universities	*$45,750*	*$29,167*	*64%*	*18%*

Source: National Science Foundation, Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

Tech Transfers. An important indictor of the success of university research and development is how effective that university is at transferring technology to the private sector. In terms of volume, the URC ranks fourth in average annual number of invention disclosures and patents, and sixth in number of licenses granted. In terms of effectiveness of R&D expenditures, as measured by licensing revenue per expenditure, the URC is better than all comparison clusters except Northern California and Massachusetts. This means that a higher percentage of URC expenditures result in a product that is licensed and sold than most of the other comparison clusters. See Table 4 below.

TABLE 4. Average Annual Patent and Licensing Activity, 2002-2006

	Invention Disclosures	Patent Grants	Licenses/Options	Licensing Revenue (in millions)	Revenues per Expenditures
Michigan's URC	**437**	**126**	**118**	**$39**	**2.9%**
Northern California	647	199	185	$172	8.5%
Southern California	789	242	174	$28	1.6%
Illinois	412	135	104	$19	1.6%
Massachusetts	706	204	206	$59	5.1%
North Carolina	383	111	143	$10	0.8%
Pennsylvania	387	123	134	$13	1.0%

Source: Universities' websites, Association of University Technology Managers 2005 Survey

BENEFITS OF MEDICAL EDUCATION

The URC sponsors the only medical schools in the state of Michigan that provide Doctor of Medicine (M.D.) and Doctor of Osteopathic Medicine (D.O.) degrees. In 2005, the URC graduated 639 students from its allopathic (M.D.) and osteopathic (D.O.) medical schools. This is 12.1% more than in 2001. Many of these graduates

remain in Michigan for their residency and internship programs (i.e. graduate medical education or GME). In 2005, 60% of URC medical school graduates remained in Michigan for their graduate medical education. Hospitals that teach these students receive payments for GME. In 2005, hospitals that trained medical residents through a program affiliated with a URC medical school received $526.7 million in GME payments (72% of all state GME payments). Hospitals that had at least one medical residents that had graduated from a URC medical school received $569.4 million or 78% of all state GME payments in 2005.

Doctors who attended medical school or a residency program in Michigan are more likely to remain in the state to practice than active physicians in the average U.S. state. Over-half (55.1%) of active physicians in Michigan completed a residency program in Michigan, compared to the national average of 44.7%. The same trend holds for medical schools: 38.2% of active physicians in Michigan in 2005 had attended a medical school in Michigan compared to 29.6% in the average U.S. state.

CULTURE, EVENTS & COMMUNITY

The URC provides numerous cultural and entertainment venues that enrich Michigan's residents and draw visitors from across the country and around the world. These attractions include museums of art and history, library collections, theatre, and music. Athletic events are another significant entertainment offering. The most significant athletic event, in terms of attendance, is likely Big Ten football in the URC.

In 2006 the University of Michigan drew 770,183 fans to Michigan Stadium for home games and Michigan State drew 495,731 fans to Spartan Stadium. We estimate that the out-of-state visitors for these games was 132,433. We estimate that the economic impact of spending by these out-of-state visitors alone at Big Ten football games played in Michigan was $92.2 million for the 14 games played in 2006. Of course, spending by state residents related to these events was much higher. See "Culture, Events, and Community" on page 52 for our full analysis.

I. Introduction

WHAT IS MICHIGAN'S UNIVERSITY RESEARCH CORRIDOR?

The University Research Corridor (URC) is an alliance of Michigan's three largest academic institutions: Michigan State University, the University of Michigan, and Wayne State University. The purpose of this alliance is to accelerate economic development in Michigan by educating students, attracting talented workers to Michigan, supporting innovation, and encouraging the transfer of technology to the private sector.

The URC universities are present in communities throughout the state. Michigan State University is located in East Lansing, in close proximity to the state's capital. The University of Michigan's main campus is in Ann Arbor with branch campuses in Flint and Dearborn. Wayne State University is located in Detroit, the largest city in the state. Each URC university has research and teaching locations and partner hospitals located throughout the state, as shown by the map on page 3.

REPORT PURPOSE & FOCUS

Michigan's University Research Corridor universities asked Anderson Economic Group to undertake a comprehensive study that quantifies the economic impact of the URC's activities on the state of Michigan's economy. This report is to be the first in a series of annual reports and is intended to measure and benchmark the contributions of the URC universities to the state. The information in this report will help readers understand how the URC universities spend their time and money and track the URC's performance year-to-year.

The focus of this year's report is how the URC compares to other prominent university clusters. We selected six comparison university clusters in five states. We compared Michigan's URC with some of the best universities (public and private) in each of these states. We present the list of peer university clusters in Table 5 below.

TABLE 5. Comparison Peer University Clusters

Michigan's URC	Michigan State University	University of Michigan	Wayne State University
Northern California	University of California, San Francisco	University of California, Berkeley	Stanford University
Southern California	University of California, Los Angeles	University of California, San Diego	University of Southern California
Illinois	University of Chicago	University of Illinois at Urbana-Champaign	Northwestern University
Massachusetts	Harvard University	Massachusetts Institute of Technology (MIT)	Tufts University
North Carolina	Duke University	University of North Carolina (Chapel Hill)	North Carolina State University
Pennsylvania	Penn State University (all campuses)	University of Pittsburgh (all campuses)	Carnegie Mellon University

Source: Anderson Economic Group, LLC

REPORT METHODOLOGY

In order to quantify the economic impact of the URC's activities, we asked ourselves the following question: What would the loss be to the state if the URC universities left Michigan? We then studied the loss in terms of jobs, earnings, tax revenue, research, and quality of life. The following nine chapters of this report provide quantitative measures of how the URC is performing in those areas.

ABOUT THE REPORT'S AUTHORS

Anderson Economic Group, LLC is a consulting firm that specializes in economics, public policy, financial valuation, market research, and land use economics. Anderson Economic Group has completed economic and fiscal impact studies for a variety of public and private sector clients, including Michigan State University and Wayne State University. Brief bios of the report's authors are presented below. See "Appendix C: About the Authors" for bios of all project staff.

Caroline M. Sallee. Ms. Sallee is a consultant at Anderson Economic Group, working in the Public Policy, Economic, and Fiscal Analysis practice area. Her background is in applied economics and public finance. Her recent work includes fiscal and economic impact studies for Michigan State University, the benchmarking of Michigan's business taxes with other states in a project for the Michigan House of Representatives, and an analysis of the technology industry in West Virginia.

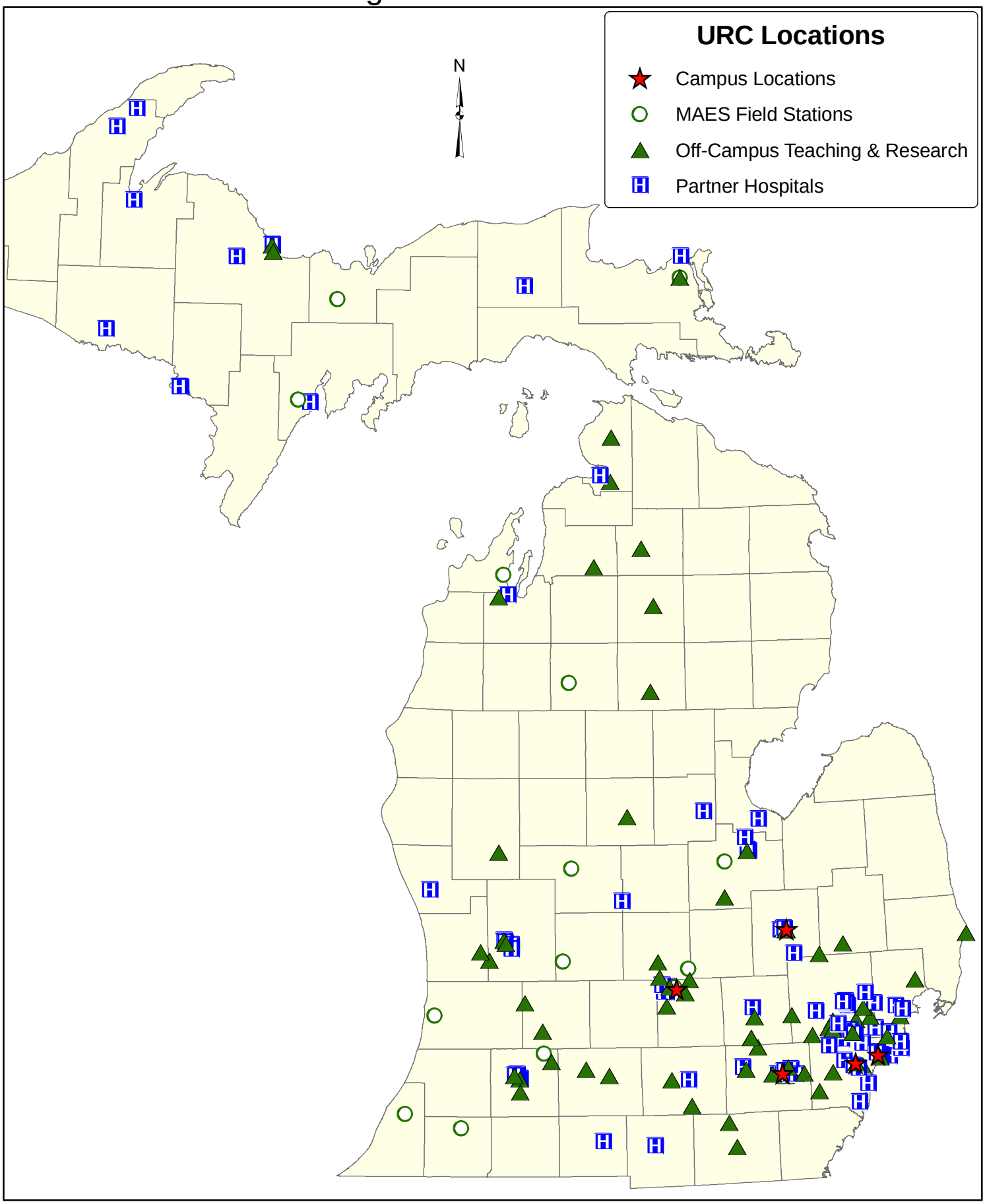
Ms. Sallee holds a Masters degree in public policy from the Gerald R. Ford School of Public Policy at the University of Michigan and a Bachelor of Arts degree in economics and history from Augustana College.

Patrick L. Anderson. Mr. Anderson founded the consulting firm of Anderson Economic Group in 1996, and serves as a principal and chief executive officer in the company. In this role he has successfully directed projects for state governments, cities, counties, nonprofit organizations, and corporations in over half of the United States.

Mr. Anderson's views are often cited in news reports throughout the United States, and his articles have been published by *The Wall Street Journal*, *The Detroit News*, *The Detroit Free Press*, *American Outlook*, *Business Economics*, and other publications. His book *Business Economics and Finance* was published in 2004, and his paper "Pocketbook Issues and the Presidency" was awarded the Edmund Mennis Award for the best contributed paper in 2004 by the National Association for Business Economics. Mr. Anderson also contributed the chapter on business valuation and commercial damages to the book *Litigation Economics*, published in 2005.

Mr. Anderson is a graduate of the University of Michigan, where he earned a Master's degree in public policy and a Bachelor's degree in political science. He is a member of the National Association for Business Economics and the National Association of Forensic Economists. The Michigan Chamber of Commerce awarded Mr. Anderson its 2006 Leadership Michigan Distinguished Alumni award for his civic and professional accomplishments.

URC's Presence in Michigan



Created By: Anderson Economic Group, LLC
Data Source: ESRI; Michigan Sate University, University of Michigan, Wayne State University
September 2007

II. URC Student Demographics

STUDENT ENROLLMENT

The University Research Corridor had 133,331 students enrolled in the fall of 2005. This represents an increase in enrollment of 5,033 (3.9%) from the fall of 2001, when total URC enrollment was 128,298.

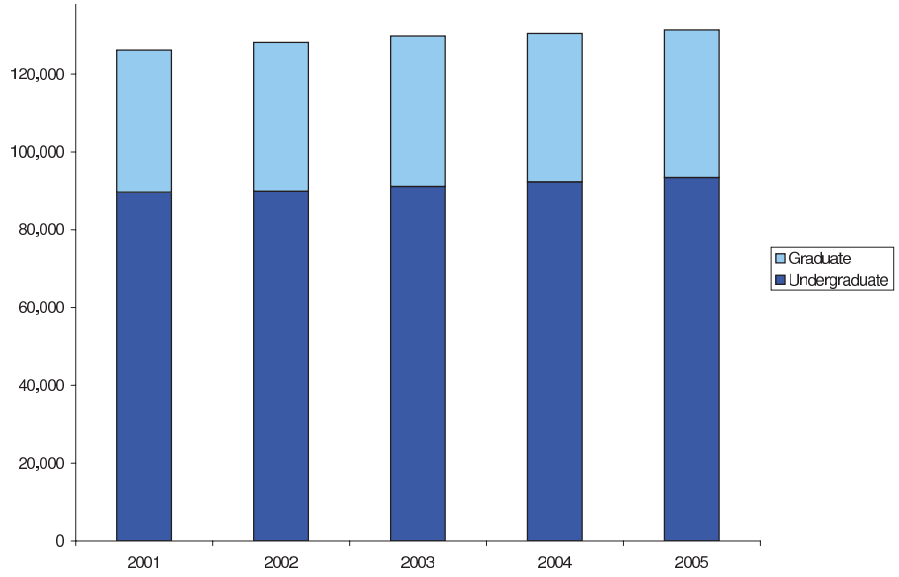
TABLE 5. URC Enrollment, Fall 2001-2005

	2001	2002	2003	2004	2005	2001-2005 CAGR
Undergraduate	89,637	89,871	91,116	92,283	93,397	1.03%
Graduate	36,543	38,265	38,698	38,167	37,969	0.96%
Other	2,118	2,099	2,024	2,052	1,965	-1.86%
TOTAL	128,298	130,235	131,838	132,502	133,331	0.97%

Source: Offices of the Registrar—University of Michigan, Michigan State University, Wayne State University.

Approximately 70% of total enrollment is comprised of undergraduate students, 29% graduate students (including doctoral and professional), and 1% enrolled in some other program, such as a certificate or executive education programs. As shown in Figure 1, the ratio of undergraduate to graduate students has remained constant from 2001 to 2005, while total enrollment has slightly increased.

FIGURE 1. URC Enrollment, Fall 2001-2005



Data Source: Offices of the Registrar, URC universities
Analysis: Anderson Economic Group, LLC

The students at the URC are drawn from throughout Michigan, across the United States, and around the world. Students from Michigan accounted for 77% of total enrollment in fall 2005. Another 14% came from elsewhere in the United States, and the remaining 9% came from other countries or territories. In all, the URC has students from every county in Michigan, every state, and more than 150 different countries. The majority of international students come from China, The Republic of Korea, India and Canada while others come from as far away as South Africa, Russia, Iran, Finland, and Uruguay.

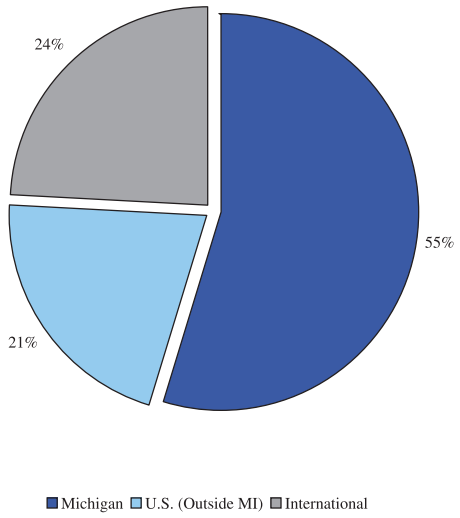
TABLE 6. Origin of URC Students, Fall 2001-2005

	2001	2002	2003	2004	2005
State of Michigan	100,960	100,688	102,888	103,655	103,562
Other States	16,743	17,409	17,652	18,036	18,478
International and other (including territories)	10,595	12,138	11,298	10,811	11,977
TOTAL ENROLLMENT	128,298	130,235	131,838	132,502	134,017

Source: Offices of the Registrar—University of Michigan, Michigan State University, Wayne State University

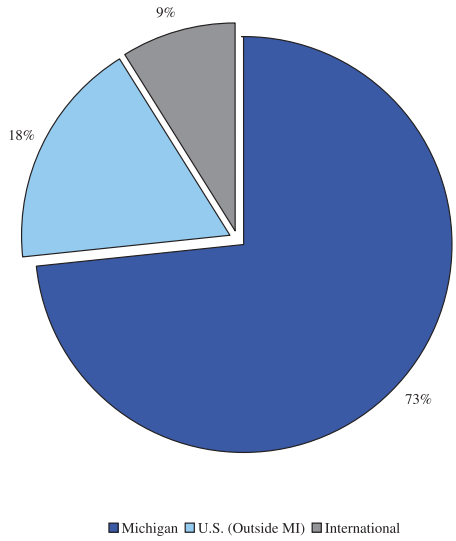
A greater share of the URC's graduate students come from outside the state than the undergraduate student population. As shown in Figure 2 and Figure 3 on page 6, almost half of the URC's graduate students come from outside Michigan, while less than a quarter of the URC's undergraduate student are from outside Michigan. The diversity of student origins within Michigan's schools is important to the state's developing economy and the URC has accomplished that diversity.

FIGURE 2. Origin of URC Graduate Students, Fall 2005



Data Source: Offices of the Registrar, URC universities
Analysis: Anderson Economic Group, LLC

FIGURE 3. Origin of URC Undergraduate Students, Fall 2005



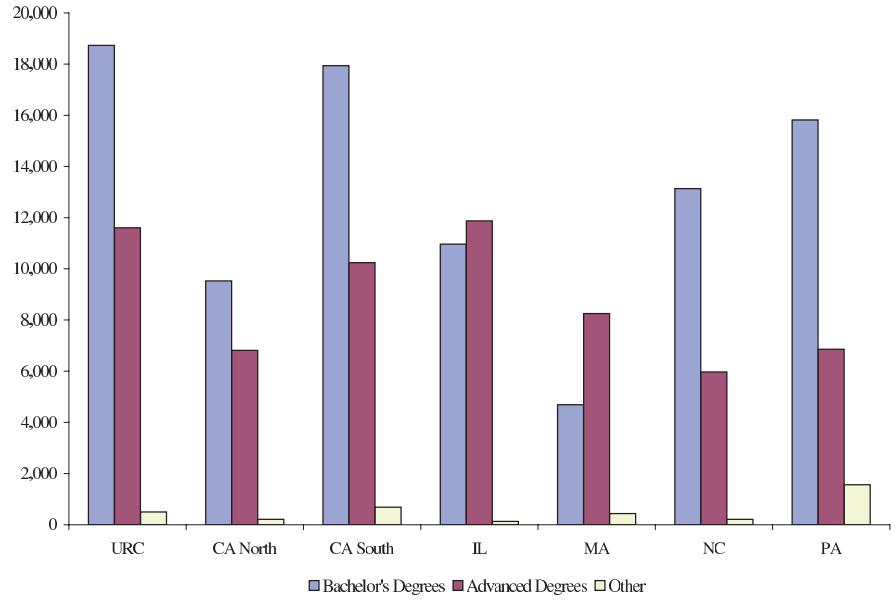
Data Source: Offices of the Registrar, URC universities
Analysis: Anderson Economic Group, LLC

COMPARISON WITH OTHER UNIVERSITY CLUSTERS

We compared the URC's enrollment and degrees granted with other peer university clusters in five states: California, Illinois, Massachusetts, North Carolina, and Pennsylvania. We present the list of peer university clusters in Table 5 on page 1.

The URC's 133,331 students make it the largest research university cluster, in terms of enrollment, of those in our analysis. The next highest is the Southern California cluster (UCLA, UC San Diego, USC), with just over 93,000 students enrolled in fall 2005. As shown in Figure 4, the URC awarded more bachelor's degrees (18,731) than any of the comparison clusters, and were second only to the Illinois cluster in terms of advanced degrees awarded (11,606 versus 11,873).

FIGURE 4. Completions by Type of Degree, 2004-05 academic year



Data Source: National Center for Education Statistics, IPEDS Enrollment
Analysis: Anderson Economic Group, LLC

Total enrollment (undergraduate and graduate) at these university clusters has grown slightly in the past four years. The average annual growth rate for the URC was just under 1% during the 4-year period, and most of our comparison university clusters experienced annual growth that was similar to the URC. However, the North Carolina university cluster (Duke, UNC, NC State) experienced average annual growth in graduate students well above the other clusters at 3.77%. See Table A-1, "Total Enrollment, Fall 2001- 2005," on page A-1 for the enrollment growth rates by university cluster.

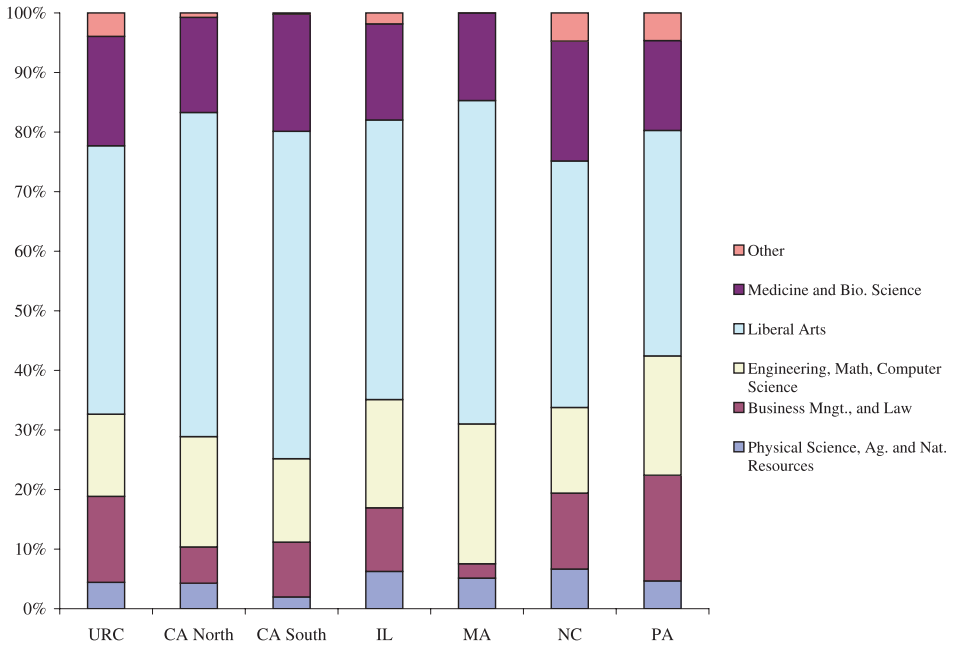
The URC ranks first among the university clusters in our study for total number of degrees (undergraduate and graduate) conferred in *Physical Science, Agriculture and Natural Resources*, as well as in *Medicine and Biological Science*. The URC is in the top three in number of *Engineering* and *Math and Computer Science* and

Business Management and Law degrees awarded.[1] While the URC confers more degrees in medicine, the physical sciences, and business than most of our comparison university clusters, this is partially a result of the URC teaching thousands more students each year overall than these comparison schools.

To put the number of degrees awarded into context, Figure 5, "Undergraduate Degrees Conferred by Area, 2004-2005," and Figure 6, "Graduate Degrees Conferred by Area, 2004-2005," illustrate the concentration of type of degree conferred, as measured by the total numbers of degrees awarded during the 2004-05 academic year.

As shown in Figure 5, after accounting for total number of undergraduate degrees conferred, the URC ranks #5 in *Physical Science, Agriculture, and Natural Resources* degrees conferred, #2 in *Business Management and Law*, #7 in *Engineering, Math, Computer Science*, and #3 in *Medicine and Biological Science.* The North Carolina university clusters ranks first in medical and physical science undergraduate degree share, while Massachusetts is the most concentrated in granting engineering degrees.

FIGURE 5. Undergraduate Degrees Conferred by Area, 2004-2005

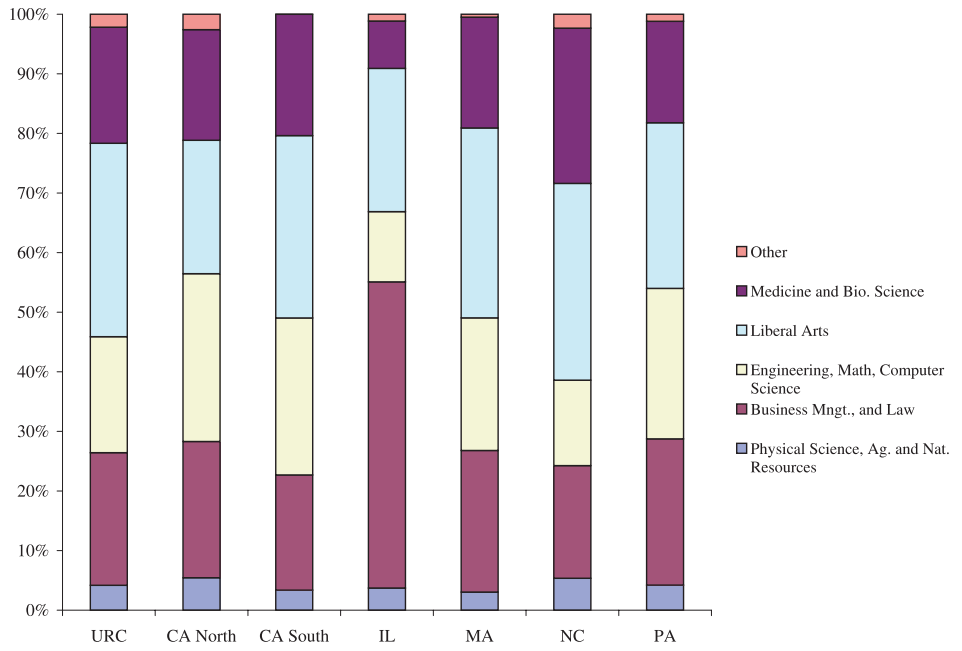


Data Source: National Center for Education Statistics, IPEDS
Analysis: Anderson Economic Group, LLC

1. See the academic program definitions at the end of this section for information on the composition of each academic program area.

As shown in Figure 6, as a share of total graduate degrees conferred, the URC ranks #4 in *Physical Science, Agriculture, and Natural Resources*, #4 in *Business Management and Law*, #5 in *Engineering, Math, Computer Science*, and #3 in *Medicine and Biological Science.* Graduate degrees in the liberal arts make up the largest share of total graduate degrees conferred in the URC.

FIGURE 6. Graduate Degrees Conferred by Area, 2004-2005



Data Source: National Center for Education Statistics, IPEDS
Analysis: Anderson Economic Group, LLC

Academic Program Definitions. The academic program areas used in this section are based on the National Center for Education Statistics (NCES) Classification of Instructional Programs (CIP) codes for 2000. The composition of each program area follows.

The *Physical Science, Agriculture, and Natural Resources* academic program area includes the following fields of study: agriculture, agriculture operations, and related sciences; natural resources and conservation; physical sciences.

The *Business, Management, and Law* academic program area includes the following fields of study: legal professions and studies; business, management, marketing, and related support services.

The *Engineering, Mathematics, and Computer Science* academic program area includes the following fields of study: architecture and related services; computer

and information sciences and support services; engineering; mathematics and statistics.

The *Liberal Arts* academic program area includes the following fields of study: area, ethnic, cultural, and gender studies; communication, journalism, and related programs; education; foreign languages, literatures, and linguistics; family and consumer sciences/human sciences; English language and literature/letters; liberal arts and sciences, general studies and humanities; library science; multi/interdisciplinary studies; philosophy and religious studies; theology and religious vocations; public administration and social service professions; social sciences; visual and performing arts; history.

The *Medicine and Biological Science* academic program area includes the following fields of study: biological and biomedical sciences; psychology; health professions and related clinical sciences.

The *Other* academic program area includes the following fields of study: personal and culinary services; parks, recreation, leisure, and fitness studies; security and protective services; construction trades; mechanic and repair technologies/technicians; precision production; transportation and materials moving; undesignated field of study; communications technologies/technicians and support services; engineering technologies/technicians; military technologies; science technologies/technicians.

III. Impact on Jobs and Income

SCALE OF OPERATIONS & EXPENDITURES

The University Research Corridor makes significant contributions to the state's economy. URC institutions spent $6.5 billion on operations in FY 2006 (July 1, 2005 to June 30, 2006) and employed 46,398 full-time-equivalent faculty and staff throughout Michigan.[2] Most operational spending went toward instruction (21% of total), research (14%), and the University of Michigan Hospital (29%). See Table 7 below.

TABLE 7. Operational Expenditures by the URC, FY 2006

	Expenditures ($ in millions)	% of Total
Instruction	1,369	21%
Research[a]	916	14%
Public Services	322	5%
Academic Support	310	5%
Student Services and Scholarships and Fellowships	245	4%
Institutional Support	248	4%
Operation and Maintenance of Plants	422	7%
Auxiliary Enterprises	378	6%
Depreciation and Other Expenses	397	6%
University of Michigan Hospital	1,844	29%
Total Operational Expenditures	**$6,452**	**100%**

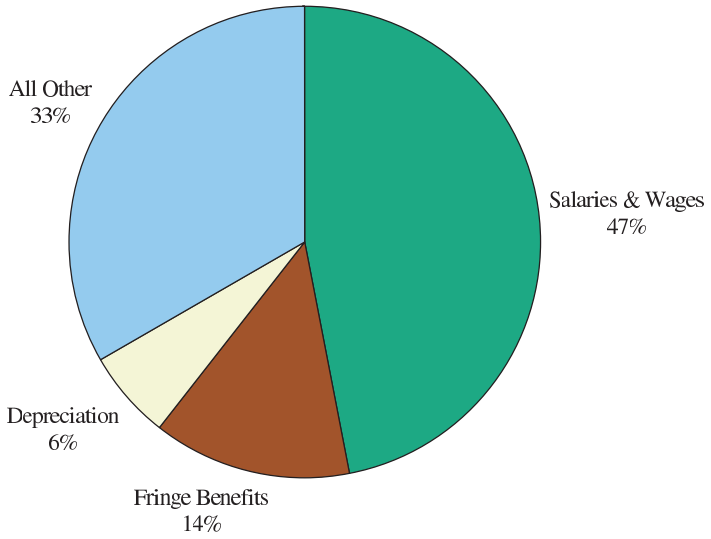
Data Source: IPEDS Finance FY 2006

a. The data reported to IPEDS for research expenditures is lower than the research expenditures reported to the National Science Foundation. Research expenditures reported to IPEDS only include direct research costs. Indirect costs, while included in NSF reporting, are counted in other spending categories when reported to IPEDS.

We can also examine these expenditures by function, as shown in Figure 7 on page 12. Almost half (47%) of all operational expenditures were for salaries and wages for faculty and staff. Fringe benefits made up 14% of expenditures, while depreciation accounted for 6%. The remaining 33% paid for supplies, equipment, and any other expenditure not included in the previous categories.

2. Faculty and staff count is full-time-equivalent positions in fall 2005. Figure includes the University of Michigan Hospital doctors and staff.

FIGURE 7. URC Operational Expenditures by Function, FY 2006



Data Source: National Center for Education Statistics, IPEDS Finance
Analysis: Anderson Economic Group, LLC

URC expenditures encourage even more economic activity throughout the state of Michigan than indicated by total spending listed in Table 7. The dollars the URC spends on supplies, equipment, and staff and faculty salaries are then re-spent as businesses and households throughout Michigan purchase other goods and services.

DEFINITION OF ECONOMIC IMPACT

We define *net economic impact* as the new economic activity directly or indirectly caused by the URC, excluding any economic activity associated with Research Corridor universities that merely replaces or displaces other economic activity in the state. For example, we exclude expenditures by students who would have attended another college in Michigan if the URC did not exist. Since these students would have stayed in Michigan and spent money in the state, we do not count these expenditures as new economic activity caused by the URC. We also exclude all expenditures by URC universities that go to firms outside Michigan.

To quantify the economic impact of URC universities' operational expenditures, we asked: What would be the loss to the state if the three Research Corridor universities left Michigan? We then studied the loss in terms of jobs and earnings.

ECONOMIC IMPACT OF OPERATIONAL EXPENDITURES

The expenditures shown in Table 7 on page 11, pay the salaries of professors, researchers, doctors, administrative staff, and purchase supplies, equipment, and maintenance of buildings. As the URC makes purchases, the money is then re-spent throughout the Michigan, creating a "multiplier" effect, generating more economic activity for the state.

In FY 2006, the URC's operations resulted in $8.0 billion in new earnings to households and 68,803 jobs in the state. This takes into account the economic activity that would replace lost URC economic activity. For example, we account for the substitution of some URC staff and faculty to other jobs in Michigan. Therefore, not all current earnings by URC faculty and staff count as new earnings in our economic impact figure.

As shown in Table 8, we estimate that the net economic impact of URC non-payroll expenditures (excluding U-M hospital) was $2.07 billion in FY 2006. This includes the direct expenditures by URC universities for materials and supplies and the additional indirect economic activity that resulted from these expenditures. U-M Hospital generated $823 million in net economic activity from its non-payroll operating expenditures. Finally, faculty and staff expenditures, after accounting for substitution, resulted in $3.6 billion in net new earnings, while student expenditures resulted in $1.6 billion in net new earnings. See Table 8 below.

TABLE 8. Net Economic Impact of URC Operational Expenditures, FY 2006

Impact Category	New Earnings in Michigan (in billions)
Non-payroll Operating Expenditures by the URC	$2.07
University of Michigan Hospital Non-payroll Operating Expenditures	$0.82
URC Faculty & Staff Expenditures	$3.61
URC Student Expenditures in Michigan	$1.58
TOTAL ECONOMIC IMPACT FROM OPERATIONS	**$8.08**

Source: Anderson Economic Group, LLC

As shown in Table 8, URC universities' non-payroll operating expenditures, including those by U-M hospital, resulted in a net economic impact of $2.89 billion in Michigan ($2.07 billion plus $0.82 billion). Table 9 on page 14 breaks down this $2.89 billion into impact by industry in Michigan. As the URC spends money on such items as books, desks, computers, and insurance policies other businesses receive and re-spend this income. We examined the portion of spending that occurs in Michigan, and used the U.S. Department of Commerce's Regional Input-Output Modeling System (RIMS II) multipliers to estimate how direct expenditures by the URC universities' indirectly affect other industries in the state.[3]

3. The U.S. Department of Commerce's RIMS II is based on input-output tables that show the distribution of inputs purchased by industry and outputs sold.

TABLE 9. Net Economic Impact of URC's Operations by Industry, FY 2006

Industry	New Earnings in Michigan (in millions)
Agriculture	$17.2
Mining	$1.2
Utilities	$48.1
Construction	$13.5
Manufacturing	$244.2
Wholesale Trade	$80.8
Retail Trade	$120.4
Transportation	$69.1
Information	$57.7
Finance and Insurance	$107.9
Real Estate, Rental, and Leasing	$287.2
Professional, Scientific, & Technical Services	$91.2
Management of Companies & Enterprises	$39.0
Administrative & Waste Management Services	$79.6
Educational Services	$974.9
Health Care & Social Assistance	$518.3
Arts, Entertainment, and Recreation	$17.7
Accommodation and Food Services	$65.4
Other Services	$56.9
TOTAL NET ECONOMIC IMPACT	**$2,890.3**

Source: Anderson Economic Group, LLC

As illustrated in Table 9, the industries benefiting the most (in terms of level of new earnings) include manufacturing, real estate, educational services, and health care. All of these industries experienced new earnings in 2006 above $240 million.

METHODOLOGY

In calculating the net economic impact, we follow a careful methodology that counts expenditures only once, takes into account substitution of one activity within the state by another, and uses very conservative multipliers for indirectly-caused activity. We detail our methodology for the economic impact of the operational expenditures by Research Corridor universities in "Operational Expenditures Methodology" in Appendix B.

IV. Human Capital

NUMBER OF URC ALUMNI

The Research Corridor universities graduated 26,832 students in 2006. According to the URC universities' alumni associations, currently 556,338 graduates of a URC university live in Michigan, making up 7.3% of Michigan's population over the age of 18 years in 2006.[4] Currently, at least one URC graduate lives in every state. The distribution of graduates follows state population levels; the most populous states have the most URC graduates. These states include California, Florida, Illinois, Texas, New York, and Ohio. See "URC Alumni by State, 2006" on page 16.

The number of individuals in Michigan who attended a URC university for *some period of time* is larger than the half million individuals who earned a degree from a URC university. In 2006, over 615,000 individuals who had attended a URC university lived in Michigan. "URC Alumni by Michigan County, 2006" on page 17 displays the number of these URC alumni by county. Every county in Michigan has at least one URC alum. The greatest concentration live in Southeast Michigan.

WAGE EARNINGS OF MICHIGAN-RESIDENT URC ALUMNI

Alumni of URC universities contribute greatly to the state's economy. We calculated the earnings in 2006 of 556,338 URC alums living in Michigan using a model that accounts for the higher wages of URC alumni over the average college graduate's salary, the university of the graduate, and the alum's year of graduation. We detail our methodology in "Alumni Earnings Methodology" in Appendix B.

We estimate that in 2006 URC alumni earned over $25 billion, or 13.4% of all wage and salary income in Michigan. While much of these earnings cannot be said to have been *caused* by the URC universities, this figure shows the scale of the URC's role in attracting and educating Michigan's workforce.

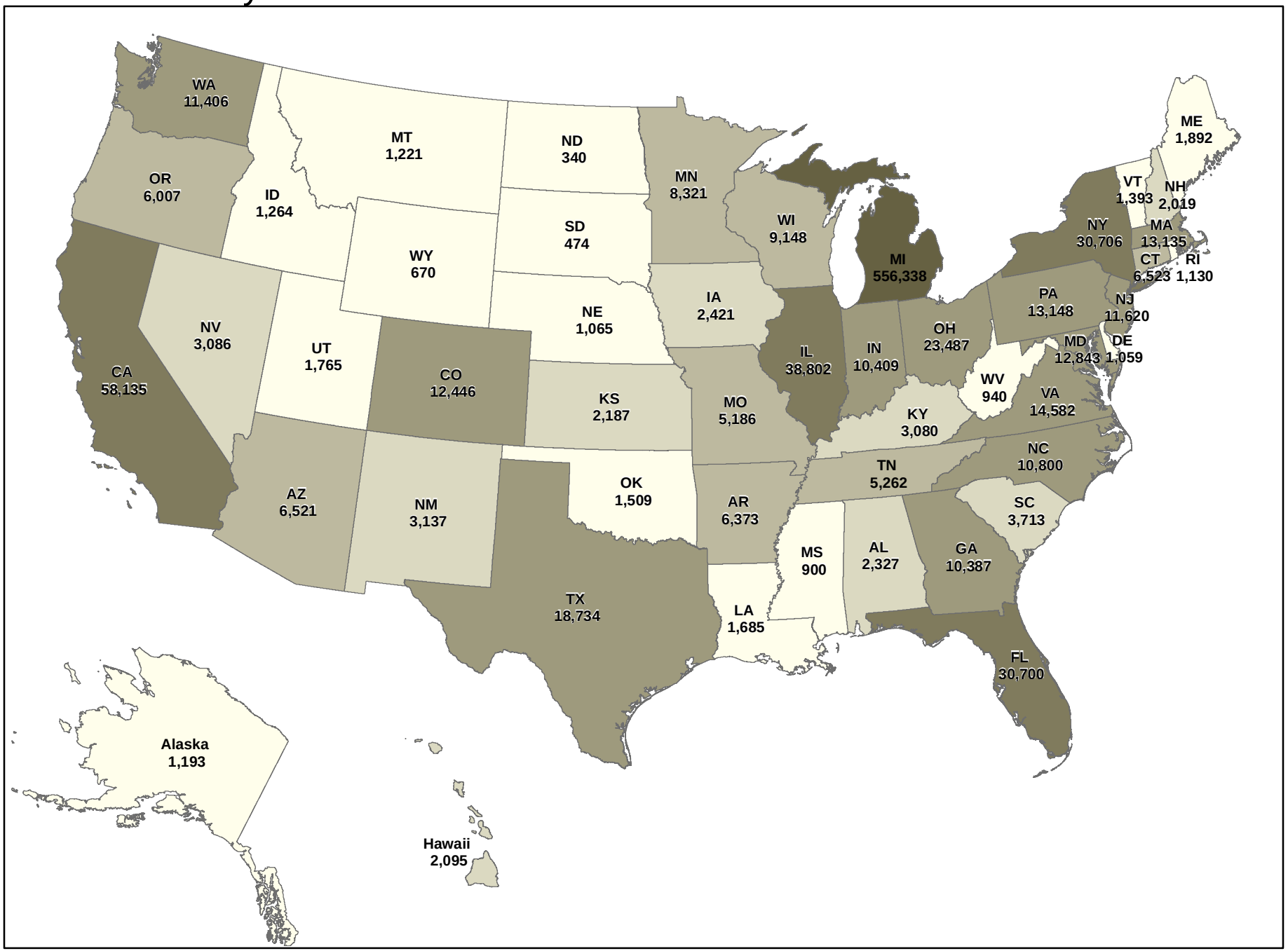
TABLE 10. Michigan Earnings of URC Alumni by Age and Degree, 2006 ($ Millions)

	21-24 Years	25-34 Years	35-44 Years	45-64 Years	Over 65 Years	Total
Bachelor Degree	298	4,345	3,602	6,556	387	15,189
Advanced Degree	2	2,175	2,586	4,641	464	9,868
Total Earnings	300	6,520	6,189	11,198	851	$25,057
memo: Earnings as a % of wages & salary income in Michigan						*13.4%*

Source: Anderson Economic Group, LLC

4. According to the U.S. Census's annual population estimates for July 1, 2006, Michigan's population over the age of 18 years was 7,617,287.

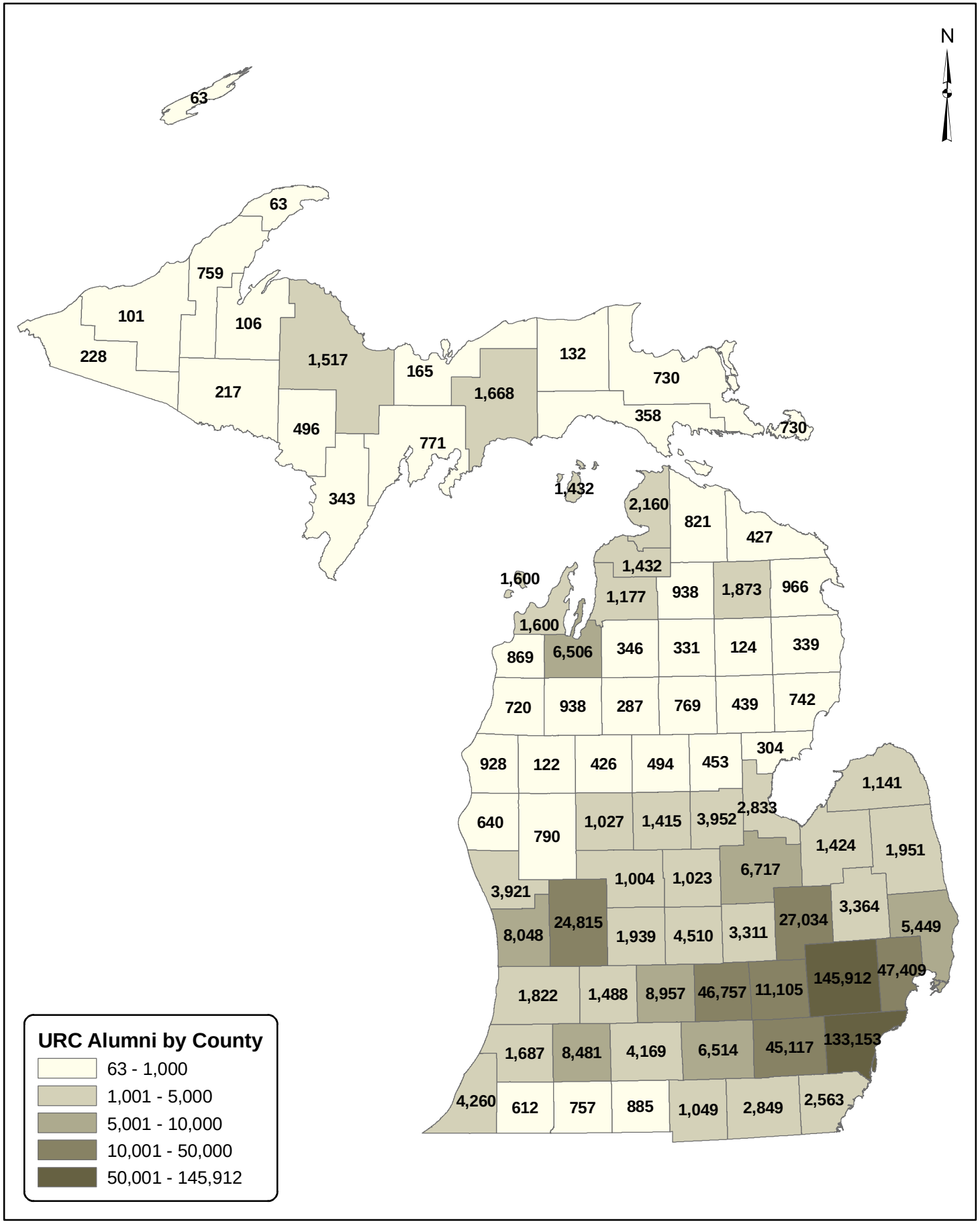
URC Alumni by State



Created By: Anderson Economic Group, LLC
Data Source: ESRI; University Alumni Associations
July 2007

Miles 0 500 1,000 2,000

URC Alumni by County



Data: ESRI, Inc. 2007; analysis by Anderson Economic Group, LLC

COLLEGE CHOICES AND EARNINGS IN MICHIGAN

Like all educational institutions, Research Corridor universities strive to increase the knowledge and skills of the students they teach. An increase in the usable knowledge and skills adds to their *human capital* and often allows a person to earn a higher wage—much like adding physical capital (e.g. buildings and equipment) allows a factory to increase production. For some small share of the URC's students, having access to a research university in Michigan is the difference between going to college and not. For others, it is the difference between remaining in the state for their college degree or pursuing their education outside Michigan. For the remainder of the students, the existence of URC universities simply means finding the right mix of features, location, and price, whatever their specific reason for choosing Michigan State, the University of Michigan, or Wayne State.

The main components of estimating the additional earnings of URC graduates are: (1) projecting the additional earnings of URC graduates, and (2) allowing for substitution of earnings that would have occurred even if the individual had not attended a URC university. We detail our methodology in Appendix B. Note that using this methodology assumes that most of the current earnings of Michigan-resident URC alumni are earnings they would have had even without the URC.

ADDITIONAL WAGE EARNINGS CAUSED BY URC

By applying certain assumptions about the educational, geographic and workforce participation choices, we can estimate the higher earnings that URC alumni in Michigan earned this past year. We count only the earnings above what the alum would otherwise be making had the graduate not attended a Research Corridor university. URC graduates earn higher wages because of their school and thus positively affect the state's economy through increased spending, creating jobs and additional income for businesses throughout the state.[5] We describe this methodology in "Alumni Earnings in 2006 Caused by URC" on page B-8.

Table 11 on page 19 shows the results of this analysis. In 2006, the 556,338 URC alums living in Michigan earned over $25 billion; we estimate that over $4 billion is earnings due to these research institutions. $2.5 billion is due to URC graduates with a bachelor's degree, while $1.5 billion is due to graduates with an advanced degree. To place this figure in context, $4 billion is 2.1% of 2006 wage and salary income in Michigan.

5. We attribute higher earning power to certain URC graduates based on two factors. First, students choose their specific school over other, perhaps less expensive, schools. Their choice indicates that the students themselves may think they will earn more through that choice. Second, a university's reputation for higher admissions standards affects employers' perception of the school's graduates, potentially raising the graduate's starting pay. Note that we do not rely on self-reported salary data from URC graduates, as we strongly suspect this data would have an upward bias in wages.

TABLE 11. Additional Earnings of Current URC Alumni, Living in Michigan, 2006

	$ (millions)
Additional Earnings of Graduates with URC Bachelor's Degree	$2,496
Additional Earnings of Graduates with URC Advanced Degree	$1,548
TOTAL 2006 ADDITIONAL EARNINGS OF URC GRADUATES LIVING IN MICHIGAN	**$4,044**

Source: Anderson Economic Group, LLC

ADDITIONAL LIFETIME EARNINGS DUE TO URC EDUCATION

We estimate that the *lifetime* earnings in Michigan of the class of 2006 will be $5.6 billion higher (in 2006 dollars) than it would have been without the URC. As Table 12 illustrates, we estimate that lifetime earnings in Michigan for students with a bachelor's degree is $3.4 billion higher and $2.2 billion higher for individuals who earned an advanced degree.

TABLE 12. Projected Additional Lifetime Earnings in Michigan of Class of 2006 URC Graduates

	$ (millions)	
Lifetime Earnings of Students Currently Pursuing Bachelor's Degree		
Earnings of Class of 2006 with URC Degree	19,795	
Earnings of Class of 2006 without URC Degree	(16,359)	
Additional Earnings, Bachelor's Degree		3,437
Lifetime Earnings of Students Currently Pursuing Advanced Degree		
Earnings of Class of 2006 with URC Degree	8,514	
Earnings of Class of 2006 without URC Degree	(6,346)	
Additional Earnings, Advanced Degree		2,168
TOTAL ADDITIONAL LIFETIME EARNINGS IN MICHIGAN OF CLASS OF 2006 URC GRADUATES		**5,605**

Source: Anderson Economic Group, LLC

Figure 10 and Figure 11 on page 20 show the projected lifetime earnings of URC graduates and their lifetime earnings had they not attended a URC school. The difference between the two curves is our estimate of the additional lifetime earnings caused by having attended a URC university.

FIGURE 10. Projected Lifetime Earnings of 2006 URC Graduates with Bachelor's Degree

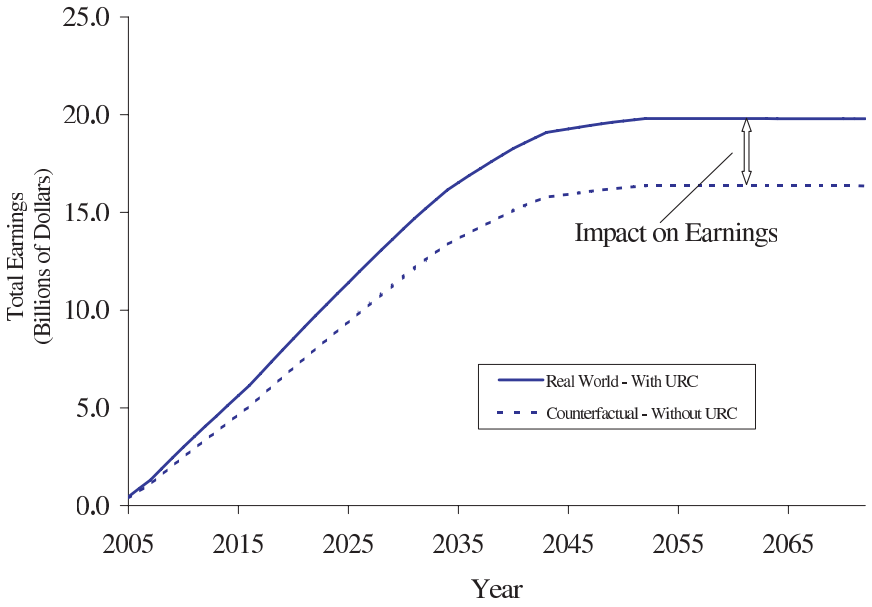
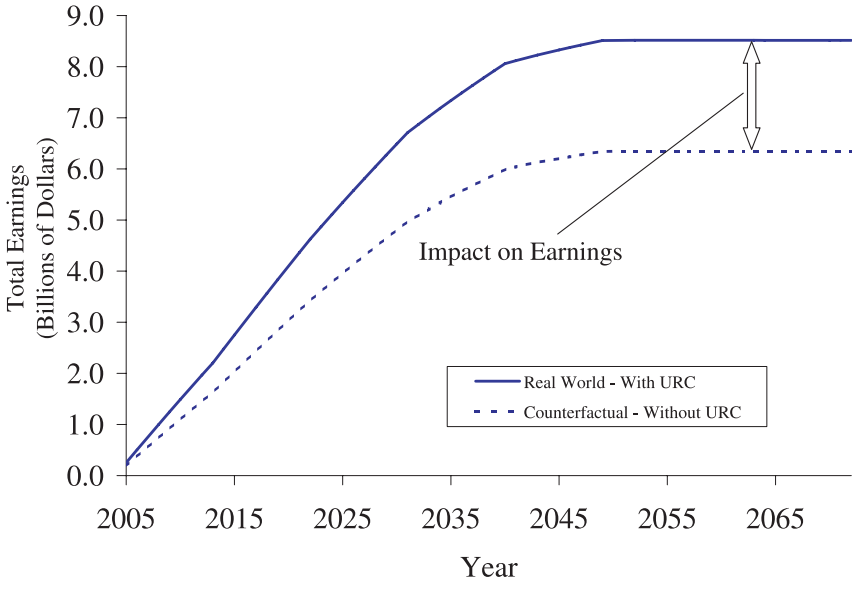


FIGURE 11. Projected Lifetime Earnings of 2006 URC Graduates with Graduate Degrees.



V. URC Revenue Sources

SOURCES OF URC REVENUE

The URC universities' many activities are funded by a variety of sources. URC university revenue is provided by individuals (e.g. tuition, fees, gifts), governments (local, state, and federal), and organizations (public and private). We discuss the source and categorization of URC university revenue in this section.

The Governmental Accounting Standards Board (GASB) establishes accounting standards for local and state entities, including colleges and universities. The GASB requires that all revenues and expenses be classified as either "operating," "non-operating," or "other revenues and additions." The data we present in this section are from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). IPEDS defines operating revenue as revenue resulting from providing goods and services. Non-operating revenue comes from those activities that are outside the operating activities of the institution. Most government appropriations are non-operating because they are not generated by the operations of the institution. However, federal and state governments often give grants or contracts for specific research projects or programs that are classified as operating revenues because they aid in the operation of the project.[6] Other revenue and additions includes capital appropriations, grants, and gifts, and additions to endowment.

Michigan's URC universities received collectively $7.8 billion in revenue during FY 2006. This is 35% more than the three URC universities received in FY 2002. Most of the URC universities' revenue is operating revenue. In FY 2006, 68% of revenue was operating revenue compared to 28.6% in non-operating revenue and 3.4% from other revenue and additions. A detailed breakdown by sub-category is presented in Table A-5, "URC Revenue Sources, FY 2002 & FY 2006," on page A-5.

TABLE 13. Source of URC Revenue, FY 2002 and FY 2006

	FY 2002 (billions)	FY 2006 (billions)	% of Total FY 2006 Revenue	% Change FY 2002-2006
Operating Revenue	$4.2	$5.3	68.0%	*29.4%*
Non-operating Revenue	$1.5	$2.2	28.6%	*50.7%*
Total Other Revenue and Additions	$0.19	$0.26	3.4%	*39.1%*
TOTAL URC REVENUE	$5.8	$7.8	100%	*35.2%*

Base Data Source: NCES, IPEDS Finance
Analysis: Anderson Economic Group, LLC

As shown in Figure 12 and Figure 13 on page 22, the composition of total URC university revenue has remained relatively stable during the four-year period with two exceptions. First, in FY 2006 state appropriations make up a smaller share of total

6. IPEDS Glossary, available at http://nces.ed.gov/ipeds/Glossary/.

revenue the universities receive; in FY 2002, state appropriations made up 18% of revenue and in FY 2006 it made up 12%. The second category to substantially change is investment income. In FY 2002, investment income comprised 5% of university revenue while in FY 2006 it comprised 15%. Tuition and fee revenue has remained the same share of total revenue during the four-year period at 15%.

FIGURE 12. URC Revenue Sources, FY 2006

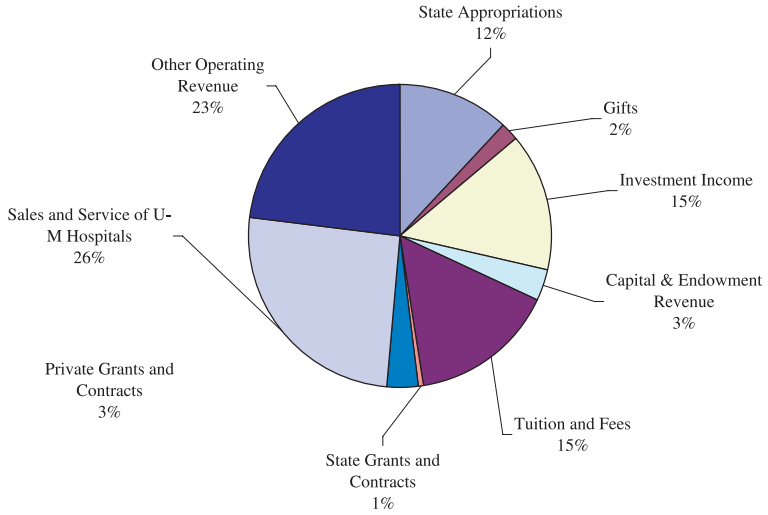


FIGURE 13. URC Revenue Sources, FY 2002

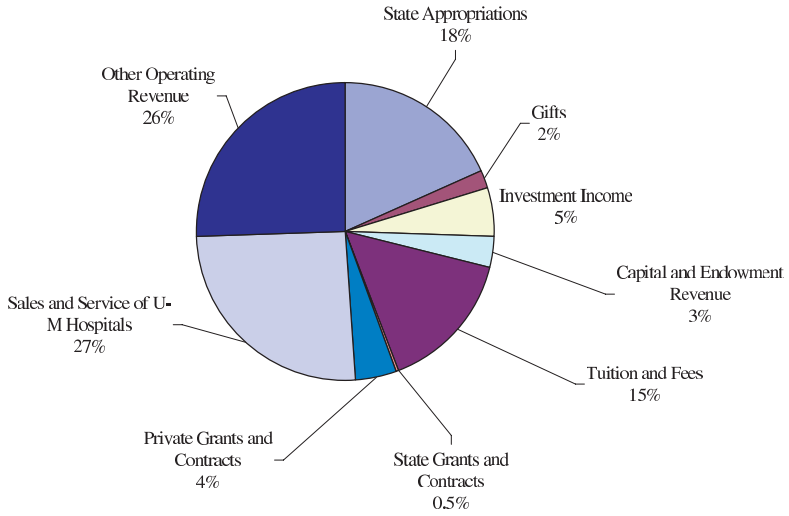
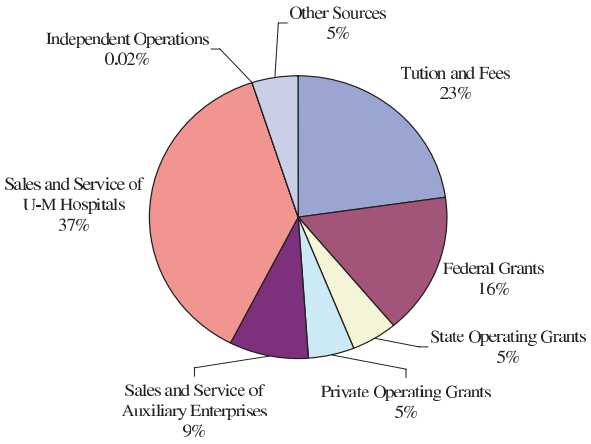


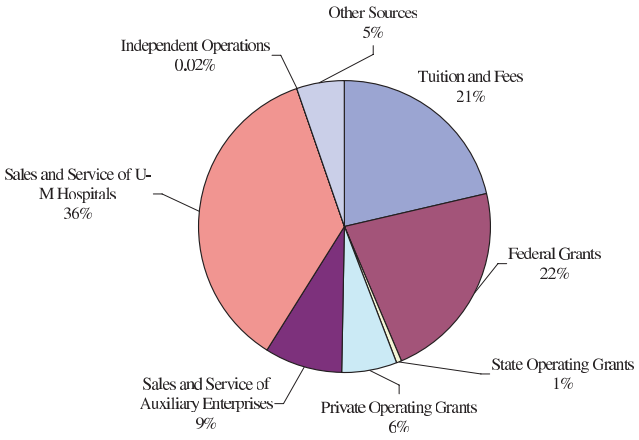
Figure 14 and Figure 15 show the composition of URC operating revenue in FY 2002 and FY 2006. URC tuition and fees and revenue from University of Michigan Hospital dominate operating revenue in both fiscal years. In FY 2006, a slightly larger share of operating revenue came from tuition and fees than in FY 2002. In FY 2006, 23% of operating revenue came from tuition and fees compared to 21% in FY 2002.

FIGURE 14. URC Operating Revenue Sources, FY 2006



Data Source: National Center for Education Statistics, IPEDS Finance Analysis: Anderson Economic Group, LLC

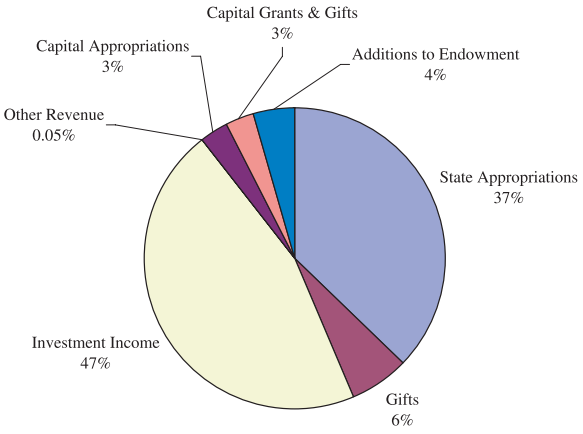
FIGURE 15. URC Operating Revenue Sources, FY 2002



Data Source: National Center for Education Statistics, IPEDS Finance Analysis: Anderson Economic Group, LLC

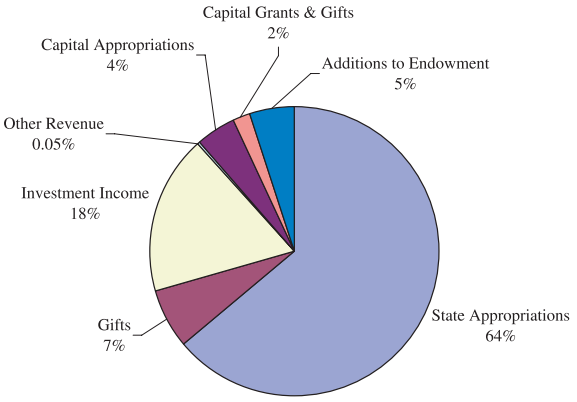
Almost half of non-operating revenue comes from investments income. State appropriations make up the majority of the remaining non-operating income, 37% of the total in FY 2006. This is a change from FY 2002 when investment income made up only 18% of non-operating income and state appropriations accounted for 64%. See Figure 16 and Figure 17 below.

FIGURE 16. URC Non-Operating Revenue Sources, FY 2006



Data Source: National Center for Education Statistics, IPDES Finance Analysis: Anderson Economic Group, LLC

FIGURE 17. URC Non-Operating Revenue Sources, FY 2002



Data Source: National Center for Education Statistics, IPDES Finance Analysis: Anderson Economic Group, LLC

FOCUS ON ALUMNI AND INSTITUTIONAL GIVING TO THE URC

A significant portion of the URC universities' non-operating revenue comes from gifts by individuals and businesses. Investment by remarkably successful individuals (often alumni of the recipient university) and by corporations shows the sense of pride and community that is created at high-quality institutions of higher learning such as these. This investments range from direct donations to the schools to alumni-guided decisions by corporations to invest and expand in Michigan.

Alumni, foundations, corporations, and other sources donated over $384 million dollars to URC institutions in 2006.[7] We state this figure not to add to the bottom line of the URC's economic impact (we did not double-count these investments as we focused on URC expenditures), but instead to show the magnitude of donor's belief that URC universities will use their donation wisely. These gifts and grants, ranging in size from thousands to millions of dollars, come from within Michigan and from all over the United States, and address a wide range of goals. Total gifts to URC universities fell by 0.2% from 2005 to 2006 as a rise in alumni and other giving was matched by a fall in corporate and foundation giving. See Table 14.

TABLE 14. Gifts to Michigan's URC Universities

Category	2005	2006	% Change
Alumni	$208,508,971	$218,820,618	*4.9%*
Foundations	$68,308,115	$63,459,088	*-7.1%*
Corporations	$71,817,060	$63,755,563	*-11.2%*
Other[a]	$36,764,896	$38,783,384	*5.5%*
TOTAL	$385,399,043	$384,818,653	*-0.2%*

Source: AEG analysis of data from URC universities.

a. Includes estates, non-alumni individual donors, and other sources.

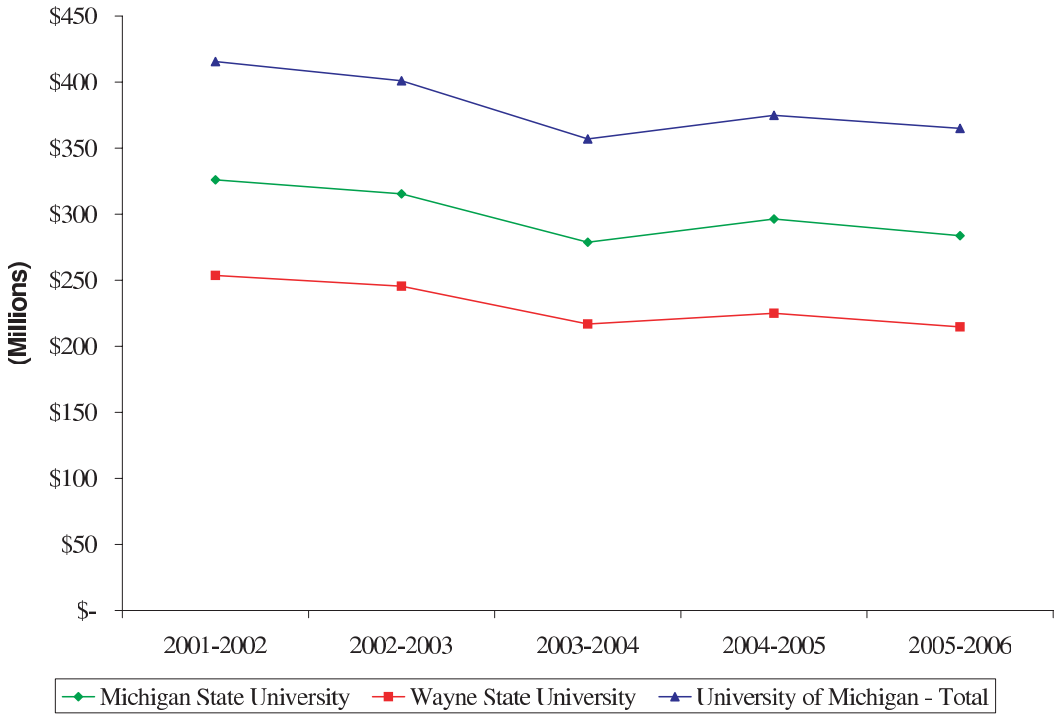
FOCUS ON STATE APPROPRIATIONS

State appropriations to the URC universities is one portion of public university revenue that is under the direct control of the Michigan state government. The recent history of state appropriations to the URC universities shows a strong downward trend. Figure 18 on page 26 shows the state appropriation to URC universities from FY 2002 to FY 2006.[8] Each of the three universities shows a steady drop in state appropriations punctuated by a brief rise from 2003 to 2004. Between FY 2002 and FY 2006, total appropriations to URC universities fell 13%.

7. URC universities provided data on gifts by category. We use this data as it is more detailed than the National Center for Education Statistics IPEDS Finance data. These two data sources differ slightly in amount.

8. In order to provide a look at the trend of state appropriations we use data provided in the House Fiscal Agency report, "State University Summary Data: Fiscal Years 2001-02 to 2005-06" published May 4, 2007. The source of this data is the Michigan Higher Education Institutional Data Inventory. The appropriations in this report differ slightly than the appropriations appearing in the IPEDS reports.

FIGURE 18. State Appropriations to URC Universities, FY 2002 to FY 2006



Data Source: Michigan House Fiscal Agency, "State University Summary Data Fiscal Years 2001-02 to 2005-06" May 2007; URC Universities

Analysis: Anderson Economic Group, LLC

VI. Impact on State Revenue

This section provides an estimate of tax revenue the state of Michigan receives because of the URC's presence in Michigan. We calculate new tax revenue by first calculating the new wage and salary income these groups receive because of the URC.[9] Then, we estimate the income, sales, property, and transportation taxes generated as a result of this additional income. This estimate is, by necessity, an approximation, as the actual tax revenue collected by the state government is the result of millions of individual purchasing and tax planning decisions by URC employees and alumni. While we do not estimate *every* tax and fee the state collects because of the URC, we provide an estimate of most *new tax revenue* the state collects from (1) earnings of employees at URC universities and (2) earnings by graduates of the URC living in Michigan.

ADDITIONAL INCOME DUE TO THE URC

In "Impact on Jobs and Income" on page 11, we estimate that $2.25 billion in wages of URC employees in Michigan was *caused by* the URC in 2006. This figure accounts for substitution of URC employees for other Michigan wages that would have been paid in the absence of the URC. See "Impact on Jobs and Income" on page 11.

In "Human Capital" on page 15, we calculated the earnings of URC alums that was caused by the URC in 2006. We estimate that URC alums living in Michigan in 2006 earned $4 billion more due to the URC.

CATEGORIZING INCOME

We categorize the earnings of employees and alumni caused by the URC into *marginal* and *average* income. The portion of alumni earnings that is earned *in addition to* what would have been earned without the URC (as estimated in "Human Capital" on page 15) is treated as "marginal income." We treat entire new salary and wage income for an employee or alum that is earned only because of the URC as "average income." This matters because people spend their first $1,000 of income differently than their last, and the state government taxes this income differently because of exemptions.

Employee Earnings. The income of URC employees is treated as average income. The earnings of URC employees comes largely from out-of-state income sources, so it is reasonable as a first approximation to treat URC employee jobs as jobs that would not exist without the URC, meaning each employee's entire income generates net new tax revenue. While it is possible that some of the income of URC employees could be treated as marginal income, treating it as average income is

9. As described in "Human Capital" on page 15, we use a conservative methodology to estimate the current earnings caused by the URC. Specifically, we assume that most URC graduates would have attended college somewhere else if these institutions were not in Michigan, and would have earned wages near those of the average for college graduates of their age.

more conservative because average income is taxed at a lower average rate than is marginal income, as shown in Table 15 on page 28.

URC Alumni. For some graduates, attending a URC university likely had no impact on their annual Michigan earnings (and therefore to the taxes they pay to the state of Michigan). Other graduates will earn extra income due to the URC, and therefore will pay additional taxes to the state. The proportion of their additional income that goes to taxes depends on whether their additional Michigan income due to the URC represents a pay boost (for graduates who would still be working in Michigan without the URC) or if their entire Michigan income is due to the URC (for graduates who otherwise would not be working in Michigan). As described below, we apply different effective tax rates to "average" and "marginal" income.

EFFECTIVE TAX RATES ON INCOME

This analysis recognizes that average and marginal income are taxed and spent differently. To account for this difference, we estimate an "effective rate" for each type of income that is taxed, which is the amount we anticipate they will pay in taxes divided by their income.[10] Table 15 below shows the percentage of income we assume is paid to the State of Michigan. Note that our analysis includes major taxes such as income, sales, state-level property, and gasoline taxes, but does not consider additional, non-sales taxes on alcohol and tobacco, nor other state taxes and fees.

TABLE 15. Percentage of Income Paid to State of Michigan

Tax	On Additional Marginal Income	On Additional Average Income
Personal Income Tax	3.90%	2.08%
Sales and Use Tax	1.70%	2.62%
Property Tax	0.38%	0.47%
Transportation Tax	0.11%	0.24%

Source: Analysis by Anderson Economic Group

Income Tax. The tax rate on marginal income in Michigan is 3.9%. We do not attempt to estimate the proportion of marginal income going toward tax exempt expenditures. To calculate the 2.08% income tax rate on average income, we divided the state's revenue from the income tax in 2005 by the state's personal income.[11]

Sales Tax. We calculate the sales and use tax burden using data from the U.S. Bureau of Labor Statistics' 2005 Consumer Expenditure Survey. First, we identified

10. For example, if someone makes $10,000 and spends $7,000 of that on items subject to the 6% state sales and use tax, he or she will pay 6% of $7,000, or $420 in taxes. His or her effective sales tax rate is $420 divided by $10,000, or 4.2%.

11. Base data source for the income tax in 2005 was the Michigan Senate Fiscal Agency. Revenue from income tax in 2005 was $7,060,300,000. According to the U.S. Bureau of Economic Analysis, personal income was $338,829,970,366 in 2005.

spending categories subject to the sales and use tax.[12] We estimate that consumers in the middle 20% of earners (making between $33,381 and $53,358 in income) spent approximately 43.6% of their 2005 income on goods subject to the sales and use tax, yielding an effective rate on *income* of 43.6% times the 6% sales tax rate, or 2.62% of their entire income. This is the effective sales tax rate on additional average income. To calculate the effective rate on marginal income, we calculated the proportion subject to sales tax of the additional spending done by people in the middle 20% of earners and the second highest 20% of earners (making between $53,358 and $85,147 in income). We estimate that 28.4% of this additional income is spent in sales-taxable categories, resulting in an effective sales tax on marginal income of 28.4% times the 6% sales tax, or 1.70%.

Property Tax. We estimate the proportion of expenditures that goes toward property taxes on average using the 2005 Consumer Expenditure Survey. We find that, on average, people in the middle 20% of income spend 2.8% of their income on property taxes. We multiply 2.8% by the proportion state property taxes to all state and local property taxes (16.7%) to arrive at an effective rate on income of 0.47%.[13] We also find that 2.3% of the additional income earned by earners in the second highest quintile goes toward property taxes. Again multiplying by 16.7% of taxes going to the state government, we estimate the effective property tax rate on marginal income to be 0.38%.

Transportation Taxes. We estimate the proportion of expenditures that goes toward gasoline using the Consumer Expenditure Survey. We find that, on average, people in the middle 20% of income spend 4.7% of their income on gasoline. We multiply this rate by 6.3%, the effective rate of the gasoline tax,[14] resulting in an effective rate on income of 0.30%. We also find that 2.1% of the additional income earned by earners in the second highest quintile goes toward fuel. Again multiplying by the 6.3% effective gas tax rate, we estimate the effective gas tax rate on marginal income to be 0.13%.

12. We identified 15 such spending categories, including travel; alcoholic beverages; housing maintenance; repairs, and other household expenses; postage and stationery; clothing; vehicles and vehicle maintenance; entertainment; personal care products, and others. Although we are aware that some expenditures currently are subject to the state's sales and use tax, but are not reported, we did not account for evasion or avoidance in this analysis.

13. *See 2004 U.S. Census of Governments State and Local Finance data.

14. Gasoline is not taxed as a percentage of its price, but rather at a per-unit rate of $0.15 per gallon. The gasoline tax of $0.19 per gallon is divided by $3 per gallon of gasoline to yield a 6.3% effective rate.

TOTAL ADDITIONAL STATE TAX REVENUES

We find over $1.15 billion in income categorized as "marginal," and $5.1 billion in "average" income ($2.89 billion from URC alumni and $2.25 billion in net income from URC employees). We calculate the additional taxes to the State of Michigan due to the URC universities by multiplying this income by the effective tax rates identified in the preceding section. Table 16 below shows the results of this analysis: $351.6 million in additional tax revenue to the state of Michigan paid by URC graduates in 2006.

TABLE 16. Additional Tax Revenue to State of Michigan Caused by URC, 2006

	Effective Tax Rate on Marginal Income	Marginal Income and Tax Receipts (million)	Effective Tax Rate on Average Income	Average Income and Tax Receipts (million)
Total Additional Income		$1,151		$5,144
Personal Income	3.90%	$44.9	2.08%	$107.2
Sales and Use Tax	1.70%	$19.6	2.62%	$134.6
Property Tax	0.38%	$4.4	0.47%	$24.1
Gasoline Tax	0.13%	$1.5	0.30%	$15.3
Subtotal		$70 .4(A)		$281.1 (B)
			Total Tax Receipts (A+B)	$351.6

Base Data Sources: AEG; 2005 Consumer Expenditure Survey by BLS

VII. Research, Development and Tech Transfer

ACADEMIC RESEARCH & DEVELOPMENT

In 2005, academic institutions in the U.S. spent over $45 billion on research and development.[15] According to the National Science Foundation (NSF), academic institutions accounted for 54% of U.S. basic research, about 33% of total research (basic plus applied), and 14% of all research and development conducted in the U.S. in 2004.[16]

In 2005, academic institutions in Michigan spent $1.45 billion on research and development, with the URC spending 94% of this amount, or $1.37 billion. $832 million, or approximately 60%, came from federal funding. Since 2000, total expenditures on R&D by the URC universities increased by approximately 45%, or 7.6% compounded annually. Federal dollars coming into the state of Michigan because of the URC's research and development activities increased 58% between 2000 and 2005. URC research and development expenditures are provided in Table 17 below.

TABLE 17. URC Research & Development Expenditures in 2000 and 2005 (in millions)

	2005		2000	
	Total R&D Expenditures	**Federally Funded R&D Expenditures**	**Total R&D Expenditures**	**Federally Funded R&D Expenditures**
All Academic Institutions in Michigan	$1,456	$880	$1,008	$554
Michigan State University	$334	$156	$238	$97
University of Michigan	$809	$555	$552	$364
Wayne State University	$226	$121	$157	$64
URC TOTAL	**$1,369**	**$832**	**$947**	**$526**
URC % of All Michigan Expenditures	*94%*	*94%*	*94%*	*95%*

Source: National Science Foundation: Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

In 2005, the University of Michigan was one of the top 10 academic institutions for total R&D expenditures (ranked 2nd) and federally funded expenditures (ranked 4th). Only The Johns Hopkins University had higher total expenditures and only

15. National Science Foundation, Integrated Science and Engineering Resources Data System.

16. National Science Foundation, *Science and Engineering Indicators 2006*, Chapter 5, Academic Research and Development.
Basic research is the pursuit of new scientific knowledge or understanding that does not have specific immediate commercial objectives. *Applied research* applies the findings of basic research or other existing knowledge toward discovering new scientific knowledge that has specific commercial objectives. *Development* is the systematic use of the knowledge or understanding gained from research or practical experience directed toward the production or significant improvement of useful products, services, processes, or methods.

Johns Hopkins University, the University of Washington at Seattle and Stanford University had higher federally funded expenditures. Furthermore, Michigan State and Wayne State both ranked in the top 100 of all academic institutions for total and federally funded expenditures.[17] See Table 18 for rankings.

TABLE 18. 2005 URC Members Ranking for Expenditures for all U.S. Institutions

	Rank: Total R&D Expenditures (out of over 600 universities)	Rank: Federally Funded R&D Expenditures (out of over 600 Universities)
Michigan State	42	59
University of Michigan	2	4
Wayne State	72	78

Source: National Science Foundation, Integrated Science & Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

Table 19 contains the source of funds for URC R&D expenditures. Compared to the U.S. average, the URC as a group had lower expenditures as a percent of total from federal funding. This was primarily offset by higher expenditures of institutional funds. The URC's funding from the federal government, as a percent of total, increased from 55% in 2000 to 61% in 2005. This is consistent with an increase in the average for all U.S. universities from 58% to 64%. Source of funds during 2000 are shown in Table 20 on page 33.

TABLE 19. Source of Funds for URC Research and Development Expenditures, 2005

	Total R&D Expenditures (in millions)	Federal Government[a]	State & Local Government[b]	Industry[c]	Institution[d]	Other[e]
Michigan State	$334	47%	13%	3%	32%	4%
University of Michigan	$809	69%	1%	4%	21%	5%
Wayne State	$226	53%	7%	6%	28%	6%
URC TOTAL	**$1,369**	**61%**	**5%**	**4%**	**25%**	**5%**
All U.S. Universities	*$45,750*	*64%*	*6%*	*5%*	*18%*	*7%*

Source: National Science Foundation: Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

a. Includes funds from federal agencies that have been specifically designated for R&D.

b. Includes funds from state and local governments that have been specifically designated for R&D.

c. Includes funds from for-profit organizations that have been specifically designated for R&D.

d. Includes funds from the institution to finance organized research expenditures and indirect costs. These funds can come from any unrestricted source that were not included in another category as specifically designated for R&D.

e. Includes funds from non-profit organizations and individual donors that have been specifically designated for R&D.

17. National Science Foundation, Integrated Science and Engineering Resources Data System

TABLE 20. Source of Funds for URC Research and Development Expenditures, 2000

	Total R&D Expenditures (in millions)[a]	Federal Government	State & Local Government	Industry	Institution	Other
Michigan State	$238	41%	18%	5%	34%	3%
University of Michigan	$552	66%	1%	6%	20%	7%
Wayne State	$157	41%	8%	7%	32%	12%
URC TOTAL	**$947**	**55%**	**6%**	**6%**	**25%**	**7%**
All U.S. Universities	*$30,070*	*58%*	*7%*	*7%*	*20%*	*7%*

Source: National Science Foundation, Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

a. See Table 16 for descriptions of sources

URC'S ROLE IN TECHNOLOGY TRANSFER

Michigan State, the University of Michigan, and Wayne State University all work with faculty members and students within their respective universities to help them obtain patents and license their new technology through technology transfer offices.

The process works as follows. When a faculty member has an idea that might be granted a patent, the person files an invention disclosure detailing the particulars of the discovery. The faculty member's university then decides whether a provisional patent should be filed. A provisional patent provides the inventor with legal protection for a year. This allows the inventor time to prepare the utility patent application, a much more extensive application where the inventor must demonstrate that the invention is allowed patent protection, and demonstrates that the invention is new, non-obvious (i.e. required an inventive step), and useful.

If the university decides that the invention is worth patenting, it assumes the costs of obtaining the patent. This system allows for more patents to be filed than if faculty members had to incur the time and cost of patenting their invention themselves. Technology transfer offices also often will conduct patent searches and analyze the invention's commercialization potential and, if the product receives a patent, will help the faculty member market the product to potential licensing partners and investors.

Although the academic community has always been involved in technology transfer in the U.S., it was not until the U.S. Congress passed the Bayh-Dole Act (USC Title 35, Chapter 18) in 1980, that institutions were able to patent and retain ownership of their inventions. Prior to the passage of the Bayh-Dole Act, inventions borne out of federally-funded research became the property of the federal government.

The ability to own a patent enables an institution to profit directly from the innovation. Specifically, institutions sell the rights to the innovation in the form of a license or option to an existing or start-up commercial enterprise. They receive royalties in the form of a lump sum payment or an annuity over the life of the patent. According to the U.S. Patent and Trade Office (USPTO), academic sources

accounted for approximately 1.5% of patenting by U.S. private and nonprofit (non-governmental) sectors in 1981. By 2003, they accounted for almost 4.5%.[18] Patents can translate into large sources of revenue. According to data from the NSF, academic patents generated net royalties of $866 million in 2003, a more than four-fold increase from the $195 million net royalties generated in 1993.[19]

Table 21 and Table 22 on page 34 show the technology transfer activity of the universities in the URC for 2005 and 2002, respectively. The number of invention disclosures, licenses/options granted, and number of start-ups increased for all the universities from 2002 to 2005. The number of patents granted remained stable or increased for each of the universities, and it is possible that the 2005 grants would have been even greater if it were not for the increased amount of time it takes for patents to be granted due to a backlog of patent applications.The amount of revenue decreased between 2002 and 2005. However, revenue from technology transfer is often erratic due to a large sale of a technology in a given year.

TABLE 21. Technology Transfer Activity, FY 2005

	Invention Disclosures	Licenses/ Options	Patents Granted	Number of Start-ups	Revenue (in millions)
Michigan State	124	48	36	6	$9.7
University of Michigan	287	86	80	7	$16.7
Wayne State	57	15	18	1	$3.3
URC TOTAL	**468**	**149**	**134**	**14**	**$29.7**

Source: University Research Corridor

Analysis: Anderson Economic Group, LLC

TABLE 22. Technology Transfer Activity, FY 2002

	Invention Disclosures	Licenses/ Options	Patents Granted	Number of Start-ups	Revenue (in millions)
Michigan State	82	12	43	1	$30.0
University of Michigan	237	61	56	5	$5.7
Wayne State	49	10	18	0	$1.9
URC TOTAL	**368**	**83**	**117**	**6**	**$37.6**

Source: University Research Corridor

Analysis: Anderson Economic Group, LLC

Each of the three URC universities has played a significant role in the research and development activities that occur within the state. This occurs through close relationships with research parks around the state, partnerships with Michigan businesses, licensing of patents, and assistance with start-ups.

18. U.S. Patent Office, U.S. Colleges and Universities, Utility Patent Grants 1969-2003.

19. National Science Foundation, *Science and Engineering Indicators 2006*.

Wayne State University, for example, co-founded "TechTown," a 47-acre, multi-million dollar research and business technology park. TechTown is a community of entrepreneurs, investors, and corporate partners that empowers entrepreneurs to build successful technology businesses. The project's goal is to attract mature and incubator-stage companies involved in life sciences, advanced engineering, advanced manufacturing industries, and information technology. Among its 24 current tenants is Asterand, a tissue bank that serves genomic researchers around the world. At capacity, approximately 60 companies and over 1,600 employees are expected to locate at TechTown.

Michigan State University hosts the MSU Product Center for Agriculture and Natural Resources (ANR). The center's mission is "to be a catalyst for the creation of a profitable future for businesses and industries engaged in Michigan's agricultural, food, and natural resource systems." Founded in 2003 with funds from the Michigan Agricultural Experiment Station and MSU Extension, the Product Center for ANR links clients with experts who can help with business planning, product testing, and market analysis.

Since the center has opened, it has helped almost 500 individuals with product ideas, 178 with developing business plans, and has assisted with the launch of 50 ventures. The value of these businesses' annual sales is estimated at $41 million. The number of jobs created by these ventures is 310, and annual payroll is $33 million.[20]

The University of Michigan pledged $1 million over a five year period from 2005 to 2010 to support SPARK, an economic development and marketing organization for the Ann Arbor area. SPARK offers services including business acceleration, business outreach, talent development, early-stage funding, and regional marketing and events. SPARK is aimed at high-tech companies and has the goal of doubling the number of technology companies and tripling the number of tech jobs by 2010.[21]

An example of U-M and SPARK working collaboratively towards economic development is their response to Pfizer Incorporated's announcement in January 2007 of its plans to close its Ann Arbor operations, which employed over 2,000 workers at the time of the announced closing. SPARK and U-M quickly devised plans to help retain talented Pfizer workers in the region. U-M set up a $3 million fund to help Pfizer researchers transition into research roles at U-M. U-M and SPARK invested jointly in turning Pfizer lab space into a high tech wet lab incubator for several life science start-up companies.[22]

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20. See Product Center for Agriculture and Natural Resources, *MSU Product Center Performance Statistics, FY 2005-2006*.

21. SPARK, *Regional Collaboration Sets SPARK to Greater Ann Arbor Innovation*, Press Release, May 23, 2005, available at: http://www.annarborspark.org/about-us/press-releases/regional-collaboration/.

FACULTY START-UP COMPANIES

Thanks to the support of the URC, faculty members at each university have developed and marketed ground-breaking technology and innovations that help fuel Michigan's knowledge industry. Below, we highlight some of their achievements.

A Faster Way of Conducting Lab Tests. U-M professors Dr. Mark Burns and Dr. David Burke and former U-M graduate students Kalyan Handique and Sundaresh Brahmasandr created and developed the innovative lab-on-a-chip, the prototype that helped launch the Ann Arbor-based company HandyLab. The lab-on-a-chip uses a small disposable cartridge and portable analyzer to test for Group B Streptococcus, a pathogen usually carried by expectant mothers and often causes sepsis, pneumonia, and meningitis in newborns. Thanks to this new technology, a lab test that once could take anywhere from 36 hours to four days can now be done in less than an hour, making prompt treatment much easier. Recently, the company generated $11.5 million in C-Round Funding and received an additional $5.6 million from Pfizer, one of its strategic investors.[23]

Harnessing Ocean and River Currents for Power. U-M Professor Michael M. Bernitsas developed the idea to harness the energy-producing power of vortex-induced vibrations (VIV). VIV is a natural phenomenon that occurs whenever a flexible cylinder is exposed to a flow of air or water. Initially, VIV were seen as a serious risk to cables, mooring lines, marine pipelines, smokestacks, nuclear fuel rods, and thousands of other structures. However, Professor Bernitsas created a device called the Vortex Induced Vibrations Aquatic Clean Energy, which is capable of harnessing the VIV energy generated by ocean and river currents and creating from it a scalable source of power more efficient than ocean-energy converters currently used around the world. Last year, Dr. Bernitsas founded Vortex Hydro Energy, LLC to create a prototype and market his invention. He is now working with student-consultants from U-M Tech Transfer's TechStart program to identify potential investors.[24]

Smaller Lasers. Dr. Marcos Dantus, a professor in the Departments of Chemistry and Physics-and-Astronomy at Michigan State University, founded Biophotonis Solutions, Inc. in 2003. The company researches and develops biotechnology-related detection and imaging methods using lasers. Though the company is small (two full-time employees and eight part-time employees), it is at the cusp of potentially tremendous growth. Specifically, Biophotonis Solutions, Inc. recently partnered with Coherent, Inc., a large laser systems company based in California, to develop a laser pulse-shaping product called Silhouette. This technology has been used in such diverse applications as micromachining (cutting very small pieces of material), surgery, and repairing integrated circuits. Coherent and Biophotonic Solutions project revenue of $150,000 in 2007, rising each year from there.[25]

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22. Information provided by University of Michigan and from SPARK, *U-M Leasing Pfizer Labs*, Press Release, April 20, 2007, obtained at: http://www.annarborspark.org/about-us/newsroom/u-m-leasing-pfizer-labs/.
23. U-M TechTransfer, *2006 Annual Report*, available at: http://www.techtransfer.umich.edu.
24. U-M TechTransfer, *2006 Annual Report*, available at: http:// www.techtransfer.umich.edu.

A Faster Way to Bring New Drugs to the Market. Professor Milton Smith and Associate Professor Robert Malecka have also used the help of Michigan State University to bring their research to the market. Professor Smith's recently patented method for creating boron compounds jump-starts a chemical process associated with carbon-hydrogen bonding and produces carbon-boron bonds, the building blocks of the pharmaceutical industry, in a single step. His method reduces production and material costs associated with both the discovery and production of drugs. Furthermore, the method operates on the core structures present in more than 90% of the top selling drugs, including Lipitor. In 2004, the patent for the catalytic compound was the eighth most requested patent from the Chemical Abstract Service, an information service with the American Chemical Society. On September 6, 2006, Smith and Maleczka were awarded $1.38 million through Michigan's 21st Century Jobs Fund to support and increase their production.[26]

Better Bandages for Chronic Wounds. KeraCure was formed to commercialize a simplified cell-based dressing for use across a number of medical disciplines. Its leading device, the KeraPac™ dressing, is an interactive wound covering comprised of living human cells for use in the treatment of chronic wounds. The dressing originally was developed by a team of Wayne State and University of Michigan professors. The team's leader was Dr. Riley Rees, a U-M professor, and Dr. William Lindblad represented Wayne State University. KeraCure's unique, cell-based technology addresses one of the most pressing current and future medical challenges—effective treatment of chronic wounds. KeraCure believes that its KeraPac™ will improve the lives of more than 10 million patients requiring treatment each year.[27]

Creating Digital Images of Sound. Dr. Sean Wu, a professor in Wayne State's College of Engineering, developed the technology to understand and visualize sound sources and transmission paths and developed the company SenSound, LLC to market his idea. The technology creates three-dimensional digital images of sound as it travels through space and time, which quickly, accurately, and cost-effectively maps sound sources on arbitrary three-dimensional surfaces. The technology has broad application in product development, manufacturing, and architecture where noise needs to be identified, understood, and eliminated or where manufacturing and machinery defects need to be identified.

25. For more information on this company, please see Anderson Economic Group's study on *The Economic Impact of Michigan State University* (2007) available at http://www.andersoneconomicgroup.com.
26. MSU Newsroom "MSU Research has good chemistry for jobs, drug breakthroughs" available at http://newsroom.msu.edu.
27. Information provided by Wayne State University Technology Transfer Office.

VIII. Comparison with Peer University Clusters

COMPARISON PEER UNIVERSITY CLUSTERS

To judge how the URC compares with other university clusters in the nation, we selected a handful of the best-known groups of universities in California (North and South), Illinois, Massachusetts, North Carolina, and Pennsylvania. Each of these clusters has three universities from the same state and are well known for their research and development activities. We present the list of peer university clusters in Table 23 below.

TABLE 23. Comparison Research University Clusters

Michigan's URC	Michigan State University	University of Michigan (all campuses)	Wayne State University
Northern California	University of California, San Francisco	University of California, Berkeley	Stanford University
Southern California	University of California, Los Angeles	University of California, San Diego	University of Southern California
Illinois	University of Chicago	University of Illinois at Urbana-Champaign	Northwestern University
Massachusetts	Harvard University	Massachusetts Institute of Technology (MIT) - Excludes Lincoln Lab	Tufts University
North Carolina	Duke University	University of North Carolina (Chapel Hill)	North Carolina State University
Pennsylvania	Penn State University (all campuses)	University of Pittsburgh (all campuses)	Carnegie Mellon University

Source: Anderson Economic Group, LLC

ACADEMIC R&D EXPENDITURES

We first compared the research and development expenditures for each of the clusters. In relation to the comparable university clusters, the URC has received less federal funding as a percentage of total than the Massachusetts, Pennsylvania, Illinois, and California clusters. The URC relies on institutional funds for a significantly higher proportion of its R&D spending than the other six comparison clusters. See Table 24 on page 39.

TABLE 24. Source of Funding for R&D Expenditures (in millions), 2005

	Total R&D Expenditures	Federal Government	State & Local Government	Industry	Institution	Other
Michigan's URC	**$1,369**	**61%**	**5%**	**4%**	**25%**	**5%**
Northern California	$2,024	64%	3%	5%	15%	13%
Southern California	$1,952	65%	2%	4%	19%	10%
Illinois	$1,181	66%	4%	2%	22%	6%
Massachusetts	$1,159	82%	0%	8%	2%	8%
North Carolina	$1,374	59%	10%	13%	16%	3%
Pennsylvania	$1,337	71%	6%	8%	12%	2%
All U.S. Universities	*$45,750*	*64%*	*6%*	*5%*	*18%*	*7%*

Source: National Science Foundation: Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

In 2004, the URC had the third highest R&D spending of seven university clusters at $1.32 billion, topped only by the two California clusters.[28] In 2005, however, North Carolina had surpassed the URC's spending of $1.37 billion by $5 million.[29] The URC's fall from third to fourth place can be explained by North Carolina's significant growth in R&D expenditures between 2004 and 2005. Most of the university clusters had similar levels of expenditures in 2004, but as shown in Table 25 on page 40, the North Carolina cluster increased expenditures 11.7% while the URC increased expenditures only 3.7%.

28. Data is from the National Science Foundation Integrated Science and Engineering Resources Data System.

29. The spending reported by the Massachusetts Institute of Technology to the NSF does not include spending for the Lincoln Lab, which is approximately $500 million but is not classified as academic research and development. Information provided by MIT's Technology Licensing Office. Lincoln Lab includes communications, space surveillance, missile defense, tactical surveillance systems, and air traffic control.

TABLE 25. Growth in Total Academic R&D Expenditures

	Annual Growth 2000 - 2005 (CAGR)	Annual Growth 2004 - 2005
Michigan's URC	**7.7%**	**3.7%**
Northern California	7.4%	5.1%
Southern California	7.7%	2.3%
Illinois	8.4%	3.8%
Massachusetts	5.8%	3.1%
North Carolina	8.7%	11.7%
Pennsylvania	9.2%	5.5%
All U.S. Universities	*8.8%*	*6.5%*

Source: NSF, Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

Share of science and engineering R&D expenditures for the URC is fairly consistent with U.S. university averages. As shown in Table 26 on page 41, there was slightly higher than average spending (as a percentage of total spending) for life and social sciences and slightly lower than average spending for environmental sciences. The seven comparison university clusters deviated significantly from the U.S. average for life sciences; the North Carolina and Northern California clusters spent significantly more, and the other university clusters spent significantly less. Furthermore, Massachusetts, Illinois and Northern California spent significantly more on the physical sciences.

TABLE 26. Share of Total R&D Expenditures by Science and Engineering Fields, 2004

	Environmental Sciences[a]	Life Sciences[b]	Math & Computer Sciences	Physical Sciences[c]	Psychology	Social Sciences[d]	Sciences, Other	Engineering[e]
Michigan's URC	**1%**	**63%**	**2%**	**8%**	**2%**	**10%**	**0%**	**15%**
Northern California	1%	65%	2%	11%	1%	3%	1%	16%
Southern California	7%	48%	6%	6%	1%	3%	0%	7%
Illinois	4%	51%	12%	11%	2%	4%	1%	15%
Massachusetts	4%	52%	5%	14%	1%	3%	2%	20%
North Carolina	4%	73%	3%	5%	1%	6%	0%	9%
Pennsylvania	3%	48%	12%	8%	3%	3%	1%	22%
All U.S. Universities	*5%*	*60%*	*4%*	*8%*	*2%*	*4%*	*2%*	*15%*

Source: National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges, FY 2004.

Analysis: Anderson Economic Group, LLC

a. Environmental sciences includes atmospheric and earth sciences, oceanography and other miscellaneous environmental sciences.

b. Life sciences includes agricultural, biological, medical and other miscellaneous life sciences.

c. Physical sciences includes astronomy, chemistry, physics other miscellaneous physical sciences.

d. Social sciences includes economics, political sciences, sociology and other miscellaneous social sciences.

e. Engineering includes aeronautical, biomedical, bioengineering, chemical, civil, electrical, mechanical. metallurgical, and other.

TECHNOLOGY TRANSFERS

Beyond the direct impact of the initial R&D spending, these innovations also lead to the production and sale of new products and services. The pharmaceutical, medical, computer technology, consumer electronic, telecommunication, agricultural products, and manufacturing industries are among the many industries benefiting from research and development conducted at universities. Research and development is also important to universities for its role in attracting and retaining high quality professors and students, who in turn benefit business enterprises that need a high quality workforce and research partnerships.

The success of academic research and development activities is often measured in terms of technology transfer. Common indicators include R&D expenditures, the number of patent applications filed, and the number of inventions disclosed in a given year. While these statistics show activity, they do not necessarily indicate the effectiveness of the activity. Other statistics, such as the number of patents granted, the number of licenses or options entered into, the royalty revenue, and the number of new start-ups are perhaps more telling indicators of technology transfer. We examined these indicators and attempted to find others to demonstrate the performance of the URC relative to the average U.S. institution and our comparison groups.

Since we have already examined expenditures, we will begin with invention disclosures, which is the process by which the university becomes aware of an innovation and decides whether to apply for a patent. In exchange for the disclosure, the inventor receives some assurance that if his or her idea is successful, the inventor also will benefit.

The URC performs well against the comparison university clusters in terms of its technology transfer activities. It lags behind the Northern California and Massachusetts clusters in invention disclosures, licensing revenue, and patent grants and the California-South cluster in every measure except licensing revenue. In terms of the numbers of new licenses/options, the URC ranked 6th. See Table 27 below.

TABLE 27. Average Annual Patent and Licensing Activity,[a] 2002-2006

	Invention Disclosures	Patent Grants	Licenses/Options	Licensing Revenue (in millions)
Michigan's URC[b]	**437**	**126**	**118**	**$39**
Northern California[c]	647	199	185	$172
Southern California[d]	789	242	174	$28
Illinois[e]	412	135	104	$19
Massachusetts[f]	706	204	206	$59
North Carolina[g]	383	111	143	$10
Pennsylvania[h]	387	123	134	$13

Source: Universities' websites, Association of Technology Managers 2005 Survey

a. Average includes 2002-2006 data where available. Some universities and some reported statistics are based on averages of less than 5 years.

b. Michigan State, the University of Michigan, and Wayne State information was obtained from the URC website. Five-year averages were available for all schools.

c. The University of California provided statistics for all their campuses through their Office of Technology and the office's Annual Reports for 2002-2006. Stanford University provided all statistics for 2002-2006 through their website except the number of patents issued, which was provided by their Office of Technology Licensing.

d. The University of California provided statistics for all their campuses through their Office of Technology and the office's Annual Reports for 2002-2006. We used the University of Southern California's AUTM submissions for 2002-2005. 2006 data for USC is not yet available.

e. Northwestern University provided all statistics for 2002-2006 through their website and Technology Transfer Program Office. University of Chicago provided all statistics through their Technology Office Five Year Report and through their office.University of Illinois, Urbana-Champaign provided all statistics through their Office of Technology Management website.

f. MIT, Harvard and Tufts reported 2002-2006 data on their websites with the exception of the number of startups for Harvard which was taken from the 2005 AUTM report.

g. UNC Chapel Hill has a five-year average for all statistics from their website. NC State University has a 2002-2005 average for all statistics from their website. Duke does not report statistics on their website. We have used their 2002 - 2005 AUTM submissions.

h. Penn State provided all statistics for 2002-2006. The University of Pittsburgh published statistics on their website for 2002-2006, except start-ups, which were obtained from the 2005 AUTM report. CMU's website provided statistics for 2002-2005.

The URC and the Massachusetts cluster only have one university in the United States Patent Office's list of the top ten grant-receiving universities in the country for 2003. In contrast, all the universities from the Northern California cluster and two of the three universities from the California-South cluster are among the top ten grant-receiving universities. These representatives are grouped together in the University of California system. However, neither the North Carolina, Pennsylvania, or Illinois clusters have any representatives on the list, suggesting that though the URC is not the leading cluster in the field of patent grants, it is still a leader in tech transfer activities. See Table 28 below.

TABLE 28. Top 10 Grant-Receiving Universities by First Named Assignee, 2003[a]

	2003 Patent Grants	Rank
University of California, The Regents of	437	1
California Institute of Technology	138	2
Massachusetts Institute of Technology	127	3
University of Texas	94	4
Stanford University, Leland Junior, The Board of Trustees of	85	5
Wisconsin Alumni Research Foundation	84	6
Johns Hopkins University	70	7
University of Michigan	*63*	*8*
Columbia University	61	9
Cornell Research Foundation Inc.	59	10

Source: USPTO, "U.S. Colleges and Universities - Utility Patent Grants 1969-2003"

Analysis: Anderson Economic Group, LLC

a. These numbers may differ slightly from the numbers reported by universities as the USPTO only captures the first named assignee.

The URC has helped cultivate an average of 15 start-ups annually between 2002 and 2006. As shown in Table 29 on page 44 this is more than was cultivated by the North Carolina or the Illinois cluster, equal to that of the Pennsylvania cluster, and lower than those of the Massachusetts, Northern California and California-South clusters.[30]

30. We relied on information provided by the universities for number of start-ups.

TABLE 29. Average Annual Number of Start-ups[a] Cultivated at University Clusters, 2002-2006

Michigan's URC	**15**
Northern California	31
Southern California	28
Illinois	13
Massachusetts	29
North Carolina	11
Pennsylvania	15

Sources: Universities' websites, AUTM [b]

a. Average includes 2002-2006 data where available. Some universities and some reported statistics are based on averages of less than 5 years. See footnotes in Table 27 on page 42 for data limitations.

b. See footnotes in Table 27 on page 42 for data limitations.

To measure the success of each University's research and development spending, we examined the amount of licensing revenue generated by each dollar of spending. Since licensing revenue can have large year-to-year changes caused by the sale of a large license, we compared the average revenue over a five-year period (2002-2006) to the 2005 expenditures. Table 30 shows that the URC has done better than the U.S. average, North Carolina cluster, Pennsylvania cluster, Southern California cluster and Illinois cluster in terms of revenues earned per R&D dollar spent.

TABLE 30. 2002-2006 Average Annual Licensing Revenue as a Percent of 2005 Expenditures

	Licensing Revenue[a] (in millions)	Total Expenditures[b]	Revenues per Expenditures
Michigan's URC	**$39**	**$1,369**	**2.9%**
Northern California	$172	$2,024	8.5%
Southern California	$28	$1,772	1.6%
Illinois	$19	$1,181	1.6%
Massachusetts	$59	$1,159	5.1%
North Carolina	$10	$1,374	0.8%
Pennsylvania	$13	$1,337	1.0%
U.S. Average (2003 Figures)	$880	$40,057	2.2%

Sources: Universities' websites, AUTM, National Science Foundation, Integrated Science and Engineering Resources Data System

Analysis: Anderson Economic Group, LLC

a. See footnotes in Table 27 on page 42 for data limitations. Revenue for U.S. is 2003.

b. Total expenditures for URC and other groups is 2005. Total expenditures for U.S. is 2003.

IX. Benefits of Medical Education

MEDICAL EDUCATION IN THE URC

The URC sponsors the only medical schools in the state of Michigan that provide Doctor of Medicine (M.D.) and Doctor of Osteopathic Medicine (D.O.) degrees. Michigan's URC has four medical schools. All three Research Corridor universities have allopathic (M.D.) medical schools and Michigan State has an osteopathic (D.O.) medical school.

These medical schools train students through a combination of classes taught on campus and in clinical settings. Students typically spend the first two years of their medical education in a classroom on campus and the next two years in clerkships at hospitals located throughout Michigan. For example, Michigan State's College of Human Medicine has students at six community campuses, five of which are located outside East Lansing. MSU's College of Osteopathic Medicine has 13 partner hospitals in which they place third- and fourth-year medical students. University of Michigan trains students primarily in its own hospital and health centers and in other locations in Southeast Michigan. Wayne State trains many students in hospitals close to its medical school in Detroit.

In 2005, Michigan's URC graduated 639 students from its medical schools. This is 12.1% more than in 2001. As shown in "URC Student Demographics" on page 4, URC institutions graduate the most students in medicine and biological science compared to the other university clusters in this report.[31]

TABLE 31. URC Medical School Graduates, 2001-2005

University	Degree Granted	2001	2002	2003	2004	2005	% Change from 2001
Michigan State University	M.D.	99	109	68	121	117	*18.2%*
Michigan State University	D.O.	128	115	128	134	122	*-4.7%*
University of Michigan	M.D.	160	161	154	165	162	*1.3%*
Wayne State University	M.D.	183	238	218	245	238	*30.1%*
TOTAL	M.D. & D.O.	570	623	568	665	639	*12.1%*

Source: National Center for Education Statistics, IPEDS
Analysis: Anderson Economic Group, LLC

Clinical and Hospital Care

In addition to teaching students, URC medical school faculty members provide patient care in clinical practices associated with each university. The most extensive of these practices is at the University of Michigan. The University of Michigan Health System (UMHS) consists of University Hospital, C.S. Mott Children's Hos-

31. The *Medicine and Biological Science* academic program area includes the following fields of study: Biological and biomedical sciences; psychology; health professions and related clinical sciences.

pital, Women's Hospital, 30 health centers, 120 outpatient clinics, the U-M Medical School, and Michigan Health Corporation. Until December 2006, the U-M Health System also included the M-CARE health plan, before its sale by the University to Blue Cross Blue Shield of Michigan and its Blue Care Network. In FY 2006, 1.67 million clinic visits were made to UMHS at 30 sites throughout Michigan and Northern Ohio.[32]

As Table 32 demonstrates, UMHS is a very large employer. In FY 2006, UMHS employed 18,610 full-time-equivalent faculty and staff. This employment has grown steadily since 2001; between 2001 and 2006 total employment increased by 29% or at an average annual rate of 5.3%.

TABLE 32. Staff and Faculty Employed at the U-M Health System, FY 2001-2006[a]

	2001	2002	2003	2004	2005	2006	% Change 2001-2006
EVPMA[b]	22	27	29	29	34	45	104.5%
M-CARE	399	348	385	368	364	380	-4.8%
Medical School	4,530	4,895	5,176	5,377	5,494	5,614	23.9%
Hospitals	9,445	9,974	10,725	11,288	11,864	12,571	33.1%
Total	14,396	15,244	16,315	17,062	17,756	18,610	29.3%

Source: University of Michigan

a. As of June 30th (end of fiscal year)

b. Executive Vice President for Medical Affairs

U-M Health System maintains a reputation as one of the strongest research systems in the nation. In 2006, UMHS was ranked 12th in the country on *U.S. News & World Report*'s honor roll of the 14 best hospitals in the country, and was the only hospital in Michigan to make the magazine's list of "America's Best Hospitals" that year. [33] U-M Health System also has earned a reputation in research; in 2006, there were 1,588 active, sponsored research projects at the U-M Medical School.[34]

GRADUATE MEDICAL EDUCATION

Graduate medical education (GME) is the second phase of medical training. Upon completion of four years of medical school, students who wish to obtain full medical licensure and board certification in a medical specialty must complete a period of residency training. Most residency programs last three to five years. Students typically complete their training at "teaching hospitals" located throughout the country.[35]

32. *University of Michigan Medical School Financial Report 2006.*

33. Information obtained from the University of Michigan Health system's website at www.med.umich.edu.

34. *University of Michigan Medical School Financial Report 2006.*

URC Medical Graduates & Residency Programs

URC medical schools have relationships with hospitals in Michigan and support graduate medical education. University of Michigan is the only URC university to own and operate a hospital where URC medical school graduates can complete their GME training. Many URC medical school graduates complete their residency training at hospitals in Michigan. We estimate that in the fall of 2005, there were 987 medical residents in Michigan who had graduated from an allopathic URC medical school.[36] This is 20% of all residents in Michigan in 2005.[37]

Of the URC medical school graduates in 2005, 60% remained in Michigan for their graduate medical education. Between 2000 and 2005, Wayne State was able to consistently place a higher percentage of their allopathic medical school graduates in residency programs in Michigan than the other two allopathic medical schools in the URC. In 2005, 65% of Wayne State medical school graduates remained in Michigan for graduate medical education compared to 55% of the graduating class at Michigan State and 28% at University of Michigan. A higher percentage of MSU's College of Osteopathic Medicine graduates remain in Michigan for GME than allopathic medical school graduates. Since 2001, over 90% of the graduating class has remained in Michigan for GME. See Table 33 below.

TABLE 33. Percentage of URC Medical School Graduates Remaining in Michigan for GME

University	Degree	2000	2001	2002	2003	2004	2005
Michigan State	D.O.	NA	97%	97%	91%	97%	97%
Michigan State	M.D.	49%	42%	48%	45%	47%	55%
University of Michigan	M.D.	34%	38%	35%	39%	34%	28%
Wayne State	M.D.	59%	62%	60%	55%	57%	65%
URC TOTAL	M.D. & D.O.	49%	60%	59%	57%	58%	60%

Data Source: Medical Schools, URC Universities

Analysis: Anderson Economic Group, LLC

Graduate Medical Education Payments

Hospitals rely on private insurance, self-paying patients, and state and federal insurance programs to finance patient services. Teaching hospitals that have graduate medical education programs receive money from federal and state governments for the additional cost of training new doctors. These payments, "GME payments," for the training of students come from three sources: Medicaid (the state program that

35. Information obtained from William T. Mallon, *The Handbook of Academic Medicine: How Medical Schools and Teaching Hospitals Work*, Association of American Medical Colleges (2004).
36. This statistic is based on AEG's analysis of placement records provided by the URC medical schools.
37. Total number of residents in Michigan in 2005 provided by the Association of American Medical Colleges.

provides health insurance for low-income families and individuals); Medicare (the national health insurance program for individuals over the age of 65 years and the disabled); and private insurance companies.

The URC affects GME payments to Michigan hospitals in several ways. First, through their experience as medical students in Michigan hospitals that offer internship and residency programs affiliated with URC institutions, URC students are more likely to know about and apply for these programs than they would be if they attended medical school outside the state of Michigan. Second, URC medical schools affiliate with a variety of Michigan hospitals to develop residency programs, and hospitals receive GME dollars based in part on how many residents they train. Third, one of the URC institutions, the University of Michigan, develops and operates its own GME programs at the hospitals it owns, thereby deriving hospital GME revenue.

In FY 2005, State of Michigan Medicaid payments to Michigan hospitals for GME was $162 million. Medicare GME payments to hospitals in Michigan during calendar year of 2005 was $565.8 million.[38] As mentioned above, private insurers must also make GME payments. Blue Cross Blue Shield of Michigan (BCBSM) is the largest private insurer, contributing a majority of private insurance payments, approximately $100 million annually. Since we did not have data on the GME payments from BCBSM by hospital, we do not include these payments in the table on page 49. The average GME payment per medical resident in Michigan was $150,646 in 2005.

As Table 34 on page 49 illustrates, we estimate that 72% of state GME dollars went to URC affiliated hospitals in 2005. We calculated this percentage by dividing GME payments to hospitals affiliated with a URC university by total GME payments to hospitals in Michigan in 2005. We estimate that 78% of Michigan GME dollars went to hospitals where a URC graduate was in a residency position in 2005.[39] We calculated this percentage by dividing all GME payments to hospitals with at least one graduate of a URC medical school in its residency program in the fall of 2005 by total GME payments to hospitals in Michigan in 2005. We describe our methodology for calculating fall 2005 URC graduates in residency programs in Michigan in "Appendix B. Methodology."

38. Medicaid GME payment data is from the Michigan Department of Community Health, and can be obtained at: http://www.michigan.gov/mdch/0,1607,7-132-2945_5100-87515--,00.html. Medicare data is from the Centers of Medicare and Medicaid and was provided by the MSU College of Human Medicine.

39. This is based of placement of graduates from all URC allopathic medical schools between 2000 and 2005, and graduates of MSU's College of Osteopathic Medicine in 2004. Affiliated hospitals were provided by the universities and not all hospitals received GME dollars in the data provided by DCH and CMS.

TABLE 34. GME Payments (in millions) in 2005

	Medicare (CY 2005)[a]	Medicaid (FY 2005)	Total GME	% of State Total GME
All Hospitals in Michigan	$565.8	$162.2	$727.9	*100%*
URC Affiliated Hospitals	$393.5	$133.2	$526.7	*72%*
Hospitals with a URC Graduate as a Resident in Fall 2005	$475.0	$94.3	$569.4	*78%*

Data Sources: Michigan Department of Community Health, Centers for Medicare and Medicaid; see footnote 38.

Analysis: Anderson Economic Group, LLC

a. We only included direct and indirect GME payments and not Disproportionate Share (DSH) payments.

MICHIGAN DOCTORS FROM URC MEDICAL SCHOOLS

Doctors who attended medical school or a residency program in Michigan are more likely to remain in the state to practice than active physicians in the average U.S. state. To determine how well Michigan is able to retain its graduating medical students to practice in-state, we referred to two measures created by the Association of American Medical Colleges (AAMC).

As Table 35 demonstrates, Michigan has consistently ranked highly in its ability to retain its medical graduates to practice in-state as compared to the average U.S. state. Over-half (55.1%) of active physicians in Michigan completed a residency program in Michigan, compared to the national average of 44.7%. The same trend holds for medical schools: 38.2% of active physicians in Michigan in 2005 had attended a medical school in Michigan compared to 29.6% in the average U.S. state.

TABLE 35. Medical School Retention Rates, 2005

	MI	US Average
Of Active Physicians in a State:		
Percentage of Active Physicians Who Completed In State Graduate Medical Education[a]	55.1%	44.7%
Percentage of Active Physicians In-State that Attended an In-State Medical School[b]	38.2%	29.6%

Source: Association of American Medical Colleges Center for Workforce Studies

a. Number of active physicians in the state who completed training in-state divided by the total number of active physicians in-state.

b. Of the total active physicians in the state, the percentage that graduated from in-state medical schools. Includes MDs and DOs. Includes only states with a medical school located in the state.

DENTISTRY PROGRAM

The University of Michigan School of Dentistry offers students a Doctor of Dental Surgery (DDS) program and a dental hygiene program.[40] In addition, the school teaches all specialty programs (endodontics, oral and maxillofacial surgery, orthodontics, oral diagnosis, oral pathology, pediatric dentistry, and periodontics) and continuing education programs for practicing dentists.

The four-year DDS program involves 1,756 hours of clinical experience during the student's time in the program. Students benefit both from observing and assisting in clinical treatments during the first semester of their first year and from participating in hospital rotations at the University of Michigan Health System throughout their time at the University.

Students pursuing a Bachelor of Science in Dental Hygiene degree join the school during the second year of their undergraduate studies. Graduates of the dental hygiene program are prepared to work in both the private and public health sectors, as well as in educational dental hygiene programs.

In 2005, the University of Michigan School of Dentistry program graduated 104 students with a DDS degree. The same year, 27 students graduated with a dental hygienist degree. See Table 36 below.

TABLE 36. Graduates from the University of Michigan Ann Arbor Dental School

Program	2000	2005	Change 2000-2005
Dentistry (DDS)	95	104	*9*
Dental Hygiene (Bachelor's and Master's Degree)	28	27	*-1*
TOTAL	123	131	*8*

Source: National Center for Education Statistics, IPEDS
Analysis: Anderson Economic Group, LLC

In 2004, the school placed second among the nation's dental schools in terms of research grant funding, having received $13.3 million from the National Institute of Health that supports over 30,000 square feet of research space. The School of Dentistry also has a large clinical practice. It treated 79,618 patients in Ann Arbor during the 2006-2007 academic year, 20% of whom were Medicaid patients.We discuss the School of Dentistry's role in serving the Medicaid population in "Community Outreach" on page 53.

40. The DDS (Doctor of Dental Surgery) and DMD (Doctor of Dental Medicine) are the same degree. The majority of dental schools award the DDS degree; however, some award a DMD degree. The amount of education required for the degrees and the essence of the degrees are the same.

VETERINARY MEDICINE

Michigan State University hosts the only school of veterinary medicine in the state and one of only 28 veterinary schools in the country.[41] Its College of Veterinary Medicine offers a four-year Doctor of Veterinary Medicine (DVM) degree requiring five semesters of classroom training and four semesters of clinical work. Third- and fourth-year veterinary students spend three weeks in equine and food-animal practices throughout Michigan to experience the daily routine of large-animal practice.[42]

As seen in Table 37 below, the college has issued 216 students a Doctorate in Veterinary Medicine since 2000. The college also operates the Veterinary Teaching Hospital (VTH), the only tertiary referral center for veterinary medicine in the state of Michigan. Every year, the VTH sees more than 24,000 animals from all parts of the state.

TABLE 37. Graduates from Michigan State's College of Veterinary Medicine

Program	2000	2005	Change 2000-2005
Veterinary Medicine (DVM)	106	110	4
Veterinary Biomedical and Clinical Sciences - Master's Degree	0	6	6
Veterinary Biomedical and Clinical Sciences - Doctor's Degree	0	4	4
Total Degrees Granted	0	10	10

Source: National Center for Education Statistics

The college houses over 15 research centers and facilities, through which it provides research and service programs. In particular, the college's Diagnostic Center for Population and Animal Health runs over 1.5 million tests a year to provide an early warning system for impending epidemics; to identify infectious animal disease, contaminants, and regulatory diseases, and to diagnose nutritional diseases. The Veterinary Extension within the college focuses on solving and preventing animal health management problems to ensure its safety for human consumption. The program is currently researching Johnes Disease, Avian Influenza, and Mad Cow Disease.[43]

41. Information provided by MSU's College of Veterinary Medicine.

42. Information provided by MSU's College of Veterinary Medicine.

43. Information provided by MSU's College of Veterinary Medicine.

X. Culture, Events, and Community

CULTURAL AND ENTERTAINMENT ATTRACTIONS

Not only does the University Research Corridor provide a vital source of talent, training, and discovery, but it also provides numerous cultural and entertainment venues that enrich the lives of Michigan residents and draw visitors from across the country and around the world. The URC also provides a wide range of services to the community, such as medical clinics, athletic and academic programs for children, and legal aid services.

Highlights of the events and attractions that URC schools offer include athletic events, museums of art and history, library collections, theatre, and music. In this year's report, we focus on the theatre at each of these schools.

THEATRE IN THE URC

At Wayne State University, one of the nation's leading theatre programs performs for the public at the Bonstelle Theatre and the Hilberry Theatre. The 1,143-seat Bonstelle is home to the WSU undergraduate theatre company, which performs shows throughout the year for roughly 13,000 people. The Hilberry Theatre is home to the nation's only graduate repertory company, which performs six plays each year for some 35,000 attendees.

The University Musical Society (UMS) is a not-for-profit performing arts organization affiliated with the University of Michigan. UMS hosts approximately 80 performances each year and sponsors over 200 educational programs with over 20,000 participants annually. In FY 2006, UMS sponsored 63 programs and sold over 83,000 tickets.[44]

In the fall 2006, UMS hosted the Royal Shakespeare Company (RSC), with performances including *Antony and Cleopatra, Julius Caesar,* and *The Tempest.* These three productions were the center of many cultural and educational programs put on by the RSC and drew an attendance of 27,382 throughout the three-week program.[45] The additional cultural and educational programs were hosted by the University of Michigan free of charge to families and students from all over Michigan, and included keynote lectures, open courses, and interviews with RSC actors. The RSC's home theater is in Stratford-upon-Avon, the hometown of William Shakespeare.

Wharton Center for Performing Arts is a nonprofit performing arts facility at Michigan State University. Its mission is to "enrich the lives of Michigan residents" through arts education and entertainment.[46] They do this most visibly by bringing top performances, such as *Rent*, *The Lion King*, and *Wicked* to East Lansing. They

44. Data provided by the University Musical Society.

45. Attendance provided by the University Musical Society.

46. Mission statement provided by Wharton Center.

also provide educational programs for more than 30,000 children and their families to participate in each season.

Wharton Center for Performing Arts sold 229,132 tickets during the 2005-06 season. A majority of the tickets sold were for Wharton Center's presentation of *THE LION KING*. Revenue from ticket sales last season totaled almost $12 million. AEG estimates that the net economic impact of Wharton Center's activities for the 2005-06 season on the tri-county region of Ingham, Clinton, and Eaton Counties is $4.67 million.[47]

COMMUNITY OUTREACH

The URC also provides a number of valuable services and programs throughout the state. These range from employee-giving campaigns and student volunteerism, to medical and legal assistance programs targeting low-income individuals and others needing assistance.

WSU Provides Math Corps Program for Youth. At Wayne State University, the mathematics department works in the community to develop the interest and abilities of middle school and high school students in Detroit public schools. They accomplish this through tutoring and after school instruction, including a summer Math Corps program. The six-week-program serves some 400 middle and high school students. High school students assist teaching middle school students in the morning, and spend the afternoon in advanced math courses. The middle school students are provided hands-on learning opportunities in an environment designed to engage their interest. The program, which is supported almost exclusively by WSU and the Detroit Public Schools, has shown clear success. Typical summer camp test scores go from a pre-camp median of 30% correct answers to a post-camp median of 90% correct answers. In addition to the summer program, Math Corps also offers Saturday sessions during the school year, and a Family Mathematics Initiative.

U-M School of Dentistry Treats Medicaid Patients. The University of Michigan School of Dentistry treated 79,618 patients in Ann Arbor during the 2006-2007 academic year, 20% of whom were Medicaid patients. This makes the University of Michigan one of the largest providers of dental treatment for patients with Medicaid benefits, having provided $4.3 million in Medicaid services. In addition to treating patients at the University of Michigan campus, an outreach program sends dental and dental hygiene students to seven Federally Qualified Health Centers (FQHC) throughout the lower peninsula. Through this outreach program, U-M students spend four weeks during their last year of dental school providing dental services for under-served populations.

MSU Extension Provides Services in Every Michigan County. MSU's Extension program (MSUE) works closely with community leaders, governments, private businesses, and entrepreneurs to encourage economic development in the state. For

47. See Caroline M. Sallee, Alex L. Rosaen, and Patrick L. Anderson, *The Economic Impact of Michigan State University* (2006) for a complete discussion of Wharton Center's activities and economic impact on the state of Michigan.

example, MSUE agents in Saginaw County established the Saginaw Family Child Care Network, which has trained daycare operators and offers low-income adults the opportunity to become licensed childcare providers.[48] MSU Extension also created Senior Project Fresh (SPF) to give low-income seniors nutrition education and coupons that they can redeem at area farm markets to buy locally grown produce. In 2006, the second year of the program, seniors have redeemed almost $90,000 worth of coupons, improving their diets and supporting local farmers. This project is an expansion of the larger Project FRESH, which provides coupons and nutrition counseling to low-income families across the state.

BIG TEN FOOTBALL VISITOR SPENDING

Athletic events are another significant cultural and entertainment offering from URC schools. The most significant athletic event, in terms of attendance, is likely football at the University of Michigan and Michigan State University, both of which compete in the Big Ten Conference. In 2006, the University of Michigan played seven games in Ann Arbor, and five of those were against an out-of-state opponent U-M also hosted games against Central Michigan University and Michigan State University. Michigan State University played seven home football games in 2006, six of which were against teams from outside the state. MSU hosted a game against Eastern Michigan University.

These games were all well attended, with 770,183 fans attending games at Michigan Stadium (average of 110,026 per game) and 495,731 fans being drawn to Spartan Stadium in East Lansing (average of 70,819 per game). The combined attendance for 2006 Big Ten football games played in Ann Arbor and East Lansing was 1,265,914. While many of these fans live and work in Michigan, a significant portion come from outside the state, and their spending creates a significant economic impact in the state.

Out-of-State Visitor Economic Impact. By making some informed assumptions about how many visitors come from outside the state, how long they stay, and how much they spend while here, we estimate that the economic impact of spending by visitors at Big Ten football games played at URC schools was $92,198,994 for the 14 games played in 2006. This includes a direct economic impact of $57,624,371, and an indirect economic impact of $34,574,623. See “Appendix B. Methodology” for the data and methodology we used to calculate the economic impact of these visitors.

48. *Contributing to Michigan's Success*, an impact report by MSU Extension and Michigan Agricultural Experiment Station, February 2006.

Appendix A: Data

TABLE A-1. Total Enrollment, Fall 2001- 2005

	2001	2002	2003	2004	2005	2001-2005 CAGR
Michigan's URC						
Undergraduate Enrollment	89,637	89,871	91,9116	92,283	93,397	1.03%
Graduate Enrollment	36,543	38,265	38,698	38,167	37,969	0.96%
Other	2,118	2,099	2,024	2,052	1,965	-1.86%
TOTAL	128,298	130,235	131,838	132,502	133,331	0.97%
Northern California						
Undergraduate Enrollment	30,600	31,230	30,286	29,443	30,058	-0.45%
Graduate Enrollment	20,219	20,233	19,705	21,318	21,811	1.91%
Other	3,474	3,506	3,661	3,632	3,583	0.78%
TOTAL	54,293	64,969	53,652	54,393	55,452	0.53%
Southern California						
Undergraduate Enrollment	58,870	60,132	61,968	61,759	62,387	1.46%
Graduate Enrollment	25,026	26,597	25,712	25,921	26,225	1.18%
Other	4,969	5,080	5,086	5,109	5,169	0.99%
TOTAL	88,865	91,809	92,766	92,789	93,781	1.36%
Illinois						
Undergraduate Enrollment	41,988	42,625	42,941	43,292	44,664	1.56%
Graduate Enrollment	23,704	24,579	25,523	25,416	25,938	2.28%
Other	3,482	3,500	3,506	3,596	3,551	0.49%
TOTAL	69,174	70,704	71,970	72,304	74,153	1.75%
Massachusetts						
Undergraduate Enrollment	18,625	18,862	18,718	18,567	19,627	1.32%
Graduate Enrollment	20,777	21,444	21,635	21,711	21,611	0.99%
Other	4,351	4,412	4,347	6,380	3,815	-3.23%
TOTAL	43,753	44,178	44,700	46,658	45,053	0.73%
North Carolina						
Undergraduate Enrollment	44,465	44,946	45,363	45,580	46,065	0.89%
Graduate Enrollment	18,065	18,834	18,674	19,717	20,951	3.77%
Other	4,176	4,373	4,399	4,308	4,483	1.79%
TOTAL	66,706	68,153	68,436	69,605	71,499	1.75%

TABLE A-1. Total Enrollment, Fall 2001- 2005 (Continued)

(Continued)	2001	2002	2003	2004	2005	2001-2005 CAGR
Pennsylvania						
Undergraduate Enrollment	57,647	58,214	57,899	57,534	57,284	-0.16%
Graduate Enrollment	18,478	19,854	20,299	20,023	19,698	1.61%
Other	2,337	2,322	2,350	2,319	2,358	0.22%
TOTAL	78,462	80,390	80,548	79,876	79,340	0.28%

Source: *NCES, IPEDS Enrollment*

TABLE A-2. Completions and Awards by Academic Program Area, 2004-05 academic year

	Physical Science, Ag, and Nat. Resources	Business, Mngt, and Law	Engineering, Math, Computer Science	Liberal Arts	Medicine and Bio. Science	Other
Michigan's URC						
Bachelor's Degrees	827	2,703	2,585	8,438	3,440	738
Advanced Degrees	484	2,582	2,258	3,768	2,261	253
Other	89	5	17	325	50	13
TOTAL	1,400	5,290	4,860	12,531	5,751	1,004
Northern California						
Bachelor's Degrees	407	579	1,766	5,183	1,521	72
Advanced Degrees	370	1,557	1,919	1,525	1,264	177
Other	1	-	39	149	25	-
TOTAL	778	2,136	3,724	6,857	2,810	249
Southern California						
Bachelor's Degrees	354	1,651	2,510	9,854	3,527	40
Advanced Degrees	343	1,980	2,698	3,133	2,085	2
Other	58	35	138	334	120	-
TOTAL	755	3,666	5,346	13,321	5,732	42
Illinois						
Bachelor's Degrees	686	1,171	1,992	5,148	1,769	203
Advanced Degrees	439	6,101	1,399	2,854	944	136
Other	-	20	-	19	78	12
TOTAL	1,125	7,292	3,391	8,021	2,791	351

TABLE A-2. Completions and Awards by Academic Program Area, 2004-05 academic year (Continued)

	Physical Science, Ag, and Nat. Resources	Business, Mngt, and Law	Engineering, Math, Computer Science	Liberal Arts	Medicine and Bio. Science	Other
Massachusetts						
Bachelor's Degrees	240	113	1,101	2,546	689	1
Advanced Degrees	250	1,960	1,836	2,629	1,534	41
Other	1	303	13	50	71	-
TOTAL	491	2,376	2,950	5,225	2,294	42
North Carolina						
Bachelor's Degrees	872	1,676	1,887	5,435	2,643	623
Advanced Degrees	319	1,128	856	1,971	1,555	140
Other	193	-	-	3	19	-
TOTAL	1,384	2,804	2,743	7,409	4,217	763
Pennsylvania						
Bachelor's Degrees	735	2,807	3,166	5,986	2,387	736
Advanced Degrees	288	1,684	1,732	1,907	1,168	82
Other	8	223	103	1,030	144	55
TOTAL	1,031	4,714	5,001	8,923	3,699	873

Source: National Center for Education Statistics, IPEDS Enrollment

TABLE A-3. Undergraduate Degrees Conferred 2004-2005, Percentage of Total Degrees Conferred

	Physical Science, Ag. and Nat. Resources	Business Mngt., and Law	Engineering, Math, Computer Science	Liberal Arts	Medicine and Bio. Science	Other
Michigan's URC	**4.42%**	**14.43%**	**13.80%**	**45.05%**	**18.37%**	**3.94%**
Northern California	4.27%	6.08%	18.53%	54.40%	15.96%	0.76%
Southern California	1.97%	9.20%	13.99%	54.94%	19.66%	0.22%
Illinois	6.25%	10.68%	18.16%	46.93%	16.13%	1.85%
Massachusetts	5.12%	2.41%	23.48%	54.29%	14.69%	0.02%
North Carolina	6.64%	12.76%	14.37%	41.37%	20.12%	4.74%
Pennsylvania	4.65%	17.75%	20.02%	37.85%	15.09%	4.65%

Source: National Center for Education Statistics, IPEDS Enrollment

Analysis: Anderson Economic Group, LLC

TABLE A-4. Graduate Degrees Conferred 2004-2005, Percentage of Total Degrees Conferred

	Physical Science, Ag. and Nat. Resources	Business Mngt., and Law	Engineering, Math, Computer Science	Liberal Arts	Medicine and Bio. Science	Other
Michigan's URC	**4.17%**	**22.25%**	**19.46%**	**32.47%**	**19.48%**	**2.18%**
Northern California	5.43%	22.86%	28.17%	22.39%	18.56%	2.60%
Southern California	3.35%	19.33%	26.35%	30.59%	20.36%	0.02%
Illinois	3.70%	51.39%	11.78%	24.04%	7.95%	1.15%
Massachusetts	3.03%	23.76%	22.25%	31.87%	18.59%	0.50%
North Carolina	5.34%	18.90%	14.34%	33.02%	26.05%	2.35%
Pennsylvania	4.20%	24.54%	25.24%	27.79%	17.02%	1.20%

Source: National Center for Education Statistics, IPEDS Enrollment

Analysis: Anderson Economic Group, LLC

TABLE A-5. URC Revenue Sources, FY 2002 & FY 2006

	FY 2002	FY 2006	FY 2006 % of Total Revenue	% Change
Operating Revenue				
Tuition and Fees	$883,071,069	$1,208,278,814	15.4%	*36.8%*
State Operating Grants and Contracts	$26,528,151	$55,540,322	0.7%	*109.4%*
Private Operating Grants and Contracts	$247,566,863	$266,170,428	3.4%	*7.5%*
Sales and Service of Auxiliary Enterprises	$358,536,015	$460,088,558	5.9%	*28.3%*
Sales and Service of U-M Hospitals	$1,476,290,000	$1,990,453,000	25.4%	*34.8%*
Independent Operations	$1,019,959	$966,195	0.01%	*-5.3%*
Federal Operating Grants and Contracts	$908,523,060	$1,077,191,560	15.7%	*18.6%*
Other	$214,226,642	$265,747,131	3.7%	*24.0%*
TOTAL OPERATING REVENUE	$4,115,761,759	$5,324,436,008	68.1%	*29.4%*
Non-operating Revenue				
State Appropriations	$1,067,136,636	$929,065,500	11.9%	*-12.9%*
Gifts	$110,748,060	$159,926,857	2.0%	*44.4%*
Investment Income	$299,242,170	$1,145,648,102	14.6%	*282.8%*
Other	$6,316,071	$1,331,905	0.02%	*-78.9%*
TOTAL NON-OPERATING REVENUE	$1,483,442,937	$2,235,972,364	28.6%	*50.7%*
Other Revenues and Additions				
Capital Appropriations	$71,422,125	$75,287,399	1.0%	*5.4%*
Capital Grants and Gifts	$34,699,873	$77,121,186	1.0%	*122.3%*
Additions to Endowment	$82,456,631	$109,996,076	1.4%	*33.4%*
TOTAL OTHER REVENUES	$188,578,629	$262,404,661	3.4%	*39.1%*
TOTAL URC REVENUE	**$5,787,783,325**	**$7,822,813,033**	100%	*35.2%*

Source: National Center for Education Statistics, IPEDS Finance
Analysis: Anderson Economic Group, LLC

Appendix B. Methodology

OPERATIONAL EXPENDITURES METHODOLOGY

In order to quantify the economic impact of the URC's activities, we asked ourselves the following question: What would the loss be to the state if the Research Corridor universities left Michigan? We then studied the loss in terms of jobs, earnings, and output.

We quantified the *net economic impact*, which we define as the new economic activity directly or indirectly caused by the University Research Corridor, excluding any economic activity that replaces or displaces other activity in the state. We followed the following steps to calculate the economic impact of the URC's operational expenditures.

Determined In-State Expenditures. The first step in estimating the economic impact of the URC's operational expenditures was to determine the payroll and non-payroll expenditures by the URC that remained within the state. We did this in the following steps.

1. We obtained salary, fringe benefit, and non-payroll expenditures for the Research Corridor universities for fiscal year 2005-06 from the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS).
2. We relied on information provided by the universities to determine the percentage of expenditures that went to businesses located outside of Michigan.
3. We used data from the universities and the 2005 Consumer Expenditure Survey from the U.S. Bureau of Labor Statistics to calculate URC student expenditures in Michigan, and to account for a percentage of expenditures that go to firms outside Michigan.

Accounted for Likely Substitution. After calculating the non-payroll and payroll expenditures by the URC and student expenditures, we accounted for spending that would have occurred even if the URC were not part of the state's economy. For instruction of Michigan residents, we used a substitution effect of 10%. One way to think about this is that 10% of URC students from Michigan would remain in Michigan for their college degree if the URC disappeared, and that the spending associated with their education would also remain in the state. Thus, this is not *new* economic activity caused by the URC.

We used a zero substitution effect for out-of-state students who come to Michigan. It is unlikely that most out-of-state students would come to Michigan for their bachelor's or advanced degree if the URC were not in operation. We counted the expenditures on the instruction of and spending by these students as new economic activity caused by the URC.

Most research dollars come from out-of-state sources. URC universities receive 94% of all federal research dollars in Michigan. To account for a small increase in research expenditures by other universities in Michigan in the absence of the URC, we chose a small substitution effect of 2% for research expenditures.

We used a substitution effect of 30% for faculty and staff expenditures. We assumed that almost all tenured faculty would leave the URC, but about half the staff would find jobs in Michigan. We used a substitution effect appropriate to the payroll share of staff and faculty that would leave the state. For hospital faculty and staff, we use a 14% substitution effect, assuming that some staff would go to other hospitals in Michigan if the URC universities did not exist.

Finally, we used a substitution effect of 30% for non-payroll hospital expenditures. Based on the operations of the hospital, we accounted for some of the clinical care currently provided by UMHS being taken up by other hospitals in Michigan. We assumed that speciality clinics and most research would go elsewhere.
See Table B-1 below.

TABLE B-1. Substitution Effect Parameters for URC Expenditures Analysis

Category	Parameter
Instruction of Resident MSU Students	0.10
Instruction of Non-resident MSU Students	0.00
Research Dollars	0.02
Student Expenditures	0.06
Faculty Expenditures	0.30
Hospital Expenditures	0.30
Hospital Faculty and Staff	0.14

Source: Anderson Economic Group, LLC

Direct and Indirect Impacts. The *direct* economic impact is calculated as the in-state non-payroll operational expenditures by the URC and the in-state expenditures of URC faculty, staff, and students, after accounting for substitution. This is spending that only occurs in the state because of the URC. See Table B-7 on page B-11.

We calculated the *indirect* economic impact of URC's expenditures by multiplying the direct expenditures by U.S. Department of Commerce's Regional Multipliers (RIMS II). See Table B-7 on page B-11.

HUMAN CAPITAL METHODOLOGY

Alumni Earnings Methodology

We used individual and aggregate alumni data provided by Michigan State, University of Michigan, and Wayne State to estimate alumni earnings. We excluded from our analysis recipients of honorary degrees and certificates. We also excluded alums whose residence in Michigan we could not confirm. We performed our analysis using 556,338 URC alums.

We estimated the 2006 earnings by URC alums in three steps:

1) Estimate Age Distribution. We divided the existing alums into seven age brackets using microdata supplied by the alumni offices of Wayne State and Michigan

State, and summary data provided by the alumni office of the University of Michigan.[49] There were tens of thousands of graduates for whom complete data was not available. In order to estimate their age distribution, we made the following assumptions:

- Data on age was not available for University of Michigan alums. We used the year of graduation to estimate the age distribution, assuming that all University of Michigan graduates with bachelor's degrees are 22 years old, and all graduates with advanced degrees are 25 years old.
- We were missing the age but had the year of graduation for 54,454 Wayne State University graduates known to live in Michigan. Similarly, we were missing the year, but had the year of graduation for 18,404 Michigan State University graduates known to live in Michigan. We estimated the age distribution of these alums by assuming that the age distribution for alums of any given graduation year (calculated using alums for whom we had both the age and graduation year) also applied to the missing-age-data alums. There were several years for which there were no alums for whom we knew the age; since each of these had a graduation year before 1940, we assumed each of these alums to be over the age of 75.
- There were 812 alums of Michigan State University (all graduates with bachelor's degrees) for whom we had neither age nor year of graduation. We conservatively assumed that these alums were between the ages of 21 and 24 in 2006. This is a conservative assumption when estimating the 2006 earnings of URC alums because workers age 21 to 24 have lower wages on average than do older workers.

2) Estimate Workforce Participation and Wage. We estimated the workforce participation rate and average wage of URC alums in each age bracket using data from the 2000 Decennial Census. This data provides separate, age-bracketed estimates for Michigan workers with bachelor's degrees and with advanced degrees. We used the following assumptions in conjunction with this data:

- We assumed that workforce participation for Michigan workers with bachelor's and advanced degrees was the same in 2006 as it was in 2000.
- The Census Bureau does not provide an estimate of wages or workforce participation for workers under the age of 21 years or over the age of 75 years. We assumed that alums under the age of 21 exhibit the same workforce participation and earnings as alums aged 21-24, and that workforce participation is zero for alums over the age of 75.
- We assumed that wages grew in Michigan at the rate of inflation between 2000 and 2006. We used the U.S. Bureau of Labor Statistics' Detroit-Ann Arbor-Flint Consumer Price Index (CPI), which grew by a total of 15.78% between 2000 and 2006.
- We assumed that alums that are not in the labor force have no personal income.
- We assumed that some URC alums earned a higher wage than the average wage for Michigan workers with bachelor's and advanced degrees for each age bracket. Specifically, we assumed that University of Michigan graduates earned 10% more than average, and that Michigan State University alums earned 5% more than average in 2006. This assumption is a professional estimate based on these universities' reputation for higher-than-average admissions standards within Michigan (improving their graduates' reputation among potential employers), and the fact that URC students'

49. The age brackets are 21-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, and 75 years and over.

choice to attend a URC university reveals that they believe it will improve their employment prospects more than their next-favorite school. Our assumption implies that the higher admissions standards of these schools translates to higher earning power throughout the graduates' careers.

3) Estimate Total Earnings. The final step consisted of multiplying the number of alums for each school in each age bracket by the estimated workforce participation rate and estimated wage, then summing the earnings across schools and ages as necessary to estimate total earnings.

Additional Lifetime Earnings of URC Alumni

To estimate the economic impact of the URC's contribution to human capital in Michigan, we used the following methodology:

1. We examined the number of students at the graduate and undergraduate level at URC universities, and the share of each originally from Michigan.
2. Using data on URC alumni and professional judgement, we estimated the share of out-of-state students from undergraduate and graduate programs who leave the state for work after graduating. This group of students is part of the "substitution effect" discussed above; they are graduates from URC universities who have no net impact because they would not have earnings in Michigan with or without the URC.
3. Using admissions office data on where else MSU freshmen applied to school, we estimated the proportion of undergraduates who, if MSU did not exist, would have gone to school outside Michigan. Not having access to similar data for advanced degree programs, we assumed that, if MSU did not exist, all out-of-state students in graduate programs would have gone to school outside Michigan. We further assumed all in-state advanced degree students would have either gone to another graduate school in Michigan, or else would have stopped school after completing a bachelor's degree. We used professional judgement to estimate the proportion who would have stopped school after completing their bachelor's degree. We modified these assumptions for the University of Michigan and Wayne State University based on our professional judgement.
4. Having estimated the proportion of in-state students who would have gone to school out of state if not for the URC universities, we used professional judgement to estimate the proportion who would return to Michigan to work despite having gone to school elsewhere. This is another "substitution effect," since people who would have earned the same degree and worked in Michigan with or without the URC universities carry no net economic impact from the schools.
5. Using data on URC alumni, we estimated the rate at which graduates from each URC university move out of the state (in aggregate, accounting for people moving in and out of the state) as they age, for both graduates with bachelor's and advanced degrees.
6. Using data from the 2000 census, we estimated the share of graduates participating in the workforce by age and education level. We used these estimates for earnings estimates in both the "real world" (where URC graduates live) and the counterfactual world (in which current URC graduates went to a different school or did not complete as many years of schooling).
7. We estimated the mortality rate by age group of people in our human capital model using federal data from the Centers for Disease Control's 2002 "National Vital Statistics Report."

8. Using data from the 2000 Census, we estimated the average earnings of full-time Michigan workers with a high school diploma, bachelor's, or advanced degree. We adjusted these annual salaries by the change in general price level in the Bureau of Labor Statistics' Detroit-Ann Arbor-Flint CPI series.
9. MSU graduates were divided into six groups based on their state of origin (Michigan or otherwise) and the state in which they would work after graduation. These six types of students are described below in "Sorting Graduates into Types" on page 5.
10. These data were then used in a simulation model. The simulation model takes base data and calculates the value of certain variables over time.[50] The key calculations can be summarized as follows:
    i. The graduates are sorted into their respective types and run through a simulation of their careers with and without attending MSU, based on assumptions about their wages, likelihood of moving out of Michigan, and their chance of dying in a given year.
    ii. The graduating class's lifetime earnings with and without attending MSU are then compared using constant 2006 dollars.

Sorting Graduates into Types

As described in the methodology above, our Human Capital Model relies on placing all MSU graduates in one of 6 categories that allows us to compare their lifetime earnings with their MSU education to their likely lifetime earnings without their MSU education.

Graduates Earning Lower Wages without the URC.

- Type 1: In-state students who otherwise would have gone to an another college or university in Michigan. If not for the URC universities, these graduates would earn the average wage for a person of their age and the same level of education. These college- and graduate-school-bound students chose their school because it fit their educational needs and goals better than other schools. Without it, they would attain the same level of education, but would earn slightly less throughout their careers.
- Type 2: In-state URC students who otherwise would not have completed the degree they are currently seeking (i.e. a bachelor's degree for undergraduates, an advanced degree for graduate students). If not for their URC university, these graduates would earn the average wage for a person of their age with one level less education: a high school graduate's wage for undergraduates, and a bachelor's degree wage for graduate students.

Graduates Earning Identical Wages Without the URC.

- Type 3: In-state URC students who otherwise would have gone to an out-of-state college similar to a URC university, and returned to Michigan to work,

50. The simulation model was implemented in Matlab and Simulink, which are mathematical simulation software. The use of simulation models for this type of analysis is described in Patrick L. Anderson, *Business Economics and Finance,* CRC Press, 2004.

earning the same wage in either case. The school therefore has no impact on their lifetime wages earned in Michigan.

- Type 4: Out-of-state URC students who will work outside Michigan when they graduate whether or not they would attend another Michigan college if the URC universities did not exist. The URC universities therefore has no impact on their lifetime wages earned in Michigan.

Graduates Earning No Wages in Michigan Without the URC.

- Type 5: In-state URC students who otherwise would have gone to a college outside Michigan and would have stayed outside of Michigan to work as a result. Without the URC universities, these graduates would have earned no wages in Michigan.
- Type 6: Out-of-state URC students who will work in Michigan when they graduate, but would not work in Michigan if they did not attend a URC university. If not for the URC universities, these students would earn no lifetime wages in Michigan.

Table B-2 below shows the parameters used in our human capital simulation model that affect the URC graduates' path.

TABLE B-2. Parameters Used in Sorting Graduates

	MSU		U-M		WSU	
Description	**Bachelor's Degrees**	**Advanced Degrees**	**Bachelor's Degrees**	**Advanced Degrees**	**Bachelor's Degrees**	**Advanced Degrees**
Number of graduates per year[a]	7,783	2,876	7,500	3,500	3,000	1,800
Proportion of graduates from out of state[b]	9.7%	47.2%	28%	45%	6%	19%
Proportion of graduates from out of state who leave MI to work[c]	75%	85%	75%	90%	75%	75%
Proportion of graduates who otherwise would not have attended college or would not have attained an advanced degree[d]	2%	10%	4%	2%	6%	5%
Proportion of graduates who otherwise would not have gone to school in MI[e]	8%	47%	26%	4%	4%	18%
Of graduates from Michigan who, if not for the URC, would have gone to school out of state, the proportion who would return to work in MI[f]	50%	50%	50%	50%	50%	50%

a. Data Sources: *MSU 2006 Data Digest*, AEG estimates based on data provided by Offices of Alumni Relations at U-M and WSU.

b. Source: URC universities

c. Base Data: MSU Office of Alumni Relations

d. Source: AEG estimate

e. Base Data: 2004 Survey of Incoming Freshman, MSU Admissions Office. U-M and WSU estimated by AEG relative to MSU data.

f. AEG estimate.

Human Capital Model Parameters

This section contains tables of parameters used in our Human Capital Model.

TABLE B-3. Proportion of URC Alumni Leaving the State Annually

	MSU		U-M		WSU	
Age Range	Bachelor's Degrees	Advanced Degrees	Bachelor's Degrees	Advanced Degrees	Bachelor's Degrees	Advanced Degrees
21-24	1.1%	11.2%	4.9%	4.9%	1.7%	5.3%
25-34	2.6%	2.8%	1.4%	1.0%	0.5%	0.0%
35-44	0.9%	0.1%	0.9%	0.8%	0.1%	0.0%
45-54	0.4%	0.3%	1.5%	0.9%	0.6%	0.0%
55-64	0.9%	1.0%	3.0%	0.0%	1.0%	1.3%
65-74	0.9%	0.5%	0.0%	0.0%	0.6%	0.2%

Source: Calculations by AEG, based on base data from MSU, U-M, and WSU Offices of Alumni Relations

TABLE B-4. Workforce Participation Rate of Michigan Workers

Age Range	High School Diploma	Bachelor's Degrees	Advanced Degrees
21-24	73.4%	80.7%	70.4%
25-34	73.8%	85.7%	87.8%
35-44	76.5%	85.5%	90.1%
45-54	71.8%	87.6%	91.6%
55-64	47.7%	64.7%	72.6%
65-74	14.2%	23.0%	30.0%

Data Source: U.S. Census Bureau, 2000 Decennial Census

TABLE B-5. U.S. Mortality Rate, All Races, 2002

Age Range	Annual Mortality Rate
21-24	0.1%
25-34	0.1%
35-44	0.2%
45-54	0.4%
55-64	1.0%
65-74	2.3%

Data Source: Centers for Disease Control, "National Vital Statistics Report - Deaths: Leading Causes for 2002"

TABLE B-6. Average Annual Wage of Michigan Workers, 2005

Age Range	High School Diploma	Bachelors Degree	Advanced Degree
21-24	$25,874	$31,382	$29,646
25-34	$34,940	$45,007	$52,979
35-44	$42,215	$57,875	$69,749
45-54	$46,912	$58,285	$69,364
55-64	$46,643	$60,295	$70,569
65-74	$36,352	$54,635	$74,339

Note: Wages adjusted to 2005 dollars using Detroit-Ann Arbor-Flint CPI (annual CPI, not seasonally adjusted)

Data Sources:U.S Census Bureau, 2000 Decennial Census; Bureau of Labor Statistics
Analysis: Anderson Economic Group, LLC

Alumni Earnings in 2006 Caused by URC

While our simulation results show the additional lifetime earnings of the URC's class of 2006 graduates (i.e. the results for a single graduating class in all future-years), we also estimated the additional 2006 earnings of the existing stock of URC alumni (i.e. a single year's results for all past graduating classes). We estimate the additional 2006 earnings using data on URC alumni, using outputs from our human capital model simulation (regarding sorting graduates, as detailed in "Sorting Graduates into Types" on page 5 of this appendix), and using other data, such as wage and workforce participation data, which were part of our human capital simulation model.

We followed the following methodology:

1. Estimate the current earnings of Michigan-based URC alumni as detailed in "Alumni Earnings Methodology" on page 2 of this appendix.
2. Estimate the proportion of URC alumni in each counterfactual group (types 1 through 6, as detailed in "Sorting Graduates into Types" on page 5 of this appendix) by assuming that all past years' graduating classes exhibited the same behavior as our estimates for the current year's graduating class.
3. Use census and workforce participation data (identical to the human capital simulation model inputs detailed above) to calculate each counterfactual category's total earnings.
4. Subtract the current earnings from the counterfactual earnings to find the *additional* earnings of current URC alumni due to the URC.

URC MEDICAL RESIDENTS IN FALL 2005

To calculate the number of residents from a URC allopathic medical school in a GME program in Michigan in the fall of 2005, we used the following methodology:

1. We obtained information on the residency placements for each URC university's graduates between 2000 and 2005.
2. We assigned number of years to complete residency program based on the Accreditation Council for Graduate Medical Education's requirements.
3. We treated all students as having fulfilled their residency requirements. To simplify our calculations, we did not have students drop out or switch to another residency program.
4. If a student was listed as completing two programs in different states, and it was not clear which program came first, we treated the Michigan program as chronologically first.

BIG TEN FOOTBALL ECONOMIC IMPACT ASSESSMENT

AEG has completed a number of other economic impact assessments associated with sporting events, including the 2006 Super Bowl, the 2004 and 2006 Ryder Cups, and 2006 Detroit Tigers' baseball games. The basis for our methodology is stated in the book *Business Economics and Finance* written by Patrick Anderson, principal and CEO for Anderson Economic Group.[51]

Unfortunately, many "economic impact" reports do not follow a consistent methodology or a conservative approach, and are done largely for public relations purposes. Our analysis uses a consistent, conservative methodology that avoids double-counting of costs or benefits, properly considers the shifting and substitution of economic activity, and does not unnecessarily inflate the impact by using excessive multipliers.

The assumptions used in our estimate of the economic impact associated with out-of-state visitors for Big Ten Football games in Michigan are:

1. 15% of attendees at each University of Michigan home game against an out-of-state opponent have come from outside Michigan, and 7% of attendees at each game against an in-state opponent have come from outside Michigan.[52]
2. 12% of attendees at each Michigan State University home game against an out-of-state opponent have come from outside Michigan, and 7% of attendees at each game against an in-state opponent have come from outside Michigan.[53]
3. Each out-of-state attendee stays in the state for 1.5 days, on average.
4. Each visitor spends, on average, $205 per day during their visit for food, shopping, gasoline, lodging, and all other local expenditures.[54] This figure assumes that 70% of visitors pay for their lodging with an average of 1.5 people per hotel room. The

51. Patrick L. Anderson, *Business Economics and Finance,* CRC Press, 2004.

52. Based on information provided by the University of Michigan.

53. Based on information provided by Michigan State University.

54. A 2000 study from the Michigan State University Department of Park Recreation & Tourism Resources pegged average daily expenditures of visitors in Greater Lansing at $197 per day, and a 2002 study from the same group pegged average daily expenditures of visitors in Washtenaw County, Michigan (Ann Arbor) at $214 per day.

other 30% of visitors are assumed not to incur lodging costs as they will stay with friends or relatives.

5. The average price for a non-student ticket at a Michigan or Michigan State football game in 2006 was $45.[55]
6. Every dollar of direct expenditure has a multiplier effect of 1.6, which is to say that dollar of expenditure from out-of-state visitors creates an additional economic impact of $0.60 in the state.[56]

Finally, note that this analysis only estimates the economic impact associated with expenditures by fans coming into Michigan from another state. There is also likely to be some economic impact generated from expenditures made by game attendees coming from within the state, but we have not quantified that amount here.

55. Based on a weighted average of ticket prices for Michigan State University and University of Michigan non-student tickets.

56. This is consistent with the multiplier effect used in our past economic impact studies of sporting events, including the 2006 Super Bowl, the 2006 Ryder Cups, and the 2006 World Series. See:

Economic Impacts from 2006 Detroit Tigers' Game Attendance, Anderson Economic Group, September 2006.

Likely Economic Impact to Ireland from the 2006 Ryder Cup, Anderson Economic Group and Amarach Consulting, September 2006.

Likely Economic Impact of Super Bowl XL, Anderson Economic Group, February 2006.

Table B-7. Net Economic Impact of URC's Operations

FY 2006 (July 1, 2005 - June 30, 2006)

Direct Expenditures In-State, After Likely Substitution

				Impact in State of Michigan
A.	Instruction of In-State Students (Non-payroll)		$ 956,687,831	
	less: expenditures out of state	*40%*	$ (382,675,133)	
	Subtotal: Expenditures in state		$ 574,012,699	
	less: substitution of higher expenditures by other MI colleges & univ.	*10%*	$ (57,401,270)	
				$ 516,611,429
B.	Instruction of Out-of-State Students (Non-payroll)		$ 452,782,752	
	less: expenditures out of state	*40%*	$ (181,113,101)	
	Subtotal: Expenditures in state		$ 271,669,651	
	less: substitution of out-of-state students to other MI colleges & univ.	*0%*	$ -	
				$ 271,669,651
C.	Research Expenditures (Non-payroll)		$ 323,588,222	
	less: expenditures out of state	*50%*	$ (161,794,111)	
	Subtotal: Expenditures in state		$ 161,794,111	
	less: substitution of more research dollars coming into other MI colleges & univ.	*2%*	$ (3,235,882)	
				$ 158,558,229
D.	Student Living Expenses (excludes tuition and fee expenditures)		$ 1,359,370,263	
	less: expenditures out of state	*5%*	$ (67,968,513)	
	Subtotal: Expenditures in state		$ 1,291,401,750	
	less: likely substitution of students to other colleges in MI	*6%*	$ (77,484,105)	
				$ 1,213,917,645
E.	URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital)		$ 2,522,242,647	
	less: expenditures out of state, savings	*20%*	$ (504,448,529)	
	Subtotal: Expenditures in state		$ 2,017,794,118	
	less: likely substitution to jobs with other universities in Michigan	*30%*	$ (605,338,235)	
				$ 1,412,455,882
F.	Hospital Expenditures (Non-payroll)		$ 669,890,000	
	less: expenditures out of state	*20%*	$ (133,978,000)	
	Subtotal: Expenditures in state		$ 535,912,000	
	less: likely substitution of higher spending by other MI hospitals	*30%*	$ (160,773,600)	
				$ 375,138,400
G.	Hospital Employee Earnings & Fringe Benefits, After Taxes		$ 1,016,757,230	
	less: expenditures out of state, savings	*20%*	$ (203,351,446)	
	Subtotal: Expenditures in state		$ 813,405,784	
	less: likely substitution to jobs with other health care systems in Michigan	*14%*	$ (113,876,810)	
				$ 699,528,974
	Total Direct Expenditures (in state, after substitution)			**$ 4,647,880,210**

Data Sources: National Center for Education Statistics, IPEDS Finance; URC Universities; 2005 Consumer Expenditure Survey

Indirect Expenditures In-State, After Likely Substitution

A.	Instruction of In-State Students (Non-payroll)	*2.1822*	$ 610,738,031
B.	Instruction of Out-of-State Students (Non-payroll)	*2.1822*	$ 321,167,861
C.	Research Expenditures (Non-payroll)	*2.1822*	$ 187,447,538
D.	Student Living Expenses (excludes tuition and fee expenditures)	*1.3047*	$ 369,880,706
E.	URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital)	*1.6781*	$ 957,786,334
F.	Hospital Expenditures (Non-payroll)	*2.1968*	$ 448,965,637
G.	Hospital Employee Earnings & Fringe Benefits, After Taxes	*1.7672*	$ 536,678,629
	Total Indirect Expenditures (in state, after substitution)		**$ 3,432,664,737**

Table B-7. Economic Impact of URC's Operations (continued)

				Impact in State of Michigan
Total Direct & Indirect Expenditures In-State, After Likely Substitution				
A.	Instruction of In-State Students (Non-payroll)			$ 1,127,349,460
B.	Instruction of Out-of-State Students (Non-payroll)			$ 592,837,512
C.	Research Expenditures (Non-payroll)			$ 346,005,767
D.	Student Living Expenses (excludes tuition and fee expenditures)			$ 1,583,798,351
E.	URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital)			$ 2,370,242,216
F.	Hospital Expenditures (Non-payroll)			$ 824,104,037
G.	Hospital Employee Earnings & Fringe Benefits, After Taxes			$ 1,236,207,603
	TOTAL NET ECONOMIC IMPACT OF UNIVERSITY OPERATIONS			**$ 8,080,544,948**
Jobs Impact on the State, After Likely Substitution				
A.	Number of FTE Faculty, Excluding Hospital		8,606	
	less likely substitution to other jobs in Michigan	*12%*	(1,033)	
	Subtotal: New faculty jobs in Michigan		7,573	
	** Indirect Employment Multiplier*	*2.20*	9,087	
	Total Faculty in Michigan Caused by URC Operations			16,660
B.	Number of FTE Faculty, Hospital		1,404	
	less likely substitution to other jobs in Michigan	*8%*	(112)	
	Subtotal: New faculty jobs in Michigan		1,291	
	** Indirect Employment Multiplier*	*1.93*	1,206	
	Total Faculty in Michigan Caused by URC Operations			2,498
C.	Number of FTE Staff, Excluding Hospital		19,183	
	less likely substitution to other jobs in Michigan	*40%*	(7,673)	
	Subtotal: New staff jobs in Michigan		11,510	
	** Indirect Employment Multiplier*	*2.00*	11,510	
	Total Staff in Michigan Caused by URC Operations			23,019
D.	Number of FTE Staff in Hospital		17,207	
	less likely substitution to other jobs in Michigan	*20%*	(3,441)	
	Subtotal: New staff jobs in Michigan		13,765	
	** Indirect Employment Multiplier*	*1.93*	12,861	
	Total Staff in Michigan Caused by URC Operations			26,626
	Total Direct & Indirect Jobs Caused by URC			**68,803**

Table B-8: Net Economic Impact of Out-of-State Visitor Attendance at Big Ten Football Games

Out-of-State Visitors to Area				
U-M Average Home Attendence	110,026			
Home Games v. Out-of-State Opponent	5			
Share of attendees from out of state	15%			
Home Games v. In-State Opponent	2			
Share of attendees from out of state	7%			
Subtotal: U-M Out-of-State Attendence		97,923		
MSU Average Home Attendence	70,819			
Home Games v. Out-of-State Opponent	6			
Share of attendees from out of state	12%			
Home Games v. In-State Opponent	1			
Share of attendees from out of state	7%			
Subtotal: MSU Out-of-State Attendence		55,947		
Average length of stay (days and nights)		1.5		
Total Visitor Days				230,805
Visitor expenditures per day				
Food and drink			$	55
Shopping and other spending in area			$	30
Gasoline, parking, other auto in-area			$	45
Lodging, average price per night		$ 160.00		
Share paying for accommodations		70%		
Average room occupancy		1.5		
Average lodging expense			$	75
Total visitor expenditures per day			$	205
Total direct expenditures by visitors			$	47,238,136
Ticket Revenues				
Average Ticket Price		$ 45		
Total ticket revenues in area			$	10,386,235
Total Direct Economic Impact			$	57,624,371
Indirect Economic Impact			$	34,574,623
Multiplier		0.6		
Total Direct and Indirect Economic Impact			**$**	**92,198,994**

Appendix C: About the Authors

CAROLINE M. SALLEE

Ms. Sallee is a consultant at Anderson Economic Group, working in the Public Policy, Fiscal, and Economic Analysis practice area. Ms. Sallee's background is in applied economics and public finance.

Ms. Sallee's recent work includes economic and fiscal impact studies for Michigan State University, and the benchmarking of Michigan's business taxes with other states in a project for the Michigan House of Representatives. She has also completed several technology industry reviews, estimating the wages and employment of technology workers in Southeast Michigan and West Virginia.

Prior to joining Anderson Economic Group, Ms. Sallee worked for the U.S. Government Accountability Office (GAO) as a member of the Education, Workforce and Income Security team. She also has worked as a market analyst for Hábitus, a market research firm in Quito, Ecuador and as a legislative assistant for two U.S. Representatives.

Ms. Sallee holds a master's degree in public policy from the Gerald R. Ford School of Public Policy at the University of Michigan and a Bachelor of Arts degree in economics and history from Augustana College.

PATRICK L. ANDERSON

Mr. Anderson, principal and CEO, founded the consulting firm of Anderson Economic Group in 1996. Since founding the firm, he has successfully directed projects for state governments, cities, counties, nonprofit organizations, and corporations in over half of the United States.

Prior to founding Anderson Economic Group, Mr. Anderson served as the chief of staff of the Michigan Department of State and as a deputy director of the Michigan Department of Management and Budget, where he was involved in the largest state privatization project in U.S. history and the landmark 1994 school finance reform constitutional amendment. Prior to his involvement in state government, Mr. Anderson was an assistant vice president of Alexander Hamilton Life Insurance, an economist for Manufacturers National Bank of Detroit, and a graduate fellow with the Central Intelligence Agency.

Mr. Anderson has written over 100 articles published in periodicals such as *The Wall Street Journal, The Detroit News, The Detroit Free Press, Crain's Detroit Business*. His book *Business Economics and Finance* was published by CRC Press in August 2004, and his paper on "Pocketbook Issues and the Presidency" was awarded the Edmund Mennis Award for best contributed paper in 2004 by the National Association for Business Economics. He is a graduate of the University of Michigan, where he earned a master's degree in public policy and a bachelor's degree in political science.

CONTRIBUTORS

Alex L. Rosaen. Mr. Rosaen is a senior analyst at Anderson Economic Group, working in the Public Policy and Economics practice area. Mr. Rosaen's background is in applied economics and public finance.

Prior to joining Anderson Economic Group, Mr. Rosaen worked for the Office of Retirement Services (part of the Michigan Department of Management and Budget) for the Benefit Plan Design group. He also has worked as a mechanical engineer for Williams International in Walled Lake, MI.

Mr. Rosaen holds a master's in public policy from the Gerald R. Ford School of Public Policy at the University of Michigan. He also has a Master of Science degree and a Bachelor of Science degree in mechanical engineering from the University of Michigan.

Darci R. Keyes. Ms. Keyes is a senior consultant at Anderson Economic Group, with expertise in Finance and Law. She works primarily in the Finance and Business Valuation, and Public Policy, Fiscal and Economic Analysis areas.

Prior to joining Anderson Economic Group, Ms. Keyes worked as a financial analyst for Ford Motor Company where she held positions in manufacturing, internal audit, marketing and sales, accounting policy and transactional accounting. Prior to joining Ford, Ms. Keyes worked as an attorney in Pittsburgh, Pennsylvania, where she served as a consultant in such areas as tax reporting and planning, estate planning and administration, real property acquisitions and dispositions, and other general business law.

Ms. Keyes holds an M.B.A from the Katz School of Business at the University of Pittsburgh; a Juris Doctorate, with a concentration in taxation and real property, from the State University of New York at Buffalo; and a B.A. in French and business from Nazareth College in Rochester, New York. Ms. Keyes is a licensed attorney in the states of Pennsylvania, New York, and Michigan. She is also a Certified Internal Auditor.

Naomi Joseph. Ms. Joseph is a research associate at Anderson Economic Group working in the Public Policy, Economic and Fiscal Analysis practice area. She is a senior at James Madison College, Michigan State University, working toward a dual major in International Relations and English. She also works as a consultant for the James Madison College Writing Consultancy. Her academic interests include economic development and the relationship between business and government both in the United States and abroad.

Scott D. Watkins. Mr. Watkins is a consultant and the director of marketing and administration at Anderson Economic Group. His consulting work involves economic and policy analyses, and as AEG's director of marketing and administration he oversees the firm's administrative staff and procedures and implements marketing strategies.

Among the clients for whom he has worked are the Michigan Manufacturers Association, Michigan State University, Wayne State University, Michigan Chamber of Commerce, Michigan Retailers Association, Collier County, Florida; and the West Virginia High Technology Consortium Foundation. Recent reports by Mr. Watkins include: "Economic Impacts from 2006 Detroit Tigers' Game Attendance," "Automation Alley's Second Annual Technology Industry Report: Driving Southeast Michigan Forward," and "Benchmarking for Success: Education Performance among the American States." He also has provided testimony to the Michigan House of Representatives on matters of education finance, and is the editor of the *State Economic Handbook 2008*, which will be published by Palgrave MacMillan in the fall of 2007.

Mr. Watkins holds an M.B.A. from the Eli Broad College of Business at Michigan State University. He also has a B.A. in marketing from Eli Broad College of Business and a B.A. in international relations from the James Madison College, both at Michigan State University.

Tyler Marie Theile. Ms. Theile is an office assistant with Anderson Economic Group. She performs office management tasks, including accounts payable, inventory and quality control. She also is responsible for assisting with economic and policy research, collecting and analyzing data, and contributing written analysis for reports and publications.

Prior to joining AEG, Ms.Theile worked in the Office of the Attorney General. Prior to that, she worked in finance and fundraising for the Michigan Republican Party and the DeVos for Governor Campaign, respectively.

Ms. Theile is a graduate of Michigan State University, James Madison College, where she received a B.A. in international relations with a specialization in political economy.