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ANDERSON ECONOMIC GROUP

# *Empowering Michigan*

## Sixth Annual Economic Impact Report of Michigan's University Research Corridor

Commissioned by Michigan's University Research Corridor

Michigan State University
University of Michigan
Wayne State University

*Prepared by:*
*Erin A. Grover, Senior Analyst*
*Colby W. Spencer, Senior Analyst*
*Alex L. Rosaen, Director*

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

www.AndersonEconomicGroup.com

# *Executive Summary*

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. Since 2007, the URC has commissioned Anderson Economic Group to provide an annual report that estimates the economic impact of the URC's activities on Michigan's economy and compares its performance to peer universities nationwide. In these reports we present data on the URC's contributions to jobs and income for residents, its impact on state tax revenue, the number of degrees it awards to students, its research and development (R&D) expenditures, and its activities transferring knowledge and technology to the private sector. Over time these measurements will reveal trends in how the URC impacts Michigan, and how this impact compares to peer universities in other states.

## KEY BENCHMARKS

This report presents benchmarks using the most recent data available. We used fiscal year 2011 (July 1, 2010 to June 30, 2011) financial data to estimate the economic impact of the URC's operations on Michigan's economy in 2011. The rankings of technology transfer activities are based on the average of the annual data for the previous five years from the date of the report. For example, the ranking for start-up companies is based on the average number of companies the URC helped start each year between 2007-2011. A ranking of "1" indicates the university cluster with the highest tech transfer activity for that indicator.

The URC's economic impact in Michigan was $12.9 billion in 2007. In five years, the URC's economic impact has grown by $2.6 billion. See Table 1 below.

**TABLE 1. Key Benchmarks of the URC**

| | 2007 Benchmark Report (2006 data) | 2012 Report (2011 Data) | Change Since Benchmark Year of 2007 |
|---|---|---|---|
| Operational Expenditures | $6.5 billion | $7.9 billion | + $1.4 billion |
| Fall Enrollment (Degree-Seeking Only) | 131,635 | 137,673 | + 6,038 students |
| Net Economic Impact | $12.9 billion | $15.5 billion | + $2.6 billion |
| Tax Revenue Impact on State of Michigan | $351 million | $375 million | + $24 million |
| Total R&D Expenditures | $1.369 billion | $2.0 billion | + $631 million |
| Rank of Technology Transfer Activities[a] | | | |
| No. of Start-up Companies Cultivated[b] | 5 | 5 | +0 Improvement |
| U.S. Patent Grants Awarded[c] | 4 | 4 | +0 Improvement |
| Technology Licenses Issued | 5 | 5 | +0 Improvement |

*Source: Bureau of Economic Analysis, Census Bureau, National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS), URC Universities, and the National Science Foundation (NSF).*
*Analysis: Anderson Economic Group, LLC; See remainder of report body for detailed sources and calculations.*

a. Rankings are out of seven clusters and based on the average annual activity five years prior. The 2007 report uses 2002-2006 data, and the 2011 report uses 2007-2011 data.

b. In 2011, the URC and Illinois cluster had the same average number of startups over the past five years, with a tying rank of fifth.

c. The benchmark year (2007 report) ranking reflects revised patent grant data.

## SCALE OF THE URC

The URC universities are the largest public universities in Michigan. We summarize the size of the URC in 2011, including number of students, employees, alumni, and amount of operational expenditures in Table 2 below.

**TABLE 2. Scale of the URC in FY 2011**

| Category | Impact |
|---|---|
| Number of Enrolled Students (degree seeking) | 137,673 |
| Number of Full-Time-Equivalent Employees | 52,215 |
| Operational Expenditures (e.g. supplies, payroll, equipment) | $7.9 billion |
| Known URC Alumni Living in Michigan | 589,240 |
| Wage and Salary Earnings of URC Alumni in Michigan | $29.2 billion |

*Data Sources: IPEDS Finance FY 2011; URC Universities*
*Analysis: Anderson Economic Group, LLC*

The URC universities had 137,673 students enrolled in the fall of 2011. URC students made up 23% of full-time students attending a higher education institution (including community colleges, for-profit institutions, and traditional two- and four-year colleges and universities) in Michigan last year.[1] These students were drawn to the URC from throughout Michigan and around the world. More than a quarter of these students came from locations outside Michigan. The URC has students from every county in Michigan, every state, and more than 100 countries. See "URC Students" on page 3.

The URC universities collectively spent $7.9 billion on operations in FY 2011. Expenditures were made for the salaries of 52,215 full-time-equivalent staff and faculty, supplies, equipment, and maintaining buildings. The $7.9 billion in expenditures is about 2.1% of all economic activity in the state, as measured by Michigan's gross state product. See "URC Expenditures in FY 2011" on page 17.

As of summer 2011, there were 589,240 known URC alums living in Michigan, making up 7.8% of Michigan's population over the age of 18 years.[2] These alums earned an estimated $29.2 billion in salary and wages in 2011, or 15.9% of all wage and salary income in Michigan. See "Alumni Expenditures" on page 22.

## ECONOMIC IMPACT

We define *net economic impact* as new economic activity that occurs in a defined geographic region directly or indirectly caused by the URC. We present two geographies of economic impact in "Components of Economic Impact" on page 21; the State of Michigan, as well as ten economic regions in Michigan, as defined by the Michigan Economic Development Corporation (MEDC).[3] Our regional impact allocates the net economic impact on the state into regions based on where in Michigan the URC and its students spend their money, and where URC staff, faculty, and

1. According to IPEDS, 532,205 full-time students were enrolled at a public or private higher education institution in Michigan last year. We used full-time enrollment, which is slightly different than head count reported elsewhere for the URC universities, to calculate this share.
2. According to the U.S. Census Bureau, Michigan had 7,590,636 residents over the age of 18 years on July 1, 2011.

alumni reside in the state. See Map 5, "Net Economic Impact of URC Universities' Operations and Employment Created by Region, FY 2011," on page 20.

In estimating 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 that 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 the state even if the URC institutions left Michigan. We describe our methodology for the total economic impact in "Estimating Net Economic Impact" on page A-1.

In FY 2011, the URC's operations contributed $15.5 billion to the Michigan economy. This was due to (1) expenditures by the URC universities on non-payroll items (such as supplies and equipment) for instruction and research, and (2) incremental earnings by employees, students, and alumni. The total impact includes both direct and indirect impacts. See Table 3 below.

**TABLE 3. Net Economic Impact of URC in Michigan, FY 2011 (in billions)**

| Impact Category | Net Economic Impact |
|---|---|
| Non-payroll Operating Expenditures | $3.4 |
| Faculty & Staff Wages and Benefits | $4.6 |
| URC Student Expenditures | $2.3 |
| Incremental Alumni Earnings[a] | $5.2 |
| **TOTAL NET ECONOMIC IMPACT** | **$15.5** |

*Source: Anderson Economic Group, LLC*

a. We estimate that URC alumni in Michigan earned $28.6 billion in wage and salary earnings last year. Of this, we only count $4.35 billion as incremental earnings directly caused by the URC. Once we account for taxes, savings, and indirectly-generated activity, we estimate a total economic impact of $5.2 billion ($3.1 direct and $2.1 indirect). See "Alumni Expenditures" on page 22.

In addition to new earnings, 74,301 jobs in Michigan were directly and indirectly supported by the URC's operations in the state in FY 2011. This jobs figure includes 11,406 faculty members and 40,810 staff directly employed by the URC universities. It also includes indirectly-generated jobs in other industries in the state due to the expenditures by the URC universities and their faculty, staff, and students. Our complete analysis is in "Jobs Impact of URC Operations" on page 19.

3. In March of 2011, Governor Snyder emphasized in his special message the importance of communities working together to promote the advantages of their regions. He asked the MEDC to develop strategies to engage in regional collaboration among economic and community development organizations. Together with local economic development partners, the MEDC defined ten geographies to align economic development efforts. See Map , "We present two geographies of economic impact in this section; the State of Michigan, as well as ten economic regions in Michigan, as defined by the Michigan Economic Development Corporation (MEDC). These regions and their estimated economic impact are shown in Map 5 on page 20.

We show the URC's economic impact by region below in Table 4. It is not surprising that the regions in which the universities are located are impacted the greatest in terms of economic activity and jobs created by the URC. As shown below, the economic impact and jobs caused by the URC in each region total to those in the State of Michigan.

**TABLE 4. Net Economic Impact of URC Operations and Employment Created by Region, FY 2011**

| Economic Development Collaboratives | Net Economic Impact of University Operations (in millions) | Total Direct and Indirect Jobs Caused by URC |
|---|---|---|
| Upper Peninsula Region | $ 63.5 | 60 |
| Northwest Region | $ 169.8 | 85 |
| Northeast Region | $ 55.2 | 45 |
| West Central Region | $ 638.6 | 586 |
| Bay Region | $ 215.3 | 249 |
| Southwest Region | $ 239.3 | 264 |
| Central Region (MSU) | $ 3,234.6 | 12,494 |
| East Central Region | $ 631.9 | 2,238 |
| South Central Region (U of M) | $ 4,622.1 | 40,862 |
| Southeast Region (WSU) | $ 5,636.1 | 17,421 |
| State of Michigan | $ 15,506.3 | 74,301 |

*Note: Rounded numbers for each region do not add precisely to state totals.*

*Source: Anderson Economic Group, LLC*

## NEW STATE TAX REVENUE DUE TO URC

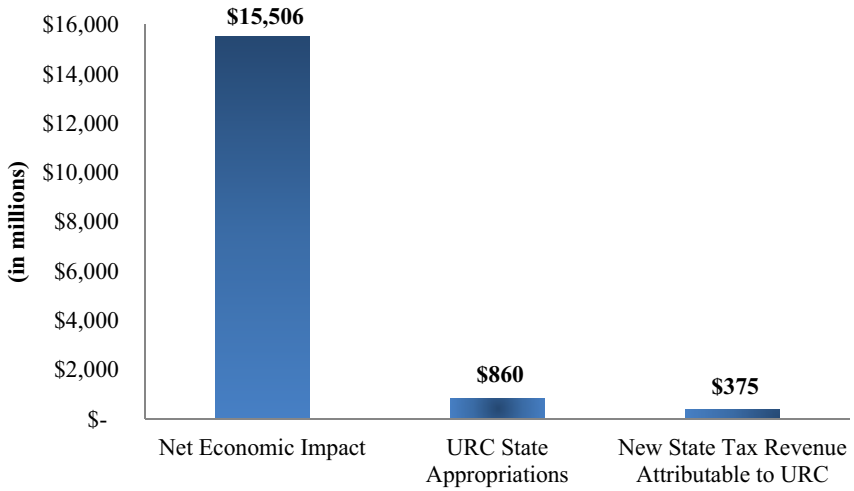
In 2011, we estimate that $2.73 billion in wages of URC employees and over $4.37 billion of URC alumni earnings in Michigan were caused by the URC. We attribute this share of alumni earnings to the URC since these universities helped graduates earn more than they would have otherwise. We estimate that the tax revenue the state received in 2011 because of these additional earnings was $375 million. This includes 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 25.

**Comparison of Economic Impact with State Appropriations.** Of course the main goal of these universities is not generating economic impact and tax revenue for the state. However, since the state government provides funding for these universities, we compare the net economic benefit these universities provide to the "cost" to the state government in Figure 1 on page v.

The $15.5 billion in net economic impact is over 17 times greater than the state's funding for URC universities. Additionally, the State of Michigan receives $375

million in tax revenue from URC employees and alumni that it would otherwise not have received if the URC universities were not located in Michigan.

**FIGURE 1. URC Net Economic Impact vs. State Appropriations, FY 2011**




*Sources: AEG Estimates; House Fiscal Agency, Senate Fiscal Agency*
*Analysis: Anderson Economic Group, LLC*

## DEGREES AWARDED

One direct measure of the URC's contributions to the state is the number of degrees granted by its institutions. Last year the URC granted 31,683 degrees, up nearly 1.5% from last year. The 2011 figure includes 19,268 undergraduate degrees, a slight decrease from 2010. The number of graduate degrees rose by roughly 3.9% from last year, going from 11,952 graduate degrees to 12,415. See "Total URC Degrees Granted" on page 5.

**High-Tech Degrees.** Michigan has a vibrant high-tech industry, and the URC universities graduate a large number of students with degrees that prepare them for jobs in these industries. We acknowledge that many people with degrees in other fields work in high-tech industries, but define "high-tech" as those in biological and biomedical sciences, physical sciences, computer sciences, architecture, engineering, mathematics and statistics, and some agricultural sciences.

This past year the URC's total high-tech degrees awarded increased from 9,257 degrees awarded in 2010 to almost 9,307 total degrees in high-tech fields in 2011, a 0.54% increase. The number of graduate degrees in these fields has historically risen more steadily than undergraduate degrees. Between 2010 and 2011 the number of high-tech graduate degrees awarded increased by 5% from 3,135 graduates to 3,286.

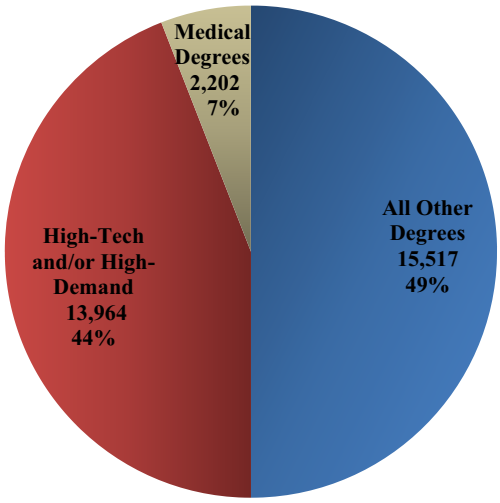
**Degrees in High-Demand Fields.** The three fields of study with the highest demand among employers are Business, Computer Science, and Engineering, according to a survey done by the National Association of Colleges and Employers.[4] In 2011, the

URC awarded 8,937 degrees in these "high demand" fields or 28% of all degrees awarded.

**Degrees in Medical Fields.** Michigan's URC is home to four medical schools, a school of dentistry, and a college of veterinary medicine. In 2011, the URC granted 841 degrees from its medical schools, 160 degrees from U-M's School of Dentistry, and 121 degrees by MSU's College of  College of Veterinary Medicine.

We show the number of students earning a high-tech, high demand or medical degree in Figure 2 below.[5] Note that there is some overlap in fields that count as high demand and high-tech. Since 2006, the number of URC degrees awarded has increased across the board, including degrees awarded in these areas. However, the share of degrees in these fields has remained roughly constant at approximately 44% of all URC degrees.

**FIGURE 2. High-Tech, High Demand and Medical Degrees Awarded by URC**




*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

## R&D EXPENDITURES

In 2011, the URC spent over $2 billion on research and development. This is a 6.7% increase from last year when the universities spent almost $1.9 billion. In the last five years (2007 to 2011), the URC increased their R&D spending by 43%. This is the largest growth in spending of any of its peer clusters during that time. The next

4. The National Association of Colleges and Employers' *Job Outlook 2011 Report* surveyed approximately 200 employers from a variety of sectors. We describe the degree categories in "Net Economic Impact of URC's Operations" on page A-4.
5. We include degrees in nursing and dental hygienist in our category of medical degrees. For further description of IPEDS categories included see "Summary of Degrees in High-Tech, High Demand, and Medical Fields" on page A-15.

closest clusters in terms of growth were North Carolina (36%) and Pennsylvania (38%). Over half (60%) of this research was funded by the federal government. The URC institutions themselves funded 38% of total R&D spending in 2011, with state and local governments, non profits, and business partners funding the remainder.

From 2010 to 2011, the URC's R&D expenditures increased among almost all subject areas (or fields), with the largest nominal increase occurring in life sciences ($72 million). Life sciences continues to account for the majority of R&D expenditures ($1.18 billion) at the URC universities. The field with the largest percentage increase was math and computer sciences, with an increase in R&D funds of 16%, to a total of $36 million in 2011. R&D spending in non-science and non-engineering fields was substantial, as well, at $105 million in 2011. See "Research Benchmarks for URC and its Peers" on page 37.

## TECHNOLOGY TRANSFER

An important function of successful university R&D is its effectiveness at transferring technology to the private sector. University research and development expenditures often lead to the production and sale of new products and services in the private sector. The pharmaceutical, medical, computer technology, consumer electronic, telecommunication, agricultural, and manufacturing industries are among the many industries benefiting from research and development conducted at universities.

We report the following measures of technology transfer in this report:

- **Patent and Licensing Activity** includes invention disclosure, patents issued and agreements of licensing and options entered into. The URC has issued more patents and entered into more licensing/options in 2011 than their five-year averages, and there were also more invention disclosures in 2011 than the past five year average.
- **The Number of Cultivated Start-Ups** is one indicator of the research and development process. Although it is impossible to accurately measure the number of new companies assisted in some way by the URC, we have some data on the number we can directly attribute to the URC. In 2011, the URC produced 18 start-ups, which is great than their longer-run trend of 15 start-ups annually. Since 2002, the URC has cultivated 149 start-up companies, 71 of which have formed within the past five years.

We describe the number of patents granted, inventions disclosed, number of licenses or options entered into, and the number of new start-ups in "Technology Transfers" on page 40

## ABOUT ANDERSON ECONOMIC GROUP

Anderson Economic Group, LLC (AEG) is a consulting firm that specializes in economics, public policy, financial valuation, market research, and land use economics. AEG has completed economic impact studies for universities across the country. AEG has provided the URC with economic impact reports since 2007. See "About the Authors" for more information.

# *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 have main campuses in East Lansing, Ann Arbor, Flint, Dearborn, and Detroit, and its reach extends to all areas of the state. Each URC university has research, teaching locations, and partner hospitals located throughout the state, as shown on page 2.

## REPORT PURPOSE & METHODOLOGY

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 the sixth in a series of annual reports intended to measure and benchmark the contributions of the URC universities to Michigan. The information in this report allows readers to track the URC's performance year-to-year and to understand how the URC universities spend their time and money.

In order to quantify the economic impact of the URC's activities, we asked ourselves the following questions: What would the loss be to the state if the URC universities left Michigan? What would be the loss to various regions within the state if the URC were not here? We then studied the loss in terms of jobs, earnings, tax revenue, and research. The following four chapters of this report provide quantitative measures of how the URC is performing in these areas.

## PEER UNIVERSITY CLUSTERS

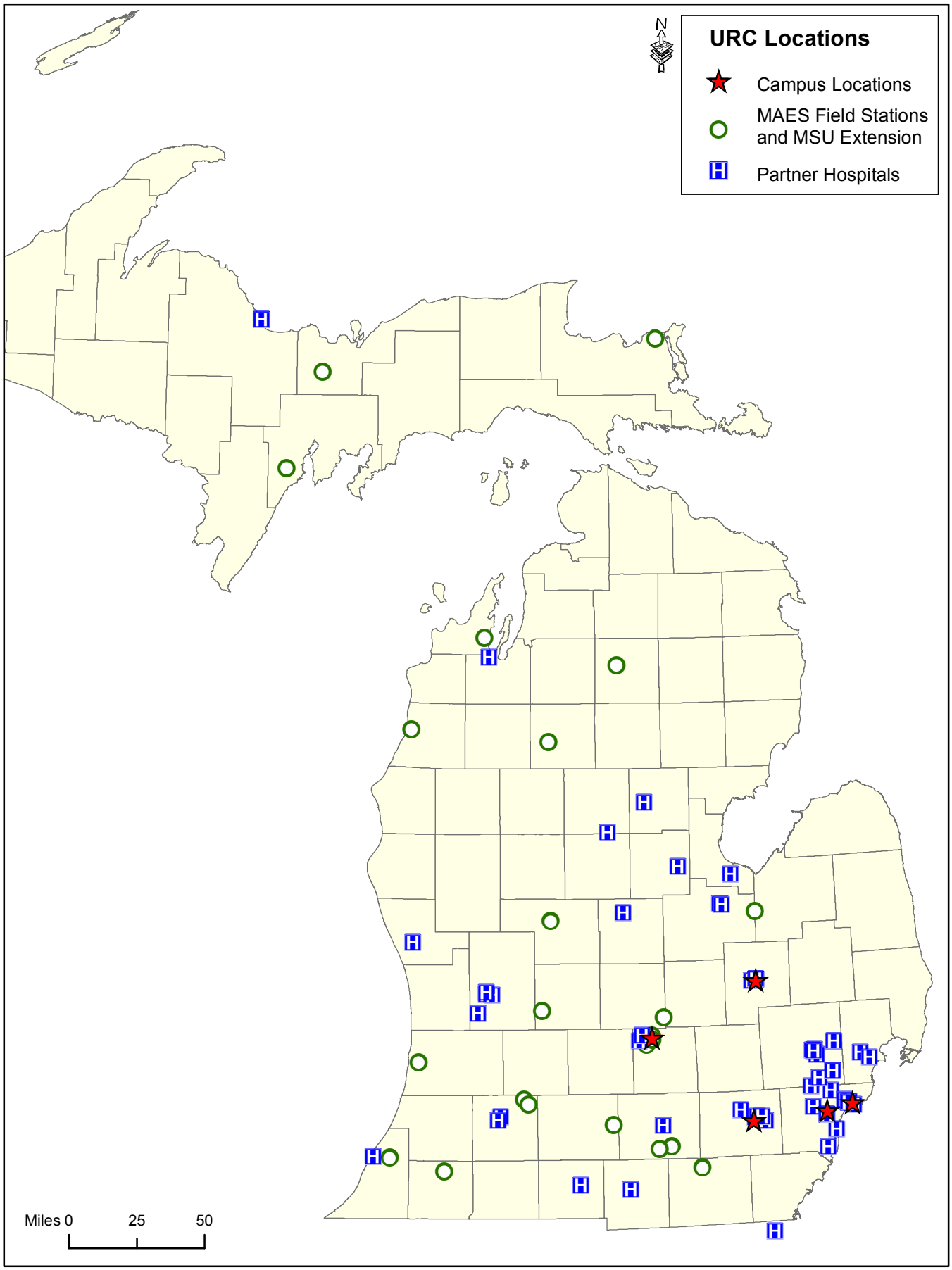
In addition to tracking the URC's performance year-to-year, we compare the URC to six peer university clusters in five states. We compare Michigan's URC with some of the best universities (public and private) in each of these states, as shown in Table 5 below, on a number of education and research metrics.

**TABLE 5. Comparison Peer 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) | 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*

Map 1. URC's Presence in Michigan




*Source: MSU AgBioResearch Centers; MSU Land Management Office; MSU College of Osteopathic Medicine; WSU Physician Group; U-M Hospital; and ESRI, Inc.*
*Analysis: Anderson Economic Group, LLC*

# *II. URC Students*

An important way the URC institutions contribute to Michigan's economy is by educating and training the state's future workforce. Last year, URC students made up 23% of all students attending a higher education institution (including community colleges, for-profit institutions, and traditional 4-year colleges and universities) in Michigan.[6] This section first discusses the students who attend a URC university and then URC alumni currently living in the state.

## URC STUDENT ENROLLMENT

In the fall of 2011, the URC universities had 137,673 enrolled students. This represents a slight increase in enrollment from the fall of 2010, when total URC enrollment was 137,583. See Table 6 below. From 2010 to 2011 the number of undergraduates increased by 0.31%. The number of graduate students, however, declined half of a percent (0.54%).

**TABLE 6. URC Enrollment, Fall 2007-2011**

| | 2007 | 2008 | 2009 | 2010 | 2011 | Change 2010-11 |
|---|---|---|---|---|---|---|
| **Undergraduate** | 93,519 | 92,939 | 102,381 | 98,020 | 98,323 | 0.31% |
| **Graduate** | 40,126 | 39,069 | 34,771 | 39,563 | 39,350 | -0.54% |
| **TOTAL** | 133,645 | 132,008 | 137,152 | 137,583 | 137,673 | 0.07% |

*Data: Integrated Postsecondary Education Data System (IPEDS) 2007-2010 fall enrollment for degree-seeking students; Offices of the Registrar URC Universities 2010 and 2011.*
*Analysis: Anderson Economic Group, LLC*

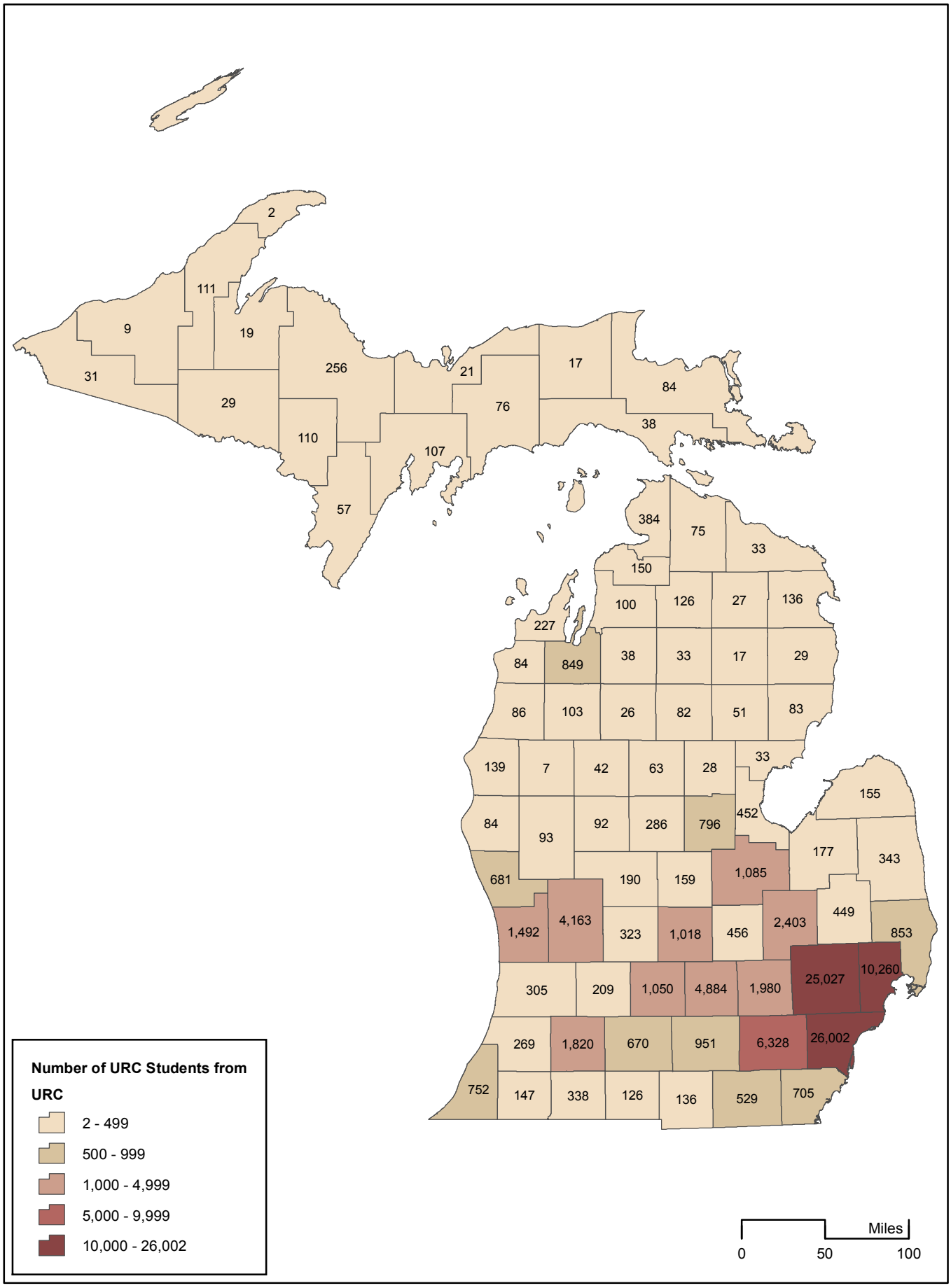
The ratio of undergraduate to graduate students remained fairly constant over the past years, with roughly 70% of the total student body being undergrads. In 2011, undergraduate students made up approximately 71% of total enrollment while graduate students (including doctoral and professional) made up 29%.

Students who attend URC universities are drawn from throughout Michigan, across the United States, and around the world. In fall of 2011, students from the state of Michigan accounted for the majority (74%) of total enrollment in URC universities.[7] We show the number of URC students by county in Michigan in Map 2, on page 4.

About 16% came from elsewhere in the United States, and 10% came from other countries, as shown in Figure 3 on page 5. Many of the talented students that the URC helps draw to Michigan spend their working careers in the state.

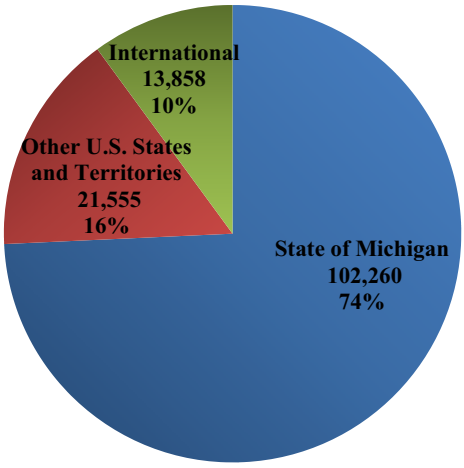
6. According to IPEDS, 701,404 students were enrolled with full or part-time status at a public or private higher education institution in Michigan last year. We used full-time enrollment to calculate this share while the remainder of this section looks at head-count at URC universities.
7. See Figure 3, "Origin of URC Students, Fall 2011," on page 5.

Map 2. URC Students from the State of Michigan by County, 2011




*Data: Esri, Inc.; URC Universities; see also "Map Methodology" on page A-1.*
*Analysis: Anderson Economic Group, LLC 2012.*

**FIGURE 3. Origin of URC Students, Fall 2011**

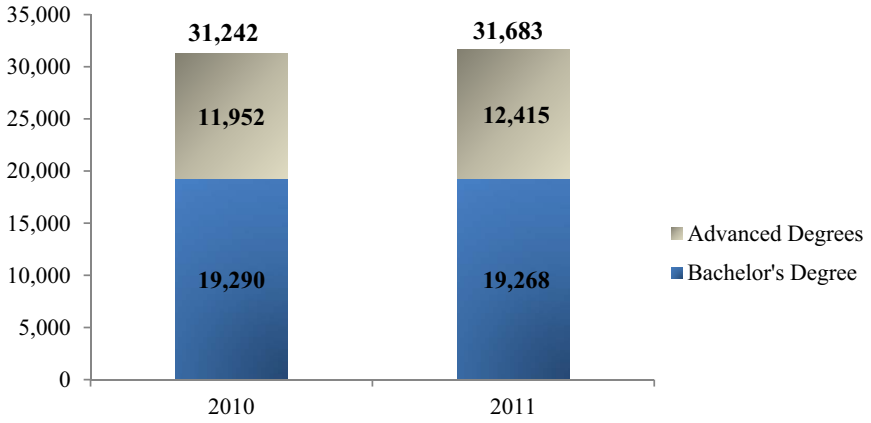



*Data: Offices of the Registrar URC Universities 2011*
*Analysis: Anderson Economic Group, LLC*

## TOTAL URC DEGREES GRANTED

The URC granted 31,683 total undergraduate and graduate degrees in 2011, which is roughly a 1.4% increase from 2010.[8] As shown in Figure 4 below, the URC increased its number of graduate degrees awarded and the number of undergraduate degrees declined slightly.

**FIGURE 4. Completions by Type of Degree at URC Universities, 2010-2011**




*Data: IPEDS 2010 and 2011 Total Completions*
*Analysis: Anderson Economic Group, LLC*

8. The completions data contained in this section may not perfectly match the numbers in our previous report, as we have reassessed whether both first and second majors should be included in total degrees awarded. To be consistent, the 2010 data was updated to reflect the methodology used to calculate 2011 degree totals. See "Total Degree Completions" on page A-13.

## DEGREES BY PROGRAM AREA

In this section we discuss the number of degrees granted by the URC universities by academic program. We base these on the National Center for Education Statistics (NCES) Classification of Instructional Programs (CIP) codes. We created the following academic program areas, which have been used for the past five benchmarking reports:

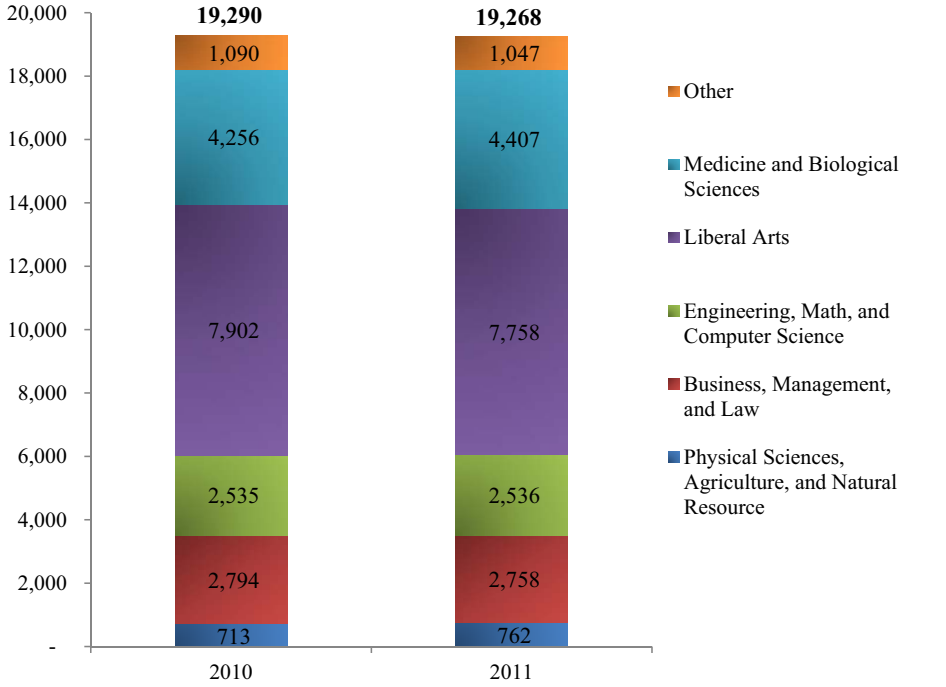
- *Physical Science, Agriculture, and Natural Resources*
- *Business, Management, and Law*
- *Engineering, Mathematics, and Computer Science*
- *Liberal Arts*
- *Medicine and Biological Science*
- *Other*

See "Academic Program Definitions" on page A-13 for the composition of each program area.

### *Undergraduate Degrees Conferred*

As shown in Figure 5 below, the URC awarded more undergraduate degrees in 2011 than 2010 in every area, except for *Business, Management, and Law; Liberal Arts; and Other.* The number of *Physical Sciences, Agriculture, and Natural Resources* degrees increased the most at 6.87%. *Medicine and Biological Science* increased 3.55%.

**FIGURE 5. Undergraduate Degrees Conferred by Area, 2010-2011**

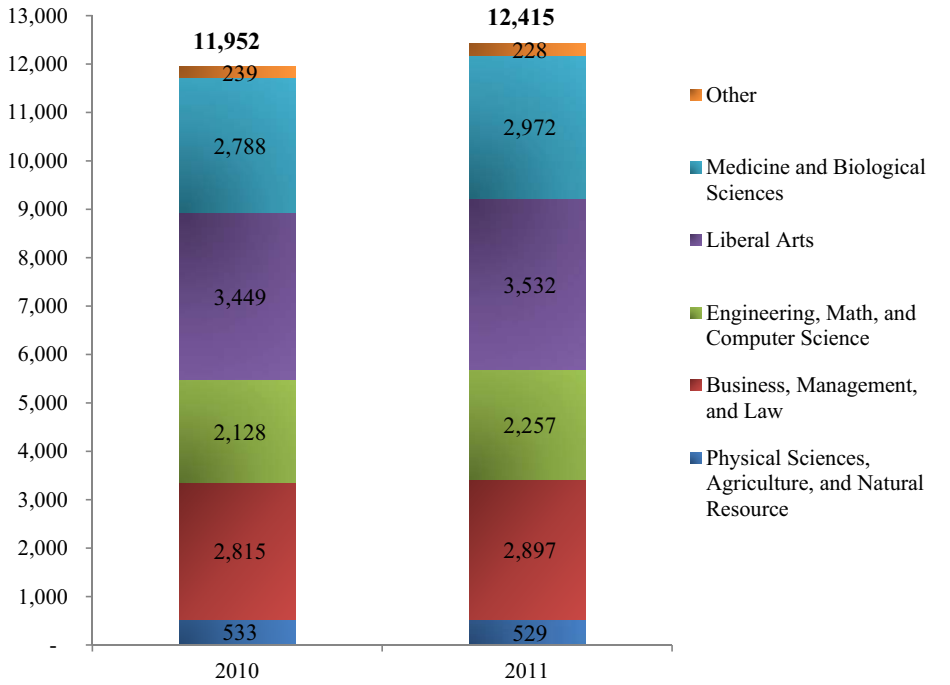



*Data: IPEDS 2010 and 2011 Undergraduate Completions*
*Analysis: Anderson Economic Group, LLC*

### *Graduate Degrees Conferred*

Graduate degrees represented 39% of all degrees granted by the URC in 2011. The number of graduate degrees grew by 3.9% between 2010 and 2011. In Figure 6 on page 7 we show the composition of graduate degrees conferred by the URC over the past two years. The only areas that fell in number of degrees awarded below 2010 levels were *Physical Sciences, Agriculture, and Natural Resources* and *Other.* All other categories of degrees grew. *Engineering, Mathematics, and Computer Science* and *Medicine and Biological Sciences* both grew over 6% between 2010 and 2011. *Business, Management, and Law* grew 2.9% while *Liberal Arts* grew 2.4%.

**FIGURE 6. Graduate Degrees Conferred by Area, 2010-2011**




*Data: IPEDS 2010 and 2011 Graduate Completions*
*Analysis: Anderson Economic Group, LLC*

## HIGH-TECH AND HIGH DEMAND DEGREES

In addition to the academic program areas above, we define two specialized categories of degrees: high-tech and high demand. These degrees prepare students for jobs in a "high-tech" industry, or those in "high demand" by employers.

### *Specialized Degree Definitions*

As with the degrees by program area, we used the CIP codes in IPEDs to pull degrees that fit our definition of these two categories of degrees:

1. *High-Tech Degrees*. We define high-tech degrees as those in biological sciences, physical sciences, computer sciences, engineering, architecture, and some agri-

cultural sciences. This definition is one that AEG regularly uses to assess Michigan's high tech industry, such as in Southeast Michigan.[9]

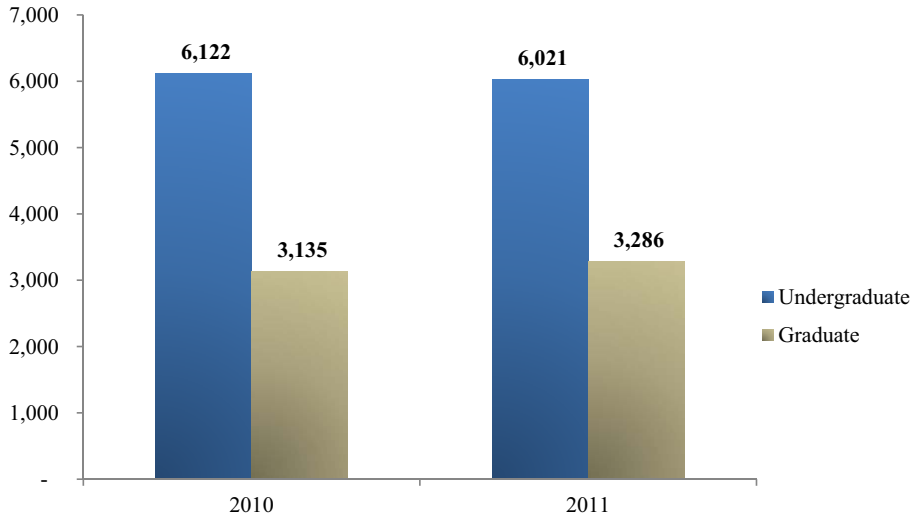
2. *High Demand Degrees.* We define degrees in high demand to include: business, management, marketing, and related support services, which we label as "business"; computer and information sciences and support services, which we label as "computer science"; and engineering and engineering technologies/technicians, which we include in the "engineering" category. [10]

For further details and discussion see "High Tech and High Demand Degrees" on page A-14.

### *High-Tech Degrees*

Michigan has a vibrant high-tech industry, and the URC universities graduate a large number of students with degrees that prepare them for jobs in this industry. The number of URC graduates with high-tech degrees continues to increase. In 2010, 9,257 graduates received a degree in a high-tech field. In 2011 the number increased by 0.54% to 9,307 total degrees. Figure 7 below shows the number of high-tech degrees awarded in 2010 and 2011. While the number of high-tech undergraduate degrees declined slightly, there was an almost 5% increase in high-tech graduate degrees awarded.

**FIGURE 7. Completion of High-Tech Degrees, 2010-2011**



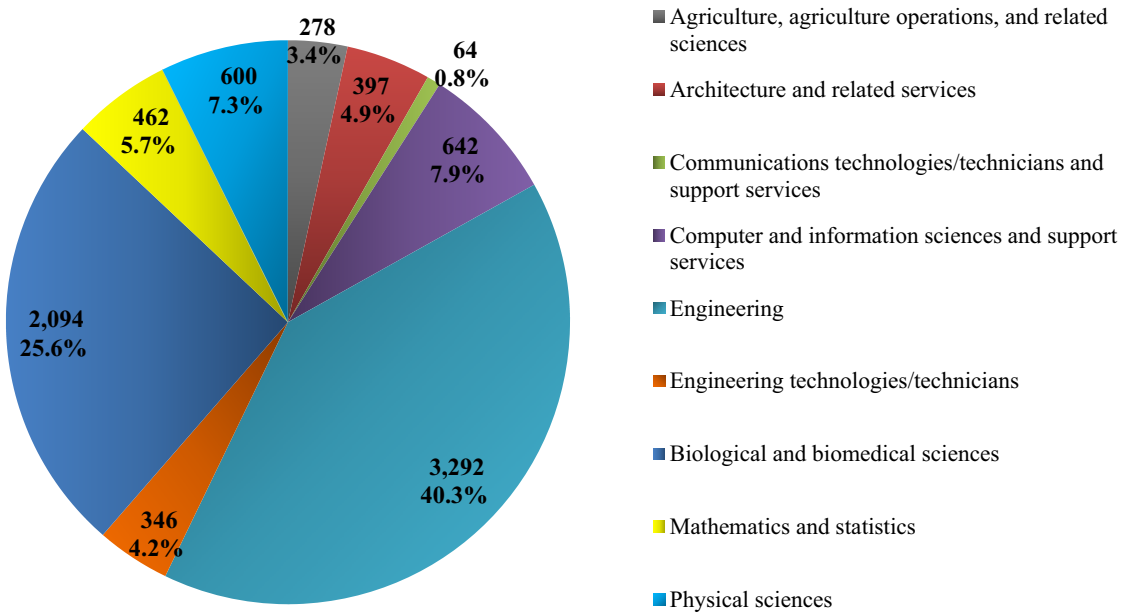

*Data: IPEDS 2010 and 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

9. See Scott D. Watkins, Cameron Van Wyngarden, and Lauren Hathaway, *Driving Southeast Michigan Forward*, prepared for Automation Alley (November 2008).

10. According to a survey done by the National Association of Colleges and Employers, the three fields of study in the highest demand among employers, were business, computer science, and engineering. AEG determined which of the degrees by CIP code would fall into each of these fields using professional judgment.

Figure 8 below shows the number and share of high-tech degrees awarded by each specific field of study included in our definition of high-tech degrees. *Engineering* (40.3%) and *Biological and Biomedical Sciences* (25.6%) represent the largest share of high-tech degrees awarded at the URC universities.

**FIGURE 8. Completion of Undergraduate and Graduate High-Tech Degrees by Field of Study, 2011**




*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

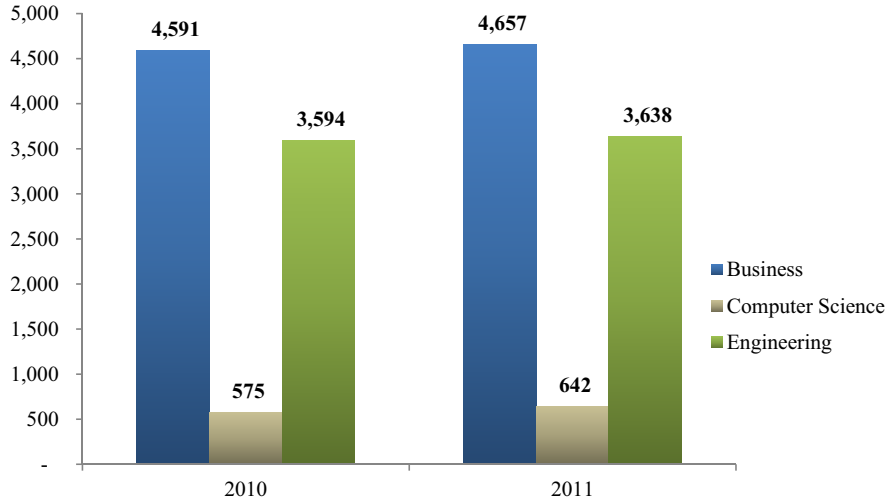
### *Degrees in High Demand Among Employers*

Based on a survey done by the National Association of Colleges and Employers (NACE), we created three fields of study to represent those in the highest demand among employers: Business, Computer Science, and Engineering.[11] While business degrees tend to be a staple degree that is attractive to employers, engineering and computer sciences are both in particular demand in Michigan. As the birthplace of the modern auto industry, engineering grads are still heavily recruited throughout the state.[12] Computer science degrees are also sought after, as information and communications technology (ICT) products and workers become increasingly integrated into major sectors of the state's economy.[13]

11. We describe the degree categories we created based on the NACE's *Job Outlook 2011 Reports* in "High Tech and High Demand Degrees" on page A-14.
12. See Caroline Sallee and Erin Agemy, *The University Research Corridor's Support for Information and Communication Technology in Michigan*, AEG, May 31, 2011.

Figure 9 below shows high demand degrees by field of study over the past two years. In 2011, the URC awarded 8,937 degrees in high demand fields. Business and Engineering represent the largest share of these degrees. Computer Sciences makes up a smaller share, but grew 11.7% from 2010 to 2011.

**FIGURE 9. High Demand Degrees by Field of Study, 2010-2011**




*Data: IPEDS 2010 and 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

The share of degrees being awarded in these fields was about 28.2% of all degrees awarded by URC universities in 2011, as shown below in Table 7.

**TABLE 7. High Demand Share of Total URC Degrees, 2011**

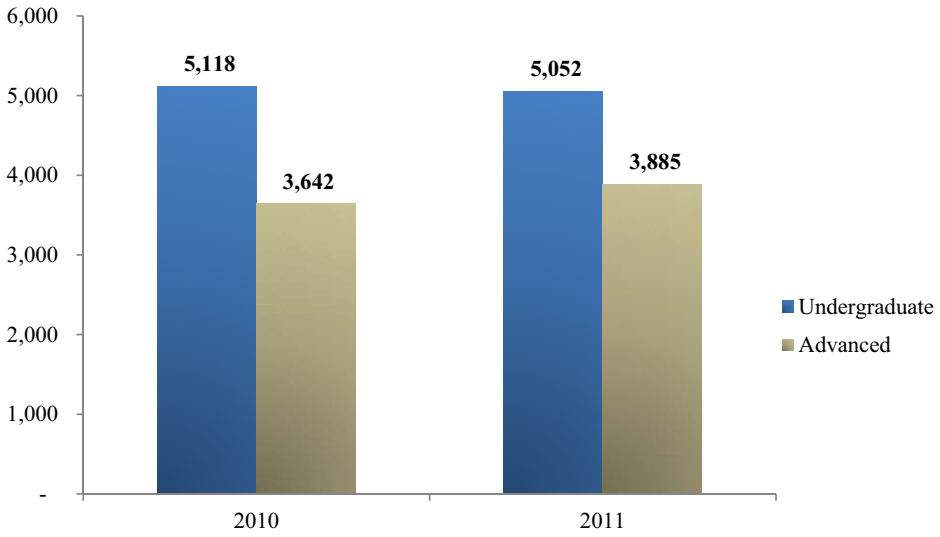
| Program Type | Bachelor's | Advanced | Total Degrees |
|---|---|---|---|
| Business | 2,670 | 1,987 | 4,657 |
| Computer Science | 358 | 284 | 642 |
| Engineering | 2,024 | 1,614 | 3,638 |
| ***Total High Demand Degrees*** | ***5,052*** | ***3,885*** | ***8,937*** |
| **Total URC Degrees** | **19,268** | **12,415** | **31,683** |
| *Business Share of URC Total* | *13.9%* | *16.0%* | *14.7%* |
| *Computer Science Share of URC Total* | *1.9%* | *2.3%* | *2.0%* |
| *Engineering Share of URC Total* | *10.5%* | *13.0%* | *11.5%* |
| **Total Share High Demand** | **26.2%** | **31.3%** | **28.2%** |

*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

13. See author, Caroline Sallee, et al. *The URC's Contributions to the Automotive Industry*, AEG, May 30, 2012.

Figure 10 below shows the breakdown of undergraduate and graduate high demand degrees. While undergraduate degrees in high demand have dropped slightly, graduate high demand degrees have grown nearly 7% in the past year.

**FIGURE 10. High Demand Degrees by Type, 2010-2011**




*Data: IPEDS 2010 and 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

## MEDICAL EDUCATION IN THE URC

Michigan's URC is home to four of Michigan's five medical schools. All three URC universities have an allopathic (M.D.) medical school and Michigan State also 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.[14] 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 28 affiliated hospital training sites in which they place third- and fourth-year medical students.[15] University of Michigan trains students primarily in its own hospital and health centers and in other locations in Southeast Michigan. Wayne State University trains many students in hospitals close to its medical school in Detroit.

14. In medical education, clerkships refer to third and fourth year medical students training in teaching hospitals.

15. See "Statewide Campus System" at MSU's College of Osteopathic Medicine's website at http://www.scs.msu.edu/hospitals.

Table 8 shows the total number of medical graduates from each URC medical program for each year between 2007 and 2011. In 2011, Michigan's URC graduated 841 students from its medical schools, a 30% increase from 2007. Michigan State's D.O. program shows the fastest growth since 2007 (46%), nearly doubling in size. Michigan State's M.D. program has grown nearly 30% since 2007 and University of Michigan's M.D. program has grown by nearly 10% in the same time-frame. Wayne State's M.D. program has grown 36% since 2007 and continues to have the largest program.

**TABLE 8. URC Medical Graduates by School and Field of Study, 2007-2011**

| University | Degree Granted | 2007 | 2008 | 2009 | 2010 | 2011 | % Change 2007-2011 |
|---|---|---|---|---|---|---|---|
| MSU | M.D. | 120 | 82 | 107 | 102 | 154 | *28.3%* |
| MSU | D.O. | 138 | 135 | 173 | 213 | 202 | *46.4%* |
| U-M | M.D. | 165 | 169 | 161 | 165 | 180 | *9.1%* |
| WSU | M.D. | 224 | 243 | 250 | 270 | 305 | *36.2%* |
| **URC Total** | **M.D. and D.O.** | **647** | **629** | **691** | **750** | **841** | **30.0%** |

*Data: National Center for Education Statistics, IPEDS 2007-2011 Completions*
*Analysis: Anderson Economic Group, LLC*

**Dentistry Program.** The University of Michigan School of Dentistry offers students a Doctor of Dental Surgery (DDS) program and a dental hygiene program.[16] In addition, the school teaches specialty programs (endodontics, oral and maxillofacial surgery, orthodontics, oral diagnosis, oral pathology, pediatric dentistry, and periodontics) and continuing education programs for practicing dentists.

In 2011, the University of Michigan School of Dentistry graduated a total of 121 students with a DDS degree, as shown below in Table 9. During the same period, 39 students graduated with a dental hygienist degree (Bachelor's or Masters). Since 2007, the number of dental degrees conferred at the University of Michigan has increased 13.5%.

**TABLE 9. University of Michigan School of Dentistry, 2007-2011**

| Program | 2007 | 2008 | 2009 | 2010 | 2011 | % Change 2007-2011 |
|---|---|---|---|---|---|---|
| Dentistry (DDS) | 111 | 111 | 111 | 112 | 121 | *9.0%* |
| Dental Hygiene (Bachelor's and Master's) | 30 | 28 | 28 | 37 | 39 | *30.0%* |
| **Total Degrees Granted** | **141** | **139** | **139** | **149** | **160** | ***13.5%*** |

*Data: National Center for Education Statistics, IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

16. 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 has the only school of veterinary medicine in the state and one of only 28 veterinary schools in the country. 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.[17]

As seen in Table 10 on page 13, the college issued to 111 students a Doctorate in Veterinary Medicine in 2011. The college also operates the Veterinary Teaching Hospital (VTH), the only tertiary referral center for veterinary medicine in the state of Michigan. The VTH has one of the largest case loads in the nation, seeing more than 136,000 animals annually (23,000 on-site and an additional 113,000 in the field).

**TABLE 10. Michigan State University Veterinary Medical Degrees, 2007-2011**

| Program | 2007 | 2008 | 2009 | 2010 | 2011 | % Change 2007-2011 |
|---|---|---|---|---|---|---|
| Veterinary Medicine (DVM) | 104 | 107 | 107 | 101 | 111 | 6.7% |
| Veterinary Biomedical and Clinical Sciences (Cert, MS, PhD) | 7 | 7 | 5 | 5 | 10 | 42.9% |
| **Total Degrees Granted** | **111** | **114** | **112** | **106** | **121** | **9.0%** |

*Data: National Center for Education Statistics, IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

The College of Veterinary Medicine 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 handles more than 220,000 cases and runs over 1.5 million tests a year. This allows the Center 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 problems in animal health management, ensuring that they are safe for human consumption. The program is currently researching Johnes Disease, Avian Influenza, and Mad Cow Disease.[18]

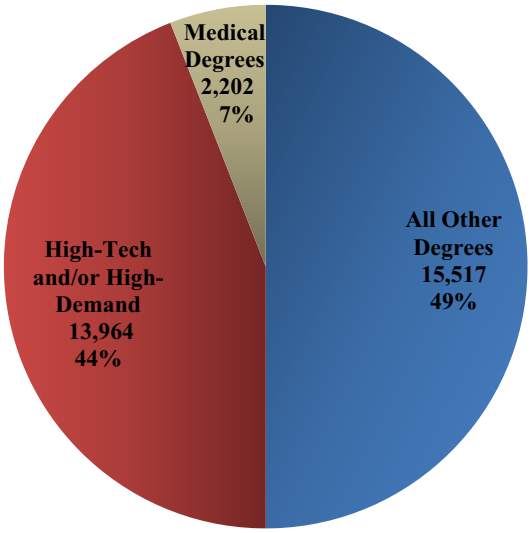
17. Information provided by MSU's College of Veterinary Medicine.

18. Ibid.

## SUMMARY OF HIGH-TECH, HIGH DEMAND, AND MEDICAL DEGREES

Many students pursue an education to maximize their employment prospects. Degrees that are in high demand by employers and/or in growing industries include those in high-tech, high-demand, and medical fields.[19] As shown below in Figure 11, degrees in these fields comprise about half of the total degrees awarded at the URC universities.[20]

**FIGURE 11. High-Tech, High Demand, and Medical Degrees, 2011**



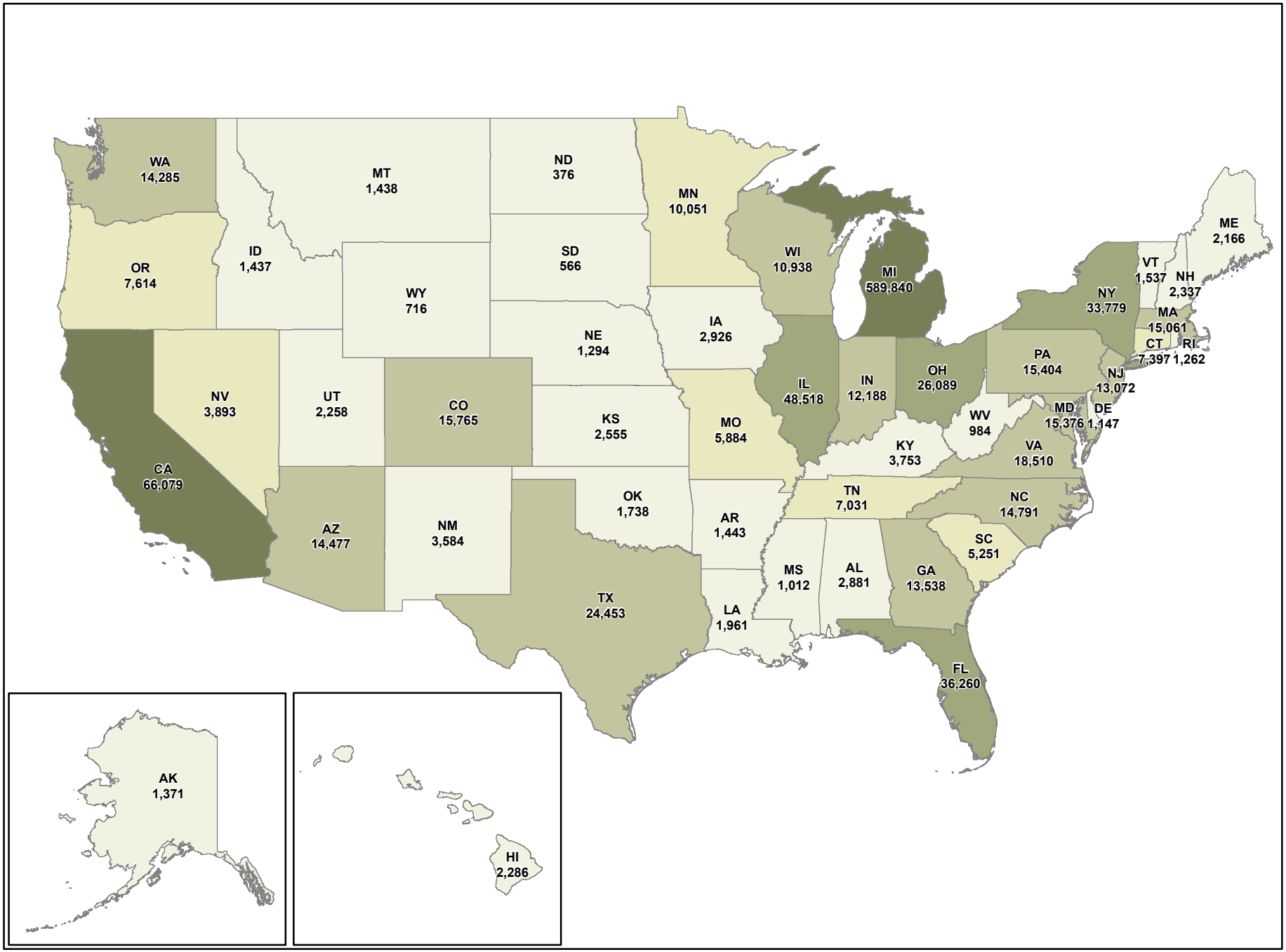

*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

## NUMBER OF URC ALUMNI

As of summer of 2012, the URC had over 1.1 million alums worldwide. There were 589,840 URC alumni living in Michigan, which accounts for roughly 7.8% of Michigan's population over the age of 18 years.[21] URC universities currently have alumni in every state in the U.S. (see Map 3, "URC Alumni by State, 2012," on page 15), and in every county in Michigan (see Map 4, "URC Alumni by ZIP Code, 2012," on page 16). URC alumni also live in more than 170 countries across the world.

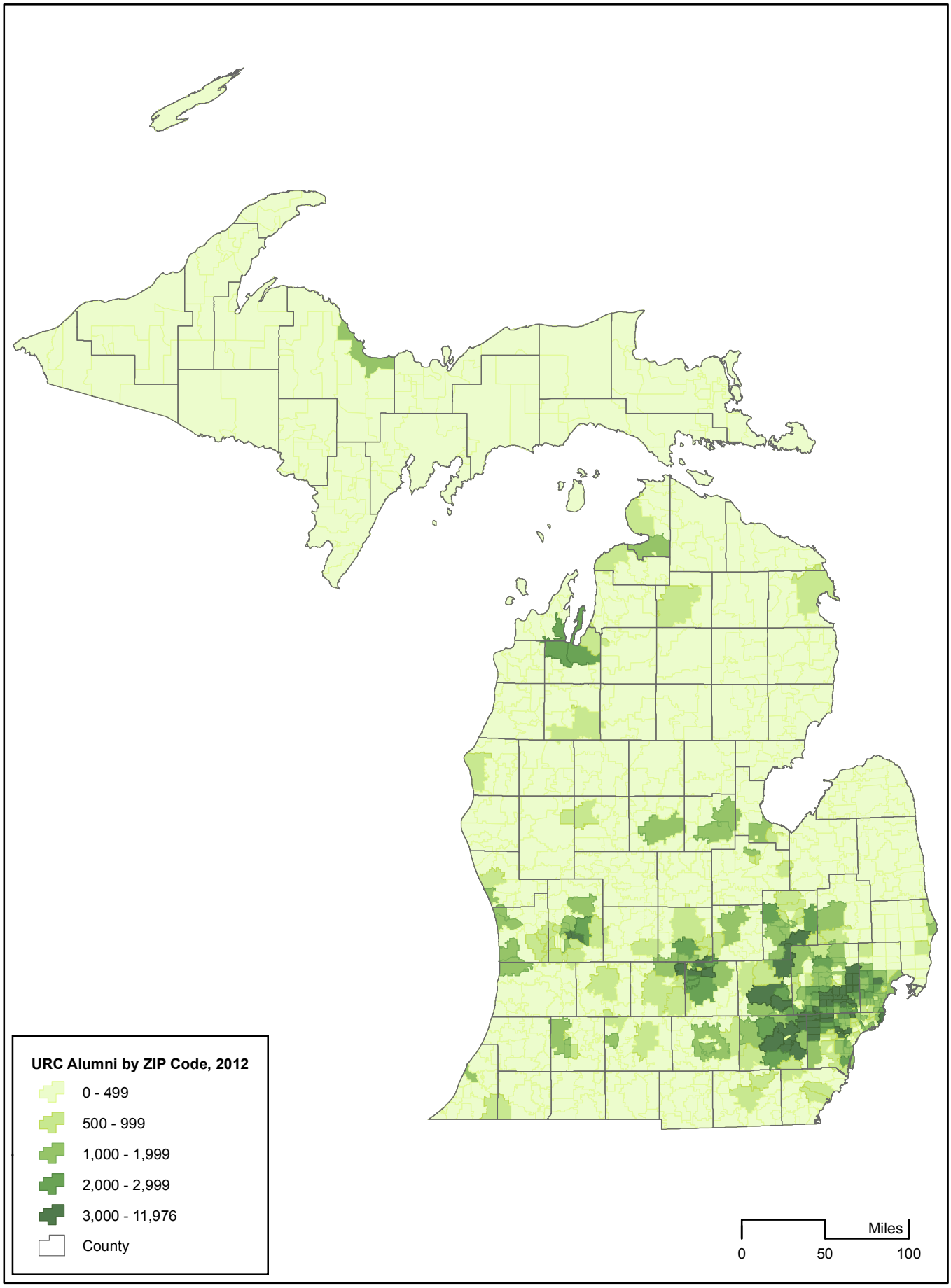
19. A 2008 Michigan Department of Community Health survey of 4,546 physicians found that around 62% of Michigan's doctors are at patient capacity (in comparison to 42% in 2005). According to the survey, the percentage of physicians in primary care, especially those who treat Medicaid patients, is declining despite the increase in need. See michigan.gov/mdch/ for more information on Michigan's physicians.
20. We include degrees in nursing and dental hygienist in our category of medical degrees. For further description of IPEDS categories included see "Summary of Degrees in High-Tech, High Demand, and Medical Fields" on page A-15.
21. According to the U.S. Census Bureau, Michigan had 7,590,636 residents over the age of 18 years on July 1, 2011.

Map 3. URC Alumni by State, 2012




*Data: ESRI, Inc.; University Alumni Associations.*
*Analysis: Anderson Economic Group, LLC, 2012.*

Map 4. URC Alumni by ZIP Code, 2012




*Data: Esri, Inc.; University Alumni Association.*
*Analysis: Anderson Economic Group, LLC 2012.*
*Note: Data include alumni with known ZIP codes.*

# *III. Impact on Jobs and Income*

This section discusses the impact that the URC universities have on jobs and income throughout the State of Michigan. It starts with a summary of the size of expenditures by URC universities in Michigan in 2011. It then discusses the definition of "economic impact" that we use to assess the state-level impact, and defines specific regions *within* the state that we also analyzed. It then summarizes the results of the total state-wide economic impact and the impact by region within the state. The section concludes with a detailed discussion of the components of these economic impact results, and a note on the methodology used.

## URC EXPENDITURES IN FY 2011

The University Research Corridor makes significant contributions to the state's economy. URC institutions spent over $7.9 billion on operations in FY 2011 and employed 52,215 full-time-equivalent faculty and staff throughout Michigan.[22] About a quarter (22%) of expenditures paid for instruction of students, while 16% of expenditures went towards university research, as shown in Table 11 below. A little less than a third (29%) of all expenditures paid for equipment, supplies, salaries, and maintaining U-M Hospital facilities.

**TABLE 11. Operational Expenditures by the URC, FY 2011**

| | Expenditures ($ in millions) | % of Total |
|---|---|---|
| Instruction | $1,778 | 22% |
| Research[a] | $1,262 | 16% |
| Public Services, Academic Support, Student Services, and Institutional Support | $1,378 | 17% |
| Operation and Maintenance of Plants, Auxiliary Enterprises, and Other Expenses | $1,185 | 15% |
| University of Michigan Hospital | $2,342 | 29% |
| **Total Operational Expenditures** | **$7,946** | **100%** |

*Data: IPEDS Finance FY 2011*
*Analysis: Anderson Economic Group, LLC*

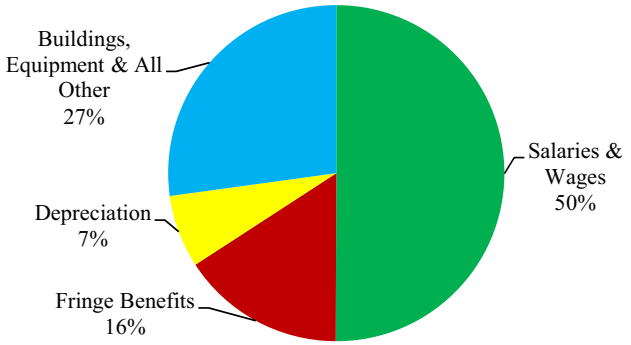
a. The data reported to IPEDS for research expenditures are different than the research expenditures reported to the National Science Foundation. See "R&D Expenditures" on page A-15.

We also examined URC expenditures by function, which is shown in Figure 12 on page 18. Half of all operational expenditures paid for the salaries and wages for university faculty and staff. Fringe benefits made up 16% of expenditures, while depreciation accounted for 7%. The remaining 27% paid for supplies,

22. Faculty and staff counts reflect full-time-equivalent positions in Fall 2011. Figure includes the University of Michigan Hospital doctors and staff. FY 2011 is the fiscal year for each university; U-M and MSU's fiscal year was July 1, 2010 to June 30, 2011 and WSU's was October 1, 2010 to September 30, 2011.

equipment, maintenance of plant, and any other expenditure not included in the previous categories.

**FIGURE 12. URC Operational Expenditures by Function, FY 2011**




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

## DEFINITION OF ECONOMIC IMPACT

URC expenditures are at the foundation of the URC's impact on the state economy, but the full impact goes further than simply summarizing spending, for two reasons. First, an economic impact analysis should count only net-new spending, which accounts for spending that would have occurred in the state even without the URC universities and spending that is crowded out by URC spending. Second, as the URC makes these expenditures, the money is then re-spent throughout the Michigan economy, creating a "multiplier" effect. To quantify the economic impact of URC universities' operational expenditures, we asked, in effect, "What would be the loss to the state if the three University Research Corridor universities closed their doors?"

We define *net economic impact* as the new economic activity that occurs in a defined geographic region directly or indirectly caused by the URC. A direct impact stems from initial spending while indirect and induced impacts stem from the recirculation of dollars within the defined geographic region.

### *Geographic Regions of Economic Impact*

We present two geographies of economic impact in this section; the State of Michigan, as well as ten economic regions in Michigan, as defined by the Michigan Economic Development Corporation (MEDC).[23] These regions and their estimated economic impact are shown in Map 5 on page 20.

23. In March of 2011, Governor Snyder emphasized in his special message the importance of communities working together to promote the advantages of their regions. He asked the MEDC to develop strategies to engage in regional collaboration among economic and community development organizations. Together with local economic development partners, the MEDC defined ten geographies to align economic development efforts.

To estimate net new expenditures for each region and the entire state, we exclude any economic activity associated with the URC universities that merely replaces or displaces other economic activity in those geographies. For example, we exclude expenditures by students who would have otherwise attended another college (and spent money in the state). We also exclude all expenditures by URC universities that go to firms outside Michigan.

We present two measures of economic impact in this section:

- *Economic Output*
  This is the total value of all economic activity generated by the URC's operational expenditures in Michigan. This measure includes all new expenditures by the URC in Michigan after substitution plus indirectly-generated activity by both firms and households in the state.
- *New Jobs*
  The URC directly employs over 50,000 people and indirectly generates more jobs in Michigan due to the multiplier effect of employee spending in the State.

## TOTAL NET ECONOMIC IMPACT

In FY 2011, we estimate that the value of the economic activity that the universities generated in the state, benefiting households and businesses, was $15.5 billion. See the components of the total net economic impact of the URC for the state below in Table 12. This net economic impact figure does not include any economic activity that would have occurred in Michigan even without the URC. See Map 5 on page 20 for the economic impact by region, which adds up to the total economic impact in the state.

**TABLE 12. Net Economic Impact of URC in Michigan, FY 2011 (in billions)**

| Impact Category | Direct Impact | Indirect Impact | Net Economic Impact |
|---|---|---|---|
| Non-payroll Operating Expenditures for Instruction, Research, and U-M Hospital | $1.5 | $1.9 | $3.4 |
| Faculty & Staff Wages and Benefits | $2.8 | $1.9 | $4.6 |
| URC Student Expenditures | $1.7 | $0.6 | $2.3 |
| Incremental Alumni Earnings | $3.1 | $2.1 | $5.2 |
| **TOTAL ECONOMIC IMPACT** | **$9.1** | **$6.4** | **$15.5** |

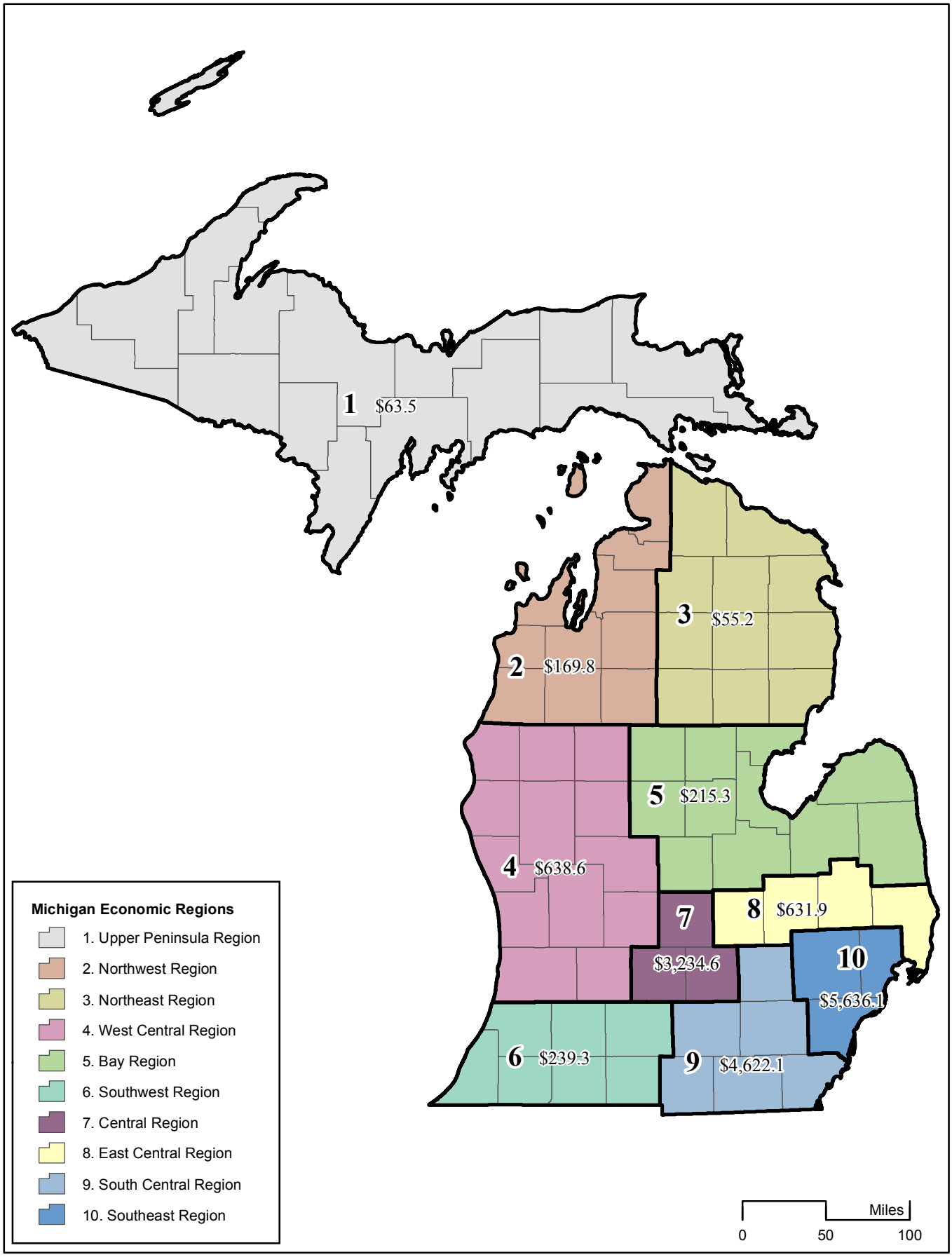
*Source: National Center for Education Statistics, Finance Section; URC Universities; Bureau of Economic Analysis; Census Bureau*

*Analysis: Anderson Economic Group, LLC*

### *Jobs Impact of URC Operations*

We estimate that 74,301 jobs in Michigan in 2011 were directly or indirectly caused by the URC's operations in Michigan. This jobs figure includes 11,406 faculty members and 40,810 staff directly employed by the URC universities. It also includes indirectly-generated jobs in other industries in the state due to expenditures by the URC universities and their faculty, staff, and students. See Table 13 on page 21 for the jobs created within each of the state's ten regions.

Map 5. Net Economic Impact of URC Operations by Region, FY 2011 (in millions)




*Data: Esri, Inc.; Michigan Economic Development Corporation, Pure Michigan.*
*Analysis: Anderson Economic Group, LLC 2012.*
*Note: See also Table A-5 "Estimates of URC Economic Impact by Region," on page A-10.*

It is not surprising that the regions shown as being impacted the greatest in Map 5 are the regions in which the universities are located. This is also true for the jobs created by the URC university's activities, as shown below in Table 13.

**TABLE 13. Net Economic Impact of URC Operations and Employment Created by Region, FY 2011**

| Economic Development Collaboratives | Net Economic Impact of University Operations (in millions) | Total Direct and Indirect Jobs Caused by URC |
|---|---|---|
| Upper Peninsula Region | $ 63.5 | 60 |
| Northwest Region | $ 169.8 | 85 |
| Northeast Region | $ 55.2 | 45 |
| West Central Region | $ 638.6 | 586 |
| Bay Region | $ 215.3 | 249 |
| Southwest Region | $ 239.3 | 264 |
| Central Region (MSU) | $ 3,234.6 | 12,494 |
| East Central Region | $ 631.9 | 2,238 |
| South Central Region (U of M) | $ 4,622.1 | 40,862 |
| Southeast Region (WSU) | $ 5,636.1 | 17,421 |
| State of Michigan | $ 15,506.3 | 74,301 |

*Note: Rounded numbers for each region do not add precisely to state totals.*

*Source: Anderson Economic Group, LLC*

## COMPONENTS OF ECONOMIC IMPACT

The spending shown in Table 11, "Operational Expenditures by the URC, FY 2011," on page 17 purchases supplies, equipment, and maintain university buildings, as well as pay the salaries of professors, researchers, doctors, and administrative staff. As the URC makes these expenditures, the money is then re-spent throughout the Michigan economy, creating a "multiplier" effect, generating more economic activity throughout the state. We describe the components of the URC's economic impact on Michigan and its ten regions below.[24]

### *Nonpayroll Operating Expenditures*

Nonpayroll operating expenditures include payments made for instruction of students, research equipment and supplies, and U-M hospital supply and equipment purchases. After accounting for expenditures that went to businesses located outside Michigan and substitution, we estimate that the URC spent $1.5 billion directly on these items in Michigan in FY 2011. Of this spending, the Central and Southeast Regions account for the greatest proportion of spending, representing 32% and 43%, respectively. We estimate the total economic impact of nonpayroll expenditures (including indirect activity) is $3.4 billion.

24. The components of economic impact for each region is shown in detail in Table A-5, "Estimates of URC Economic Impact by Region," on page A-10.

### *Payroll Expenditures for Faculty and Staff*

The URC universities spent $5.2 billion on salary, wages, and fringe benefits for their employees in FY 2011. After taxes and substitution for wages that would have been earned in Michigan in the absence of the URC, we estimate that faculty and staff spent $2.8 billion directly in Michigan. The South Central and Southeast Regions comprised the largest proportion of this spending, representing 55% and 21% of expenditures, respectively. This is unsurprising, as staff and faculty live in these regions, which are near to the URC universities and heavily populated. We estimate the total net economic impact of faculty and staff earnings in Michigan is $4.6 billion (including expenditures indirectly generated).

### *Student Local Spending*

The URC universities have students from every county in Michigan, every state in the U.S., and more than 100 countries. Some of these students would not have remained in or come to the state of Michigan for a college degree if it were not for the URC universities. We count these expenditures as new economic activity. We estimate that new student direct expenditures in Michigan due to the URC were $1.67 billion in FY 2011. Of these expenditures, the Central and South Central Regions account for the greatest proportions, with 34% and 38%, respectively.[25] We estimate the indirect earnings from these expenditures were $618 million for a total economic impact of $2.3 billion on the state.

### *Alumni Expenditures*

Alumni of URC universities contribute to the state's economy, as university graduates with bachelors and graduate degrees produce and earn more than the average worker. In 2011, there were 589,240 URC alums living in Michigan. We estimated their earnings for that year was $29 billion, after accounting for wages of URC alumni and the alum's year of graduation.[26] This accounts for almost 16% of all wage and salary income in the state. 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.[27] Table 14 on page 23 shows our estimates of how URC alumni earnings are distributed across Michigan's ten regions based on the current location of alumni

25. We primarily allocated student expenditures to the region with the university that they attended in 2011. See "Regional Economic Impact" on page A-7.

26. Universities add to students' *human capital* by imparting skills, knowledge, and habits that improve their productivity, as well as expose them to people, ideas, and industry contacts they may not otherwise have had access to. Just as adding physical capital (e.g. buildings and equipment) allows a business to increase production, improving a worker's human capital often increases their earning power. See "Impact of Alumni Earnings" on page A-6.

27. See Table A-3 on page A-6 for URC alumni earnings by age and degree.

**TABLE 14. Share of 2011 URC Alumni Earnings in Michigan by Economic Development Collaborative Region**

| Regions - Economic Development Collaboratives | No. Counties | Number of URC Alums | | Share of URC Alumni Earnings (in billions) | | *2011 Population* |
|---|---|---|---|---|---|---|
| | | Total | % of Total | Total | % of Total | *% of Total* |
| Upper Peninsula Region | 15 | 5,498 | 0.9% | $ 272.2 | 0.9% | *3.2%* |
| Northwest Region | 10 | 16,137 | 2.7% | $ 798.5 | 2.7% | *3.0%* |
| Northeast Region | 11 | 5,524 | 0.9% | $ 272.7 | 0.9% | *2.1%* |
| West Central Region | 13 | 45,351 | 7.7% | $ 2,239.9 | 7.7% | *15.4%* |
| Bay Region | 11 | 18,977 | 3.2% | $ 938.6 | 3.2% | *7.2%* |
| Southwest Region | 7 | 19,315 | 3.3% | $ 955.2 | 3.3% | *7.9%* |
| Central Region | 3 | 49,575 | 8.4% | $ 2,418.7 | 8.3% | *4.7%* |
| East Central Region | 4 | 39,634 | 6.7% | $ 1,990.7 | 6.8% | *7.5%* |
| South Central Region | 6 | 68,807 | 11.7% | $ 3,465.8 | 11.9% | *10.0%* |
| Southeast Region | 3 | 320,675 | 54.4% | $ 15,807.4 | 54.2% | *39.0%* |
| | 83 | 589,493 | 100.0% | $ 29,159.5 | 100.0% | *100.0%* |

*Data: URC university alumni offices; US Bureau of Labor Statistics; US Census Bureau*
*Analysis: Anderson Economic Group LLC*

*Note: See Table A-6, "Estimate of Additional URC Alumni Earnings by Region," on page A-12.*

As shown above in Table 14, the Southeast, Central, and Souths Central regions have a larger share of URC alumni earnings than their share of state population. The West Central region, which includes the Grand Rapids area, is notable for having a significantly lower share of URC alumni earnings than state population. Not coincidentally, the West Central region is the most populous region not to contain a URC university.

### *Incremental Earnings*

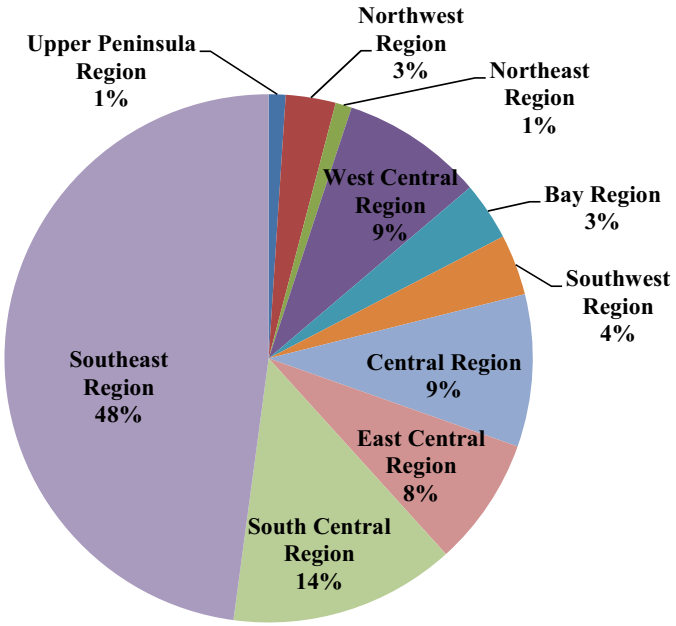
In addition to the gross earnings of URC alumni, we estimate the incremental earnings to URC graduates that are a result of their education at a URC university. The main components considered in estimating the additional earnings of URC graduates are: (1) projections of the earnings of URC graduates, (2) substitution of earnings that would have occurred even if the individual had not attended a URC university.

We estimate that URC alums living in Michigan in 2011 earned $4.37 billion more due to the URC.[28] We show each region's share of alumni incremental earnings in the state below in Figure 13. The Southeast, South Central, and Central regions lead the state in share of incremental URC alumni earnings, with

28. Note that using this methodology assumes that most of the current earnings of URC alumni living in Michigan are earnings they would have had (even without the URC).

other populous regions such as the West Central and East Central regions also benefitting from hundreds of millions of additional earnings.

**FIGURE 13. Share of Incremental Alumni Earnings in Michigan by Region, FY2011**




*Data: URC university alumni offices; US Bureau of Labor Statistics; US Census Bureau*
*Analysis: Anderson Economic Group LLC*

Once we account for taxes on these earnings, expenditures outside Michigan, and savings, we estimate that alumni spent $3.1 billion in Michigan last year. Applying a conservative multiplier to the state's incremental earnings as a whole, we estimate that the total impact of alumni earnings was nearly $5.2 billion. Table A-5 on page A-10 shows how additional URC alumni earnings attributable to the URC is distributed across Michigan's ten regions.

## 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 conservative multipliers for indirectly-caused activity. We detail our methodology for the economic impact on the State of Michigan in "Estimating Net Economic Impact" on page A-1 and show our estimates in Table A-2 on page A-4.

The state economic impact is broken down by region in Table A-5 on page A-10 and discussed in "Regional Economic Impact" on page A-7. For a detailed discussion of the human capital component of the analysis (incremental alumni earnings), see Table A-6 on page A-12 and "Regional Alumni Earnings and Incremental Earnings Estimates" on page A-7.

# *IV. 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 estimate new tax revenue by first calculating the new wage and salary income that URC employees and alumni receive because of the URC.[29] 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 *new tax revenue* the state collects from (1) earnings of employees at URC universities and (2) earnings by URC alumni living in Michigan.

## ADDITIONAL INCOME DUE TO THE URC

We estimate that $2.73 billion in wages of URC employees in Michigan was *caused by* the URC in 2011. This figure accounts for substitution of URC employees for other Michigan wages that would have been paid in the absence of the URC. We also estimate that URC alums living in Michigan in 2011 earned $4.37 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 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. Our methodology for this analysis is detailed in Appendix B, which we have used since of our first annual benchmarking study, released in 2007.

**Employee Earnings.** The income of URC employees is treated as average income. The earnings of URC employees come largely from out-of-state income sources, so it is reasonable as a first approximation to treat URC

29. As described in the first annual benchmarking study, released in 2007, 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.

employee jobs as jobs that would not exist without the URC, meaning each employee's entire income generates net new tax revenue.[30] While it is possible that some of the income of URC employees could be treated as marginal income, treating it as average income is more conservative because average income is taxed at a lower average rate than is marginal income, as shown below in Table 15.

**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 Michigan taxes depends on whether their additional 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 people will pay in taxes divided by their income.[31]

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, or other state taxes and fees.

**TABLE 15. Percentage of Income Paid to the State of Michigan**

| Tax | On Additional Marginal Income | On Additional Average Income |
|---|---|---|
| Personal Income Tax | 4.35% | 1.73% |
| Sales and Use Tax | 1.70% | 2.62% |
| Property Tax | 0.38% | 0.47% |
| Transportation Tax | 0.10% | 0.22% |

*Source: Anderson Economic Group, LLC*

30. The out-of-state income sources we refer to as supporting instruction and research expenses for URC employees includes tuition from out-of-state students and R&D funding (60% of which comes from the federal government).

31. 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%.

**Income Tax.** The tax rate on marginal income in Michigan was 4.35% in 2011. We do not attempt to estimate the proportion of marginal income going toward tax exempt expenditures. To calculate the 1.73% income tax rate on average income, we divided the state's revenue from the income tax in FY 2010-11 by the state's personal income.[32]

**Sales Tax.** We calculate the sales and use tax burden using data from the U.S. Bureau of Labor Statistics' 2005 Consumer Expenditure Survey.[33] First, we identified spending categories subject to the sales and use tax.[34] 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 ratio of state property taxes to all state and local property taxes (16.7%) to arrive at an effective rate on income of 0.47%.[35] We also find that 2.3% of the additional income earned by earners in the second highest quintile goes toward property taxes. Again multi-

32. Base data source for the income tax in FY 2010-11 was the Michigan Senate Fiscal Agency. Revenue from income tax in 2011 was $6.25 billion. According to the U.S. Bureau of Economic Analysis, personal income was $360.8 billion in 2011.

33. We use the proportions of spending in the 2005 consumer expenditures as an indicator of "typical" spending behavior by consumers, as this was during the middle of a moderate economic expansion. This is an attempt to maintain continuity with our previous benchmarking reports and not over-count any temporary behavior effects from the late housing bubble or recent recession.

34. 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.

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

plying 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 4.75%, the effective rate of the gasoline tax,[36] resulting in an effective rate on income of 0.22%. 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 4.75% effective gas tax rate, we estimate the effective gas tax rate on marginal income to be 0.10%.

## TOTAL ADDITIONAL STATE TAX REVENUES

Of the additional income in Michigan, we estimate that $1.17 billion is "marginal," and $5.92 billion is "average" income ($3.20 billion from alumni and $2.73 billion 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 Table 15 of the preceding section. Table 16 below shows the results of this analysis: $375 million in additional tax revenue to the state of Michigan paid by URC graduates and employees in FY 2011.[37]

**TABLE 16. Additional Tax Revenue to State of Michigan Caused by URC, 2011**

| | 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 | | $1,173 | | $5,924.7 |
| Personal Income | 4.35% | $51.0 | 1.73% | $102.6 |
| Sales and Use Tax | 1.70% | $20.0 | 2.62% | $155.0 |
| Property Tax | 0.38% | $4.5 | 0.47% | $27.7 |
| Gasoline Tax | 0.10% | $1.2 | 0.22% | $13.2 |
| Subtotal | | (A) $76.7 | | (B) $298.5 |
| | | | Total Tax Receipts (A+B) | $375.2 |

*Data: Bureau of Labor and Statistics*

*Analysis: Anderson Economic Group, LLC*

36. Gasoline is not taxed as a percentage of its price, but rather at a per-unit rate of $0.19 per gallon. The gasoline tax of $0.19 per gallon is divided by $4 per gallon of gasoline to yield a 4.75% effective rate.

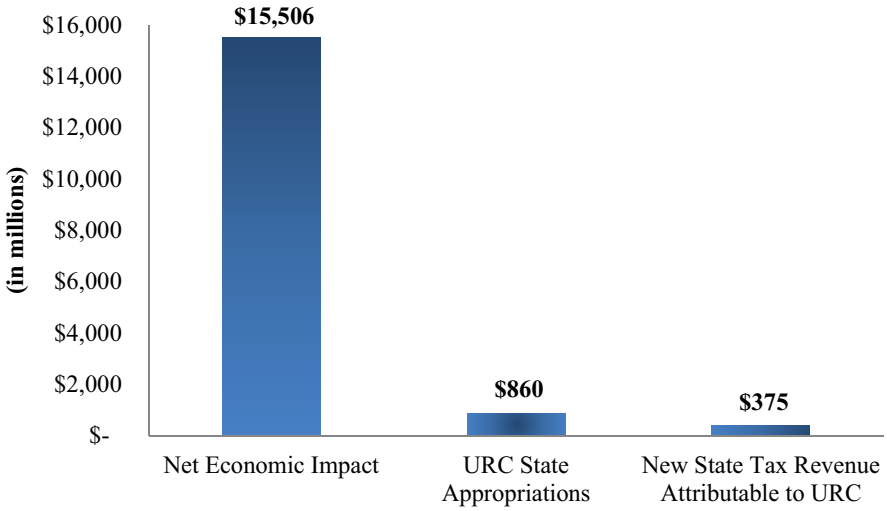
37. Tax revenue is slightly lower than last year, reflecting changes in tax rates within the state.

## COMPARISON WITH ECONOMIC IMPACT AND URC APPROPRIATIONS

Clearly the main goal of the URC universities is not generating economic impact and tax revenue for the state. However, since the state government provides funding for these universities, we compare the URC's net economic impact on the state to the state's appropriations for universities, which illustrates how much greater the benefits of the URC universities are than the costs.

As shown below in Figure 14, the $15.5 billion in net economic impact is over 17 times greater than the state's funding for the URC universities in FY 2011 of $860 million. In addition, the State of Michigan received an estimated $375 million in tax revenue from URC employees and alumni that it would otherwise not have received if the URC did not exist in Michigan.

**FIGURE 14. URC Net Economic Impact vs. State Appropriations**




*Data: AEG Estimates; Senate Fiscal Agency and House Fiscal Agency*
*Analysis: Anderson Economic Group, LLC*

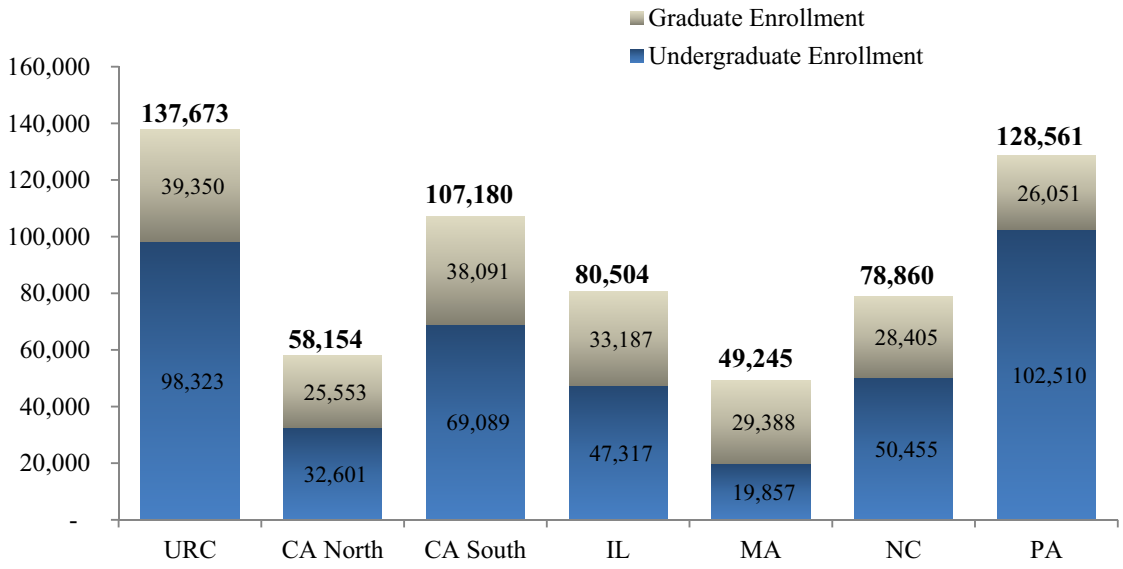
# *V. Education Benchmarks for the URC and Its Peers*

In addition to tracking the URC's performance year-to-year, we compare the URC to the six peer clusters shown in Table 5, "Comparison Peer University Clusters," on page 1. In this section we compare the URC universities to its peers on education metrics including student enrollment, total degrees awarded, and types of degrees awarded.

## STUDENT ENROLLMENT

The University Research Corridor had 137,673 students enrolled in the fall of 2011. As shown below in Figure 15, the URC is the largest university cluster of those in this analysis. Pennsylvania is the second largest with 128,561 students. Massachusetts is the smallest cluster and has more graduate students than undergraduates. Nearly 60% of the Massachusetts cluster's students are graduate students.

**FIGURE 15. Student Enrollment for the URC and Peer Clusters, 2011**

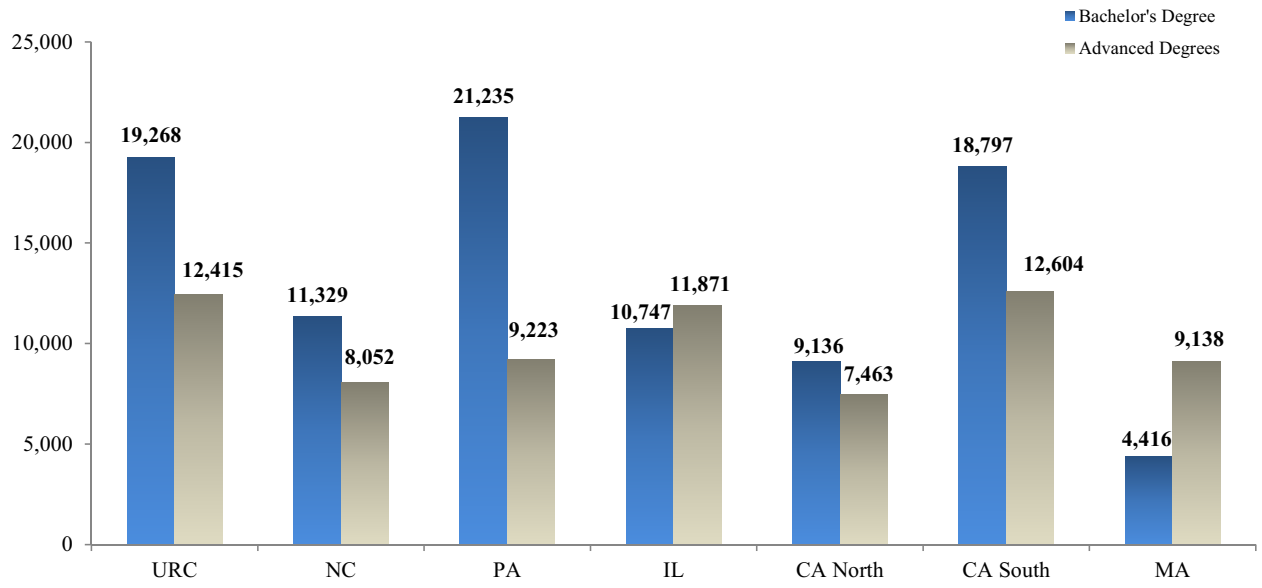



*Data: IPEDS Enrollment Data; Offices of the Registrar URC Universities, 2011*
*Analysis: Anderson Economic Group, LLC*

## TOTAL DEGREES GRANTED

In 2011, the URC ranked first in total number of degrees (undergraduate and graduate) conferred at 31,683. The Southern California cluster conferred the second most degrees (31,401 total degrees). As shown in Figure 16 on page 31, the URC issued 19,268 bachelor degrees and 12,415 advanced degrees. Only the Pennsylvania cluster awarded more bachelor degrees (21,235) than the URC. The Southern California cluster was the only cluster to award more advanced degrees (12,604) than the URC.

**FIGURE 16. Completions by Type of Degree for the URC and Peer Clusters, 2011**




*Data : IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

## DEGREES BY PROGRAM AREA

We present the number of degrees granted by the URC and the peer university clusters by subject area in this section:

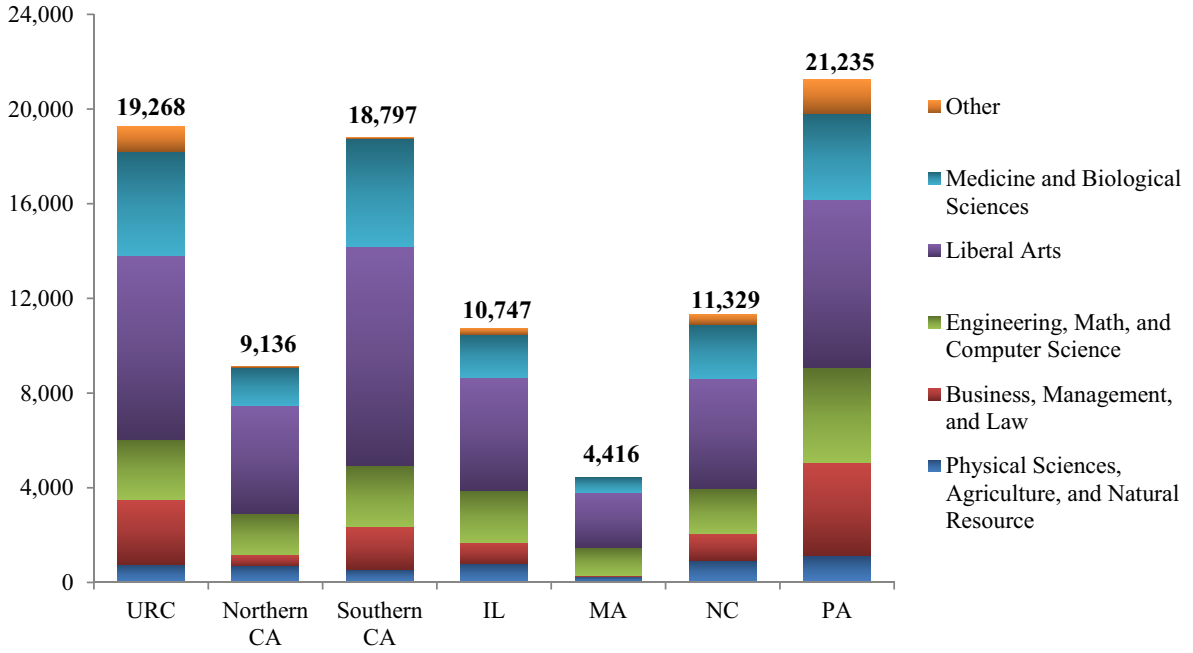
- *Physical Science, Agriculture, and Natural Resources*
- *Business, Management, and Law*
- *Engineering, Mathematics, and Computer Science*
- *Liberal Arts*
- *Medicine and Biological Science*
- *Other*

See "Academic Program Definitions" on page A-13 for the composition of each program area.

### *Undergraduate Degrees Conferred*

The URC conferred the second largest number of *Medicine and Biological Science* and *Liberal Arts* degrees next to Southern California. The URC also conferred the second largest number of *Business, Management, and Law* degrees next to the Pennsylvania cluster. See Figure 17 and Table 17 on page 32.

**FIGURE 17. Undergraduate Degrees Conferred by Area for the URC and Peer Clusters, 2011**




*Data: IPEDS Completions, 2011*
*Analysis: Anderson Economic Group, LLC*

**TABLE 17. Undergraduate Degrees Conferred by Area for the URC and Peer Clusters, 2011**

| Field | Michigan's URC | Northern CA | Southern CA | IL | MA | NC | PA |
|---|---|---|---|---|---|---|---|
| Physical Science, Ag, and Nat. Resources | 762 | 702 | 544 | 793 | 232 | 925 | 1,143 |
| Business, Mngt, and Law | 2,758 | 467 | 1,800 | 911 | 63 | 1,134 | 3,924 |
| Engineering, Math, Computer Science | 2,536 | 1,743 | 2,583 | 2,164 | 1,168 | 1,897 | 4,009 |
| Liberal Arts | 7,758 | 4,571 | 9,281 | 4,797 | 2,353 | 4,669 | 7,103 |
| Medicine and Bio. Science | 4,407 | 1,591 | 4,540 | 1,807 | 600 | 2,273 | 3,635 |
| Other Areas | 1,047 | 62 | 49 | 275 | - | 431 | 1,421 |
| **Total Degrees** | **19,268** | **9,136** | **18,797** | **10,747** | **4,416** | **11,329** | **21,235** |

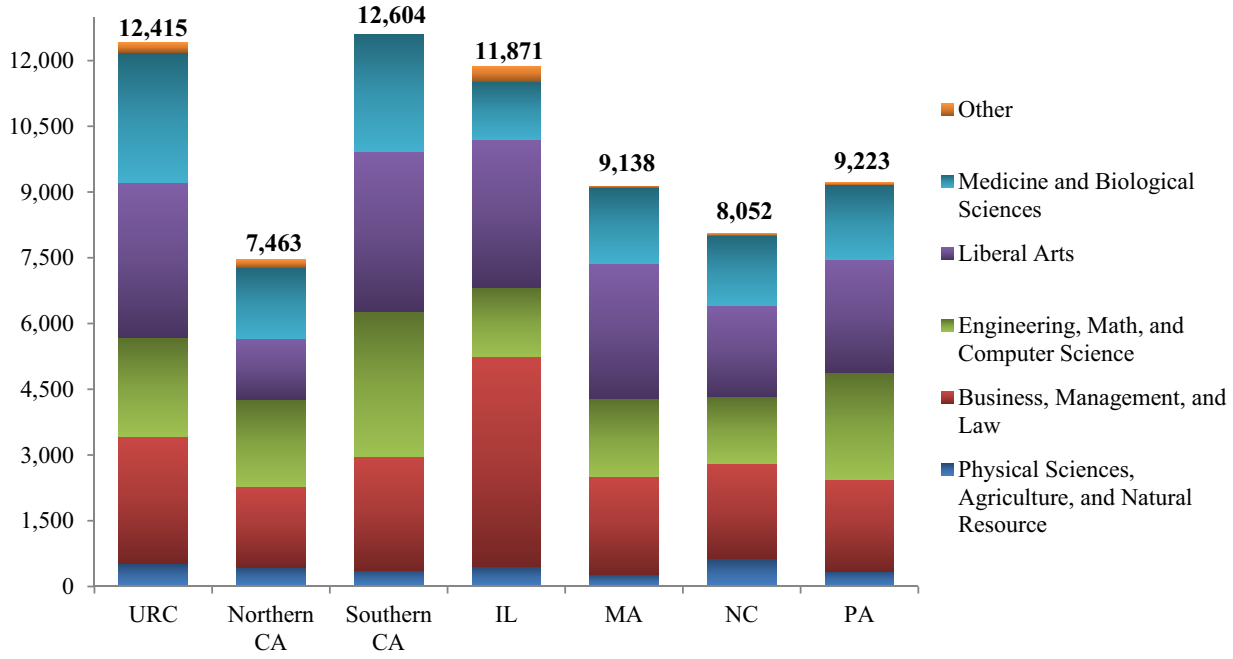
*Data : IPEDS 2011 Degree Completions, Academic Year*
*Analysis: Anderson Economic Group, LLC*

*Note: See the academic program definitions in Appendix A for information on the composition of each academic program area.*

### *Graduate Degrees Conferred*

The URC awarded the most advanced degrees in *Medicine and Biological Science* fields and the second largest number of advanced degrees in *Liberal Arts; Physical Science, Agriculture, and Natural Resources;* and *Business, Management, and Law.* See Figure 18 and Table 18 on page 33.

**FIGURE 18. Graduate Degrees Conferred by Area for the URC and Peer Clusters, 2011**




*Data: IPEDS Completions, 2011*
*Analysis: Anderson Economic Group, LLC*

**TABLE 18. Graduate Degrees Conferred by Area for the URC and Peer Clusters, 2011**

| Field | Michigan's URC | Northern CA | Southern CA | IL | MA | NC | PA |
|---|---|---|---|---|---|---|---|
| Physical Science, Ag, and Nat. Resources | 529 | 446 | 376 | 455 | 281 | 629 | 348 |
| Business, Mngt, and Law | 2,897 | 1,841 | 2,595 | 4,786 | 2,226 | 2,183 | 2,102 |
| Engineering, Math, Computer Science | 2,257 | 1,978 | 3,312 | 1,592 | 1,775 | 1,521 | 2,429 |
| Liberal Arts | 3,532 | 1,401 | 3,649 | 3,374 | 3,089 | 2,074 | 2,583 |
| Medicine and Bio. Science | 2,972 | 1,614 | 2,672 | 1,314 | 1,737 | 1,608 | 1,702 |
| Other Areas | 228 | 183 | - | 350 | 30 | 37 | 59 |
| **Total Degrees** | **12,415** | **7,463** | **12,604** | **11,871** | **9,138** | **8,052** | **9,223** |

*Data: IPEDS 2011 Degree Completions, Academic Year*
*Analysis: Anderson Economic Group, LLC*

*Note: See the academic program definitions in Appendix A for information on the composition of each academic program area.*

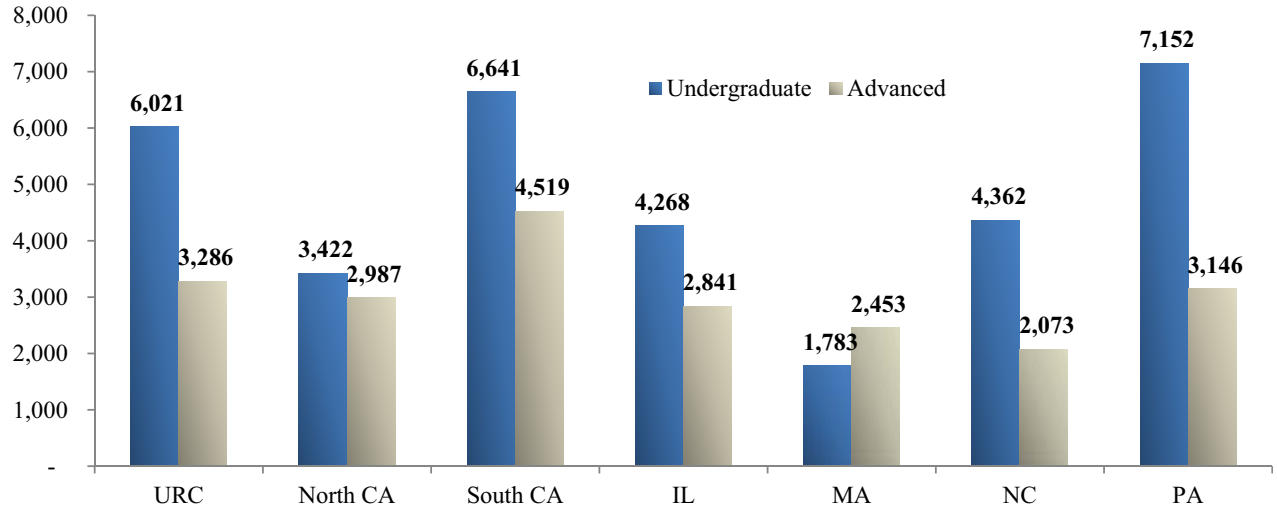
## HIGH-TECH AND HIGH DEMAND DEGREES

In this section we identify the number of degrees awarded by cluster that prepare students for jobs in the "high-tech" industry or that are in "high demand" by employers. We use the same definitions as those discussed in "High-Tech and High Demand Degrees" on page 7. See "High Tech and High Demand Degrees" on page A-14 for further description of our methodology.

### *High-Tech Degrees by Cluster*

As shown below in Figure 19, the URC awarded the third highest number of undergraduate high-tech degrees (6,021) and the second most advanced high-tech degrees (3,286) in the 2011 academic year. In total, the URC awarded the third most high-tech degrees of the peer clusters at 9,307. Only the Southern California (11,160) and Pennsylvania (10,298) university clusters awarded more high-tech degrees than the URC.

**FIGURE 19. Completion of High-Tech Degrees for the URC and Peer Clusters, 2011**




*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

### *High Demand Degrees by Cluster*

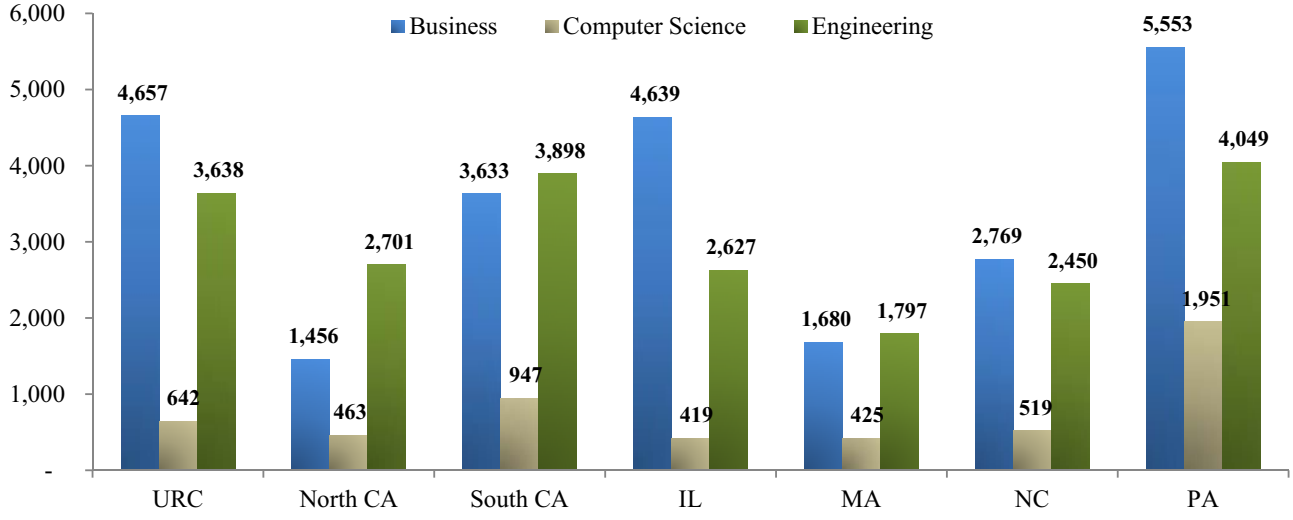
The three fields of study with the highest demand among employers surveyed were Business, Computer Science, and Engineering.[38] We analyzed the number of degrees awarded at the undergraduate and graduate levels in these fields in 2011.

Figure 20 on page 35 shows the total number of high demand degrees conferred by academic area for the URC and each peer cluster. The URC conferred the second highest number of business degrees (4,657), behind the Pennsylvania cluster

38. The National Association of Colleges and Employers' *Job Outlook 2011 Report* surveyed approximately 200 employers from a variety of sectors. We describe the degree categories in "Degrees by Program Area" on page A-31.

(5,553). The URC had the third highest in computer science and engineering, but awarded the second highest number of high demand degrees overall in 2011.

**FIGURE 20. Completion of High Demand Degrees for the URC and Peer Clusters, 2011**




*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

## SUMMARY OF HIGH-TECH, HIGH DEMAND, AND MEDICAL DEGREES

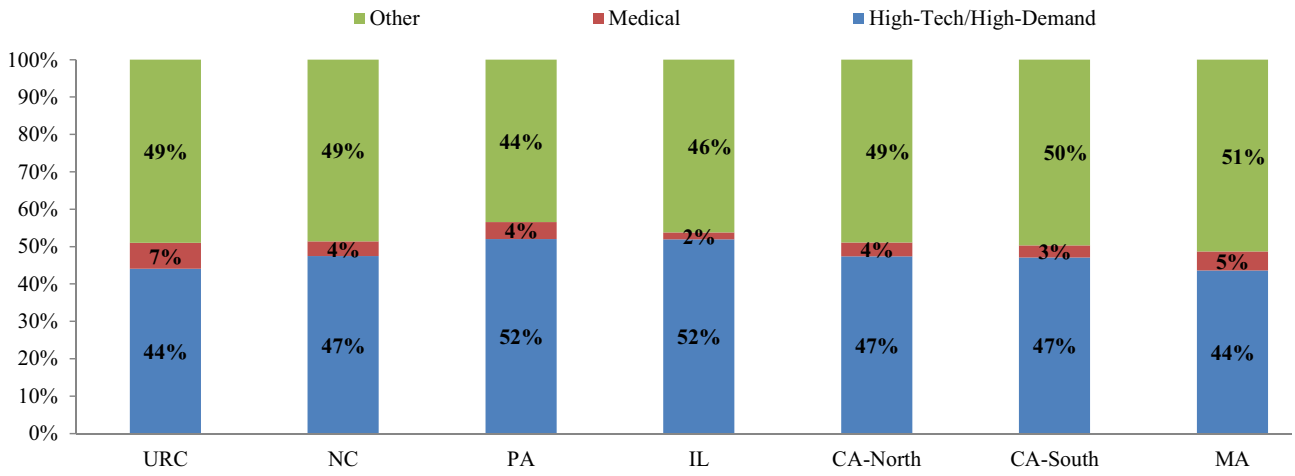
Many students pursue a particular degree in order to maximize their employment prospects. As discussed in "High-Tech and High Demand Degrees" on page 34, degrees that are in growing fields and/or in demand by employers include those that fall into the categories of high-tech and high-demand, as well as those in medical fields.[39] We compare the URC's composition of awarded degrees in these fields to its peer clusters in Figure 21 on page 36.[40]

In 2011, the Northern California cluster had the greatest share of high-tech degrees, Pennsylvania had the highest share of high-demand degrees, and the URC had a significantly higher proportion of medical degrees than the other clusters. As a share of total degrees awarded, the Pennsylvania cluster had the greatest combined proportion of high-tech, high-demand, and medical degrees.

39. Note that we include nursing degrees in the medical field. See "Summary of High-Tech, High Demand, and Medical Degrees" on page 14 and

40. For further description of IPEDS degree categories included in these fields see "Summary of Degrees in High-Tech, High Demand, and Medical Fields" on page A-15.

**FIGURE 21. Composition of Degree Completions in High-Tech, High Demand, and Medical Fields for the URC and Peer Clusters, 2011**




*Data: IPEDS 2011 Completions*
*Analysis: Anderson Economic Group, LLC*

In the following section we compare the URC universities to its peer clusters in research metrics involving R&D expenditures and technology transfer activities.

# *VI. Research Benchmarks for URC and its Peers*

In addition to benchmarking the URC against its peers using education metrics, such as student enrollment, total degrees awarded, and types of degrees awarded, we use research metrics. Each university in a peer cluster are classified as engaging in very high research activity.[41] This section compares the URC to its peers in terms of total academic R&D expenditures, source of R&D funding, research expenditures by field, and technology transfer activities.

## ACADEMIC R&D EXPENDITURES

In FY 2011, academic institutions in the U.S. spent over $65 billion on research and development.[42] Using the most recent data available from the National Science Foundation, we show the sources for research and development (R&D) expenditures for each university cluster below in Table 19. Total R&D expenditures by the seven university clusters totaled approximately $114.5 billion in 2011, making up about 22% of R&D expenditures by all U.S. universities. In 2011, the URC had the fourth largest R&D expenditures of the seven university clusters at about $2 billion.

**TABLE 19. Source of R&D Expenditures for URC and Peer Clusters in 2011 (in millions of dollars)**

| | Total R&D Expenditures | Federal Government | State & Local Government | Industry[a] | Non-Profits | Institution | All Other Sources |
|---|---|---|---|---|---|---|---|
| **Michigan's URC** | **$2,002** | **$1,200** | **$50** | **$51** | **$70** | **$601** | **$30** |
| Northern California | $2,611 | $1,562 | $129 | $198 | $291 | $330 | $99 |
| Southern California | $2,595 | $1,654 | $98 | $150 | $242 | $319 | $132 |
| Illinois | $1,618 | $1,095 | $39 | $64 | $93 | $313 | $13 |
| Massachusetts | $1,530 | $1,154 | $3 | $146 | $152 | $29 | $46 |
| North Carolina | $2,168 | $1,302 | $134 | $282 | $124 | $325 | $0.7 |
| Pennsylvania | $1,946 | $1,336 | $69 | $94 | $66 | $373 | $8 |
| *Average U.S. Universities* | $71.3 | $44.7 | $4.2 | $3.5 | $4.2 | $13.6 | $1.1 |

*Data: National Science Foundation (NSF), Higher Education Research and Development (HERD) Survey, FY 2011*
*Analysis: Anderson Economic Group, LLC*

a. This category is labeled "business" in the NSF survey, but we have kept the category label "industry," as we have in prior reports.

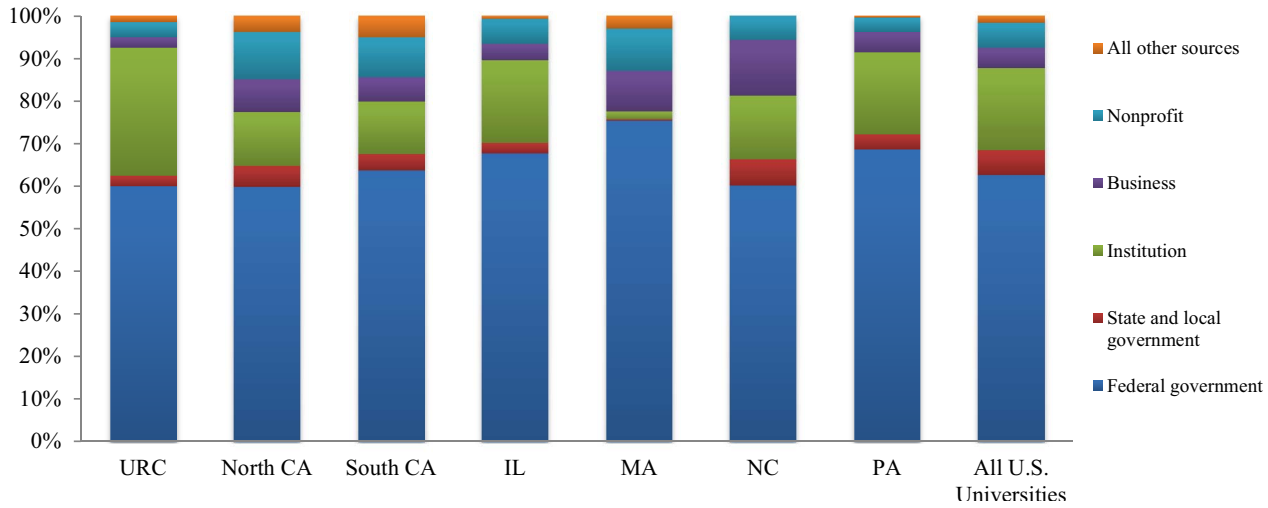
The majority of university funding for R&D comes from the federal government, as shown in Figure 22 on page 38. While the URC received 60% of its funding in 2011 from the federal government, the URC receives less as a percentage of total funding

41. "Very high research activity" is a classification designated by the Carnegie Foundation for the Advancement of Teaching, and the highest category assigned to doctorate-granting institutions based on a measure of their research activity. Carnegie classifications have been the leading framework for recognizing and describing institutional diversity in U.S. higher education for the past four decades.

42. National Center for Science and Engineering Statistics, Higher Education Research and Development (HERD) Survey, FY 2011.

than its peers, except for the Northern California cluster (59.8%). The URC relies on institution funds (which come from the universities themselves rather than outside entities) for a significantly higher proportion of its R&D spending than the other six comparison clusters, as well as the average U.S. university. In 2011, the URC universities relied on their own funds for 38% of total R&D expenditures.

**FIGURE 22. Source of Funding for R&D Expenditures for URC and Peer Clusters, 2011**




From 2010 to 2011, the URC increased total R&D expenditures by 6.6%, which is the third highest percentage increase among the clusters. As shown below in Table 20, this growth rate was higher than the average for all U.S. universities. It is notable that in the last five years (2007 to 2011), the URC increased their R&D spending by 43%, which is more than any of its peer clusters during that time. The the next closest clusters in terms of growth is North Carolina (36%) and Pennsylvania (38%).

**TABLE 20. Growth in Total Academic R&D Expenditures for URC and Peer Clusters, FY 2010-2011**

| | R&D Expenditures (in millions) | | Annual Growth 2010-2011 | *Rank Growth 2010-2011* |
|---|---|---|---|---|
| | FY 2010 | FY 2011 | | |
| **Michigan's URC** | **$1,878** | **$ 2,002** | **6.6%** | ***3*** |
| Northern California | $2,469 | $2,611 | 5.7% | *4* |
| Southern California | $2,473 | $2,595 | 4.9% | *5* |
| Illinois | $1,557 | $1,618 | 4.0% | *6* |
| Massachusetts | $1,417 | $1,530 | 8.0% | *1* |
| North Carolina | $2,099 | $2,168 | 3.3% | *7* |
| Pennsylvania | $1,816 | $1,946 | 7.1% | *2* |
| *All U.S. Universities* | *$61,235* | *$65,073* | *6.3%* | |

*Data: NSF HERD Survey, FY 2011*
*Analysis: Anderson Economic Group, LLC*

Between 2010 and 2011, the URC increased its science and engineering R&D expenditures by 6.4%, which is the second highest percentage increase of the university clusters, as shown below in Table 21. This growth rate was higher than the average increase by all universities.

**TABLE 21. Growth in Science and Engineering R&D Expenditures for URC and Peer Clusters, FY 2010-2011**

| | S&E R&D Expenditures (in millions) | | Growth 2010-2011 | *Rank Growth 2010-2011* |
|---|---|---|---|---|
| | FY 2010 | FY 2011 | | |
| **Michigan's URC** | **$1,783** | **$1,897** | **6.4%** | ***2*** |
| Northern California | $2,405 | $2,535 | 5.4% | *5* |
| Southern California | $2,412 | $2,526 | 4.7% | *6* |
| Illinois | $1,481 | $1,565 | 5.7% | *4* |
| Massachusetts | $1,323 | $1,472 | 11.2% | *1* |
| North Carolina | $2,085 | $2,155 | 3.4% | *7* |
| Pennsylvania | $1,796 | $1,906 | 6.1% | *3* |
| *All U.S. Universities* | *$58,338* | *$61,891* | *6.1%* | |

*Data: NSF HERD Survey, FY 2011*
*Analysis: Anderson Economic Group, LLC*

Research priorities vary across the university clusters, which impact what fields receive higher amounts of R&D funding. By and large, universities focus the greatest amount of their spending on science and engineering (S&E) fields, as shown below in Table 22.

**TABLE 22. URC and Peer Clusters' Share of Total R&D Expenditures by Field, 2011**

| | Environmental Sciences | Life Sciences | Math & Computer Sciences | Physical Sciences | Psychology | Social Sciences | Other Sciences | Engineering | All Non-S&E fields |
|---|---|---|---|---|---|---|---|---|---|
| **Michigan's URC** | **1%** | **59%** | **2%** | **7%** | **2%** | **9%** | **1%** | **14%** | **5%** |
| Northern CA | 2% | 67% | 1% | 8% | 1% | 3% | 5% | 11% | 3% |
| Southern CA | 7% | 64% | 6% | 6% | 2% | 2% | 1% | 9% | 3% |
| Illinois | 1% | 58% | 8% | 10% | 2% | 2% | 1% | 14% | 3% |
| Massachusetts | 4% | 43% | 4% | 12% | 1% | 3% | 6% | 24% | 4% |
| North Carolina | 3% | 76% | 3% | 3% | 2% | 4% | 0% | 8% | 1% |
| Pennsylvania | 4% | 54% | 8% | 5% | 3% | 2% | 1% | 21% | 2% |
| *All U.S. Universities* | *5%* | *57%* | *4%* | *7%* | *2%* | *3%* | *2%* | *15%* | *5%* |

*Data: NSF HERD Survey, FY 2011*
*Analysis: Anderson Economic Group, LLC*
*Note: Fields determined by NSF. See "R&D Expenditures" on page A-15 for further description of S&E fields.*

In 2011, the North Carolina and California clusters spent a larger share on life sciences, while the Massachusetts and Pennsylvania clusters both spent less than the national average on life sciences. The Illinois and Massachusetts clusters spent

higher shares on physical sciences, while the North Carolina and Pennsylvania clusters spent lower than the U.S. average. The Pennsylvania and Massachusetts clusters also spent significant shares on engineering. The URC is mostly consistent with U.S. university averages for spending shares, but spends a significantly lower share on environmental sciences, and a higher share on social sciences.

### *Expenditures by Research Type*

Universities devote their time to different types of research: basic, applied, and development. The NSF defines *basic research* as research undertaken primarily to acquire knowledge without any particular application or use in mind, and *applied research* as research conducted to meet a specific, recognized need. *Development* is the systematic use of research towards the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes.

Below in Table 23, we show the percentage of R&D funds going towards basic research, applied research, and development. The URC spends the second highest amount of their funding on applied research (32.7%), only behind the Pennsylvania cluster (34.0%).

**TABLE 23. Share of R&D Expenditures Spent on Basic, Applied, and Development Research by URC and Peer Clusters, 2011**

| University Cluster | Basic Research | Applied Research | Development |
|---|---|---|---|
| **Michigan's URC** | **64.5%** | **32.1%** | **3.4%** |
| Northern California | 80.3% | 12.1% | 7.6% |
| Southern California | 69.8% | 25.4% | 4.8% |
| Illinois | 73.5% | 19.6% | 7% |
| Massachusetts | 67.4% | 23.2% | 9.4% |
| North Carolina | 57.4% | 22.4% | 20.2% |
| Pennsylvania | 52.1% | 34% | 13.9% |
| *All U.S. Universities* | *64.9%* | *26.3%* | *8.8%* |

*Data: NSF HERD Survey, FY 2011*
*Analysis: Anderson Economic Group, LLC*

*Note: Due to non-responses from universities on this new question, some of the data is estimated by NSF.*

## TECHNOLOGY TRANSFERS

University research and development expenditures often lead to the production and sale of new products and services in the private sector. The success of academic research and development activities is often evaluated in terms of technology transfer to the private sector. The pharmaceutical, medical, computer technology, consumer electronic, telecommunication, agricultural, and manufacturing industries are among the many industries benefiting from research and development conducted at universities. Common indicators of tech transfer achievement include the number of patent applications 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, royalty revenue, and the number of new start-ups are more informative indicators of technology transfer. We examine these indicators and compare the URC's performance to that of the other clusters.

The URC ranks in the lower half when comparing its 2007-2011 average annual technology transfer activities to the peer university clusters. The URC ranks fourth in average annual number of patent grants, seventh in invention disclosures, and fifth in licenses and options issued, and licensing revenue, as shown below in Table 24.

**TABLE 24. Average Annual Patent and Licensing Activity for URC and Peer Clusters, 2007-2011**

| | Invention Disclosures | *Rank* | U.S. Patent Grants | *Rank* | Licenses/ Options | *Rank* | Licensing Revenue (in millions) | *Rank* |
|---|---|---|---|---|---|---|---|---|
| **Michigan's URC[a]** | **483** | ***7*** | **141** | ***4*** | **127** | ***5*** | **$35.3** | ***5*** |
| Northern California[b] | 760 | *3* | 253 | *1* | 163 | *4* | $125.7 | *2* |
| Southern California[c] | 827 | *2* | 152 | *3* | 104 | *6* | $52.1 | *4* |
| Illinois[d] | 513 | *4* | 120 | *5* | 97 | *7* | $274.2 | *1* |
| Massachusetts[e] | 898 | *1* | 217 | *2* | 169 | *3* | $72.6 | *3* |
| North Carolina[f] | 488 | *6* | 119 | *6* | 228 | *1* | $25.2 | *6* |
| Pennsylvania[g] | 500 | *5* | 97 | *7* | 180 | *2* | $14.1 | *7* |

*Data: Universities' websites and technology transfer offices, Association of Technology Managers (AUTM) Surveys*
*Analysis: Anderson Economic Group, LLC*

a. Michigan State University, the University of Michigan, and Wayne State University information was obtained from the URC.

b. The University of California provided statistics for all their campuses through their Office of Technology and its Annual Reports for 2005-2011. Stanford University provided all statistics for 2005-2011 through their website and Office of Technology Licensing.

c. The University of California provided statistics for all their campuses through their Office of Technology and the office's Annual Reports for 2005-2011. USC data for 2006 was collected from the AUTM survey and through USC's Stevens institute for 2007-2011.

d. Northwestern University provided all statistics for 2006-2009 through their website. Northwestern data for 2010 was collected from the AUTM survey. Northwestern data for 2011 was collected from the Innovation and New Ventures Office. University of Chicago provided all statistics through their Office of Technology & Intellectual Property. University of Illinois, Urbana-Champaign provided all statistics through their Office of Technology Management website.

e. MIT, and Tufts reported 2004-2011 data on their websites. Harvard data was collected from the 2006 AUTM survey and through Harvard's Office of Technology Development for 2007-2011.

f. Data for UNC Chapel Hill and NC State University were collected from their Office of Technology Development. Data for Duke University was provided by AUTM in 2006 and through their Office of Licensing & Ventures for 2007-2011.

g. Data collected for the Pennsylvania cluster was from the University of Pittsburgh's Office of Technology Management, Penn State's Intellectual Property office, Carnegie Mellon's Center for Technology Transfer and Enterprise Creation, and the 2006 AUTM surveys.

The URC's rankings in recent years follow a longer-run trend of technology transfer activities from 2002 to 2011, as shown in Table 25 on page 42. Looking at the average annual activity for a longer period, the URC ranks fifth in average number of invention disclosures, fourth in patent grants awarded, and fifth in licenses and options, as well as licensing revenue.

**TABLE 25. Average Annual Patent and Licensing Activity for URC and Peer Clusters, 2002-2011**

| | Invention Disclosures | *Rank* | Patent Grants | *Rank* | Licenses/ Options | *Rank* | Licensing Revenue (in millions) | *Rank* |
|---|---|---|---|---|---|---|---|---|
| **Michigan's URC** | **460** | ***5*** | **133** | ***4*** | **123** | ***5*** | **$37.1** | ***5*** |
| Northern California | 704 | *3* | 226 | *1* | 174 | *2* | $148.7 | *1* |
| Southern California | 726 | *2* | 136 | *3* | 120 | *6* | $41.5 | *4* |
| Illinois | 463 | *4* | 128 | *5* | 101 | *7* | $146.7 | *2* |
| Massachusetts | 802 | *1* | 211 | *2* | 188 | *1* | $65.7 | *3* |
| North Carolina | 445 | *6* | 95 | *7* | 166 | *3* | $15.8 | *6* |
| Pennsylvania | 444 | *7* | 107 | *6* | 154 | *4* | $13.4 | *7* |

*Data: Universities' websites and technology transfer offices, Association of Technology Managers (AUTM) Surveys; see footnotes in Table 24 on page 41.*
*Analysis: Anderson Economic Group, LLC*

From 2008 to 2009, nearly every cluster's number of start-ups declined, as shown in Table 26 below. Startups had different patterns for increasing or decreasing in each cluster from 2010 to 2011. The number of URC cultivated start-ups increased from 14 in 2010 to 18 in 2011. The URC ranks third among its peers in the number of start ups cultivated in 2011. On average, 14 new companies are started each year with licensed technology from a URC university. The URC is tied for fifth in number of start-ups it has helped to create.

**TABLE 26. Annual Number of Start-ups Cultivated at University Clusters, 2007-2011**

| | 2007 | 2008 | 2009 | 2010 | 2011 | Average, 2007-11 | Rank[a] |
|---|---|---|---|---|---|---|---|
| **Michigan's URC[b]** | **14** | **17** | **8** | **14** | **18** | **14** | **5** |
| Northern California | 27 | 27 | 18 | 23 | 16 | 22 | 3 |
| Southern California | 25 | 31 | 29 | 46 | 38 | 34 | 1 |
| Illinois[c] | 16 | 12 | 13 | 14 | 17 | 14 | 5 |
| Massachusetts | 35 | 34 | 30 | 25 | 27 | 30 | 2 |
| North Carolina | 9 | 16 | 9 | 14 | 18 | 13 | 7 |
| Pennsylvania | 21 | 16 | 16 | 21 | 17 | 18 | 4 |

*Data: Universities' websites and technology transfer offices, see also footnotes in Table 24 on page 41*
*Analysis: Anderson Economic Group, LLC*

a. The URC and Illinois had the same number of average startups cultivated over the 5-year period.

b. As in our 2011 report, the 2008 data excludes the number of start-ups assisted by the URC that did not involve a licensed technology. The number for 2008 dropped from 28 to 17.

c. The five year average (2006-2010) for the University of Chicago's start-ups were used as the 2011 number.

One measure of R&D expenditure success is the amount of licensing revenue generated by each dollar of expenditure on fields of science and engineering. Since licensing revenue can have large year-to-year variations caused by the sale of a large license, we compared the average revenue over a five-year period (2007-2011) to the S&E R&D expenditures over the same five year period. Table 27 below shows that the URC has performed better than the North Carolina and Pennsylvania clusters in terms of revenues earned per science and engineering R&D dollar spent.

**TABLE 27. Average Annual Licensing Revenue as a Percent of S&E R&D Expenditures at URC and Peer University Clusters, 2007-2011**

| | Average Licensing Revenue 2007-2011 (in millions) | Average S&E R&D Expenditures 2007-2011 (in millions) | Revenues per Expenditures | *Licensing Revenue per S&E Expenditure Ranking* |
|---|---|---|---|---|
| **Michigan's URC** | **$35.3** | **$1,640** | **2.1%** | ***5*** |
| Northern California | $125.7 | $2,298 | 5.5% | *3* |
| Southern California | $52.1 | $2,321 | 2.2% | *4* |
| Illinois | $274.2 | $1,417 | 19.4% | *1* |
| Massachusetts | $72.6 | $1,318 | 5.5% | *2* |
| North Carolina | $25.2 | $1,864 | 1.3% | *6* |
| Pennsylvania | $14.1 | $1,642 | 0.9% | *7* |

*Data: Universities' websites and technology transfer offices, see also footnotes in Table 24 on page 41*
*Analysis: Anderson Economic Group, LLC*

# *Appendix A. Methodology*

This appendix describes the following: how data sources were used to create the maps included in this report; the methodology AEG used to complete our economic impact analysis; and the methods used to benchmark the URC against its peer clusters in terms of education and research metrics.

## MAP METHODOLOGY

All of the maps in this report were created using Geographic Information Software (GIS). Using data provided by the URC universities, we created Maps 1 through 4. When data was incomplete or imperfect in terms of geographies, we used professional judgement and GIS make estimations.

Map 2, "URC Students by County, 2011," on page 4 is based on county data from the URC that roughly matched the total number of students originating from Michigan. We took the number of URC students by county from the universities and calculated the share of students per county based on the total given to us. We then applied these shares to the total number of URC students from Michigan (102,260).

Map 4, "URC Alumni by ZIP Code, 2012," on page 16 was created using zip code data from the URC alumni offices. Using this data, we estimated the number of alumni per county, which we used in our regional incremental alumni earnings analysis.[43] This is discussed further in "Incremental Alumni Earnings in 2011 Caused by URC" on page A-6.

Map , "We present two geographies of economic impact in this section; the State of Michigan, as well as ten economic regions in Michigan, as defined by the Michigan Economic Development Corporation (MEDC). These regions and their estimated economic impact are shown in Map 5 on page 20.," on page 18 are based on the economic collaborative regions created by the MEDC. We display our economic impact estimates of output and employment for those regions in

## ESTIMATING NET ECONOMIC IMPACT

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 and economic 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.

43. Zip codes often

### *Operational Expenditures Methodology*

We did the following to calculate the net economic impact of the URC:

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

1. We obtained salary, fringe benefit, and non-payroll expenditures for the URC universities for FY 2011 from 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 2010 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. We updated this information using room and board information for the 2011-2012 school year provided by the URC universities.

**Accounting 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. We did this by using a substitution parameter for each category of expenditures, which are shown below in Table A-1.

**TABLE A-1. Substitution Effect Parameters for URC Expenditures Analysis**

| Category | Parameter |
|---|---|
| Instruction of Resident URC Students | 10% |
| Instruction of Non-resident URC Students | 0% |
| Research Dollars | 2% |
| Student Expenditures | 6% |
| Faculty Expenditures | 30% |
| Hospital Expenditures | 30% |
| Hospital Faculty and Staff | 14% |

*Source: Anderson Economic Group, LLC*

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 93% 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.

**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.

We calculated the *indirect* economic impact of URC's expenditures by multiplying the direct expenditures by final demand output multipliers based on those released by the U.S. Department of Commerce's Regional 2006 Multipliers (RIMS II). We used multipliers based on the following industry categories for the following expenditures: Households (H00000) to estimate indirect impact of payroll and student expenditures; Junior colleges, colleges, universities, and professional schools (611A00) to estimate indirect impact of non-payroll expenditures, and Hospitals (622000) to estimate indirect impact of non-payroll hospitals expenditures.[44] These multipliers are shown in the "Indirect Expenditures In-State, After Likely Substitution" in Table A-2 on page A-4.

Also included in the net economic impact are the earning of alumni. This is discussed in "Impact of Alumni Earnings" on page A-6, but not shown in Table A-2.

44. In order to compare the URC's annual impact each year, we have consistently used the same set of multipliers to determine indirect impact.

## Table A-2. Net Economic Impact of URC's Operations

Fiscal Year 2011

| Direct Expenditures In-State, After Likely Substitution | | | Net Economic Impact in Michigan |
|---|---|---|---|
| A. Instruction of In-State Students (Non-payroll) | | $ 1,049,424,269 | |
| *less: expenditures out of state* | *40%* | $ (419,769,708) | |
| *Subtotal: Expenditures in state* | | $ 629,654,562 | |
| *less: substitution of higher expenditures by other MI colleges & univ.* | *10%* | $ (62,965,456.15) | |
| | | | $ 566,689,105 |
| B. Instruction of Out-of-State Students (Non-payroll) | | $ 393,293,852 | |
| *less: expenditures out of state* | *40%* | $ (157,317,540.84) | |
| *Subtotal: Expenditures in state* | | $ 235,976,311 | |
| *less: substitution of out-of-state students to other MI colleges & univ.* | *0%* | $ - | |
| | | | $ 235,976,311 |
| C. Research Expenditures (Non-payroll) | | $ 537,791,792 | |
| *less: expenditures out of state* | *40%* | $ (215,116,716.72) | |
| *Subtotal: Expenditures in state* | | $ 322,675,075 | |
| *less: substitution of more research dollars coming into other MI colleges & univ.* | *2%* | $ (6,453,501.50) | |
| | | | $ 316,221,574 |
| D. Student Local Spending (excludes tuition and fee expenditures) | | $ 1,874,255,482 | |
| *less: expenditures out of state* | *5%* | $ (93,712,774.10) | |
| *Subtotal: Expenditures in state* | | $ 1,780,542,708 | |
| *less: likely substitution of students to other colleges in MI* | *6%* | $ (106,832,562.47) | |
| | | | $ 1,673,710,145 |
| E. URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital) | | $ 3,204,183,560 | |
| *less: expenditures out of state, savings* | *20%* | $ (640,836,712.09) | |
| *Subtotal: Expenditures in state* | | $ 2,563,346,848 | |
| *less: likely substitution to jobs with other universities in Michigan* | *30%* | $ (769,004,054.51) | |
| | | | $ 1,794,342,794 |
| F. Hospital Expenditures (Non-payroll) | | $ 724,813,000 | |
| *less: expenditures out of state* | *20%* | $ (144,962,600) | |
| *Subtotal: Expenditures in state* | | $ 579,850,400 | |
| *less: likely substitution of higher spending by other MI hospitals* | *30%* | $ (173,955,120) | |
| | | | $ 405,895,280 |
| G. Hospital Employee Earnings & Fringe Benefits, After Taxes | | $ 1,429,905,500 | |
| *less: expenditures out of state, savings* | *20%* | $ (285,981,100) | |
| *Subtotal: Expenditures in state* | | $ 1,143,924,400 | |
| *less: likely substitution to jobs with other health care systems in Michigan* | *14%* | $ (160,149,416) | |
| | | | $ 983,774,984 |
| **Total Direct Expenditures (in state, after substitution)** | | | **$ 5,976,610,194** |

*Data Sources: National Center for Education Statistics, IPEDS Finance; URC Universities; 2011 Consumer Expenditure Survey*

| Indirect Expenditures In-State, After Likely Substitution | | |
|---|---|---|
| A. Instruction of In-State Students (Non-payroll) | *2.2149* | $ 688,470,594 |
| B. Instruction of Out-of-State Students (Non-payroll) | *2.2149* | $ 286,687,621 |
| C. Research Expenditures (Non-payroll) | *2.2149* | $ 384,177,590 |
| D. Student Local Spending (excludes tuition and fee expenditures) | *1.369* | $ 617,599,044 |
| E. URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital) | *1.6781* | $ 1,216,743,849 |
| F. Hospital Expenditures (Non-payroll) | *2.225* | $ 497,221,718 |
| G. Hospital Employee Earnings & Fringe Benefits, After Taxes | *1.6781* | $ 667,097,817 |
| **Total Indirect Expenditures (in state, after substitution)** | | **$ 4,357,998,231** |

## Table A-2. Net 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) | | | $ 1,255,159,700 |
| B. Instruction of Out-of-State Students (Non-payroll) | | | $ 522,663,932 |
| C. Research Expenditures (Non-payroll) | | | $ 700,399,163 |
| D. Student Local Spending (excludes tuition and fee expenditures) | | | $ 2,291,309,189 |
| E. URC Employee Earnings & Fringe Benefits, After Taxes (excluding Hospital) | | | $ 3,011,086,642 |
| F. Hospital Expenditures (Non-payroll) | | | $ 903,116,998 |
| G. Hospital Employee Earnings & Fringe Benefits, After Taxes | | | $ 1,650,872,801 |
| **TOTAL NET ECONOMIC IMPACT OF UNIVERSITY OPERATIONS** | | | **$ 10,334,608,425** |

| | | | |
|---|---|---|---|
| **Jobs Impact on the State, After Likely Substitution** | | | |
| A. Number of FTE Faculty, Excluding Hospital | | 9,210 | |
| *less likely substitution to other jobs in Michigan* | *12%* | (1,105) | |
| *Subtotal: New faculty jobs in Michigan* | | 8,105 | |
| ** Indirect Employment Multiplier* | *2.20* | 9,726 | |
| *Total Faculty in Michigan Caused by URC Operations* | | | 17,831 |
| B. Number of FTE Faculty, Hospital | | 2,195 | |
| *less likely substitution to other jobs in Michigan* | *8%* | (176) | |
| *Subtotal: New faculty jobs in Michigan* | | 2,020 | |
| ** Indirect Employment Multiplier* | *2.00* | 2,020 | |
| *Total Faculty in Michigan Caused by URC Operations* | | | 4,039 |
| C. Number of FTE Staff, Excluding Hospital | | 27,408 | |
| *less likely substitution to other jobs in Michigan* | *40%* | (10,963) | |
| *Subtotal: New staff jobs in Michigan* | | 16,445 | |
| ** Indirect Employment Multiplier* | *1.93* | 15,294 | |
| *Total Staff in Michigan Caused by URC Operations* | | | 31,738 |
| D. Number of FTE Staff in Hospital | | 13,402 | |
| *less likely substitution to other jobs in Michigan* | *20%* | (2,680) | |
| *Subtotal: New staff jobs in Michigan* | | 10,722 | |
| ** Indirect Employment Multiplier* | *1.93* | 9,971 | |
| *Total Staff in Michigan Caused by URC Operations* | | | 20,693 |
| **Total Direct & Indirect Jobs Caused by URC** | | | **74,301** |

### *Impact of Alumni Earnings*

Below we describe the data used to estimate the final component of net economic impact of the URC: incremental alumni earnings attributable to the URC universities. This estimate is then added to the $10.3 billion impact from university operations.

**Alumni Data.** We used data from the alumni offices of each of the URC universities. They provided us with aggregated data on the number of known alumni by country, by U.S. state and territory, and by Michigan zip code. We were given number of alumni by graduation year and highest degree earned at the university. We show the earnings of Michigan URC alumni by age and degree in FY 2011 below in Table A-3.

**TABLE A-3. Michigan Earnings of URC Alumni by Age and Degree, 2011 (in millions)**

| | 21-24 Years | 25-34 Years | 35-44 Years | 45-64 Years | Over 65 Years | Total |
|---|---|---|---|---|---|---|
| Bachelor Degree | $1,328 | $3,941 | $4,579 | $6,796 | $356 | $16,999 |
| Advanced Degree | $74 | $3,112 | $3,448 | $5,005 | $521 | $12,160 |
| Total Earnings | $1,402 | $7,052 | $8,028 | $11,801 | $876 | $29,159 |
| *Memo: Earnings as a percentage of wages & salary income in Michigan* | | | | | | *15.9%* |

*Note: Numbers may not add up due to rounding.*

*Data: URC Universities, U.S. Census Bureau, U.S. Bureau of Economic Analysis*
*Analysis: Anderson Economic Group, LLC*

### *Incremental Alumni Earnings in 2011 Caused by URC*

Like all educational institutions, URC universities strive to increase the knowledge and skills of the students they teach. How this knowledge impacts a student's lifetime earnings often depends on the student.[45]

Our estimate of the incremental earnings of URC alumni attributable to the URC universities is, at its heart, a comparison of what the alumni currently earn with an estimate of what they would have earned in the state if not for the URC. We used data on URC alumni, outputs from our human capital model simulation (regarding sorting graduates as detailed in Appendix B of our 2007 report), and using other data, such as wage and workforce participation data, which were part of our human capital simulation model used in our 2007 analysis.

We used the following methodology:

45. For a 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.

1. We estimated the current earnings of URC alumni living in Michigan using the methodology detailed in our 2007 URC economic impact report.
2. We estimated the proportion of URC alumni in each counterfactual group. A "counterfactual group" is a group of students who would have exhibited the same labor market outcome without attending the URC, such as working outside the state, attaining less education, or attending another university in the state. (The data and assumptions underlying this methodology is detailed in our 2007 URC economic impact report.) We further assumed that all past years' graduating classes exhibited the same behavior as our estimates for the current year's graduating class, so the current set of alumni in the state are all characterized by the same set of assumptions about their earnings without the URC.
3. We used census and workforce participation data to estimate each counterfactual group's total earnings.
4. We subtracted the current earnings from the counterfactual earnings to find the *additional* earnings of current alumni due to the URC. See Table A-6 on page A-12.

See our first annual URC benchmarking study, released in 2007, for our detailed methodology in estimating certain parameters used in alumni earnings.

### *Regional Economic Impact*

Our regional economic impact analysis is meant to give the magnitude of economic impact on a more local level. It is not exact and is a conservative estimate. To perform the regional economic impact analysis, we sought to include the same expenditures as in the state economic impact (IPEDS), except at a county level. While the universities had county-by-county data, the expenditures were accounted for slightly differently than in IPEDS. We discuss how the direct economic impact by region was estimated below.

**Operational Expenditures.** We carefully took out construction expenditures that were included in the county data (but not IPEDS). We then estimated the share of spending in each county in terms of non-payroll and payroll expenses. We allocated the university operational expenditures (after substitution), which we used in the state economic impact, and allocated expenditures by county using these shares. This gives a rough estimate of the localities that the universities are making expenditures in.

**Student Local Spending.** We used our statewide estimates of URC student expenditures and after accounting for substitution, we attributed that spending to the counties that the URC universities are located. We distributed MSU student expenditures between Ingham county (75%) and Clinton (25%), as the city of East Lansing is within both counties. Wayne State student expenditures were attributed to Wayne county, as was U-M Dearborn. U-M Flint student expenditures went to Genessee county, and U-M Ann Arbor student expenditures were all attributed to Washtenaw county.

**Regional Alumni Earnings and Incremental Earnings Estimates.** An analysis of where URC alumni currently live reveals that different regions of the state account for differing shares of this total. The largest driver of these differences

comes from the number of URC alumni living in different parts of the state, but the distribution is also affected by whether the alums have bachelors or advanced degrees.

We apportioned alumni earnings based on where alumni were reported to have been residing. The best data of this at a local level was zip code data provided by each university's alumni office. We used GIS software to assist us in attributing alumni into a county when a zip code spanned more than one county.

**Indirect Economic Impact.** We then calculated the regional *indirect* economic impact of URC's expenditures by multiplying the direct expenditures by the U.S. Department of Commerce's Regional Multipliers (RIMS II). It would be a highly complex analysis (and prohibitively expensive) to use the individual set of multipliers for each of Michigan's 83 counties. Instead, we purchased the county multipliers for the three counties that had the largest share of expenditures, which were also the counties the URC universities are located; Washtenaw, Wayne, and Ingham. These counties had their actual multipliers used. The other counties were put into categories of low, medium, or high population and given multipliers accordingly. See Table A-4 below for the list of multipliers used in the regional economic impact analysis.

**TABLE A-4. Multipliers Used in Regional and County by County Economic Impact, FY 2011**

| Category of Multiplier | Payroll and Student Expenditures[a] | Non-Payroll Expenditures[b] | Hospital Expenditures[c] | Jobs[d] |
|---|---|---|---|---|
| Low Population County (<50,000 residents) | 0.6976 | 1.4685 | 1.4153 | 1.1196 |
| Medium (50,000< >100,000 residents) | 0.7094 | 1.5057 | 1.4949 | 1.2583 |
| High (>150,000) | 0.7366 | 1.6590 | 1.5524 | 1.3284 |
| Counties Using County Specific Multipliers | | | | |
| Ingham County | 0.8094 | 1.6057 | 1.5949 | 1.3583 |
| Washtenaw County | 0.7366 | 1.6590 | 1.5524 | 1.3284 |
| Wayne County | 0.8976 | 1.6685 | 1.6153 | 1.3196 |

*Source: Anderson Economic Group, LLC*

a. The Final Demand Output multipliers for the Households category (H00000) industry was used to estimate indirect impact of payroll and student expenditures.

b. The Final Demand Output multipliers or the Junior colleges, colleges, universities, and professional schools category (611A00) industry was used to estimate indirect impact of non-payroll expenditures.

c. The Final Demand Output multipliers for the Hospitals (622000) industry was used to estimate indirect impact of non-payroll hospitals expenditures.

d. The Direct Effect Employment multiplier for the Junior colleges, colleges, universities, and professional schools (611A00) industry was used to estimate indirect impact of jobs.

The state's indirect activity generated by the URC is larger than the sum of regional estimates. This is because economic activity is not contained within the

region where this spending occurs, but spills into other regions. To correct for this and apportion all indirectly-generated activity to a region, we estimated a factor of economic activity that goes beyond each county's borders. This allows our analysis of indirect economic impact by region in Michigan to total to the state's economic impact. Each direct expenditure was multiplied by that category of spending's factor and the multiplier.

We show the full economic impact by region in Table A-5 on page A-10. We show our estimates of additional URC alumni earnings by region in Table A-6 on page A-12.

## Table A-5. Estimate of URC Economic Impact by Region

### i. Estimate of Direct URC Expenditures and Employment by Region

| Economic Development Collaboratives | Non Payroll Expenditures (after substitution) | | Payroll Expenditures (after substitution) | | Student Local Spending (after substitution) | | Employment (after substitution) | |
|---|---|---|---|---|---|---|---|---|
| | Total | Share | Total | Share | Total | Share | Total | Share |
| Upper Peninsula Region | $ 3,092,446 | 0.2% | $ 2,414,596 | 0.1% | $ - | 0.0% | 35 | 0.1% |
| Northwest Region | $ 3,126,742 | 0.2% | $ 3,529,819 | 0.1% | $ - | 0.0% | 49 | 0.1% |
| Northeast Region | $ 585,754 | 0.0% | $ 1,620,219 | 0.1% | $ - | 0.0% | 26 | 0.1% |
| West Central Region | $ 67,593,858 | 4.4% | $ 23,029,409 | 0.8% | $ - | 0.0% | 302 | 0.8% |
| Bay Region | $ 8,671,069 | 0.6% | $ 7,761,340 | 0.3% | $ - | 0.0% | 134 | 0.4% |
| Southwest Region | $ 14,706,659 | 1.0% | $ 9,380,321 | 0.3% | $ - | 0.0% | 136 | 0.4% |
| Central Region | $ 485,259,586 | 31.8% | $ 532,999,654 | 19.2% | $ 569,184,116 | 34.0% | 6,214 | 16.7% |
| East Central Region | $ 12,830,097 | 0.8% | $ 71,292,792 | 2.6% | $ 70,561,222 | 4.2% | 1,180 | 3.2% |
| South Central Region | $ 275,572,472 | 18.1% | $ 1,536,346,179 | 55.3% | $ 635,576,263 | 38.0% | 20,469 | 54.9% |
| Southeast Region | $ 653,343,585 | 42.8% | $ 589,743,447 | 21.2% | $ 398,388,544 | 23.8% | 8,747 | 23.5% |
| | $ 1,524,782,270 | 100% | $ 2,778,117,778 | 100.0% | $ 1,673,710,145 | 100.0% | 37,291 | 100.0% |

### ii. Estimate of Indirect Impact of URC Expenditures and Employment by Region

| Economic Development Collaboratives | Non Payroll Expenditures | | Payroll Expenditures | | Student Local Spending | | Employment | |
|---|---|---|---|---|---|---|---|---|
| | Total | Share | Total | Share | Total | Share | Total | Share |
| Upper Peninsula Region | $ 3,162,777 | 0.2% | $ 1,288,698 | 0.1% | - | 0.0% | 25 | 0.1% |
| Northwest Region | $ 3,229,797 | 0.2% | $ 1,900,538 | 0.1% | - | 0.0% | 36 | 0.1% |
| Northeast Region | $ 585,575 | 0.0% | $ 859,630 | 0.0% | - | 0.0% | 18 | 0.0% |
| West Central Region | $ 83,527,536 | 4.5% | $ 13,633,417 | 0.7% | - | 0.0% | 284 | 0.8% |
| Bay Region | $ 9,769,108 | 0.5% | $ 4,373,624 | 0.2% | - | 0.0% | 114 | 0.3% |
| Southwest Region | $ 17,457,007 | 0.9% | $ 5,528,934 | 0.3% | - | 0.0% | 128 | 0.3% |
| Central Region | $ 572,291,658 | 30.8% | $ 391,550,125 | 20.8% | 201,201,428 | 32.6% | 6,280 | 17.0% |
| East Central Region | $ 13,837,053 | 0.7% | $ 39,788,377 | 2.1% | 16,448,828 | 2.7% | 1,058 | 2.9% |
| South Central Region | $ 336,846,114 | 18.1% | $ 944,422,387 | 50.1% | 177,430,831 | 28.7% | 20,393 | 55.1% |
| Southeast Region | $ 815,850,897 | 43.9% | $ 480,495,936 | 25.5% | 222,601,499 | 36.0% | 8,674 | 23.4% |
| | $ 1,856,557,522 | 100% | $ 1,883,841,665 | 100.0% | $ 617,682,587 | 100.0% | 37,010 | 100.0% |

## Table A-5. Estimate of URC Economic Impact by Region (continued)

### iii. Regional Economic Impact of URC Expenditures and Employment by Component (see Table A-6 for Alumni Earnings Impact)

| Economic Development Collaboratives | Non Payroll Expenditures | | Payroll Expenditures | | Student Local Spending | | Employment | |
|---|---|---|---|---|---|---|---|---|
| | Total | Share | Total | Share | Total | Share | Total | Share |
| Upper Peninsula Region | $ 6,255,223 | 0.2% | $ 3,703,294 | 0.1% | $ - | 0.0% | 60 | 0.1% |
| Northwest Region | $ 6,356,539 | 0.2% | $ 5,430,357 | 0.1% | $ - | 0.0% | 85 | 0.1% |
| Northeast Region | $ 1,171,330 | 0.0% | $ 2,479,849 | 0.1% | $ - | 0.0% | 45 | 0.1% |
| West Central Region | $ 151,121,394 | 4.5% | $ 36,662,826 | 0.8% | $ - | 0.0% | 586 | 0.8% |
| Bay Region | $ 18,440,178 | 0.5% | $ 12,134,964 | 0.3% | $ - | 0.0% | 249 | 0.3% |
| Southwest Region | $ 32,163,666 | 1.0% | $ 14,909,255 | 0.3% | $ - | 0.0% | 264 | 0.4% |
| Central Region | $ 1,057,551,245 | 31.3% | $ 924,549,779 | 19.8% | $ 770,385,545 | 33.6% | 12,494 | 16.8% |
| East Central Region | $ 26,667,150 | 0.8% | $ 111,081,169 | 2.4% | $ 87,010,050 | 3.8% | 2,238 | 3.0% |
| South Central Region | $ 612,418,586 | 18.1% | $ 2,480,768,566 | 53.2% | $ 813,007,094 | 35.5% | 40,862 | 55.0% |
| Southeast Region | $ 1,469,194,482 | 43.5% | $ 1,070,239,383 | 23.0% | $ 620,990,043 | 27.1% | 17,421 | 23.4% |
| | $ 3,381,339,793 | 100% | $ 4,661,959,443 | 100.0% | $ 2,291,392,732 | 100.0% | 74,301 | 100.0% |

### iv. Total Economic Impact of URC Expenditures and Employment by Region (includes impact of alumni earnings)

| Economic Development Collaboratives | Total Net Economic Impact of University Operations | Total Direct and Indirect Jobs Caused by URC |
|---|---|---|
| Upper Peninsula Region | $ 63,450,426 | 60 |
| Northwest Region | $ 169,794,948 | 85 |
| Northeast Region | $ 55,178,086 | 45 |
| West Central Region | $ 638,624,708 | 586 |
| Bay Region | $ 215,267,829 | 249 |
| Southwest Region | $ 239,344,008 | 264 |
| Central Region | $ 3,234,571,173 | 12,494 |
| East Central Region | $ 631,911,780 | 2,238 |
| South Central Region | $ 4,622,067,572 | 40,862 |
| Southeast Region | $ 5,636,109,185 | 17,421 |
| | $ 15,506,319,714 | 74,301 |

*Data: URC Universities and AEG estimates*
*Analysis: Anderson Economic Group, LLC*

## Table A-6. Estimate of Additional URC Alumni Earnings by Region

### i. Estimate of URC Alumni Earnings and Incremental Earnings by Region

| Economic Development Collaboratives | Number of Counties | URC Alums | | Share of URC Alumni Earnings | | Share of Incremental URC Alumni Earnings | | 2011 Michigan Population | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total | % of Total | Total | % of Total | Total | % of Total | Total | % of Total |
| Upper Peninsula Region | 15 | 5,498 | 0.9% | $ 272,172,633 | 0.9% | $ 45,182,810 | 1.0% | 311,629 | 3.2% |
| Northwest Region | 10 | 16,137 | 2.7% | $ 798,468,105 | 2.7% | $ 133,464,069 | 3.1% | 298,911 | 3.0% |
| Northeast Region | 11 | 5,524 | 0.9% | $ 272,684,635 | 0.9% | $ 43,523,040 | 1.0% | 207,137 | 2.1% |
| West Central Region | 13 | 45,351 | 7.7% | $ 2,239,895,589 | 7.7% | $ 380,809,746 | 8.7% | 1,525,175 | 15.4% |
| Bay Region | 11 | 18,977 | 3.2% | $ 938,589,107 | 3.2% | $ 156,003,681 | 3.6% | 706,263 | 7.2% |
| Southwest Region | 7 | 19,315 | 3.3% | $ 955,174,147 | 3.3% | $ 162,404,899 | 3.7% | 778,957 | 7.9% |
| Central Region | 3 | 49,575 | 8.4% | $ 2,418,601,334 | 8.3% | $ 407,200,598 | 9.3% | 465,138 | 4.7% |
| East Central Region | 4 | 39,634 | 6.7% | $ 1,990,742,107 | 6.8% | $ 343,908,746 | 7.9% | 741,645 | 7.5% |
| South Central Region | 6 | 68,807 | 11.7% | $ 3,465,771,477 | 11.9% | $ 604,674,042 | 13.8% | 986,946 | 10.0% |
| Southeast Region | 3 | 320,675 | 54.4% | $ 15,807,360,824 | 54.2% | $ 2,091,127,813 | 47.9% | 3,854,386 | 39.0% |
| | 83 | 589,493 | 100.0% | $ 29,159,459,959 | 100.0% | $ 4,368,299,444 | 100.0% | 9,876,187 | 100.0% |

### ii. Estimate of Economic Impact from URC Alumni Incremental Earnings by Region

| Economic Development Collaboratives | URC Alumni Incremental Earnings (after taxes & substitution) | Total Economic Impact of URC Alumni Incremental Earnings |
|---|---|---|
| Upper Peninsula Region | $ 31,876,472 | $ 53,491,908 |
| Northwest Region | $ 94,158,901 | $ 158,008,051 |
| Northeast Region | $ 30,705,505 | $ 51,526,908 |
| West Central Region | $ 268,661,276 | $ 450,840,487 |
| Bay Region | $ 110,060,597 | $ 184,692,688 |
| Southwest Region | $ 114,576,656 | $ 192,271,087 |
| Central Region | $ 287,280,022 | $ 482,084,605 |
| East Central Region | $ 242,627,621 | $ 407,153,410 |
| South Central Region | $ 426,597,536 | $ 715,873,326 |
| Southeast Region | $ 1,475,290,672 | $ 2,475,685,277 |
| | $ 3,081,835,258 | $ 5,171,627,746 |

*Data: URC Universities and AEG estimates*
*Analysis: Anderson Economic Group, LLC*

## BENCHMARKING METRICS

Below we include definitions of degree categories created by AEG and describe any changes to methodology compared to previous years' reports.

### *Total Degree Completions*

The completions data contained in "Total Degrees Granted" on page 30 may not perfectly match the numbers in our previous reports. While we continued to use completion data from the Integrated Postsecondary Education Data System (IPEDS) for this analysis, we no longer include second majors. Including both first and second majors over-represented degrees awarded as it double-counts students who may have two majors, but only one degree. To be consistent, we have reassessed 2010 data to reflect these changes in our methodology, so that a true year to year comparison could be done.

### *Academic Program Definitions*

The academic program areas used in "Degrees by Program Area" on page 31 are based on the National Center for Education Statistics' Classification of Instructional Programs (CIP) codes that they use in their Integrated Postsecondary Education Data System (IPEDS). The composition of each program area is as 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; and physical sciences.

The *Business, Management, and Law* academic program area includes the following fields of study: legal professions and studies; and 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; and 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; and history.

The *Medicine and Biological Science* academic program area includes the following fields of study: biological and biomedical sciences; psychology; and 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 fields of study; communications technologies/technicians and support services; engineering technologies/technicians; military technologies; and science technologies/technicians.

### *High Tech and High Demand Degrees*

Below we define these categories of degrees and provide a basic reasoning for how they were created.

**High-Tech Degree Definition.** AEG's definition of high-tech degrees is one that we use regularly to assess Michigan's high tech industry in Southeast Michigan.[46] As with the academic definitions, we used the CIP codes in IPEDs to pull degrees that fit our definition of high-tech. These degrees include:

- agriculture, agriculture operations, and related sciences (we include only 10% of this field of study as most agriculture is not high-tech)
- architecture and related services
- biological and biomedical sciences
- communications technologies/technicians and support services
- computer and information sciences and support services
- engineering technologies/technicians
- engineering; mathematics and statistics
- physical sciences

**High Demand Degree Definition.** The three fields of study with the highest demand among employers are business, computer science and engineering, according to a survey done by the National Association of Colleges and Employers. Their 2011 *Job Outlook Report* surveyed approximately 200 employers from a variety of sectors and found that computer science, engineering, accounting, finance, and business administration were in the most demand by employers.

For the purposes of this analysis we combined the three business related majors (accounting, finance, and business administration) into one category due to substantial overlap between these degrees at the undergraduate level in many universities. Specifically, our data source (IPEDS) does not distinguish clearly between them.

Additionally, for engineering degrees awarded, we included "engineering" and "engineering technologies/technicians," because the IPEDS database presents

46. See Scott D. Watkins, Cameron Van Wyngarden, and Lauren Hathaway, *Driving Southeast Michigan Forward*, prepared for Automation Alley (November 2008).

highly related concentrations under each and they likely signal similar skill sets in the entry level job market.

**Summary of Degrees in High-Tech, High Demand, and Medical Fields.** For this analysis, we used the number of high-tech and high demand degrees described above, as well as the following IPEDS categories to represent the medical field:

- Medicine  Doctor's degree - professional practice
- Osteopathic Medicine/Osteopathy  Doctor's degree - professional practice
- Veterinary Medicine  Doctor's degree - professional practice
- Registered Nursing, Nursing Administration, Nursing Research, and Clinical Nursing  (Master's and Doctorate degree)
- Dentistry  Doctor's degree - professional practice
- Advanced/Graduate Dentistry and Oral Sciences  (Master's and Doctorate degree)
- Dental Support Services and Allied Professions  (Bachelor's degree)

### *R&D Expenditures*

The data reported to IPEDS for research expenditures are lower than the research expenditures reported to the National Science Foundation because they include different things. 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.

The science and engineering (S&E) fields used in "Academic R&D Expenditures" on page 37 are based on the NSF's survey of higher education institutions. The composition of each S&E field is as follows:

- Environmental sciences includes atmospheric and earth sciences, oceanography, and other miscellaneous sciences.
- Life sciences includes agricultural, biological, medical, and other miscellaneous life sciences.
- Physical sciences includes astronomy, chemistry, physics, and other miscellaneous physical sciences.
- Social sciences includes economics, political sciences, sociology, and other miscellaneous social sciences.
- Engineering includes aeronautical, biomedical, bioengineering, chemical, civil, electrical, mechanical, metallurgical, and other engineering fields.

# *Appendix B. About the Authors*

**ERIN GROVER**

Ms. Grover is a Senior Analyst at Anderson Economic Group, working in the Public Policy and Economic Analysis practice area. Her background is in applied economics and communicating economic ideas.

Ms. Grover's recent work consists of several economic and fiscal impact analyses of counties and business ventures throughout the U.S.; evaluating policy changes and potential public funding mechanisms; as well as an analysis of the economic contribution research universities make in Michigan. She is also currently contributing to the book, Economics of Business Valuation, a forthcoming publication of Stanford Press.

Prior to joining AEG, Ms. Grover worked as a contract consultant providing research and detailed data analysis to economic and finance consulting firms in Michigan and Ohio. She was also one of four students selected as a graduate fellow at the Mercatus Center in Arlington, Virginia. While there she contributed to their Gulf Coast Recovery Project, which received the Templeton Freedom Award for Special Achievement. Ms. Grover has also conducted original fieldwork on the political economy of charter schools in New Orleans, which she presented at an international conference for the Association of Private Enterprise Education.

Ms. Grover holds a masters degree in economics from George Mason University and a Bachelors of Science degree in Political Economy from Hillsdale College.

**COLBY SPENCER**

Colby W. Spencer is a Senior Analyst at Anderson Economic Group, working in the Public Policy and Economic Analysis and Market and Industry Analysis practice areas. Ms. Spencer's background is in econometrics, public policy, local government, urban and social policy, and education.

Prior to coming to Anderson Economic Group Ms. Spencer worked with the Michigan Municipal League on the 21st Century Communities project providing consulting services to local governments in Michigan concerning local economic development initiatives. Ms. Spencer held a fellowship at Columbia University as a teaching assistant for Quantitative Analysis and Operations Management. She has also taught in the District of Columbia Public Schools.

Ms. Spencer holds a Bachelor of Science in Education from New York University and a Master of Public Administration from the School of International and Public Affairs at Columbia University.

**ALEXANDER L. ROSAEN**

Mr. Rosaen is a Consultant at Anderson Economic Group, currently serving as the Director of Public Policy and Economic Analysis. Mr. Rosaen's background is in applied economics and public finance.

Mr. Rosaen's recent work includes several economic and fiscal impact analyses, including of proposed real estate developments, power plants, and infrastructure projects; analysis of tax incentives; an analysis of the impact of federal tax incentives on the freight rail industry; and an analysis of the economic contribution that research universities make in the State of Michigan.

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 has also worked as a mechanical engineer for Williams International in Walled Lake, Michigan.

Mr. Rosaen holds a Masters in Public Policy from the Gerald R. Ford School of Public Policy at the University of Michigan. He also has a Masters of Science and a Bachelors of Science in mechanical engineering from the University of Michigan.

**SAMANTHA SUPERSTINE**

Ms. Superstine is a Senior Analyst at Anderson Economic Group, working in the Public Policy and Economic Analysis practice area. Her background is in economic analysis and tax policy, public policy, and energy policy and infrastructure development.

Prior to joining AEG, Samantha worked primarily in the non-profit sector. Past projects have involved working with the City of Chicago to develop infrastructure and policies that supported energy efficiency initiatives and economic development. She also worked in policy development with Securing America's Future Energy, where she analyzed policies for transportation-related infrastructure, and its connection to U.S. economic and national security.

Ms. Superstine holds a Bachelor of Arts degree in economics from the University of Michigan. She also attended the University of Chicago, where she earned a Master of Public Policy degree, with honors, from the Harris School of Public Policy.