

Appendix

Methodology

Research for the 2013 New Michigan Report conducted by Anderson Economic Group, a research and consulting firm with expertise in economics, public policy, finance, and industry analysis.

The data presented in this report is from several sources, all of which are publicly available. The report used the most recent data available for which there was a complete data set. Earnings data is presented in 2010 dollars, including future projections. Dollar amounts for all input metrics are in nominal amounts for the corresponding year. Real GDP figures are presented in chained 2005 dollars. (This is the conventional way to present real GDP data, as used by the Bureau of Economic Analysis.)

Identification of opportunity components

In order to estimate Michigan's performance for each of the six opportunities, a set of 4- and 6-digit NAICS industries associated with each opportunity were determined. 2010 U.S. Census Bureau County Business Patterns (CBP) data was used associated with these codes for employment and earnings estimates. Furthermore, BEA industries associated with each opportunity were used to estimate measures of economic output (GDP).

Estimation methods

Input metrics

Each opportunity has an identified set of input metrics which contribute to job and economic growth in Michigan. Each metric uses the most recent data available from the data sources. Select metrics were used to measure inputs in each opportunity. These include the following:

- **Patents Awarded:** A set of patent codes were identified that were associated with each opportunity to aggregate the total patents for that opportunity from 2011 data.
- **Number of Firms:** The number of firms were calculated based on the NAICS codes identified during the classification process. These correspond to "number of establishments" in CBP.
- **Graduates:** For each opportunity, a cluster of degrees and certificates were identified that are relevant to the opportunity at hand. Using the Integrated Postsecondary Education Data System (IPEDS) provided by the National Center for Education Statistics (NCES), completions were calculated, by state, in the 2010-2011 school year for those categories. The data include degrees and certificates conferred at public and non-profit institutions, and do not include values from for-profit institutions.

Output metrics

For each opportunity, economic output is calculated in terms of GDP, employment, and earnings. Real GDP values, presented in 2005 chained dollars, are aggregated across each category for each opportunity's total value from the Bureau of Economic Analysis (BEA). Employment presented is the number of employees on the payroll at the time of data collection (March), and is an aggregation of the data for each NAICS industry in each category. Employment is shown as a share of the working-age population, which is the population of people in the state between the ages of 20 and 64, according to U.S. Census Bureau data.

Average earnings is calculated by aggregating the total earnings associated with each NAICS category, and dividing it by the total aggregate employment. For employment and earnings in the "Higher Education" opportunity, also includes numbers for public universities from the National Center for Education Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS) because CBP data includes only private universities and colleges.

Note that, if Michigan's rank in an opportunity is lower than the rank for the overall economy, that does not imply that the absolute value of the relevant metric is lower for that opportunity than for the overall economy. For example, Michigan ranks 18th in average earnings in the Life Sciences Hub opportunity, but ranks 17th in average earnings when considering the economy as a whole, despite the fact that Michigan's average earnings in Life Sciences Hub industries are \$61,000 compared to average earnings economy-wide of \$42,000. The rank for Michigan is lower in the Life Sciences Hub opportunity because the industries that characterize this opportunity tend to be higher-paying industries in all states, and Michigan's average earnings within these industries are just a bit lower, relative to other states, than the average earnings in Michigan's overall economy.

GDP

For each opportunity, a set of industries were chosen that aligned with BEA GDP categories for each opportunity. These correspond to the "Related Industries" displayed in the report. For most of the industries, the entire amount of the Real GDP was used within that category in the BEA data. For the Life Sciences Hub opportunity, however, only the following BEA categories were used: "Miscellaneous manufacturing;" "Professional, scientific, and technical services;" "Ambulatory health care services;" and "Chemical manufacturing." In order to determine which proportion should be used for each of these industries, we used the ratio of more detailed NAICS codes total earnings to the total earnings of the NAICS industry that corresponds to the broader GDP categories. That ratio was then applied to GDP data. For example, to determine the amount of real GDP attributable to medical equipment manufacturing, the real GDP in the "Miscellaneous manufacturing" category, according to the BEA, was multiplied by the ratio of medical equipment manufacturing earnings (NAICS 3391) to miscellaneous manufacturing earnings (NAICS 339), according to County Business Patterns data.

Employment and Earnings

Due to the nature of CBP data, some information for certain industries is withheld. For these data, a specific method was used in order to estimate the missing data.

- For employment data withheld, we used the average in the range of values given by relevant code in the data. For example, the letter "b" indicates a range of 20-99 employees. For all recorded instances of b, included an assumption of employment of 59.5.

- Earnings data may be withheld to avoid disclosing information for specific companies. In order to estimate earnings when there was withheld data, we followed several steps:
 - If data for 4-digit NAICS codes was withheld, when available, average earnings data were used for the associated 3-digit NAICS codes, multiplied it by the number of employees in the industry, and added it to the total earnings from the remainder of data for the opportunity
 - In the event that the 3-digit NAICS code also contained withheld data, there was a reliance on estimations using US earnings data. The overall ratios from state to US earnings data for all reported values in CBP was determined. From those ratios, we estimated withheld data by taking each state's average earnings ratio, and applied it to the average US earnings in each 3-digit category, and multiplied the resulting value by employment in each industry.
- If data from a state was too low to report in earnings or employment for a given NAICS code, we assigned a value of zero for that NAICS category.

For the performance of Michigan's job and economic growth across all six opportunities, any duplicated codes or categories were eliminated in order to ensure that values were not overestimated.

It merits note that employment data for government workers and farm workers are not available in the sources, so this data is not included in totals shown. See Appendix B for a list of all industries excluded from the totals.

Projected Growth Scenarios

For each set of output metrics, 2020 levels for Michigan are estimated according to several different projected growth rates: Michigan's historical growth rate, a "Top Five" historical growth rate, and a "Top Ten" historical growth rate. Growth rates were calculated based on data for each output metric in each opportunity for 2005-2010 data. States were ranked based on how quickly they grew in each metric, separately, from 2005 to 2010. Then, for each separate metric, the "Top Five" growth rate was simply the fifth-ranked state in growth of that metric. Similarly, the "Top Ten" growth rate was that of the tenth-ranked state in growth of that metric.

The calculated growth rates were then applied to Michigan's 2010 levels, and the state's 2020 performance in different scenarios was projected, assuming that its growth rate would be equal to the "Top Five," "Top Ten," and Michigan growth rate. These values do not account for population change, or any other shift in economic or demographic factors. Projected growth scenarios use real GDP as a metric, and not per capita real GDP, as is used for all other estimations. This is consistent with projections that the population in Michigan will remain stagnant for the next ten years, rendering growth in real GDP and per capita real GDP equal.

³ 2005 values for earnings were adjusted to 2010 dollars according to an annual inflation rate of approximately 2%. In the case that NAICS industries were different between 2005 and 2010, we estimated 2005 values based on its share of a higher-level code.

List of NAICS Industries for Each Opportunity

2012 NAICS Code

Description

Global Engineering Village

| | |
|--------|---|
| 3252 | Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing |
| 3271 | Clay Product and Refractory Manufacturing |
| 3272 | Glass and Glass Product Manufacturing |
| 3311 | Iron and Steel Mills and Ferroalloy Manufacturing |
| 3312 | Steel Product Manufacturing from Purchased Steel |
| 3313 | Alumina and Aluminum Production and Processing |
| 3314 | Nonferrous Metal (except Aluminum) Production and Processing |
| 3331 | Agriculture, Construction, and Mining Machinery Manufacturing |
| 3332 | Industrial Machinery Manufacturing |
| 3333 | Commercial and Service Industry Machinery Manufacturing |
| 3335 | Metalworking Machinery Manufacturing |
| 3336 | Engine, Turbine, and Power Transmission Equipment Manufacturing |
| 3339 | Other General Purpose Machinery Manufacturing |
| 3341 | Computer and Peripheral Equipment Manufacturing |
| 3344 | Semiconductor and Other Electronic Component Manufacturing |
| 3345 | Navigational, Measuring, Electromedical, and Control Instruments Manufacturing |
| 3346 | Manufacturing and Reproducing Magnetic and Optical Media |
| 3351 | Electric Lighting Equipment Manufacturing |
| 3359 | Other Electrical Equipment and Component Manufacturing |
| 3361 | Motor Vehicle Manufacturing |
| 3362 | Motor Vehicle Body and Trailer Manufacturing |
| 3363 | Motor Vehicle Parts Manufacturing |
| 3364 | Aerospace Product and Parts Manufacturing |
| 3391 | Medical Equipment and Supplies Manufacturing |
| 8112 | Electronic and Precision Equipment Repair and Maintenance |
| 8113 | Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance |
| 9271 | Space Research and Technology* |
| 54171 | Research and Development in the Physical, Engineering, and Life Sciences |
| 336992 | Military Armored Vehicle, Tank, and Tank Component Manufacturing |
| 541330 | Engineering Services |

Gateway to the Midwest

| | |
|--------|---|
| 2373 | Highway, Street, and Bridge Construction |
| 2379 | Other Heavy and Civil Engineering Construction |
| 4811 | Scheduled Air Transportation |
| 4812 | Nonscheduled Air Transportation |
| 4821 | Rail Transportation* |
| 4831 | Deep Sea, Coastal, and Great Lakes Water Transportation |
| 4832 | Inland Water Transportation |
| 4841 | General Freight Trucking |
| 4842 | Specialized Freight Trucking |
| 4881 | Support Activities for Air Transportation |
| 4882 | Support Activities for Rail Transportation |
| 4883 | Support Activities for Water Transportation |
| 4884 | Support Activities for Road Transportation |
| 4885 | Freight Transportation Arrangement |
| 4889 | Other Support Activities for Transportation |
| 4911 | Postal Service* |
| 4921 | Couriers and Express Delivery Services |
| 4931 | Warehousing and Storage |
| 541614 | Process, Physical Distribution, and Logistics Consulting Services |

Higher Education Marketplace**

| | |
|--------|---|
| 5417 | Scientific Research and Development Services |
| 6112 | Junior Colleges |
| 6113 | Colleges, Universities, and Professional Schools |
| 6114 | Business Schools and Computer and Management Training |
| 6115 | Technical and Trade Schools |
| 6116 | Other Schools and Instruction |
| 6117 | Educational Support Services |
| 6243 | Vocational Rehabilitation Services |
| 8132 | Grantmaking and Giving Services |
| 923110 | Administration of Education Programs* |

Natural Resources Economy

| | |
|------|---|
| 1111 | Oilseed and Grain Farming* |
| 1112 | Vegetable and Melon Farming* |
| 1113 | Fruit and Tree Nut Farming* |
| 1114 | Greenhouse, Nursery, and Floriculture Production* |
| 1119 | Other Crop Farming* |
| 1121 | Cattle Ranching and Farming* |
| 1122 | Hog and Pig Farming* |
| 1123 | Poultry and Egg Production* |
| 1124 | Sheep and Goat Farming* |
| 1125 | Aquaculture* |
| 1129 | Other Animal Production* |
| 1131 | Timber Tract Operations |
| 1132 | Forest Nurseries and Gathering of Forest Products |

1133 Logging
 1141 Fishing
 1142 Hunting and Trapping
 1151 Support Activities for Crop Production
 1152 Support Activities for Animal Production
 1153 Support Activities for Forestry
 2111 Oil and Gas Extraction
 2121 Coal Mining
 2122 Metal Ore Mining
 2123 Nonmetallic Mineral Mining and Quarrying
 2131 Support Activities for Mining
 2371 Utility System Construction
 3112 Grain and Oilseed Milling
 3253 Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing
 3331 Agriculture, Construction, and Mining Machinery Manufacturing
 4235 Metal and Mineral (except Petroleum) Merchant Wholesalers
 4245 Farm Product Raw Material Merchant Wholesalers
 4831 Deep Sea, Coastal, and Great Lakes Water Transportation
 4832 Inland Water Transportation
 4855 Charter Bus Industry
 4861 Pipeline Transportation of Crude Oil
 4862 Pipeline Transportation of Natural Gas
 4869 Other Pipeline Transportation
 4871 Scenic and Sightseeing Transportation, Land
 4872 Scenic and Sightseeing Transportation, Water
 4879 Scenic and Sightseeing Transportation, Other
 4883 Support Activities for Water Transportation
 5615 Travel Arrangement and Reservation Services
 5622 Waste Treatment and Disposal
 5629 Remediation and Other Waste Management Services
 7121 Museums, Historical Sites, and Similar Institutions
 7139 Other Amusement and Recreation Industries
 7211 Traveler Accommodation
 7212 RV (Recreational Vehicle) Parks and Recreational Camps
 9241 Administration of Environmental Quality Programs*
 54171 Research and Development in the Physical, Engineering, and Life Sciences
 221310 Water Supply and Irrigation Systems
 311119 Other Animal Food Manufacturing
 424910 Farm Supplies Merchant Wholesalers
 481111 Scheduled Passenger Air Transportation
 541330 Engineering Services
 541620 Environmental Consulting Services
 541690 Other Scientific and Technical Consulting Services

Global Center for Mobility

2373 Highway, Street, and Bridge Construction
 3311 Iron and Steel Mills and Ferroalloy Manufacturing
 3312 Steel Product Manufacturing from Purchased Steel
 3313 Alumina and Aluminum Production and Processing
 3336 Engine, Turbine, and Power Transmission Equipment Manufacturing
 3339 Other General Purpose Machinery Manufacturing
 3341 Computer and Peripheral Equipment Manufacturing
 3344 Semiconductor and Other Electronic Component Manufacturing
 3345 Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
 3359 Other Electrical Equipment and Component Manufacturing
 3361 Motor Vehicle Manufacturing
 3362 Motor Vehicle Body and Trailer Manufacturing
 3363 Motor Vehicle Parts Manufacturing
 3365 Railroad Rolling Stock Manufacturing
 3366 Ship and Boat Building
 3369 Other Transportation Equipment Manufacturing
 4821 Rail Transportation*
 4851 Urban Transit Systems
 4852 Interurban and Rural Bus Transportation
 4882 Support Activities for Rail Transportation
 4884 Support Activities for Road Transportation
 5415 Computer Systems Design and Related Services
 9241 Administration of Environmental Quality Programs
 9251 Administration of Housing Programs, Urban Planning, and Community Development
 54171 Research and Development in the Physical, Engineering, and Life Sciences
 541330 Engineering Services
 541420 Industrial Design Services

Life Sciences Hub

3254 Pharmaceutical and Medicine Manufacturing
 3391 Medical Equipment and Supplies Manufacturing
 6215 Medical and Diagnostic Laboratories
 541711 Research and Development in Biotechnology

* Data for NAICS industry was unavailable and therefore not included in presented totals.

** For employment and earnings in the "Higher Education Marketplace" opportunity, we also added data from the National Center for Education Statistics Integrated Postsecondary Education Data System for public institutions