



Economic Diversity in Appalachia Web Tool: Data and Methods

February 2014

Prepared for the Appalachian Regional Commission



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CREC CENTER FOR
REGIONAL ECONOMIC
COMPETITIVENESS

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ABOUT THIS DOCUMENT

This document complements the *Economic Diversity in Appalachia Web Tool*¹ prepared as part of an extensive analysis of economic diversity for the Appalachian Regional Commission by the University of Illinois at Urbana-Champaign’s Regional Economics Applications Laboratory and the Center for Regional Economic Competitiveness, with assistance from the RUPRI Center for Rural Entrepreneurship and EntreWorks Consulting. Project leaders were Edward Feser, Ken Poole, Mark White, and Geoffrey Hewings, with Troy Mix serving as Project Manager.

Troy Mix authored this document. The document reviews the data sources and methods employed to generate the metrics and rankings featured on the *Economic Diversity in Appalachia Web Tool*. For more complete details on the context and interpretation of these metrics, consult the project reports available for download here:

<http://economicdiversityinappalachia.creconline.org/Report/>.

This guide to data sources and methods is organized around three main topics highlighted on the website—1) the measurement of economic diversity, 2) the identification of economic specializations, and 3) identification of comparator counties. Individual topics can be directly linked to by choosing the appropriate entries from the table of contents above, or this entire document can be read in order to comprehensively understand the data sources and methods used.

¹ <http://economicdiversityinappalachia.creconline.org/>

1. MEASURING ECONOMIC DIVERSITY

1-1. BASE DATA AND METHODS FOR CALCULATING ECONOMIC DIVERSITY

1-1A. ESTIMATES OF COUNTY EMPLOYMENT AND EARNINGS BY INDUSTRY

The diversity calculations conducted for this website use county employment estimates acquired from Economic Modeling Specialists International (EMSI). The particular datasets used were “complete” employment estimates for 2009 and the third quarter of 2012, along with “covered” employment estimates for 2009 and 2012.² Each dataset provides an individual row of data for each six-digit North American Industrial Classification System (NAICS) industry within a county, with the rows detailing the estimated employment in the industry and county in question. Based on the Bureau of Labor Statistic’s *Quarterly Census of Employment and Wages*, the covered employment dataset contains estimates for jobs covered by federal or state unemployment insurance systems. In addition to earnings and employment estimates by industry, the covered employment dataset provides estimates of the number of establishments by industry and county, although these establishment estimates are for 2011. The covered employment dataset was only used to conduct analyses that relied upon establishment estimates.

The complete employment dataset includes all employment in the covered dataset along with wage-and-salary employment exempt from unemployment insurance coverage—such as military and railroad employment and employment as a real estate or insurance agent—and self-employment that accounts for all or a portion of an individual’s income. For both datasets, EMSI uses proprietary algorithms and a variety of data sources from the Bureau of Economic Analysis, U.S. Census Bureau, and Bureau of Labor Statistics to produce estimates of employment that do not suppress employment and earnings numbers for any county or industry. With a considerable number of employment statistics suppressed to prevent the release of confidential firm information, these datasets allow for a more complete analysis of county employment than allowed for by standard federal data releases (Isserman & Westervelt, 2006).

1-1B. ENTROPY MEASURE OF ECONOMIC DIVERSITY

The entropy measure of diversity was used to calculate industry-, function-, occupation-, and knowledge-based measures of economic diversity across U.S. counties and a variety of other geographies (Malizia & Ke, 1993). These metrics were calculated according to formula 1:

$$(1) \quad ENTR = \sum_{i=1}^k (p_i) \ln \left(\frac{1}{p_i} \right)$$

² See <http://www.economicmodeling.com/data/> for more information on these datasets.

where there are $i=1$ to k industries and p_i is the share of economic activity (e.g., employment or earnings) in the i th industry. The products of industry shares of economic activity and the natural log of the inverse industry shares of economic activity are summed to arrive at the final entropy index measurement. The index has a minimum value of 0 when all economic activity is within one industry, and the value increases as the number of industries increases and the distribution of economic activity across these industries becomes more equal.

Where entropy measures were calculated for non-county geographies (e.g., the United States as a whole or individual states), the employment data were summed by industry and the geography in question before the entropy calculation was performed.

1-2. MEASURING INDUSTRIAL DIVERSITY

Industrial diversity calculations depend upon EMSI's complete employment dataset. The entropy measure serves as the base metric of *industry-based economic diversity*, which this document commonly refers to as **industrial diversity**. Employment by six-digit NAICS industry served as the share of total economic activity (p_i) specified in formula 1.

1-3. MEASURING FUNCTIONAL DIVERSITY

A region's economic function or functions represent the collection of broad economic activities that the region's workforce and firms engage in. Practically, functions can be identified by grouping industries together into categories that are broadly similar on factors such as inputs, outputs, and/or the technological or skill requirements necessary to perform the work customary to these industries. Grouping industries according to function, rather than simply accepting the NAICS industry categories, can help to broadly characterize the economic roles a county plays in its region; provide insight into the economic relationships and similarities counties have with other regions; identify factors that make regions comparatively better fits for certain economic activities; and speak to the broader economic and demographic forces that are likely to impact a county's economic prospects.

1-3A. CREATING FUNCTIONAL INDUSTRY CLASSIFICATIONS

In an examination of the rise of services as a proportion of employment, Noyelle (1983) advanced a functional classification system for services "based on the type of outputs (intermediate or final outputs) and the institutional setting under which services are provided (private, public, or nonprofit sectors)" (p. 282). Lawrence (1984) classified manufacturing industries on the basis of the primary end use of the product (e.g., intermediate goods; consumer durables; producer durables; consumer nondurables) and the necessary inputs to the industry (e.g., research and development expenditures; scientists and engineers; capital-, labor-, and resource-intensive).

This analysis draws primarily from the work of Lawrence (1984) and Noyelle (1983) to categorize industries according to functional types. In an effort to focus on the economic base of counties, industries that often serve local populations, such as retail

trade, personal services, doctor’s offices, local government, and construction, were excluded from the analysis of functions. Eleven functional categories were delineated and Table 1-1 lists the category titles and selected examples of industries within each class. The complete list of six-digit industries included within each classification appears as Table 5-1.

Table 1-1: Functional Categories with Selected Industry Examples

Functional industry category		
NAICS code and title		
<u>Agriculture & resource extraction</u>		
11 Agriculture, Forestry, Fishing and Hunting	21 Mining Quarrying, and Oil and Gas Extraction	
<u>Capital-intensive manufacturing</u>		
311 Food manufacturing	312 Beverage and tobacco product manufacturing	313 Textile mills
314 Textile product mills	315 Apparel manufacturing	316 Leather and allied product manufacturing
321 Wood Product Manufacturing	322 Paper Manufacturing	323 Printing and Related Support Activities
327 Nonmetallic Mineral Product Manufacturing	331111 Iron and steel mills	332116 Metal stamping
333414 Heating equipment (except warm air furnaces) manufacturing	335212 Household vacuum cleaner manufacturing	336111 Automobile manufacturing
<u>Corporate management & administration</u>		
551111 Offices of Bank Holding Companies	551114 Corporate, Subsidiary, and Regional Managing Offices	561110 Office Administrative Services
<u>Distributive services</u>		
22 Utilities	42 Wholesale trade	48-49 Transportation and warehousing
517110 Wired telecommunication carriers	517410 Satellite telecommunications	518 Data processing, hosting, and related services
<u>Engineering-intensive manufacturing</u>		
324110 Petroleum refineries	325110 Petrochemical manufacturing	331311 Alumina refining
332994 Small arms manufacturing	333291 Paper industry machinery manufacturing	333314 Optical instrument and lens manufacturing
334 Computer and Electronic Product Manufacturing	335121 Residential electric lighting fixture manufacturing	336411 Aircraft manufacturing
<u>Finance, insurance & real estate</u>		
52 Finance and insurance	53 Real estate and rental and leasing	
<u>Government</u>		
901149 U.S. postal service	901199 Federal civilian, except U.S. postal service	902999 State government, excluding education and hospitals
92 Public administration		
<u>Healthcare</u>		
621511 Medical laboratories	622110 General medical and surgical hospitals	622210 Psychiatric and substance abuse hospitals
623110 Nursing care facilities	902622 Hospitals, state government	903622 Hospitals, local government
<u>Higher education</u>		
611310 Colleges, universities, and professional schools	902612 Colleges and universities, state government	903612 Colleges and universities, local government
<u>Knowledge-intensive business services</u>		
541110 Offices of Lawyers	541330 Engineering services	541810 Advertising agencies
<u>Media, entertainment & recreation</u>		
511 Publishing Industries (except Internet)	512 Motion Picture and Sound Recording Industries	515 Broadcasting (except Internet)
519 Other Information Services	71 Arts, Entertainment, and Recreation	721120 Casino hotels

Data sources: North American Industry Classification System; Economic Modeling Specialists International (EMSI)

1-3B. CALCULATING FUNCTION-BASED ECONOMIC DIVERSITY

The entropy measure was used to calculate *function-based economic diversity*, which this document commonly refers to as **functional diversity**. The metric was calculated for each county with employment by functional category serving as the share of total economic activity (p_i) specified in formula 1.

1-4. MEASURING OCCUPATIONAL DIVERSITY

Understanding what a region “does”—in addition to what a region “makes”—can help an analyst to better gauge the adaptability and suitability of a region to shocks and opportunities (Feser, 2003; Thompson & Thompson, 1987). In part, knowing what a region “does” requires data on the occupations of workers employed in the region’s industries and the skills required to perform those occupations. This section reviews the methods used to estimate county-level employment by occupations. These occupational employment estimates are then used as the basis for the calculation of an occupation-based measure of economic diversity.

Occupational diversity uses the 96 minor occupational groups defined in the Bureau of Labor Statistics’ 2000 Standard Occupational Classification as the units of analysis in the calculation of entropy.³ According to the Bureau of Labor Statistics, occupations are grouped based on similarity of “work performed, skills, education, training, and credentials.” Example occupational groups include agricultural workers, life scientists, secretaries and administrative assistants, and top executives. To estimate employment by minor occupational grouping, data from the Bureau of Labor Statistics’ national Staffing Pattern Matrix were used to translate county employment by industry data to county-level employment by occupation.

1-4A. CALCULATING OCCUPATION-BASED ECONOMIC DIVERSITY

The entropy measure was used to calculate *occupation-based economic diversity*, which this document commonly refers to as **occupational diversity**. The metric was calculated for each county with employment by minor occupational group serving as the share of total economic activity (p_i) specified in formula 1.

1-5. MEASURING ECONOMIC DIVERSITY ACROSS COUNTY COMMUTING SHEDS

In most U.S. counties, workers, firms, and consumers depend upon employment, shopping, and service opportunities that lie both within and outside their home county. While there are many potential regions that could be defined to approximate the multiple economic relationships among places (e.g., firm-to-firm; worker-to-employer; consumer-to-store), the analysis of commuting patterns provides one method for defining inter-county economic relationships. Derived county commuting sheds were

³ See <http://www.bls.gov/soc/2000/socguide.htm>

used as input geographies for the calculation of economic diversity metrics, resulting in industry, function, and occupation diversity measures for each county commuting shed.

Using 2006-2010 county-to-county commuting flow data prepared by the U.S. Census Bureau, commuting sheds were defined for each U.S. county.⁴ A county's commuting shed includes all those counties that account for a significant share of the journey-to-work commuting flow headed toward or away from that county. Journey-to-work data from the U.S. Census Bureau's 2006-2010 American Community Survey were used to determine membership in a commuting shed. Specifically, counties are included in a commuting shed if they account for at least five percent of the worker flow toward or away from the county in question. Commuting sheds range in size from one to nine counties in size, including the county of interest. In order to calculate measures of commuting shed diversity, employment by industry data for all counties in a commuting shed were combined. No commuting shed data is presented on the website for counties with only one county in their commuting shed. For these counties, commuting shed diversity is identical to county diversity.

1-6. MEASURING ECONOMIC DIVERSITY ACROSS DEVELOPMENT DISTRICTS

Development districts are regional development organizations that perform a variety of planning or economic development activities across county boundaries. Common names for these organizations include Councils of Government, Economic Development Districts, Local Development Districts, and Regional Planning Commissions. Databases from the National Association of Development Organizations and the Appalachian Regional Commission were used to determine county membership in development districts.⁵ In order to calculate measures of development district diversity, employment by industry data for all counties in a development district were combined. Measures for this geography are not presented for those counties that are not a member of an identified development district.

1-7. PRESENTING ECONOMIC DIVERSITY METRICS

1-7A. QUALITATIVE CLASSIFICATION OF ECONOMIC DIVERSITY MEASURES

To provide information on the relationship of county economic diversity values to the mean value and the overall distribution of diversity, z-scores were used to group and qualitatively classify economic diversity measures.

Z-scores for each value and diversity measure were calculated as follows:

- Calculate the mean (\bar{x}) and standard deviation (s) for a particular diversity measure

⁴ See http://www.fhwa.dot.gov/planning/census_issues/ctpp/ for information on Census Transportation Planning Products

⁵ See <http://www.nado.org/wp-content/uploads/2011/04/2011-National-Profiles-of-RDOs-FINAL.pdf>

- For each diversity value (x_i), calculate the difference (d_i) between the value and the mean value ($d_i = x_i - \bar{x}$)
- Calculate the z-score for each county's diversity value (z_i) to equal the quotient of the difference between the county's value and the mean value and the standard deviation ($z_i = d_i/s$)

While the distributions of the diversity values vary by measure, and none of the measures have a perfect normal distribution, z-scores can be used to provide a shorthand classification of individual values into groups with high, low, or about average values. Z-scores were classified into groups as follows:

- *Very high* ($z_i \geq 2$)
- *High* ($1 \leq z_i < 2$)
- *Above average* ($0 < z_i < 1$)
- *Below average* ($0 > z_i > -1$)
- *Low* ($-1 \geq z_i > -2$)
- *Very low* ($z_i \leq -2$)

For the purposes of the website, the few very high and very low economic diversity measures were grouped together with the high and low classifications, respectively.

1-7B. PERCENTILE RANKS OF COUNTY DIVERSITY AND RELATED MEASURES

In addition to qualitatively classifying county diversity measures, counties were ranked based on their diversity measures and characteristics such as population and employment growth and average earnings per job. These rankings were presented as percentile ranks based on the standing of the county's measures compared to all 3,142 county equivalents across the United States and, for those counties within the formal Appalachian region, all 428 county equivalents in Appalachia.⁶ The value of a county's percentile rank represents, for a particular measure, the percentage of counties that have an equal or lower value. For example, industry diversity for Breathitt County, Kentucky ranked at the 28th percentile in 2012. This indicates that 28 percent of all U.S. counties had equal or lower values of industry-based economic diversity in 2012. Percentile ranks were also presented for county commuting sheds and county development districts.

⁶ The Appalachian Region contains 420 counties in 13 states, along with the following eight independent cities in Virginia: Bristol, Buena Vista, Covington, Galax, Lexington, Martinsville, Norton, and Radford.

1-8. CALCULATING AND REPORTING RELATED METRICS

Several measures are reported on the website that are not diversity metrics, but provide context to these measures. The details of these measures are briefly described in this section.

1-8A. EARNINGS PER JOB

All earnings per job values draw from EMSI's complete employment datasets. For average earnings per job by county, the sum of total earnings across the county is divided by the sum of total employment in the county.

1-8B. POPULATION AND EMPLOYMENT GROWTH

Presented population figures are taken from the U.S. Census Bureau Population Estimates by County for July 1, 2012 and July 1, 2009.⁷ Population change figures reflect average annualized growth between these two points in time.

Employment figures represent complete employment estimates by industry taken from EMSI's final 2009 data release and quarter 3 data release for 2012. Employment change figures reflect average annualized growth between these two points in time.

1-8C. ESTABLISHMENTS BY FUNCTIONAL INDUSTRY

To summarize the industry mix by county, the website presents estimates of employment and establishment counts by the functional industries derived as detailed in section 1-3. EMSI's covered employment dataset for 2012 was used to estimate the number of establishments by functional industry. While the dataset is for year 2012, the presented establishment estimates are for 2011.

⁷ See <http://www.census.gov/popest/>

2. IDENTIFYING COUNTY ECONOMIC SPECIALIZATIONS

2-1. CATEGORIZING COUNTIES BASED ON FUNCTIONAL SPECIALIZATIONS

A county's functional specialization represents its largest specialization relative to the share of U.S. employment accounted for by eleven broad economic functions, such as agriculture & resource extraction and finance, insurance and real estate. These economic functions are defined by grouping industries together into one of the eleven functional categories defined in section 1-3, with each category representing industries that are broadly similar on factors such as inputs, outputs, and/or the technological or skill requirements necessary to perform the work customary to these industries.

A county's functional specialization was determined by comparing county employment in each functional category to the average level employment in each category. The concept of extra jobs quantifies specializations in terms of the absolute number of jobs employed in a particular category above or below the national average. To assign a single functional industry specialization to all counties, an extra jobs value was calculated for the groups of industries comprising each functional category in each county. The functional category with the largest number of extra jobs was assigned as the functional industry specialization for the county in question.

For each county, extra jobs were calculated for each functional category as shown in formula 2:

$$(2) \quad Extra_i = \left(\frac{E_{ic}}{E_c} - \frac{E_{in}}{E_n} \right) E_c$$

where E_{ic} is employment in the functional category of interest (i) for a county (c), E_c is total employment in the county of interest, E_{in} is the nation's employment in the functional category of interest, and E_n is total national employment.

2-2. CATEGORIZING COUNTIES BASED ON OCCUPATIONAL KNOWLEDGE CLUSTER

Knowledge clusters are 12 groups of occupations categorized based on similarities in the knowledge required to work in these professions. Clusters were identified using procedures detailed in Feser (2003). US Department of Labor Occupational Information Network (ONET) data on type and level of knowledge required to work in professions were used to derive 12 clusters of occupations. Data from the Bureau of Labor Statistics' national Staffing Pattern Matrix were used to translate county employment by industry data to county-level employment by knowledge cluster. Employment in government industries, including military employment, is not accounted for by these knowledge clusters. Table 2-1 lists the 12 knowledge clusters and provides examples of common occupations and average education or training levels associated with them. Similar to the functional specializations, knowledge cluster specializations were identified for each county based on the knowledge cluster with the most extra jobs in a particular county.

Table 2-1: Illustrative Description of Knowledge Clusters**Agricultural & life sciences**

Common professions in this cluster include veterinarians, veterinary assistants and technicians, medical and clinical laboratory technicians, and supervisors of farming, fishing, and forestry workers. On average, these jobs require just over 3 years of post-secondary education—the 3rd highest average among the 12 knowledge clusters.

Arts, entertainment & spectator sports

Common professions in this cluster include photographers, musicians, actors, writers, fine artists, and reporters. On average, these jobs require just less than 2 years of post-secondary education—ranking 7th highest among the 12 knowledge clusters.

Construction & specialized mechanical

Common professions in this cluster include carpenters, maintenance workers, construction laborers, and automotive service technicians and mechanics. On average, these jobs require less than 1 year of post-secondary education—ranking 10th among the 12 knowledge clusters. The average length of on-the-job training required for these professions is the 2nd highest among the clusters.

Education, counseling & therapy

Common professions in this cluster include teachers, fitness trainers, clergy, physical therapists, and social workers. On average, these jobs require nearly 3.5 years of post-secondary education—the highest average among the 12 knowledge clusters.

Engineering, architecture & natural resource science

Common professions in this cluster include civil, mechanical, and industrial engineers, electricians, architectural drafters, architects, and chemists. On average, these jobs require approximately 3.25 years of post-secondary education—the 2nd highest average among the 12 knowledge clusters. The average length of on-the-job training required for these professions is the highest among the clusters.

Information technology & communications

Common professions in this cluster include computer support specialists, software engineers, systems analysts, and database and network administrators. On average, these jobs require just less than 3 years of post-secondary education—the 4th highest average among the 12 knowledge clusters.

Legal, clerical & administrative

Common professions in this cluster include office clerks, cashiers, bookkeepers, secretaries, lawyers, and financial advisors. On average, these jobs require just over 1 year of post-secondary education—ranking 8th among the 12 knowledge clusters.

Management & finance

Common professions in this cluster include general managers, accountants, first-line supervisors, real estate agents, and securities sales agents. On average, these jobs require nearly 2.5 years of post-secondary education—the 6th highest average among the 12 knowledge clusters. The average length of on-the-job training required for these professions is the 3rd highest among the clusters.

Medical science & health services

Common professions in this cluster include nurses, nursing aides, physicians, dental assistants, and pharmacists. On average, these jobs require just over 2.5 years of post-secondary education—the 5th highest average among the 12 knowledge clusters.

Semi-skilled service

Common professions in this cluster include retail salespersons, customer service representatives, waiters and waitresses, stock clerks, child care workers, and food preparation workers. On average, these jobs require less than 1 year of post-secondary education—ranking 9th among the 12 knowledge clusters.

Skilled, semi-skilled labor & machine operation

Common professions in this cluster include janitors, laborers, landscapers and groundskeepers, farmworkers, and welders. On average, these jobs require less than 1 year of post-secondary education—ranking 11th among the 12 knowledge clusters.

Transportation, distribution, law enforcement & safety

Common professions in this cluster include truck drivers, security guards, and pilots. On average these jobs require less than 1 year of post-secondary education—the lowest average among the 12 knowledge clusters.

Data source: Occupational Information Network (O*NET) used to characterize 12 knowledge clusters derived using the methods detailed in Feser (2003)

3. IDENTIFYING COMPARATOR COUNTIES

3-1. FILTERING COUNTIES BY FUNCTIONAL OR KNOWLEDGE CLUSTER SPECIALIZATION

The website allows for maps of economic diversity to be filtered based on county functional specialization or knowledge cluster specialization. These specializations were assigned as detailed in sections 2-1 and 2-2.

3-2. FILTERING COUNTIES BY COUNTY CHARACTER

The Isserman (2005, p. 475) typology classifies counties according to the following criteria:

Rural county: (1) The county's population density is less than 500 people per square mile, and (2) 90 percent of the county population is in rural areas or the county has no urban area with a population of 10,000 or more.

Urban county: (1) The county's population density is at least 500 people per square mile, (2) 90 percent of the county population lives in urban areas, and (3) the county's population in urbanized areas is at least 50,000 or 90 percent of the county population.

Mixed rural county: (1) The county meets neither the urban nor the rural county criteria, and (2) its population density is less than 320 people per square mile.

Mixed urban county: (1) The county meets neither the urban nor the rural county criteria, and (2) its population density is at least 320 people per square mile.

3-3. FILTERING COUNTIES BY ECONOMIC STATUS

The Appalachian Regional Commission compares economic data for each county in the Appalachian region to national economic data. A county's economic status represents the state of the county's economy relative to the national economy.⁸ Since this indicator is calculated by the Appalachian Regional Commission for Appalachian counties, counties outside of the Appalachian Region do not have economic status designations. The website allows for filtering counties based on economic status indicators. Counties may be filtered by the status designations described below and depicted in Figure 3-1.

⁸ See <http://www.arc.gov/research/SourceandMethodologyCountyEconomicStatusFY2007FY2014.asp> for more details on economic status indicators

Distressed

Distressed counties rank in the worst ten percent of U.S. counties when jointly considering the three-year average unemployment rate, per capita market income, and poverty rate.

At-Risk

At-risk counties rank between the worst ten percent and 25 percent of U.S. counties when jointly considering the three-year average unemployment rate, per capita market income, and poverty rate.

Transitional

Transitional counties rank between the worst 25 percent and best 25 percent of U.S. counties when jointly considering the three-year average unemployment rate, per capita market income, and poverty rate.

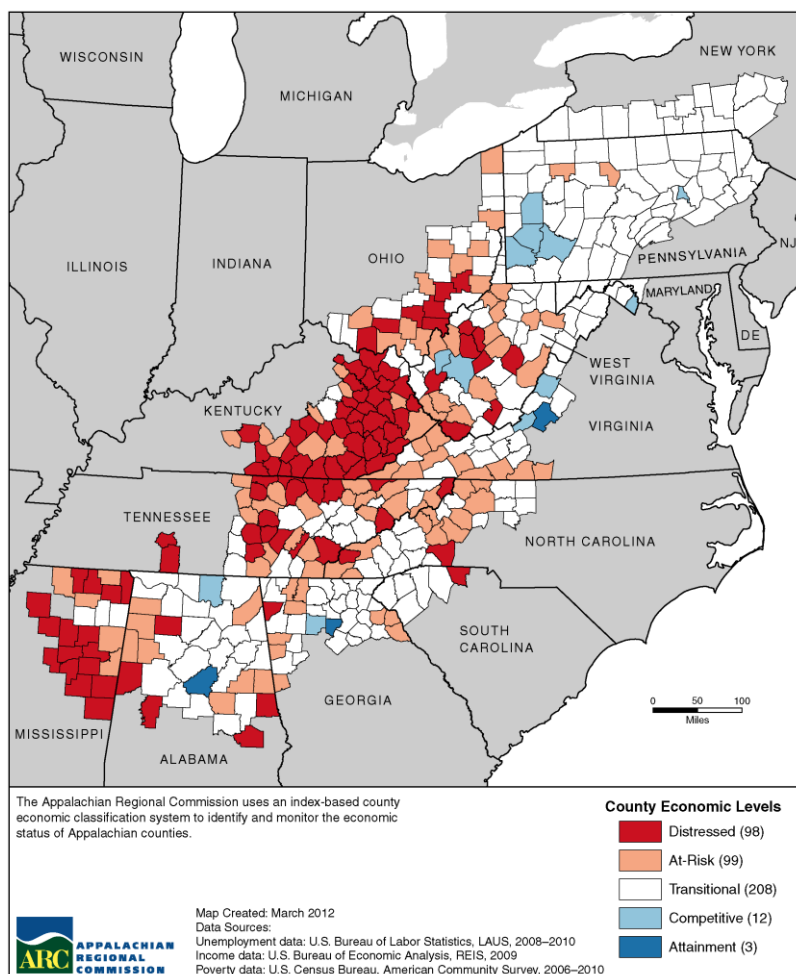
Competitive

Competitive counties rank between the best ten percent and 25 percent of U.S. counties when jointly considering the three-year average unemployment rate, per capita market income, and poverty rate.

Attainment

Attainment counties rank in the best ten percent of U.S. counties when jointly considering the three-year average unemployment rate, per capita market income, and poverty rate.

Figure 3-1: ARC’s County Economic Status Designation, Fiscal Year 2013



3-4. IDENTIFYING SIMILAR COUNTIES BASED ON ECONOMIC, DEMOGRAPHIC, AND LOCATION CHARACTERISTICS

To enable benchmarking, a county’s similar counties were identified with the use of a Mahalanobis distance metric applied to 16 economic, demographic, and location variables. The Mahalanobis indicator was calculated for all pairs of U.S. counties, and it essentially measures the difference or “distance” between county pairs when considering these 16 variables. Similar counties were qualitatively labeled based on their degree of similarity, with “strong” matches representing 62.2 percent of matches, “moderate” matches representing 30.9 percent of matches, “weak” matches accounting for 6.2 percent of matches, and “very weak” matches accounting for 0.7 percent of matches. For each county, up to five counties with the lowest distance indicator values were identified as matches. Some U.S. counties are highly unique and the quality of matches is relatively low. Counties with fewer than five matches presented do not have at least five matching counties with at least “very weak” match strength. A county that is identified as a “weak” or “very weak” match to another county is probably only similar to the first county on one or a few of the economic, demographic, and location

characteristics. Counties with no listed matches did not have available data for all the 16 variables. The following variables and data sources were used to determine similar counties:

Per capita income, 2011, Bureau of Economic Analysis, Local Area Personal Income and Employment⁹

Percent of income by source, 2011, Bureau of Economic Analysis, Local Area Personal Income and Employment¹⁰

- % Farming income
- % Dividends, interest, and rent income
- % Proprietors income

Percent of earnings by industry, 2012, Economic Modeling Specialists International (see functional specialization definitions for more details)

- % Mining earnings
- % Capital-intensive manufacturing earnings
- % Engineering-intensive manufacturing earnings
- % Finance, insurance and real estate earnings
- % Corporate management & administration earnings
- % Government earnings
- % Knowledge-intensive business services earnings

Population and area characteristics

- Total Population, 2010, U.S. Census Summary File 1
- Square Miles in Land Area, 2010, U.S. Census
- County distance in miles from an urban area with more than one million population, 2010, U.S. Census Urban Area Boundary File¹¹
Note: Distance measured from county center to closest edge of urban area.
- % Population 25 years or older with at least a high school degree, 2007-2011 American Community Survey, U.S. Census Bureau
- % Below poverty level for the population for which poverty status is determined, 2007-2011 American Community Survey, U.S. Census Bureau

⁹ <http://www.bea.gov/regional/index.htm>

¹⁰ <http://www.bea.gov/regional/index.htm>

¹¹ http://www.census.gov/geo/maps-data/data/cbf/cbf_ua.html

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5. DETAILED DOCUMENTATION

Table 5-1: NAICS 6-digit Industries by Functional Industry Categories

Functional industry category	
NAICS code and title	
Agriculture and resource extraction	
111000 Crop production	212221 Gold Ore Mining
112000 Animal production	212222 Silver Ore Mining
113110 Timber Tract Operations	212231 Lead Ore and Zinc Ore Mining
113210 Forest Nurseries and Gathering of Forest Products	212234 Copper Ore and Nickel Ore Mining
113310 Logging	212291 Uranium-Radium-Vanadium Ore Mining
114111 Finfish Fishing	212299 All Other Metal Ore Mining
114112 Shellfish Fishing	212311 Dimension Stone Mining and Quarrying
114119 Other Marine Fishing	212312 Crushed and Broken Limestone Mining and Quarrying
114210 Hunting and Trapping	212313 Crushed and Broken Granite Mining and Quarrying
115111 Cotton Ginning	212319 Other Crushed and Broken Stone Mining and Quarrying
115112 Soil Preparation, Planting, and Cultivating	212321 Construction Sand and Gravel Mining
115113 Crop Harvesting, Primarily by Machine	212322 Industrial Sand Mining
115114 Postharvest Crop Activities (except Cotton Ginning)	212324 Kaolin and Ball Clay Mining
115115 Farm Labor Contractors and Crew Leaders	212325 Clay and Ceramic and Refractory Minerals Mining
115116 Farm Management Services	212391 Potash, Soda, and Borate Mineral Mining
115210 Support Activities for Animal Production	212392 Phosphate Rock Mining
115310 Support Activities for Forestry	212393 Other Chemical and Fertilizer Mineral Mining
211111 Crude Petroleum and Natural Gas Extraction	212399 All Other Nonmetallic Mineral Mining
211112 Natural Gas Liquid Extraction	213111 Drilling Oil and Gas Wells
212111 Bituminous Coal and Lignite Surface Mining	213112 Support Activities for Oil and Gas Operations
212112 Bituminous Coal Underground Mining	213113 Support Activities for Coal Mining
212113 Anthracite Mining	213114 Support Activities for Metal Mining
212210 Iron Ore Mining	213115 Support Activities for Nonmetallic Minerals (except Fuels) Mining
Capital-intensive manufacturing	
311111 Dog and Cat Food Manufacturing	326113 Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing
311119 Other Animal Food Manufacturing	326121 Unlaminated Plastics Profile Shape Manufacturing
311211 Flour Milling	326122 Plastics Pipe and Pipe Fitting Manufacturing
311212 Rice Milling	326130 Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing
311213 Malt Manufacturing	326140 Polystyrene Foam Product Manufacturing
311221 Wet Corn Milling	326150 Urethane and Other Foam Product (except Polystyrene) Manufacturing
311222 Soybean Processing	326160 Plastics Bottle Manufacturing
311223 Other Oilseed Processing	326191 Plastics Plumbing Fixture Manufacturing
311225 Fats and Oils Refining and Blending	326192 Resilient Floor Covering Manufacturing
311230 Breakfast Cereal Manufacturing	326199 All Other Plastics Product Manufacturing
311311 Sugarcane Mills	326211 Tire Manufacturing (except Retreading)
311312 Cane Sugar Refining	326212 Tire Retreading
311313 Beet Sugar Manufacturing	326220 Rubber and Plastics Hoses and Belting Manufacturing
311320 Chocolate and Confectionery Manufacturing from Cacao Beans	326291 Rubber Product Manufacturing for Mechanical Use
311330 Confectionery Manufacturing from Purchased Chocolate	326299 All Other Rubber Product Manufacturing
311340 Nonchocolate Confectionery Manufacturing	327111 Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing

Functional industry category	
NAICS code and title	
311411 Frozen Fruit, Juice, and Vegetable Manufacturing	327112 Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing
311412 Frozen Specialty Food Manufacturing	327113 Porcelain Electrical Supply Manufacturing
311421 Fruit and Vegetable Canning	327121 Brick and Structural Clay Tile Manufacturing
311422 Specialty Canning	327122 Ceramic Wall and Floor Tile Manufacturing
311423 Dried and Dehydrated Food Manufacturing	327123 Other Structural Clay Product Manufacturing
311511 Fluid Milk Manufacturing	327124 Clay Refractory Manufacturing
311512 Creamery Butter Manufacturing	327125 Nonclay Refractory Manufacturing
311513 Cheese Manufacturing	327211 Flat Glass Manufacturing
311514 Dry, Condensed, and Evaporated Dairy Product Manufacturing	327212 Other Pressed and Blown Glass and Glassware Manufacturing
311520 Ice Cream and Frozen Dessert Manufacturing	327213 Glass Container Manufacturing
311611 Animal (except Poultry) Slaughtering	327215 Glass Product Manufacturing Made of Purchased Glass
311612 Meat Processed from Carcasses	327310 Cement Manufacturing
311613 Rendering and Meat Byproduct Processing	327320 Ready-Mix Concrete Manufacturing
311615 Poultry Processing	327331 Concrete Block and Brick Manufacturing
311711 Seafood Canning	327332 Concrete Pipe Manufacturing
311712 Fresh and Frozen Seafood Processing	327390 Other Concrete Product Manufacturing
311811 Retail Bakeries	327410 Lime Manufacturing
311812 Commercial Bakeries	327420 Gypsum Product Manufacturing
311813 Frozen Cakes, Pies, and Other Pastries Manufacturing	327910 Abrasive Product Manufacturing
311821 Cookie and Cracker Manufacturing	327991 Cut Stone and Stone Product Manufacturing
311822 Flour Mixes and Dough Manufacturing from Purchased Flour	327992 Ground or Treated Mineral and Earth Manufacturing
311823 Dry Pasta Manufacturing	327993 Mineral Wool Manufacturing
311830 Tortilla Manufacturing	327999 All Other Miscellaneous Nonmetallic Mineral Product Manufacturing
311911 Roasted Nuts and Peanut Butter Manufacturing	331111 Iron and Steel Mills
311919 Other Snack Food Manufacturing	331112 Electrometallurgical Ferroalloy Product Manufacturing
311920 Coffee and Tea Manufacturing	331210 Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
311930 Flavoring Syrup and Concentrate Manufacturing	331221 Rolled Steel Shape Manufacturing
311941 Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	331222 Steel Wire Drawing
311942 Spice and Extract Manufacturing	331312 Primary Aluminum Production
311991 Perishable Prepared Food Manufacturing	331314 Secondary Smelting and Alloying of Aluminum
311999 All Other Miscellaneous Food Manufacturing	331315 Aluminum Sheet, Plate, and Foil Manufacturing
312111 Soft Drink Manufacturing	331316 Aluminum Extruded Product Manufacturing
312112 Bottled Water Manufacturing	331319 Other Aluminum Rolling and Drawing
312113 Ice Manufacturing	331411 Primary Smelting and Refining of Copper
312120 Breweries	331419 Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)
312130 Wineries	331421 Copper Rolling, Drawing, and Extruding
312140 Distilleries	331422 Copper Wire (except Mechanical) Drawing
312210 Tobacco Stemming and Redrying	331423 Secondary Smelting, Refining, and Alloying of Copper
312221 Cigarette Manufacturing	331491 Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding
312229 Other Tobacco Product Manufacturing	331492 Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)
313111 Yarn Spinning Mills	331511 Iron Foundries
313112 Yarn Texturizing, Throwing, and Twisting Mills	331512 Steel Investment Foundries
313113 Thread Mills	331513 Steel Foundries (except Investment)
313210 Broadwoven Fabric Mills	331521 Aluminum Die-Casting Foundries

Functional industry category**NAICS code and title**

313221 Narrow Fabric Mills	331522 Nonferrous (except Aluminum) Die-Casting Foundries
313222 Schiffli Machine Embroidery	331524 Aluminum Foundries (except Die-Casting)
313230 Nonwoven Fabric Mills	331525 Copper Foundries (except Die-Casting)
313241 Weft Knit Fabric Mills	331528 Other Nonferrous Foundries (except Die-Casting)
313249 Other Knit Fabric and Lace Mills	332111 Iron and Steel Forging
313311 Broadwoven Fabric Finishing Mills	332112 Nonferrous Forging
313312 Textile and Fabric Finishing (except Broadwoven Fabric) Mills	332114 Custom Roll Forming
313320 Fabric Coating Mills	332115 Crown and Closure Manufacturing
314110 Carpet and Rug Mills	332116 Metal Stamping
314121 Curtain and Drapery Mills	332117 Powder Metallurgy Part Manufacturing
314129 Other Household Textile Product Mills	332211 Cutlery and Flatware (except Precious) Manufacturing
314911 Textile Bag Mills	332213 Saw Blade and Handsaw Manufacturing
314912 Canvas and Related Product Mills	332214 Kitchen Utensil, Pot, and Pan Manufacturing
314991 Rope, Cordage, and Twine Mills	332311 Prefabricated Metal Building and Component Manufacturing
314992 Tire Cord and Tire Fabric Mills	332312 Fabricated Structural Metal Manufacturing
314999 All Other Miscellaneous Textile Product Mills	332313 Plate Work Manufacturing
315111 Sheer Hosiery Mills	332321 Metal Window and Door Manufacturing
315119 Other Hosiery and Sock Mills	332322 Sheet Metal Work Manufacturing
315191 Outerwear Knitting Mills	332323 Ornamental and Architectural Metal Work Manufacturing
315192 Underwear and Nightwear Knitting Mills	332410 Power Boiler and Heat Exchanger Manufacturing
315211 Men's and Boys' Cut and Sew Apparel Contractors	332420 Metal Tank (Heavy Gauge) Manufacturing
315212 Women's, Girls', and Infants' Cut and Sew Apparel Contractors	332431 Metal Can Manufacturing
315221 Men's and Boys' Cut and Sew Underwear and Nightwear Manufacturing	332439 Other Metal Container Manufacturing
315222 Men's and Boys' Cut and Sew Suit, Coat, and Overcoat Manufacturing	332510 Hardware Manufacturing
315223 Men's and Boys' Cut and Sew Shirt (except Work Shirt) Manufacturing	332611 Spring (Heavy Gauge) Manufacturing
315224 Men's and Boys' Cut and Sew Trouser, Slack, and Jean Manufacturing	332612 Spring (Light Gauge) Manufacturing
315225 Men's and Boys' Cut and Sew Work Clothing Manufacturing	332618 Other Fabricated Wire Product Manufacturing
315228 Men's and Boys' Cut and Sew Other Outerwear Manufacturing	332710 Machine Shops
315231 Women's and Girls' Cut and Sew Lingerie, Loungewear, and Nightwear Manufacturing	332721 Precision Turned Product Manufacturing
315232 Women's and Girls' Cut and Sew Blouse and Shirt Manufacturing	332722 Bolt, Nut, Screw, Rivet, and Washer Manufacturing
315233 Women's and Girls' Cut and Sew Dress Manufacturing	332811 Metal Heat Treating
315234 Women's and Girls' Cut and Sew Suit, Coat, Tailored Jacket, and Skirt Manufacturing	332812 Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers
315239 Women's and Girls' Cut and Sew Other Outerwear Manufacturing	332813 Electroplating, Plating, Polishing, Anodizing, and Coloring
315291 Infants' Cut and Sew Apparel Manufacturing	332911 Industrial Valve Manufacturing
315292 Fur and Leather Apparel Manufacturing	332912 Fluid Power Valve and Hose Fitting Manufacturing
315299 All Other Cut and Sew Apparel Manufacturing	332913 Plumbing Fixture Fitting and Trim Manufacturing
315991 Hat, Cap, and Millinery Manufacturing	332919 Other Metal Valve and Pipe Fitting Manufacturing
315992 Glove and Mitten Manufacturing	332996 Fabricated Pipe and Pipe Fitting Manufacturing

Functional industry category	
NAICS code and title	
315993 Men's and Boys' Neckwear Manufacturing	332998 Enameled Iron and Metal Sanitary Ware Manufacturing
315999 Other Apparel Accessories and Other Apparel Manufacturing	332999 All Other Miscellaneous Fabricated Metal Product Manufacturing
316110 Leather and Hide Tanning and Finishing	333298 All Other Industrial Machinery Manufacturing
316211 Rubber and Plastics Footwear Manufacturing	333414 Heating Equipment (except Warm Air Furnaces) Manufacturing
316212 House Slipper Manufacturing	333415 Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
316213 Men's Footwear (except Athletic) Manufacturing	335211 Electric Housewares and Household Fan Manufacturing
316214 Women's Footwear (except Athletic) Manufacturing	335212 Household Vacuum Cleaner Manufacturing
316219 Other Footwear Manufacturing	335221 Household Cooking Appliance Manufacturing
316991 Luggage Manufacturing	335222 Household Refrigerator and Home Freezer Manufacturing
316992 Women's Handbag and Purse Manufacturing	335224 Household Laundry Equipment Manufacturing
316993 Personal Leather Good (except Women's Handbag and Purse) Manufacturing	335228 Other Major Household Appliance Manufacturing
316999 All Other Leather Good and Allied Product Manufacturing	335921 Fiber Optic Cable Manufacturing
321113 Sawmills	335929 Other Communication and Energy Wire Manufacturing
321114 Wood Preservation	336111 Automobile Manufacturing
321211 Hardwood Veneer and Plywood Manufacturing	336112 Light Truck and Utility Vehicle Manufacturing
321212 Softwood Veneer and Plywood Manufacturing	336120 Heavy Duty Truck Manufacturing
321213 Engineered Wood Member (except Truss) Manufacturing	336211 Motor Vehicle Body Manufacturing
321214 Truss Manufacturing	336212 Truck Trailer Manufacturing
321219 Reconstituted Wood Product Manufacturing	336213 Motor Home Manufacturing
321911 Wood Window and Door Manufacturing	336214 Travel Trailer and Camper Manufacturing
321912 Cut Stock, Resawing Lumber, and Planing	336312 Gasoline Engine and Engine Parts Manufacturing
321918 Other Millwork (including Flooring)	336322 Other Motor Vehicle Electrical and Electronic Equipment Manufacturing
321920 Wood Container and Pallet Manufacturing	336330 Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing
321991 Manufactured Home (Mobile Home) Manufacturing	336340 Motor Vehicle Brake System Manufacturing
321992 Prefabricated Wood Building Manufacturing	336350 Motor Vehicle Transmission and Power Train Parts Manufacturing
321999 All Other Miscellaneous Wood Product Manufacturing	336360 Motor Vehicle Seating and Interior Trim Manufacturing
322110 Pulp Mills	336370 Motor Vehicle Metal Stamping
322121 Paper (except Newsprint) Mills	336391 Motor Vehicle Air-Conditioning Manufacturing
322122 Newsprint Mills	336399 All Other Motor Vehicle Parts Manufacturing
322130 Paperboard Mills	336510 Railroad Rolling Stock Manufacturing
322211 Corrugated and Solid Fiber Box Manufacturing	336611 Ship Building and Repairing
322212 Folding Paperboard Box Manufacturing	336612 Boat Building
322213 Setup Paperboard Box Manufacturing	336991 Motorcycle, Bicycle, and Parts Manufacturing
322214 Fiber Can, Tube, Drum, and Similar Products Manufacturing	336992 Military Armored Vehicle, Tank, and Tank Component Manufacturing
322215 Nonfolding Sanitary Food Container Manufacturing	336999 All Other Transportation Equipment Manufacturing
322221 Coated and Laminated Packaging Paper Manufacturing	337110 Wood Kitchen Cabinet and Countertop Manufacturing

Functional industry category

NAICS code and title

322222 Coated and Laminated Paper Manufacturing	337121 Upholstered Household Furniture Manufacturing
322223 Coated Paper Bag and Pouch Manufacturing	337122 Nonupholstered Wood Household Furniture Manufacturing
322224 Uncoated Paper and Multiwall Bag Manufacturing	337124 Metal Household Furniture Manufacturing
322225 Laminated Aluminum Foil Manufacturing for Flexible Packaging Uses	337125 Household Furniture (except Wood and Metal) Manufacturing
322226 Surface-Coated Paperboard Manufacturing	337127 Institutional Furniture Manufacturing
322231 Die-Cut Paper and Paperboard Office Supplies Manufacturing	337129 Wood Television, Radio, and Sewing Machine Cabinet Manufacturing
322232 Envelope Manufacturing	337211 Wood Office Furniture Manufacturing
322233 Stationery, Tablet, and Related Product Manufacturing	337212 Custom Architectural Woodwork and Millwork Manufacturing
322291 Sanitary Paper Product Manufacturing	337214 Office Furniture (except Wood) Manufacturing
322299 All Other Converted Paper Product Manufacturing	337215 Showcase, Partition, Shelving, and Locker Manufacturing
323110 Commercial Lithographic Printing	337910 Mattress Manufacturing
323111 Commercial Gravure Printing	337920 Blind and Shade Manufacturing
323112 Commercial Flexographic Printing	339911 Jewelry (except Costume) Manufacturing
323113 Commercial Screen Printing	339912 Silverware and Hollowware Manufacturing
323114 Quick Printing	339913 Jewelers' Material and Lapidary Work Manufacturing
323115 Digital Printing	339914 Costume Jewelry and Novelty Manufacturing
323116 Manifold Business Forms Printing	339920 Sporting and Athletic Goods Manufacturing
323117 Books Printing	339931 Doll and Stuffed Toy Manufacturing
323118 Blankbook, Looseleaf Binders, and Devices Manufacturing	339932 Game, Toy, and Children's Vehicle Manufacturing
323119 Other Commercial Printing	339941 Pen and Mechanical Pencil Manufacturing
323121 Tradebinding and Related Work	339942 Lead Pencil and Art Good Manufacturing
323122 Prepress Services	339943 Marking Device Manufacturing
324121 Asphalt Paving Mixture and Block Manufacturing	339944 Carbon Paper and Inked Ribbon Manufacturing
324122 Asphalt Shingle and Coating Materials Manufacturing	339950 Sign Manufacturing
324191 Petroleum Lubricating Oil and Grease Manufacturing	339991 Gasket, Packing, and Sealing Device Manufacturing
324199 All Other Petroleum and Coal Products Manufacturing	339992 Musical Instrument Manufacturing
325991 Custom Compounding of Purchased Resins	339993 Fastener, Button, Needle, and Pin Manufacturing
325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing	339994 Broom, Brush, and Mop Manufacturing
326111 Plastics Bag and Pouch Manufacturing	339995 Burial Casket Manufacturing
326112 Plastics Packaging Film and Sheet (including Laminated) Manufacturing	339999 All Other Miscellaneous Manufacturing
Corporate management and administration	
551111 Offices of Bank Holding Companies	551114 Corporate, Subsidiary, and Regional Managing Offices
551112 Offices of Other Holding Companies	561110 Office Administrative Services
Distributive services	
221111 Hydroelectric Power Generation	424820 Wine and Distilled Alcoholic Beverage Merchant Wholesalers
221112 Fossil Fuel Electric Power Generation	424910 Farm Supplies Merchant Wholesalers
221113 Nuclear Electric Power Generation	424920 Book, Periodical, and Newspaper Merchant Wholesalers
221119 Other Electric Power Generation	424930 Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers
221121 Electric Bulk Power Transmission and Control	424940 Tobacco and Tobacco Product Merchant Wholesalers
221122 Electric Power Distribution	424950 Paint, Varnish, and Supplies Merchant Wholesalers

Functional industry category	
NAICS code and title	
221210 Natural Gas Distribution	424990 Other Miscellaneous Nondurable Goods Merchant Wholesalers
221310 Water Supply and Irrigation Systems	425110 Business to Business Electronic Markets
221320 Sewage Treatment Facilities	425120 Wholesale Trade Agents and Brokers
221330 Steam and Air-Conditioning Supply	481111 Scheduled Passenger Air Transportation
423110 Automobile and Other Motor Vehicle Merchant Wholesalers	481112 Scheduled Freight Air Transportation
423120 Motor Vehicle Supplies and New Parts Merchant Wholesalers	481211 Nonscheduled Chartered Passenger Air Transportation
423130 Tire and Tube Merchant Wholesalers	481212 Nonscheduled Chartered Freight Air Transportation
423140 Motor Vehicle Parts (Used) Merchant Wholesalers	481219 Other Nonscheduled Air Transportation
423210 Furniture Merchant Wholesalers	482110 Rail transportation
423220 Home Furnishing Merchant Wholesalers	483111 Deep Sea Freight Transportation
423310 Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers	483112 Deep Sea Passenger Transportation
423320 Brick, Stone, and Related Construction Material Merchant Wholesalers	483113 Coastal and Great Lakes Freight Transportation
423330 Roofing, Siding, and Insulation Material Merchant Wholesalers	483114 Coastal and Great Lakes Passenger Transportation
423390 Other Construction Material Merchant Wholesalers	483211 Inland Water Freight Transportation
423410 Photographic Equipment and Supplies Merchant Wholesalers	483212 Inland Water Passenger Transportation
423420 Office Equipment Merchant Wholesalers	484110 General Freight Trucking, Local
423430 Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	484121 General Freight Trucking, Long-Distance, Truckload
423440 Other Commercial Equipment Merchant Wholesalers	484122 General Freight Trucking, Long-Distance, Less Than Truckload
423450 Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers	484210 Used Household and Office Goods Moving
423460 Ophthalmic Goods Merchant Wholesalers	484220 Specialized Freight (except Used Goods) Trucking, Local
423490 Other Professional Equipment and Supplies Merchant Wholesalers	484230 Specialized Freight (except Used Goods) Trucking, Long-Distance
423510 Metal Service Centers and Other Metal Merchant Wholesalers	485111 Mixed Mode Transit Systems
423520 Coal and Other Mineral and Ore Merchant Wholesalers	485112 Commuter Rail Systems
423610 Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	485113 Bus and Other Motor Vehicle Transit Systems
423620 Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	485119 Other Urban Transit Systems
423690 Other Electronic Parts and Equipment Merchant Wholesalers	485210 Interurban and Rural Bus Transportation
423710 Hardware Merchant Wholesalers	485310 Taxi Service
423720 Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	485320 Limousine Service
423730 Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	485410 School and Employee Bus Transportation
423740 Refrigeration Equipment and Supplies Merchant Wholesalers	485510 Charter Bus Industry
423810 Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers	485991 Special Needs Transportation
423820 Farm and Garden Machinery and Equipment Merchant Wholesalers	485999 All Other Transit and Ground Passenger Transportation
423830 Industrial Machinery and Equipment Merchant Wholesalers	486110 Pipeline Transportation of Crude Oil
423840 Industrial Supplies Merchant Wholesalers	486210 Pipeline Transportation of Natural Gas
423850 Service Establishment Equipment and Supplies Merchant Wholesalers	486910 Pipeline Transportation of Refined Petroleum Products

Functional industry category**NAICS code and title**

423860 Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers	486990 All Other Pipeline Transportation
423910 Sporting and Recreational Goods and Supplies Merchant Wholesalers	487110 Scenic and Sightseeing Transportation, Land
423920 Toy and Hobby Goods and Supplies Merchant Wholesalers	487210 Scenic and Sightseeing Transportation, Water
423930 Recyclable Material Merchant Wholesalers	487990 Scenic and Sightseeing Transportation, Other
423940 Jewelry, Watch, Precious Stone, and Precious Metal Merchant Wholesalers	488111 Air Traffic Control
423990 Other Miscellaneous Durable Goods Merchant Wholesalers	488119 Other Airport Operations
424110 Printing and Writing Paper Merchant Wholesalers	488190 Other Support Activities for Air Transportation
424120 Stationery and Office Supplies Merchant Wholesalers	488210 Support Activities for Rail Transportation
424130 Industrial and Personal Service Paper Merchant Wholesalers	488310 Port and Harbor Operations
424210 Drugs and Druggists' Sundries Merchant Wholesalers	488320 Marine Cargo Handling
424310 Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers	488330 Navigational Services to Shipping
424320 Men's and Boys' Clothing and Furnishings Merchant Wholesalers	488390 Other Support Activities for Water Transportation
424330 Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers	488410 Motor Vehicle Towing
424340 Footwear Merchant Wholesalers	488490 Other Support Activities for Road Transportation
424410 General Line Grocery Merchant Wholesalers	488510 Freight Transportation Arrangement
424420 Packaged Frozen Food Merchant Wholesalers	488991 Packing and Crating
424430 Dairy Product (except Dried or Canned) Merchant Wholesalers	488999 All Other Support Activities for Transportation
424440 Poultry and Poultry Product Merchant Wholesalers	491110 Postal Service
424450 Confectionery Merchant Wholesalers	492110 Couriers and Express Delivery Services
424460 Fish and Seafood Merchant Wholesalers	492210 Local Messengers and Local Delivery
424470 Meat and Meat Product Merchant Wholesalers	493110 General Warehousing and Storage
424480 Fresh Fruit and Vegetable Merchant Wholesalers	493120 Refrigerated Warehousing and Storage
424490 Other Grocery and Related Products Merchant Wholesalers	493130 Farm Product Warehousing and Storage
424510 Grain and Field Bean Merchant Wholesalers	493190 Other Warehousing and Storage
424520 Livestock Merchant Wholesalers	517110 Wired Telecommunications Carriers
424590 Other Farm Product Raw Material Merchant Wholesalers	517210 Wireless Telecommunications Carriers (except Satellite)
424610 Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	517410 Satellite Telecommunications
424690 Other Chemical and Allied Products Merchant Wholesalers	517911 Telecommunications Resellers
424710 Petroleum Bulk Stations and Terminals	517919 All Other Telecommunications
424720 Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	518210 Data Processing, Hosting, and Related Services
424810 Beer and Ale Merchant Wholesalers	
Engineering-intensive manufacturing	
324110 Petroleum Refineries	333911 Pump and Pumping Equipment Manufacturing
325110 Petrochemical Manufacturing	333912 Air and Gas Compressor Manufacturing
325120 Industrial Gas Manufacturing	333913 Measuring and Dispensing Pump Manufacturing
325131 Inorganic Dye and Pigment Manufacturing	333921 Elevator and Moving Stairway Manufacturing
325132 Synthetic Organic Dye and Pigment Manufacturing	333922 Conveyor and Conveying Equipment Manufacturing

Functional industry category	
NAICS code and title	
325181 Alkalies and Chlorine Manufacturing	333923 Overhead Traveling Crane, Hoist, and Monorail System Manufacturing
325182 Carbon Black Manufacturing	333924 Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing
325188 All Other Basic Inorganic Chemical Manufacturing	333991 Power-Driven Handtool Manufacturing
325191 Gum and Wood Chemical Manufacturing	333992 Welding and Soldering Equipment Manufacturing
325192 Cyclic Crude and Intermediate Manufacturing	333993 Packaging Machinery Manufacturing
325193 Ethyl Alcohol Manufacturing	333994 Industrial Process Furnace and Oven Manufacturing
325199 All Other Basic Organic Chemical Manufacturing	333995 Fluid Power Cylinder and Actuator Manufacturing
325211 Plastics Material and Resin Manufacturing	333996 Fluid Power Pump and Motor Manufacturing
325212 Synthetic Rubber Manufacturing	333997 Scale and Balance Manufacturing
325221 Cellulosic Organic Fiber Manufacturing	333999 All Other Miscellaneous General Purpose Machinery Manufacturing
325222 Noncellulosic Organic Fiber Manufacturing	334111 Electronic Computer Manufacturing
325311 Nitrogenous Fertilizer Manufacturing	334112 Computer Storage Device Manufacturing
325312 Phosphatic Fertilizer Manufacturing	334113 Computer Terminal Manufacturing
325314 Fertilizer (Mixing Only) Manufacturing	334119 Other Computer Peripheral Equipment Manufacturing
325320 Pesticide and Other Agricultural Chemical Manufacturing	334210 Telephone Apparatus Manufacturing
325411 Medicinal and Botanical Manufacturing	334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
325412 Pharmaceutical Preparation Manufacturing	334290 Other Communications Equipment Manufacturing
325413 In-Vitro Diagnostic Substance Manufacturing	334310 Audio and Video Equipment Manufacturing
325414 Biological Product (except Diagnostic) Manufacturing	334411 Electron Tube Manufacturing
325510 Paint and Coating Manufacturing	334412 Bare Printed Circuit Board Manufacturing
325520 Adhesive Manufacturing	334413 Semiconductor and Related Device Manufacturing
325611 Soap and Other Detergent Manufacturing	334414 Electronic Capacitor Manufacturing
325612 Polish and Other Sanitation Good Manufacturing	334415 Electronic Resistor Manufacturing
325613 Surface Active Agent Manufacturing	334416 Electronic Coil, Transformer, and Other Inductor Manufacturing
325620 Toilet Preparation Manufacturing	334417 Electronic Connector Manufacturing
325910 Printing Ink Manufacturing	334418 Printed Circuit Assembly (Electronic Assembly) Manufacturing
325920 Explosives Manufacturing	334419 Other Electronic Component Manufacturing
325992 Photographic Film, Paper, Plate, and Chemical Manufacturing	334510 Electromedical and Electrotherapeutic Apparatus Manufacturing
331311 Alumina Refining	334511 Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
332212 Hand and Edge Tool Manufacturing	334512 Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
332991 Ball and Roller Bearing Manufacturing	334513 Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables
332992 Small Arms Ammunition Manufacturing	334514 Totalizing Fluid Meter and Counting Device Manufacturing
332993 Ammunition (except Small Arms) Manufacturing	334515 Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
332994 Small Arms Manufacturing	334516 Analytical Laboratory Instrument Manufacturing
332995 Other Ordnance and Accessories Manufacturing	334517 Irradiation Apparatus Manufacturing
332997 Industrial Pattern Manufacturing	334518 Watch, Clock, and Part Manufacturing

Functional industry category

NAICS code and title

333111 Farm Machinery and Equipment Manufacturing	334519 Other Measuring and Controlling Device Manufacturing
333112 Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	334611 Software Reproducing
333120 Construction Machinery Manufacturing	334612 Prerecorded Compact Disc (except Software), Tape, and Record Reproducing
333131 Mining Machinery and Equipment Manufacturing	334613 Magnetic and Optical Recording Media Manufacturing
333132 Oil and Gas Field Machinery and Equipment Manufacturing	335110 Electric Lamp Bulb and Part Manufacturing
333210 Sawmill and Woodworking Machinery Manufacturing	335121 Residential Electric Lighting Fixture Manufacturing
333220 Plastics and Rubber Industry Machinery Manufacturing	335122 Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing
333291 Paper Industry Machinery Manufacturing	335129 Other Lighting Equipment Manufacturing
333292 Textile Machinery Manufacturing	335311 Power, Distribution, and Specialty Transformer Manufacturing
333293 Printing Machinery and Equipment Manufacturing	335312 Motor and Generator Manufacturing
333294 Food Product Machinery Manufacturing	335313 Switchgear and Switchboard Apparatus Manufacturing
333295 Semiconductor Machinery Manufacturing	335314 Relay and Industrial Control Manufacturing
333311 Automatic Vending Machine Manufacturing	335911 Storage Battery Manufacturing
333312 Commercial Laundry, Drycleaning, and Pressing Machine Manufacturing	335912 Primary Battery Manufacturing
333313 Office Machinery Manufacturing	335931 Current-Carrying Wiring Device Manufacturing
333314 Optical Instrument and Lens Manufacturing	335932 Noncurrent-Carrying Wiring Device Manufacturing
333315 Photographic and Photocopying Equipment Manufacturing	335991 Carbon and Graphite Product Manufacturing
333319 Other Commercial and Service Industry Machinery Manufacturing	335999 All Other Miscellaneous Electrical Equipment and Component Manufacturing
333411 Air Purification Equipment Manufacturing	336311 Carburetor, Piston, Piston Ring, and Valve Manufacturing
333412 Industrial and Commercial Fan and Blower Manufacturing	336321 Vehicular Lighting Equipment Manufacturing
333511 Industrial Mold Manufacturing	336411 Aircraft Manufacturing
333512 Machine Tool (Metal Cutting Types) Manufacturing	336412 Aircraft Engine and Engine Parts Manufacturing
333513 Machine Tool (Metal Forming Types) Manufacturing	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
333514 Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	336414 Guided Missile and Space Vehicle Manufacturing
333515 Cutting Tool and Machine Tool Accessory Manufacturing	336415 Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
333516 Rolling Mill Machinery and Equipment Manufacturing	336419 Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing
333518 Other Metalworking Machinery Manufacturing	339112 Surgical and Medical Instrument Manufacturing
333611 Turbine and Turbine Generator Set Units Manufacturing	339113 Surgical Appliance and Supplies Manufacturing
333612 Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	339114 Dental Equipment and Supplies Manufacturing
333613 Mechanical Power Transmission Equipment Manufacturing	339115 Ophthalmic Goods Manufacturing
333618 Other Engine Equipment Manufacturing	339116 Dental Laboratories
Finance, insurance, and real estate	
521110 Monetary Authorities-Central Bank	524127 Direct Title Insurance Carriers
522110 Commercial Banking	524128 Other Direct Insurance (except Life, Health, and Medical) Carriers
522120 Savings Institutions	524130 Reinsurance Carriers
522130 Credit Unions	524210 Insurance Agencies and Brokerages

Functional industry category	
NAICS code and title	
522190 Other Depository Credit Intermediation	524291 Claims Adjusting
522210 Credit Card Issuing	524292 Third Party Administration of Insurance and Pension Funds
522220 Sales Financing	524298 All Other Insurance Related Activities
522291 Consumer Lending	525110 Pension Funds
522292 Real Estate Credit	525120 Health and Welfare Funds
522293 International Trade Financing	525190 Other Insurance Funds
522294 Secondary Market Financing	525910 Open-End Investment Funds
522298 All Other Nondepository Credit Intermediation	525920 Trusts, Estates, and Agency Accounts
522310 Mortgage and Nonmortgage Loan Brokers	525990 Other Financial Vehicles
522320 Financial Transactions Processing, Reserve, and Clearinghouse Activities	531110 Lessors of Residential Buildings and Dwellings
522390 Other Activities Related to Credit Intermediation	531120 Lessors of Nonresidential Buildings (except Miniwarehouses)
523110 Investment Banking and Securities Dealing	531130 Lessors of Miniwarehouses and Self-Storage Units
523120 Securities Brokerage	531190 Lessors of Other Real Estate Property
523130 Commodity Contracts Dealing	531210 Offices of Real Estate Agents and Brokers
523140 Commodity Contracts Brokerage	531312 Nonresidential Property Managers
523210 Securities and Commodity Exchanges	531320 Offices of Real Estate Appraisers
523910 Miscellaneous Intermediation	531390 Other Activities Related to Real Estate
523920 Portfolio Management	532120 Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing
523930 Investment Advice	532411 Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing
523991 Trust, Fiduciary, and Custody Activities	532412 Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
523999 Miscellaneous Financial Investment Activities	532420 Office Machinery and Equipment Rental and Leasing
524113 Direct Life Insurance Carriers	532490 Other Commercial and Industrial Machinery and Equipment Rental and Leasing
524114 Direct Health and Medical Insurance Carriers	533110 Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
524126 Direct Property and Casualty Insurance Carriers	
Government	
901149 US Postal Service	902999 State Government, Excluding Education and Hospitals
901199 Federal Civilian, Except US Postal Service	
Healthcare	
621511 Medical Laboratories	622310 Specialty (except Psychiatric and Substance Abuse) Hospitals
621512 Diagnostic Imaging Centers	623110 Nursing Care Facilities
622110 General Medical and Surgical Hospitals	902622 Hospitals, State Government
622210 Psychiatric and Substance Abuse Hospitals	903622 Hospitals, Local Government
Higher education	
611310 Colleges, Universities, and Professional Schools	903612 Colleges and Universities, Local Government
902612 Colleges and Universities, State Government	
Knowledge-intensive business services	
541110 Offices of Lawyers	541513 Computer Facilities Management Services
541191 Title Abstract and Settlement Offices	541519 Other Computer Related Services
541199 All Other Legal Services	541611 Administrative Management and General Management Consulting Services
541211 Offices of Certified Public Accountants	541612 Human Resources Consulting Services
541213 Tax Preparation Services	541613 Marketing Consulting Services
541214 Payroll Services	541614 Process, Physical Distribution, and Logistics Consulting Services
541219 Other Accounting Services	541618 Other Management Consulting Services
541310 Architectural Services	541620 Environmental Consulting Services
541320 Landscape Architectural Services	541690 Other Scientific and Technical Consulting Services

Functional industry category

NAICS code and title

541330 Engineering Services	541711 Research and Development in Biotechnology
541340 Drafting Services	541712 Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
541350 Building Inspection Services	541720 Research and Development in the Social Sciences and Humanities
541360 Geophysical Surveying and Mapping Services	541810 Advertising Agencies
541370 Surveying and Mapping (except Geophysical) Services	541820 Public Relations Agencies
541380 Testing Laboratories	541830 Media Buying Agencies
541410 Interior Design Services	541840 Media Representatives
541420 Industrial Design Services	541850 Display Advertising
541430 Graphic Design Services	541860 Direct Mail Advertising
541490 Other Specialized Design Services	541870 Advertising Material Distribution Services
541511 Custom Computer Programming Services	541890 Other Services Related to Advertising
541512 Computer Systems Design Services	

Media, entertainment, and recreation

511110 Newspaper Publishers	711120 Dance Companies
511120 Periodical Publishers	711130 Musical Groups and Artists
511130 Book Publishers	711190 Other Performing Arts Companies
511140 Directory and Mailing List Publishers	711211 Sports Teams and Clubs
511191 Greeting Card Publishers	711212 Racetracks
511199 All Other Publishers	711219 Other Spectator Sports
511210 Software Publishers	711310 Promoters of Performing Arts, Sports, and Similar Events with Facilities
512110 Motion Picture and Video Production	711320 Promoters of Performing Arts, Sports, and Similar Events without Facilities
512120 Motion Picture and Video Distribution	711410 Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures
512131 Motion Picture Theaters (except Drive-Ins)	711510 Independent Artists, Writers, and Performers
512132 Drive-In Motion Picture Theaters	712110 Museums
512191 Teleproduction and Other Postproduction Services	712120 Historical Sites
512199 Other Motion Picture and Video Industries	712130 Zoos and Botanical Gardens
512210 Record Production	712190 Nature Parks and Other Similar Institutions
512220 Integrated Record Production/Distribution	713110 Amusement and Theme Parks
512230 Music Publishers	713120 Amusement Arcades
512240 Sound Recording Studios	713210 Casinos (except Casino Hotels)
512290 Other Sound Recording Industries	713290 Other Gambling Industries
515111 Radio Networks	713910 Golf Courses and Country Clubs
515112 Radio Stations	713920 Skiing Facilities
515120 Television Broadcasting	713930 Marinas
515210 Cable and Other Subscription Programming	713940 Fitness and Recreational Sports Centers
519110 News Syndicates	713950 Bowling Centers
519120 Libraries and Archives	713990 All Other Amusement and Recreation Industries
519130 Internet Publishing and Broadcasting and Web Search Portals	721120 Casino Hotels
519190 All Other Information Services	721211 RV (Recreational Vehicle) Parks and Campgrounds
711110 Theater Companies and Dinner Theaters	721214 Recreational and Vacation Camps (except Campgrounds)

Sources: North American Industry Classification System; Economic Modeling Specialists International (2012)