

Massachusetts Regional Labor Market Profiles: Methodological Appendix

Measuring Labor Supply—Demographic Trends of Residents Who Live in Regional Labor Markets

To measure the labor supply of the eight regional labor markets in Massachusetts these profiles analyze trends and characteristics of the regions' total residential population, working-age population, civilian labor force, the unemployed, and commuting patterns of residents and workers. The profiles use the U.S. Census Bureau's 2000 Decennial Census, and the 2005-2007 and 2008-2010 American Community Survey, and 2000 to 2010 labor force statistics from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD).

Data Resources:

2000 Decennial Census

Data for the year 2000 was derived from the 2000 Decennial Census Public Use Microdata Sample (PUMS). This data set contains information collected on households and individuals through the U.S. Census Bureau's long-form questionnaire, subject to the limitations of sample size, geographic identification, and confidentiality protection. The PUMS contains information based on a 1-in-20 national random sample of the population, and is referred to as the 5 percent PUMS. PUMS files allow for detailed tabulations of household and population characteristics for small geographies.¹

2005-2007 and 2008-2010 American Community Survey

Similar to the Decennial Census, the American Community Survey (ACS) collects information on households and individuals. The ACS uses a series of monthly samples to produce annually updated data for the small areas surveyed via the decennial census long-form questionnaire. However, the one-year ACS PUMS data available since 2005 are based on a 1-in-100 national random sample or 1 percent PUMS. In recent years the U.S. Census Bureau has released three-year PUMS that pool together household and persons survey responses from the 1 percent ACS samples. These three-year PUMS are representative of a 3-in-100 national random sample of the population and provide more robust sample sizes for analyzing smaller geographic areas. The three-year samples are representative of the households and populations covered over a 36 month period and not necessarily representative of any single time period within the survey period.² The regional labor market profiles rely on these three-year PUMS for labor supply data from the 2005-2007 and 2008-2010 ACS. This allows for observations of population and demographic trends preceding the Great Recession (2005-2007 ACS) and during the Great Recession and early stages of recovery (2008-2010 ACS).³

¹ For further information on the 2000 Census 5 percent PUMS files, see <http://www.census.gov/census2000/PUMS5.html>.

² For further information on the American Community Survey one- and three-year PUMS files, see http://www.census.gov/acs/www/data_documentation/public_use_microdata_sample.

³ All PUMS data for the Census and American Community Survey was obtained from the Minneapolis Population Center's IPUMS USA. Source: Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

Massachusetts Executive Office of Labor and Workforce Development Labor Force Statistics

The Massachusetts EOLWD provides monthly labor force statistics by Workforce Investment Area (WIA) (See Geographic Definition Appendix for further information the geographic coverage of labor markets by WIA).⁴ The data is not seasonally adjusted and includes the totals of the civilian labor force, the number of employed, the number of unemployed, and the unemployment rate. Without seasonal adjustment the data can be fairly volatile by WIA. In order to remove volatility and compare with other demographic trends, the profiles create annual unemployment rates. This is done by averaging the monthly civilian labor force, employment, and unemployment totals over a 12-month period. The national unemployment rate in the profiles is calculated in the same manner using data from the U.S. Bureau of Labor Statistics.

Definitions, calculation notes:

Annual Growth Rates

Annual growth rates, as opposed to percent change, are used to compare growth rates over different time periods and sample periods. This allows for comparison of growth rates between 2000 and 2005-2007 to the rates of 2005-2007 to 2008-2010. The standard annual growth rate calculation is:

$$\text{Annual Growth} = \left[\left(\frac{\text{End Year}}{\text{Beginning Year}} \right)^{(1/\text{Number of Years})} \right] - 1$$

However, given that the three-year ACS samples are representative of a 36 month period, the annual growth rate calculations use the middle year of the samples for the calculations. Therefore the annual growth rates presented in the profiles were calculated as follows:

$$\text{Annual Growth Rate 2000 to 2005-2007} = \left[\left(\frac{2005-2007}{2000} \right)^{(1/6)} \right] - 1$$

$$\text{Annual Growth 2005-2007 to 2008-2010} = \left[\left(\frac{2008-2010}{2005-2007} \right)^{(1/3)} \right] - 1$$

Using the middle year of the three-year ACS samples does not overstate or understate growth between the periods. The following example illustrates this.

For a given region: in 2000, population = 100; 2005-2007, population = 110.

Using 2005 as the end year, annual growth rate = **1.9** percent between 2000 and 2005-2007.

Using 2006 as the end year, annual growth rate = **1.6** percent between 2000 and 2005-2007.

Using 2007 as end year, annual growth rate = **1.4** percent between 2000 and 2005-2007.

Using 2005 as the end year inflates the annual growth rate because it considers a shorter period. Using 2007 as the end year for the annual growth rate calculation depresses the rate because it considers growth over a longer period. Thus, using 2006 as the end year in the annual growth rate calculation is less prone to over or under estimation. The selection of the middle-year as the proxy year for the three-

⁴ For Massachusetts labor force statistics, see http://lmi2.detma.org/lmi/lmi_lur_a.asp.

year ACS has no impact on the annual growth rates between the periods of 2005-2007 and 2008-2010 as there is always a three-year difference no matter what proxy year is selected.

Total/Resident Population

The total or resident population of an area is the total civilian non-institutional population that lived in the region as of the Census or ACS time period. Excluded populations include institutionalized populations such as those residing in correctional institutions, mental institutions, and institutions of the elderly, handicapped, and poor and as well as those that reside in group quarters such as military bases, college dormitories, and group homes.

Working-Age Population

The working-age population is a subset of the resident population but excludes those 15 years of age or younger. In the profiles this group is referred to as the potential labor supply as it is comprised of all residents who could potentially participate in the labor force.

Civilian Labor Force

The civilian labor force is a subset of the working-age population, composed of only those working-age residents who are employed or unemployed. Employed residents are those that are currently employed, but not necessarily employed in the region. The unemployed are residents that are currently looking for a job but have not found one. In the profiles this group is referred to as the actual labor supply as it the supply of labor currently available for employment.

Native-Born and Immigrant Populations

The categorization of civilian populations as native-born or immigrant is based on the nativity status of residents. Those citizens classified as foreign-born are referred to as immigrants. This categorization does not consider citizenship status.

Race/Ethnicity

The Census and ACS ask two separate questions regarding race and Hispanic origin. By combining the responses the profiles break the population into five race/ethnicity categories: White, non-Hispanics; Black, non-Hispanics; Asian, non-Hispanics; Hispanics; and Other, non-Hispanic.

Educational Attainment

The educational attainment of an individual is their highest year of school or degree completed. Individuals are placed into one of six educational attainment groups: Less than High School, High School, Some College education but no degree (this includes some Certificates), Associate's Degree, Bachelor's Degree, and Master's Degree or more.

Commuting

Commuting patterns are calculated by considering a region's employed individuals' place of residence and place of work. The profiles contain data that illustrates two distinct commuting patterns: where residents of a given region work and where people working in that region live. This reveals the share of

the resident population employed in the region and the share that commute to other regions for work, as well as the share of non-resident employees who commute to work from other regions. Measuring the movements of residents and workers across regional labor markets and state borders details how interconnected labor markets are, as well as the level of mobility of regional and state labor supply.

Public Use Micro Areas

The PUMS files for the 2000 Decennial Census, and 2005-2007 and 2008-2010 ACS contain geographic units known as Public Use Microdata Areas (PUMAs). These areas have a minimum population count of 100,000 to maintain the confidentiality of the PUMS data and are the smallest geographic unit available in the PUMS data. PUMAs do not cross state lines. PUMAs in the 2005-2007 and 2008-2010 ACS are identical to those in 2000 Decennial Census. See the Geographic Definition Appendix and the Geographic Data File for further details on the geographic coverage of the labor markets by PUMAs.

Measuring Labor Demand – Employment Trends of Jobs and Workers in Regional Labor Markets

To measure the labor demand in the eight regional labor markets in Massachusetts these profiles analyze movements in the regions' employment situation relative to the state and national situation, the industries driving the movement in aggregate employment, the educational attainment of employees within industries and occupations, the distribution of occupations within and across industries, trends in jobs vacancies in recent years, and occupational jobs vacancies. The profiles feature a number of different data sources, including: Current Employment Statistics, ES-202 and Quarterly Census of Employment and Wages, Decennial Census and American Community Survey, and the Massachusetts Job Vacancy Survey.

Data sources:

Current Employment Statistics

The U.S. Bureau of Labor Statistics' (BLS) Current Employment Statistics (CES) program surveys approximately 141,000 businesses and government agencies, representing approximately 486,000 individual worksites, to provide detailed industry data on employment, hours, and earnings of workers on nonfarm payrolls for all 50 states, the District of Columbia, Puerto Rico, the Virgin Islands, and about 400 metropolitan areas and divisions.⁵ In Massachusetts, the CES comprises 4,430 business and government agencies, representing approximately 11,260 worksites. The CES estimates of employment are generated through an annual benchmark and monthly sample link procedure. Annual universe counts—or benchmark levels—are generated from administrative records on employees covered by unemployment insurance tax laws. These annual benchmarks, established for March of each year, are projected forward for each subsequent month based on the trend of the sample employment and an adjustment for the net of business births and deaths.⁶ The data exclude proprietors, the unincorporated self-employed, unpaid volunteer or family employees, farm employees, and domestic employees. The seasonally adjusted employment time-series are the most commonly tracked data for national, state, and select metropolitan employment situations. The CES state and national employment trends in the

⁵ For further information on the Current Employment Survey, see <http://www.bls.gov/ces>.

⁶ For further methodological details, see <http://www.bls.gov/web/empsit/cestn1.htm>.

profiles are important to understanding movements of the labor market overtime and their impact on the regional labor markets employment trends. However, the CES does not provide detailed employment data for smaller geographic areas than metropolitan statistical areas and therefore does not provide enough information to measure employment trends in the regional labor markets.

Quarterly Census of Employment and Wages/ES-202

The profiles use the Quarterly Census of Employment and Wages (QCEW) to measure employment changes in smaller geographic areas. The QCEW, referred to as ES-202 at the national level until 2003, is a cooperative program of the BLS and the state Employment Security Agencies. The QCEW program publishes a quarterly count of employment and wages reported by employers covering 98 percent of U.S. jobs, available at the county, metropolitan statistical area, state and national levels by industry.⁷ The QCEW program serves as a census of monthly employment and quarterly wage information by 6-digit North American Industrial Classification System (NAICS) industry at the national, state, and county levels.⁸ Employment data under the QCEW program represent the number of covered workers who worked during, or received pay for, the pay period on the 12th of the month. Excluded are members of the armed forces, the self-employed, proprietors, domestic workers, unpaid family workers, and railroad workers covered by the railroad unemployment insurance system. The Massachusetts EOLWD provides quarterly ES-202 data derived from more than 150,000 Massachusetts employers. Industry employment and payroll information is produced for the state, New England City and Town Statistical Areas (NECTAs), labor market areas, WIA, counties, cities and towns.⁹ NAICS based employment and wage data are available beginning with the first quarter of 2001. Prior to 2001 QCEW data was coded using the Standard Industrial Classification (SIC) system. The profiles utilize the availability of ES-202 data by WIA to look at employment trends across regional labor markets.

While the ES-202/QCEW provides employment data for smaller geographic areas it has a number of limitations. For one, the data is available at a considerable lag, with quarterly employment data typically available six to seven months after the measurement period; when the profiles were created, data was available only through Q2 2011. The data is also not maintained as a time-series. Coding changes to the NAICS system (which occurred in 2002, 2007, and 2012) or incorrectly coded industries are not adjusted over-time and may pose problems when analyzing industry growth rates. The lack of a time-series also means that the ES-202/QCEW employment figures are not seasonally adjusted. Without seasonally adjustment comparisons between different quarters (e.g. Q3 2010 and Q4 2010) are not possible as seasonal employment trends will lead to large variations, particularly in industries that experience large seasonal employment variations such as Retail Trade and Accommodation & Food Services.

To compensate for these shortcomings, the profiles look at total employment changes between Q1 2001-Q1 2008 to capture pre-recession employment trends. Q1 2001 was near Massachusetts' peak employment preceding the early 2000's recession and Q1 2008 was near the state's peak employment preceding the Great Recession. The profiles evaluate changes between Q4 2007-Q4 2009 to measure

⁷ For national QCEW data, see <http://www.bls.gov/cew>.

⁸ For further information on the North American Industrial Classification System (NAICS), see <http://www.bls.gov/bls/naics.htm>.

⁹ For Massachusetts ES-202 data, see http://lmi2.detma.org/lmi/lmi_es_a.asp.

employment changes in the Great Recession: Q4 2009 was the trough for the state employment situation and need to be compared against Q4 data near the preceding labor market peak. Lastly, the profiles consider changes between Q4 2009-Q4 2010 to show employment changes following the Great Recession to identify gains since the bottom of the labor market in Massachusetts.

Unfortunately, Q4 2011 data were not available at the time of analysis. Comparison between early periods, such as Q2 2009-Q2 2011, would provide an incomplete picture of employment changes following the Great Recession. For major industrial changes, the profiles mainly focus on the employment situation between Q4 2007-Q4 2009 and Q4 2009-Q4 2010 as the industrial data uses the 2007 NAICS codes over these time periods, thus minimizing the time-series issues discussed above. Employment changes from Q1 2001-Q1 2008 by industries are available in the data appendix for each region but are only meant as supplemental material to understand the changes preceding the Great Recession.

Decennial Census and American Community Survey

To measure the educational attainment of employees in industries and occupations the profiles use data from the 2000 Decennial Census and 2008-2010 ACS (See section above for survey details). Using the PUMS files the profiles compile data on the educational attainment of employed individuals by industry and occupation based on their responses to the survey. The industrial breakdown is based on the classification of the industry of employment by NAICS category, similar to the CES and ES-202/QCEW data. The occupational categorization is based upon the Standard Occupational Classification (SOC) system.¹⁰ Due to limitations of looking at small geographic areas, the profiles focus only on the major industries (17 industry groups by two-digit NAICS) and occupations (19 occupational groups by two-digit SOC).¹¹ The educational attainment of an individual is obtained by the looking at their highest year of school or degree completed. However, since a smaller sample of respondents within industries and occupations are available, in the profiles educational attainment categories are grouped into three larger cohorts: High School Degree or Less, Some College or Associate's Degree, and Bachelor's Degree or Higher. While individuals within these cohorts may have somewhat different levels of educational attainment these grouping provide an adequate sample size to assess the standard levels of educational attainment of those employed in different industries and occupations.

Massachusetts Job Vacancy Survey

For information on job vacancies, in particular those in occupations, the profiles use data from the Massachusetts Job Vacancy Survey of the EOLWD.¹² The Massachusetts Job Vacancy Survey is a survey of employers across the state that provides information on the number and types of positions open for employment, the educational and training requirements for those positions, wages and benefits offered to applicants for those positions, the degree to which employers are satisfied with the educational and

¹⁰ For more information on the Standard Occupational Classification system, see <http://www.bls.gov/SOC>.

¹¹ Due to small sample sizes in Community & Social Services, Legal, Protective Services, Farming, Forestry, & Fishing, and Military Specific occupations, the occupations were combined to form All Other occupations.

¹² For further information on the Massachusetts Jobs Vacancy Survey, see <http://www.mass.gov/lwd/economic-data/eolwd-data-and-stats/lmi/job-vacancy-survey.html>

training attainments of their new hire, and the hiring activities planned by employers for the next six months. Survey recipients are selected at random by industry, size, and region. Responses are weighted and scaled to produce statistically valid results. The survey provides information from 2002 to 2010 and is a biannual survey covering the second and fourth quarters. As with the ES-202/QCEW, the quarterly data is not seasonally adjusted and therefore can be only compared across similar time periods. Unfortunately, most of the survey information is available only at the state level. However, the survey does provide information on job vacancies by industry and occupation for seven regions beginning in Q4 2005 (See Geography Definition Appendix for further details on regions). The profiles use the total job vacancy and occupation job vacancy data to analyze movements in vacancy rates from the beginning of the Great Recession (Q4 2007) to the trough of the Great Recession (Q4 2009) and in the early stages of the labor market recovery (Q4 2010).

Measuring the Pipeline – Educational Supply from Post-Secondary Degrees Granted by Institutions Located in Regional Labor Markets

To measure the pipeline of individuals gaining post-secondary educations from institutions in the eight regional labor markets the profiles analyze the enrollment, graduation rates, and program and degree completions of post-secondary educational institutions. The data in this section comes exclusively from the Integrated Post-Secondary Education Data System (IPEDS) surveys from U.S. Department of Education's National Center for Education Statistics (NCES).

Data Sources:

Integrated Post-Secondary Education Data System

The IPEDS is a series of surveys conducted annually by the NCES.¹³ The Higher Education Act of 1965 requires that institutions participating in federal student aid programs report data on enrollments, program completions, graduation rates, faculty and staff, finances, institutional prices, and student financial aid. As a result IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. The profiles rely on four major IPEDS surveys to provide educational supply data: Institutional Characteristics, Fall Enrollment, Graduation Rates, and Degrees and Certificates Conferred.

Institutional Characteristics

The survey of Institutional Characteristics provides the detailed information necessary to be able to determine the physical location of the institution, the type of institution, and the level of institution. Survey respondents provide the physical address of the institution, including the zip code. The zip code is used to assign the institution to a regional labor market. The type of institution is classified either as public or private (private for-profit and private not-for-profit) based on their classification of whether the institution is operated by publicly elected or appointed officials (public control) or by privately elected or appointed officials and derives its major source of funds from private sources (private control). The institution level is classified as either less-than-two-year, two-year (two-year but less than four-year), and four-year (four-year or higher). Using these classifications the profiles consider

¹³ For further information on the Integrated Post-Secondary Education Data System surveys, see <http://nces.ed.gov/ipeds>.

enrollments, graduation rates, and completions by institution type and level by region from 2000 to 2010. Of note, the year reported in the profiles represents the academic year, so 2010 is the 2009-2010 academic year.

Definitions, calculations:

Enrollment

To measure the enrollment patterns at institutions the profiles use Fall Enrollment survey data. Fall enrollment data provides the enrollment status (part-time or full-time) of the student population by institution in the fall of the academic year. For example, fall enrollment in 2009 is used as a gauge for enrollment in the 2009-2010 academic year. Enrollment data is not provided by degree or program type (Certificate, Associate's Degree or Bachelor's Degree) and therefore is only reported by institution level (less-than-two-year, two-year and four-year).

Graduation Rates

The Graduation Rates survey provides the graduation status of a first-time, full-time student enrollment cohort by their completion rates over the normal time to completion of the degree or program. The normal time to completion is the amount of time necessary for a student to complete all requirements for a degree or certificate according to the institution's catalog. This is typically 4 years (8 semesters or trimesters, or 12 quarters, excluding summer terms) for a Bachelor's Degree; 2 years (4 semesters or trimesters, or 6 quarters, excluding summer terms) for an Associate's; and the various scheduled times for certificate programs based on the length of the program. The graduation rate used in the profiles is based on the share of first-time full-time enrollees who completed a program or degree within 150 percent of the normal completion time of the degree or certificate as of 2009, the year covered by the most recent Graduation Rates survey. For example, the graduation rate in 2009 for Associate's Degrees would be based the share of first-time full-time enrollees in 2005-2006 academic year that had completed their degree by the 2008-2009 academic year. If a graduation rate was not calculated for a degree or program in a region this typically means that there were no first-time, full-time enrollments in such programs to track to completion in 2009. Further, comparisons of graduation rates to enrollments or degree completions can be misleading as the first-time full-time student cohorts are a subset of the student populations enrolled at institutions and do not represent the entire number of degrees conferred by institutions in any given year.

Degrees and Certificates Conferred (Completions)

To measure the number of degree completions the profiles use the Completions survey. Completion data provides information on the number of students who complete a post-secondary education program by institution type and level, level of award (Certificates, Associate's Degree or Bachelor's Degree), and type of program. The type of program is categorized according to the Classification of Instructional Programs (CIP), a coding system for post-secondary instructional programs that breaks programs into 47 two-digit fields of study.¹⁴ However, Certificates, Associate Degree's, and Bachelor's Degree completions in Massachusetts were in only 38 of the 47 two-digit fields between 2000 and 2010.

¹⁴ For further information about the Classification of Instructional Programs, see <http://nces.ed.gov/ipeds/cipcode>.

To simplify the reporting of the field of study by degree type the profiles report degree completions in nine major fields of study by grouping common CIP codes (See Table 1, below).

Table 1. Major Fields of Study and Two-Digit CIP Code Groups

Nine Major Fields	Two-Digit CIP Code Groupings
Engineering & Computer Sciences	11 - Computer and information sciences and support services 14 - Engineering 15 - Engineering technologies/technicians
Science & Mathematics	01 - Agriculture, agriculture operations, and related sciences 03 - Natural resources and conservation 26 - Biological and biomedical sciences 27 - Mathematics and statistics 40 - Physical sciences 41 - Science technologies/technicians
Education	13 - Education
Legal	22 - Legal professions and studies
Health Sciences	51 - Health professions and related clinical sciences
Business	52 - Business, management, marketing and related support services
Arts, Humanities, & Social Sciences	05 - Area, ethnic, cultural, and gender studies 09 - Communication, journalism, and related programs 10 - Communications technologies/technicians and support services 16 - Foreign languages, literatures, and linguistics 23 - English language and literature/letters 24 - Liberal arts and sciences, general studies and humanities 38 - Philosophy and religious studies 39 - Theology and religious vocations 42 - Psychology 45 - Social sciences 50 - Visual and performing arts 54 - History
Services	12 - Personal and Culinary Services 25 - Library Science 31 - Parks, recreation, leisure, and fitness studies 43 - Security and protective services 44 - Public Administrative and Social Service Professions 46 - Construction trades 47 - Mechanic and Repair Technologies/Technicians 48 - Precision Production 49 - Transportation and Materials Moving
Other	04 - Architecture and related services 19 - Family and consumer sciences/human sciences 29 - Military Technologies 30 - Multi/interdisciplinary studies