Massachusetts Manufacturing Chartbook

Executive Office of Labor and Workforce Development
Commonwealth Corporation

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Contributors

The *Massachusetts Manufacturing Chartbook* was developed by Navjeet Singh, Jonathan Latner, and Flora Traub with editorial assistance from Caroline Kirton and graphic design by Cynthia Rodday.

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Introduction

The Manufacturing Chartbook is a detailed picture of the manufacturing sector today in Massachusetts, highlighting the sector's importance to the state economy, changes in recent years, and opportunities for workers. The chartbook is designed for workforce development professionals, guidance professionals, policy makers, and manufacturing industry stakeholders. We intend the chartbook to provide them with information about the evolving set of jobs that comprise manufacturing in Massachusetts and the skills and credentials that employees will need to succeed.

Manufacturing in Massachusetts today is not the same as it was one generation ago or even ten years ago. It employs fewer people and is more productive. Its workers are more educated and higher paid. The largest manufacturing sub-sector is still computers and electronic product manufacturing, but the other top sub-sectors now include fabricated metal, food, and chemicals (including pharmaceuticals). Despite steep employment declines, the Massachusetts manufacturing sector is still a major contributor to the economic health of the state, accounting for 10% of revenues in 2006 and allowing for significant expansions in exports over the last ten years.

We have grouped the charts and accompanying analysis in three sections:

1. Importance of Manufacturing to Massachusetts;
2. Current Status of the Massachusetts Manufacturing Sector; and
3. Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector.

In the first section, we respond to the general perception that manufacturing in Massachusetts has declined and become less relevant. It is well documented that the industry has lost jobs over the past ten years. However, we show why manufacturing continues to be vital to Massachusetts' knowledge and innovation economy. Manufacturing is the fourth largest sector in the state, employing 9% of the workforce statewide and significantly more in certain regions. Manufacturing jobs in the state are higher paid than other sectors and wages have increased faster than wages statewide. With its focus on high value-added products and innovation, the Massachusetts manufacturing sector employs proportionally more engineers, managers, and computer occupations, but fewer blue-collar workers than the manufacturing sector nationwide. Manufacturing is a large part of the knowledge and innovation economy in the state: from the production of telecommunication equipment to pharmaceuticals to the many products reliant on electronic and software-based components.

In the second section, we provide a nuanced view of the manufacturing sector in Massachusetts today. Manufacturing has changed dramatically and close examination of trends in industries, regions, and occupations is essential to understanding which skills and industries will be most important to the workers and economy of the future. While the occupational distribution of the manufacturing workforce has been changing over time due to shifts in the industries that make up the manufacturing sector in Massachusetts, production occupations are still the largest occupational group in manufacturing, followed by administrative and office workers, engineers, and managers. The various regions of the state have different concentrations of the manufacturing sub-sectors, which are

associated with different educational and skill requirements and salary and occupational structures.

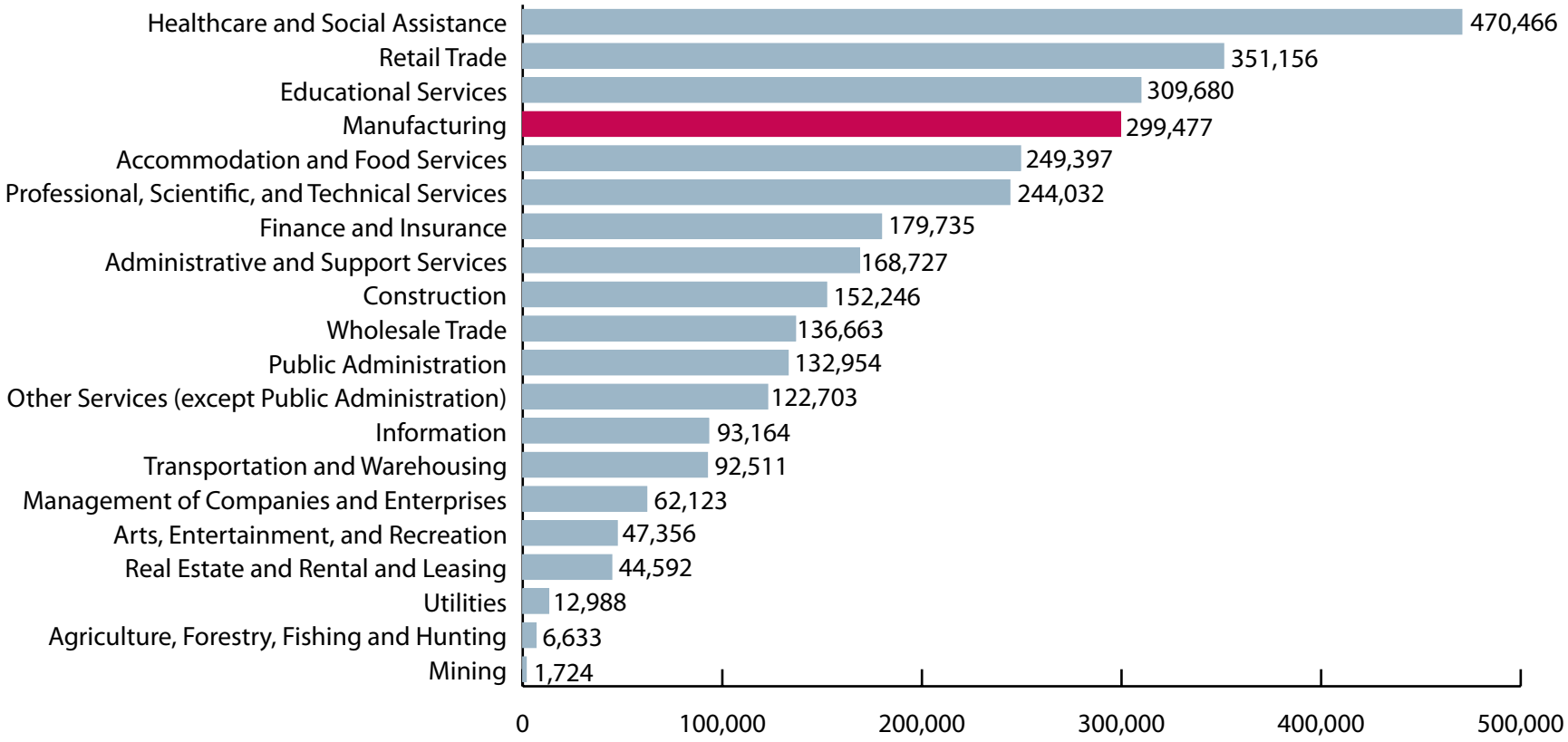
In the third section, we offer information about opportunities in the manufacturing sector for employment and advancement. There were 5,005 vacancies in manufacturing as of the second quarter of 2007, half of which were for professional and management occupations and another fifth were for production occupations. As the aging manufacturing workforce retires, younger workers are needed to ensure continued operations and transmission of vital manufacturing knowledge. Manufacturing offers well-paid jobs, with a third of manufacturing sub-sectors paying more than the state average.

In summary, while employment declines in manufacturing are well documented, the sector is still a pillar of the Massachusetts economy and continues to offer well-paid employment opportunities. Employers report difficulties in filling certain skilled jobs, suggesting that the workforce has not kept pace with the demands of the sector. The sector, as part of Massachusetts' increasingly technology-based economy, demands a more educated and skilled workforce. It is important to continue to invest workforce development resources in manufacturing to address the needs of local manufacturers and upgrade the skills of workers.

Section 1: Importance of Manufacturing to Massachusetts

Massachusetts Employment by Sector, 2006

In Massachusetts, the manufacturing sector is the fourth largest by employment, with 299,477 workers employed in 2006, or 9% of the state's workforce.



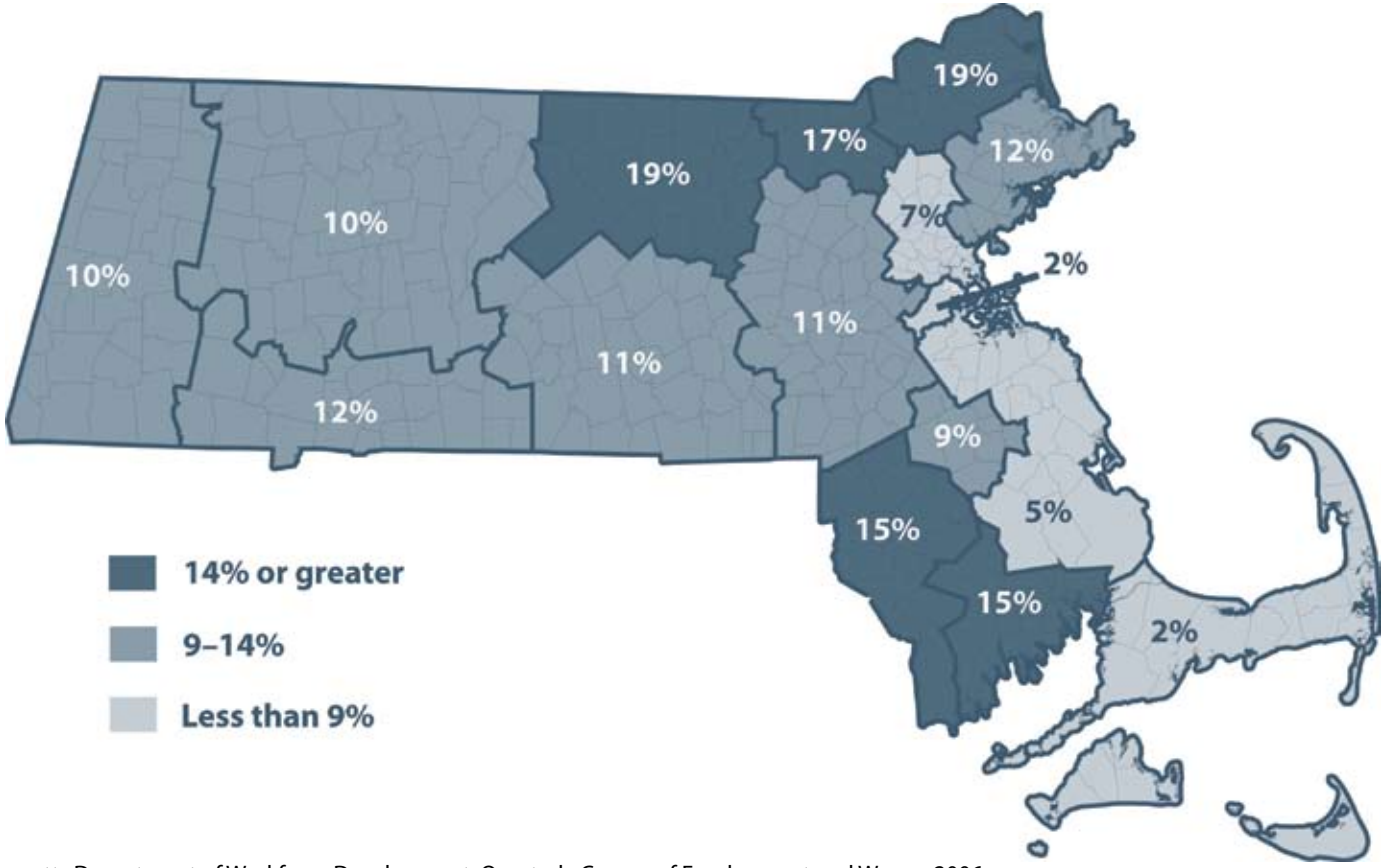
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2006

Section 1: Importance of Manufacturing to Massachusetts

Manufacturing Employment in Massachusetts Workforce Regions, 2006

Across Massachusetts, an average of 9% of workers were employed in manufacturing in 2006. Manufacturing is, however, much more important in the Lower Merrimack Valley Workforce Region and the Northern Worcester Region, which have 19% employment in manufacturing.

Manufacturing is the largest employer in the northeastern part of Massachusetts, extending from Gardner (Northern Worcester Workforce Region) east through Lawrence (Lower Merrimack Valley Workforce Region) and in the southeast from Attleboro (Bristol Workforce Region) through New Bedford (New Bedford Workforce Region).

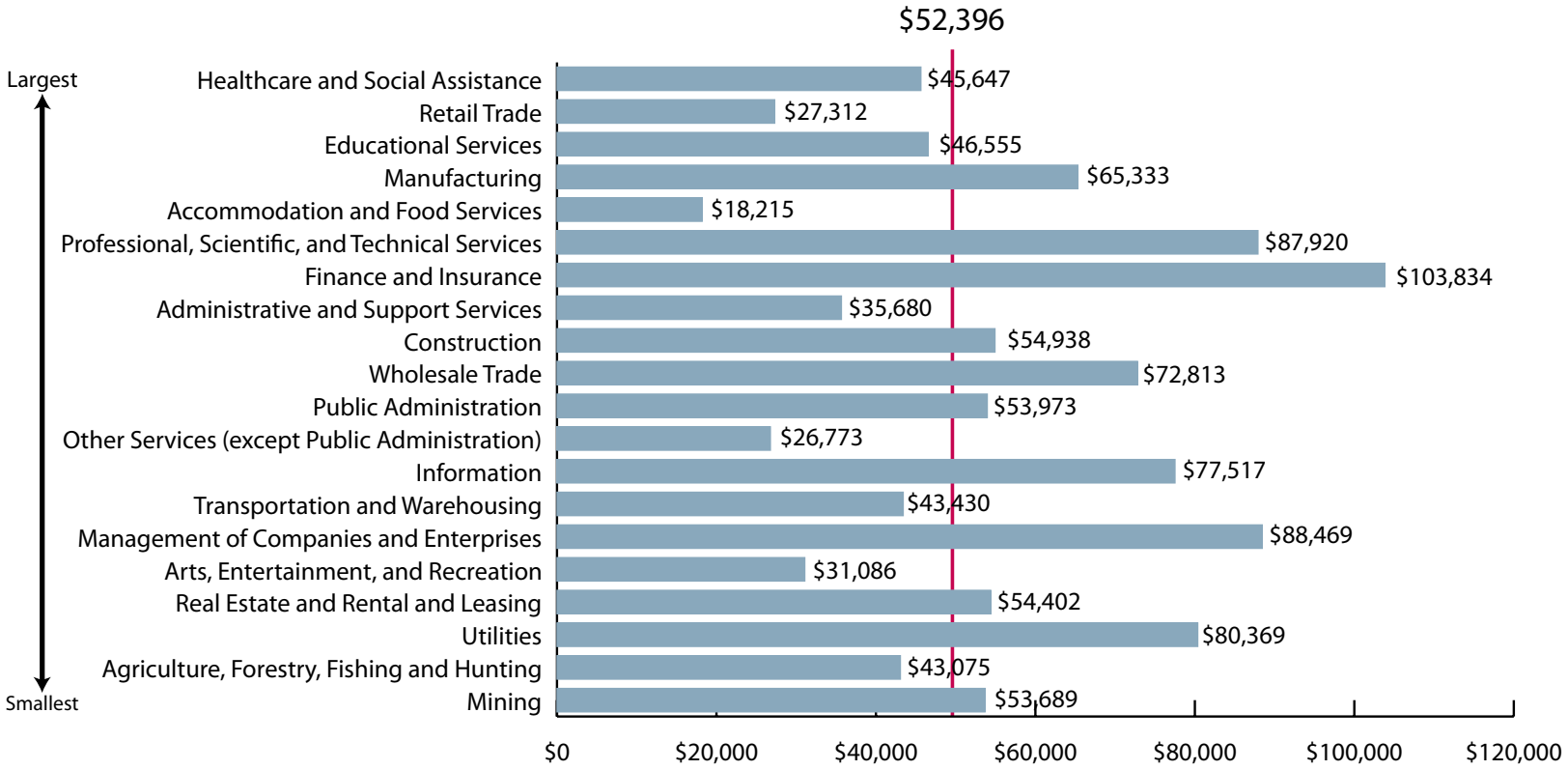


Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages, 2006
Note: Please see Appendix for a list of cities and towns in each workforce region.

Section 1: Importance of Manufacturing to Massachusetts

Massachusetts Average Total Annual Wages, 2006

The average total annual wages in 2006 for the manufacturing sector were $65,333, 25% more than the state's average of $52,396. Six of the 20 sectors in the state, including finance, management of companies, and professional and technical services, offer higher annual wages than manufacturing. However, of the five largest sectors (healthcare and social assistance; retail trade; educational services; manufacturing; and accommodation and food services), manufacturing is the only one to exceed the state average total annual wages.



Red line indicates the Massachusetts average total annual wages in 2006.

Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2006

Section 1: Importance of Manufacturing to Massachusetts

Change in Massachusetts Manufacturing Sub-Sector Average Total Annual Wages, 2001–2006

During the period of 2001–2006 manufacturing annual average pay increased faster (20%) than the average pay across all sectors (17%).

Twenty-one sub-sectors comprise the manufacturing sector. Pay in 18 of 21 manufacturing sub-sectors grew at or above the state average for 2001–2006. The three sub-sectors with fastest pay growth over these five years, food (34% increase in pay), printing and related support activities (26% increase), and electrical equipment, appliance, and component (25% increase), were also among the largest by employment.

Six of the seven largest sub-sectors by employment, including computer and electronic product, fabricated metal product, food, machinery, chemical, and printing and related support activities, had pay growth faster than the state average.

Largest

Smallest

Sub-Sector	Total Annual Wages		2001–2006 Percent Change in Wages
	2001	2006	
Massachusetts, All Sectors	$44,975	$52,396	17%
Manufacturing, All Sub-Sectors	$54,451	$65,333	20%
Computer and Electronic Product	$73,879	$88,900	20%
Fabricated Metal Product	$48,583	$60,283	24%
Miscellaneous	$49,997	$57,532	15%
Food	$32,690	$43,842	34%
Machinery	$55,257	$66,403	20%
Chemical	$71,502	$85,612	20%
Printing and Related Support Activities	$ 41,663	$52,383	26%
Plastics and Rubber Products	$42,136	$49,142	17%
Transportation Equipment	$66,031	$82,204	24%
Paper	$43,754	$51,595	18%
Electrical Equipment, Appliance, and Component	$50,360	$63,108	25%
Nonmetallic Mineral Product	$46,116	$51,763	12%
Textile Mills	$37,473	$44,102	18%
Furniture and Related Product	$37,360	$44,825	20%
Primary Metal	$43,023	$50,193	17%
Apparel	$25,169	$30,286	20%
Wood Product	$35,492	$41,572	17%
Textile Product Mills	$29,596	$33,104	12%
Beverage and Tobacco Product	$43,803	$51,847	18%
Leather and Allied Product	$39,581	$47,678	20%
Petroleum and Coal Products	$60,903	$72,828	20%

Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2001 and 2006

Section 1: Importance of Manufacturing to Massachusetts

Vacancies in the Massachusetts Manufacturing Sector, 2nd Quarter 2007

Massachusetts had 5,005 vacancies in the manufacturing sector, a 1.7% vacancy rate as of the second quarter of 2007 as compared to a 2.9% vacancy rate for all Massachusetts industries. Manufacturing has the sixth greatest number of vacancies of all sectors in the state, constituting 6% of the total number of vacancies in the second quarter of 2007. Three-fifths (61%) of manufacturing vacancies require at least an associate's degree and four-fifths (84%) require related experience. Manufacturing has very few seasonal/ temporary vacancies, similar to healthcare and social assistance, and most jobs tend to require job-related experience. Nearly all job vacancies (95%) in manufacturing provide health benefits, second only to the utilities sector in the proportion of job vacancies with health benefits.

2nd Quarter, 2007	Number of Vacancies	Vacancy Rate	Percent Requiring an Associate's Degree or Higher	Percent Requiring Related Experience	Percent Temporary/ Seasonal	Percent Providing Health Benefits
Massachusetts, All Sectors	83,852	2.9%	42%	62%	16%	67%
Healthcare and Social Assistance	16,676	3.8%	53%	78%	1%	70%
Accommodation and Food Services	11,658	4.9%	4%	33%	33%	35%
Retail Trade	9,135	2.9%	2%	19%	23%	44%
Professional, Scientific, and Technical Services	8,103	3.9%	88%	86%	9%	93%
Educational Services	6,857	2.1%	84%	78%	9%	82%
Manufacturing	**5,005**	**1.7%**	**61%**	**84%**	**2%**	**95%**

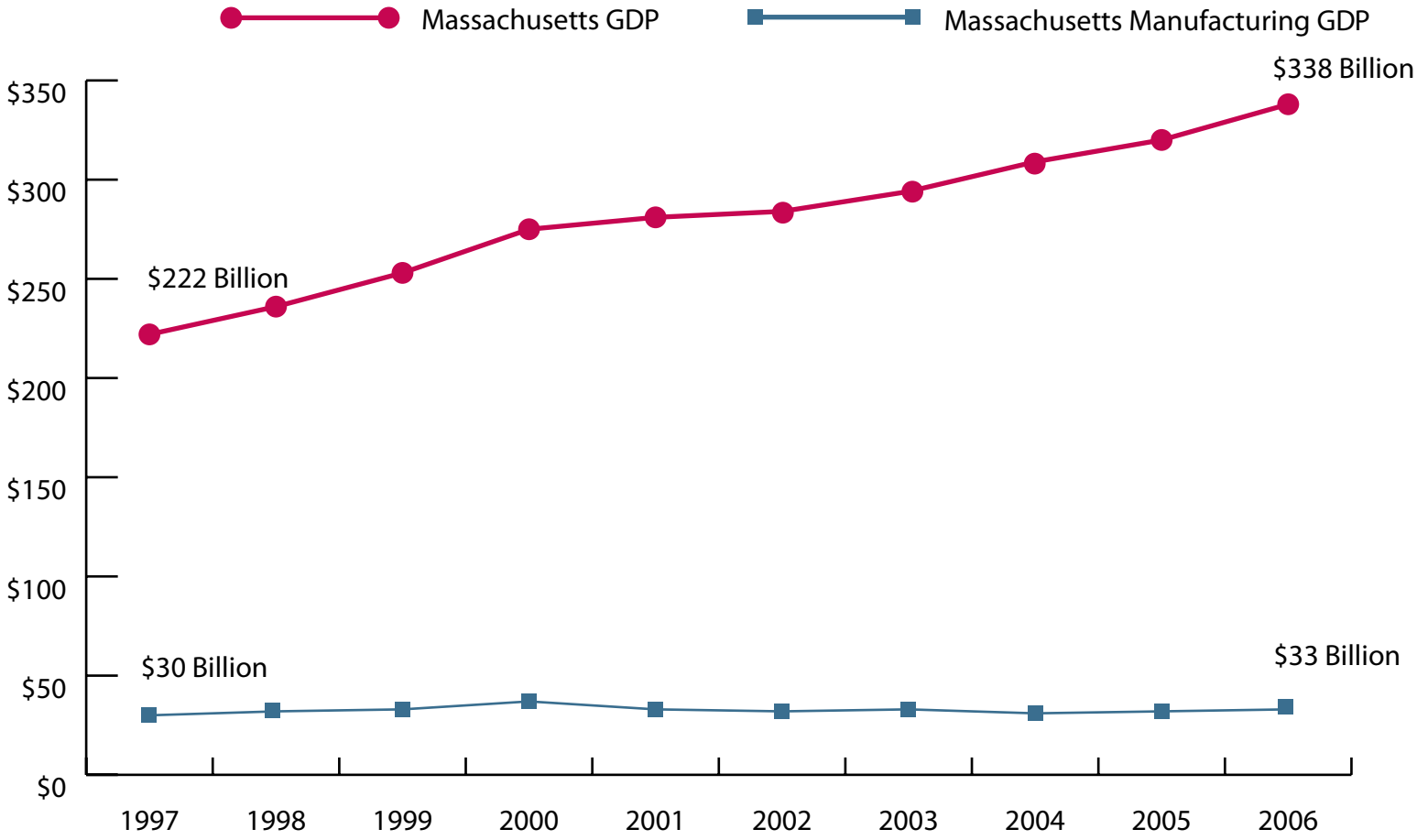
Source: Massachusetts Department of Workforce Development, Job Vacancy Survey, 2nd Quarter, 2007

Section 1: Importance of Manufacturing to Massachusetts

Manufacturing and Massachusetts Gross Domestic Product (in Billions of Dollars), 1997–2006

Manufacturing revenues comprised 10% of the state's gross domestic product (GDP) in 2006. State revenues from manufacturing have remained stable in dollar terms over the 1997–2006 period though the proportion of state revenues derived from manufacturing has declined from 14% to 10%.

The sector is generating its output with fewer employees, an indication of increasing productivity or value-added per employee.

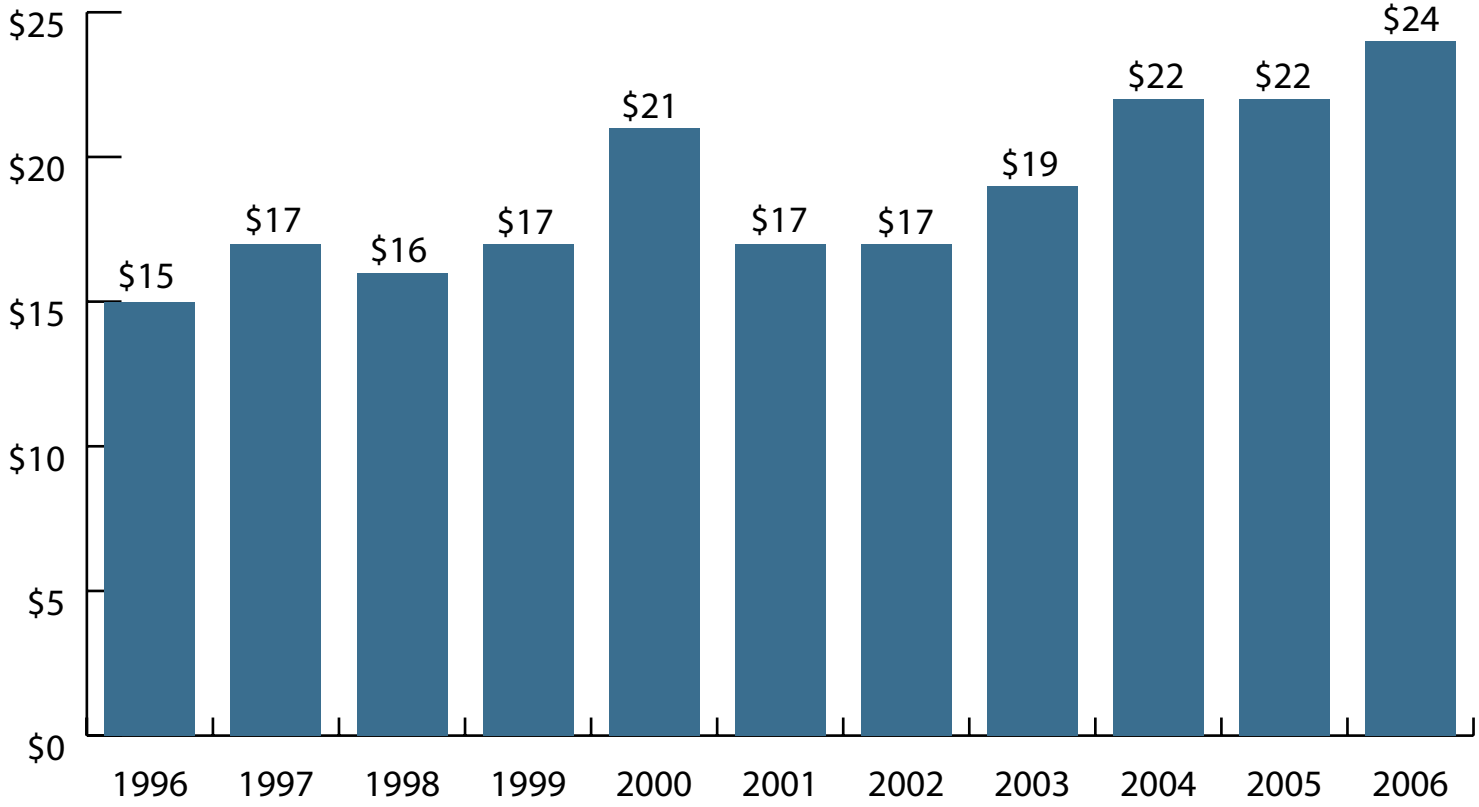


Source: United States Bureau of Economic Analysis, 1997–2006, data in constant 2006 dollars

Section 1: Importance of Manufacturing to Massachusetts

Massachusetts Total Annual Exports (in Billions of Dollars), 1996–2006

Exports are important for Massachusetts' economy because they bring in revenues from outside the country. Massachusetts exports grew substantially over the ten-year period from 1996 to 2006, from a total of $15 billion in 1996 to a total of $24 billion in 2006, a 60% increase in the value of goods exported by the state. Exports increased or held steady most years from 1996 to 2006, with the significant exception of a 19% decline from 2000 to 2001.

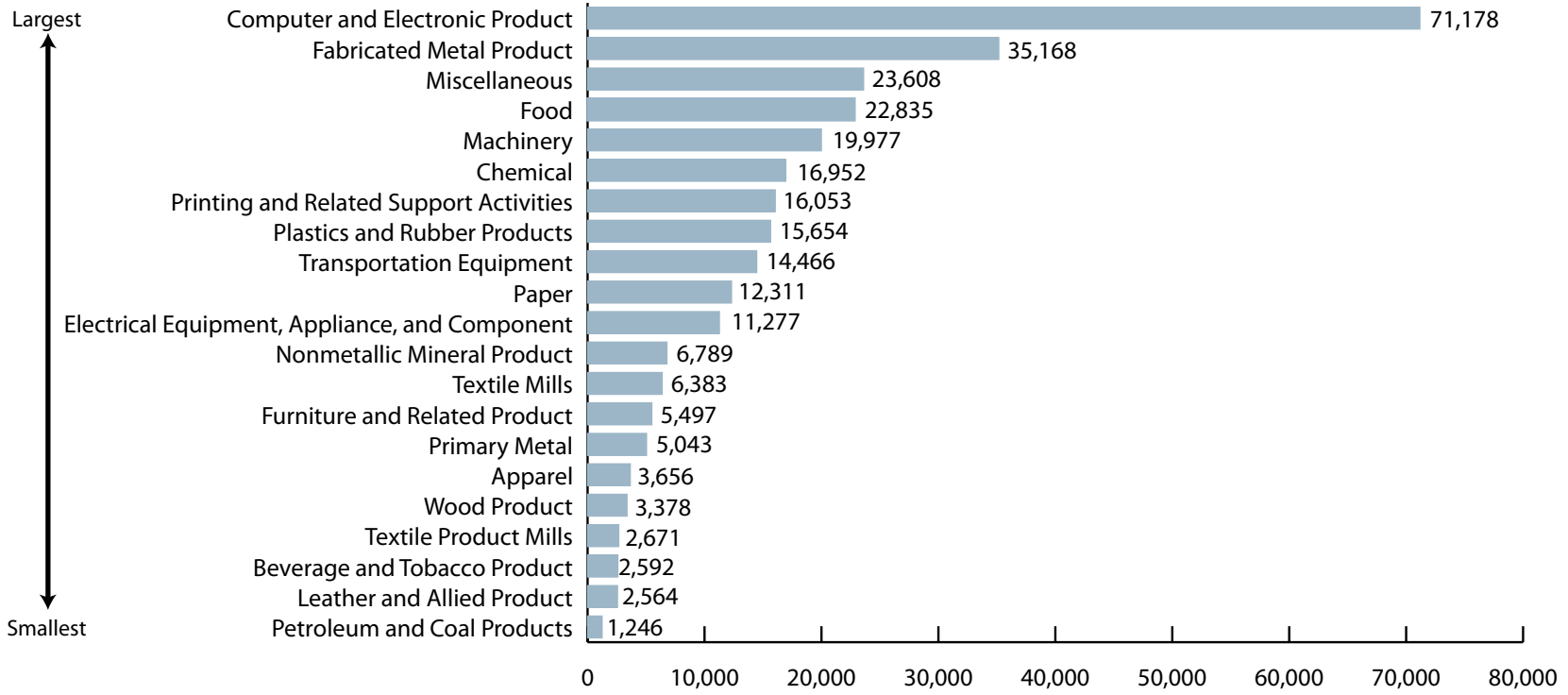


Source: Harmonized Tariff Schedule of the United States Dataset, acquired from the World Institute for Strategic Economic Research (WISER), 1996–2006, courtesy of William Lazonick, University of Massachusetts, Lowell

Section 2: Current Status of the Massachusetts Manufacturing Sector

Massachusetts Manufacturing Sub-Sector Employment, 2006

Twenty-one sub-sectors comprise the manufacturing sector. The largest sub-sector is computer and electronic product, employing 71,178 or about one quarter (24%) of all manufacturing workers in 2006, and includes a range of industries and products from electronic medical instrumentation to products for defense to telecommunication equipment. About half as many manufacturing employees (35,168) work in the fabricated metal sub-sector. The next largest sub-sector is "miscellaneous" (23,608 employees), which includes the manufacture of medical equipment, such as the supplies used for surgical procedures and laboratory work, as well as the manufacture of jewelry and silverware. Another major sub-sector is the manufacture of food (22,835), which includes, among other companies, bakeries and shops that bake or cook food. The chemical sub-sector, employing 16,952, contains the pharmaceutical and medicine industry group, often referred to as part of biotechnology.



Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2006

Section 2: Current Status of the Massachusetts Manufacturing Sector

Massachusetts' Top Export Categories, 2006

Massachusetts export categories in 2006 included electrical machinery; medical and surgical instruments; industrial machines and computers; pharmaceutical products; organic chemicals; and plastics, each of which constituted more than $1 billion in exports in 2006 and collectively represented over 75% of the total value of Massachusetts' exports in 2006.

Electrical machinery, the top export category in 1996, remains the most valuable at $5.189 billion in 2006. Pharmaceuticals and organic chemicals, which combined represented $3.772, only accounted for $248 million in 1996, an increase of 2,637% for organic chemicals and of 1,153% for pharmaceuticals over the ten-year period. Exports from medical and surgical instruments and from plastics grew at a rate greater than the overall rate of growth for Massachusetts exports.

Export Categories with over $1 Billion in exports in 2006	2006 (in Billions)	Percent Change 1996–2006
Electrical Machinery	$5.189	47%
Medical and Surgical Instruments	$4.999	154%
Industrial Machines and Computers	$3.329	–31%
Pharmaceutical Products	$2.541	1,153%
Organic Chemicals	$1.231	2,637%
Plastics	$1.103	151%
Sub Total	$18.393	67%
Total, All Export Categories	$24.047	66%

Source: Harmonized Tariff Schedule of the United States Dataset, acquired from the World Institute for Strategic Economic Research (WISER), 1996 and 2006, courtesy of William Lazonick, University of Massachusetts, Lowell

Section 2: Current Status of the Massachusetts Manufacturing Sector

Occupational Distribution of Massachusetts Manufacturing Sub-Sectors, 2005

The occupational distribution of the manufacturing sector in Massachusetts varies dramatically by sub-sector. Employment of blue-collar or trades occupations (including production; transportation and material moving; installation, maintenance and repair; and construction) varies from a low of 29% in the computer and electronic product sub-sector to a high of 86% in petroleum and coal products in 2005.

More than a third (35%) of manufacturing employment is in sub-sectors that have fewer than 50% blue-collar workers. Three sub-sectors: computer and electronic product (including telecommunication equipment, defense products, and medical devices), chemical (including pharmaceutical and bio-technology products), and machinery have over one-third of their employment in management or professional occupations. (Professional occupations include architecture and engineering; computer and mathematical; and business and financial operations.) These sub-sectors form the manufacturing core of the knowledge and innovation economy in Massachusetts.

Industries that have over 70% of their employment in blue-collar occupations account for just over a fifth (22%) of Massachusetts manufacturing employment and tend to include the more "traditional" manufacturing sub-sectors such as textile mills, transportation equipment, and fabricated metal products.

While the computer and electronic product sub-sector employs 24% of total manufacturing employees, it employs 84% of all computer professionals in manufacturing, 58% of all engineers, 45% of all finance and business operations occupations, and 32% of all management occupations in manufacturing.

The chemical sub-sector employs 58% of all science occupations in manufacturing.

All manufacturing sub-sectors employ a significant share of administrative and office support occupations—with most employing from 10–15%.

Sub-Sectors / Occupational Categories	Management	Professional	Service	Sales	Administration	Blue Collar	2005 Employment
Largest							
Manufacturing, All Sub-Sectors	8%	19%	1%	5%	13%	55%	300,840
Computer and Electronic Product	10%	45%	0%	4%	11%	29%	72,570
Fabricated Metal Product	7%	8%	1%	3%	12%	70%	35,580
Miscellaneous	9%	13%	1%	6%	16%	56%	24,520
Food	4%	3%	14%	6%	8%	65%	22,570
Machinery	10%	24%	0%	5%	13%	48%	21,320
Chemical	9%	30%	1%	5%	14%	41%	17,160
Printing and Related Support Activities	6%	8%	0%	10%	21%	55%	16,030
Plastics and Rubber Products	7%	6%	1%	3%	10%	74%	16,030
Paper	5%	5%	1%	4%	13%	74%	13,480
Electrical Equipment, Appliance, and Component	9%	22%	0%	3%	13%	53%	11,200
Transportation Equipment	11%	0%	0%	1%	13%	75%	8,590
Textile Mills	4%	5%	1%	3%	13%	75%	8,000
Nonmetallic Mineral Product	6%	5%	0%	4%	11%	75%	6,730
Furniture and Related Product	6%	6%	0%	11%	11%	66%	5,800
Primary Metal	7%	7%	0%	3%	10%	73%	5,510
Apparel	3%	3%	0%	4%	11%	79%	3,910
Wood Product	5%	3%	0%	9%	13%	70%	3,320
Textile Product Mills	6%	0%	0%	4%	11%	79%	2,760
Beverage and Tobacco Product	8%	5%	0%	16%	13%	58%	2,300
Leather and Allied Product	8%	0%	0%	6%	27%	60%	2,200
Smallest							
Petroleum and Coal Products	6%	0%	0%	0%	9%	86%	1,260

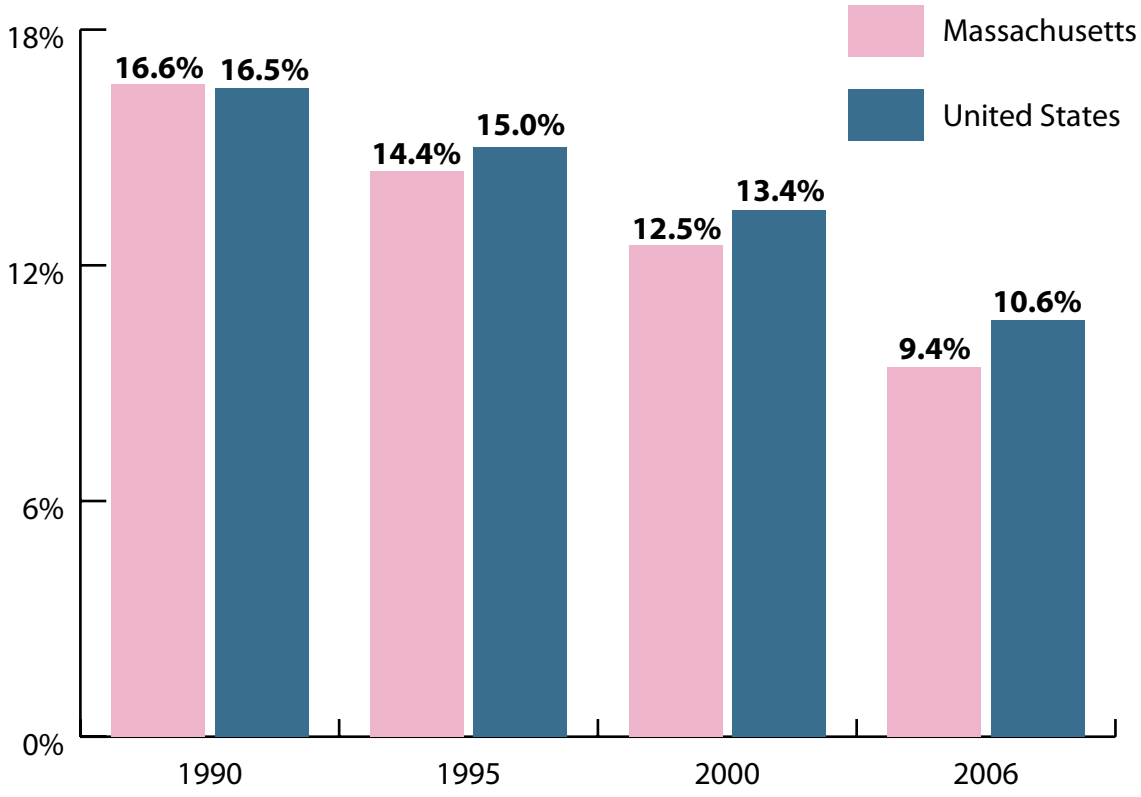
Source: Massachusetts Department of Workforce Development, Occupational Employment and Wage Industry Staffing Patterns, May 2005

Section 2: Current Status of the Massachusetts Manufacturing Sector

Share of Total Employment in Manufacturing in Massachusetts and United States, 1990–2006

The manufacturing sector's share of total state employment has fallen from 16.6% in 1990 to 9.4% in 2006. Nationwide, the proportion of employment in manufacturing also fell during the same period, from 16.5% in 1990 to 10.6% in 2006.

Manufacturing employment in Massachusetts declined from 483,858 in 1990 to 299,477 in 2006. For the United States, manufacturing employment declined during this period from 17,913,919 to 14,153,115.



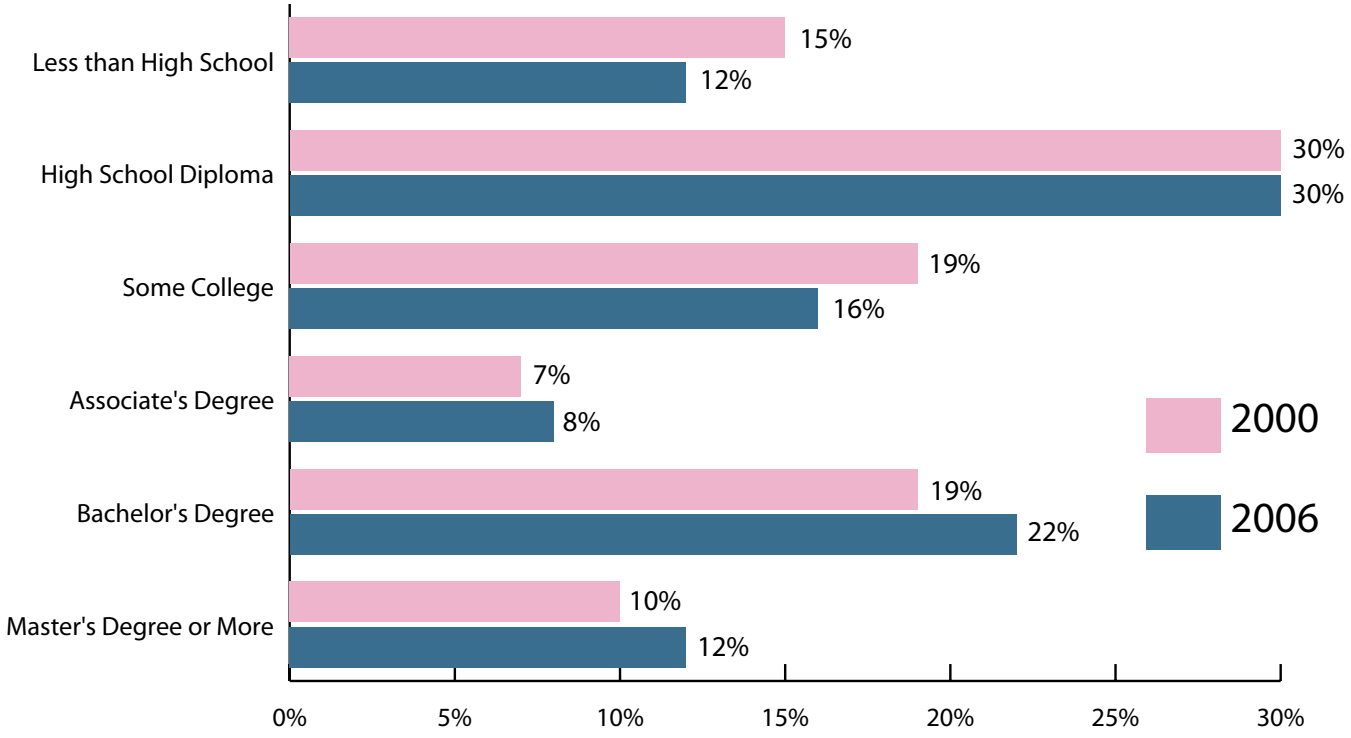
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 1990, 1995, 2000, and 2006

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Educational Attainment of Manufacturing Workers in Massachusetts, 2000–2006

Massachusetts manufacturing workers were more educated in 2006 than in 2000. Fully 42% possessed at least an associate's degree by 2006 compared to only 36% in 2000, with the greatest increase among those with bachelor's and master's degrees. Only 12% of manufacturing workers in Massachusetts lacked a high school diploma or equivalent in 2006, down from 15% in 2000.

More than half, or 58%, of manufacturing workers in 2006 do not have a college degree. This is an indication that the manufacturing sector continues to employ, in significant numbers, those without a formal college education.



Source: Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey PUMS Data
Note: Populations aged 25 or older

Section 2: Current Status of the Massachusetts Manufacturing Sector

Occupational Distribution of the Massachusetts Manufacturing Sector, 2005

Workers in many different occupations staff the manufacturing sector. The left column lists sectors or where people work; the top row shows major occupations or what people do. Occupations with more than a 5% share working in the manufacturing sector include: production (74% of them are in manufacturing), office and administration (12%), architects and engineers (9%), management (8%), and transportation occupations (6%).

While 74% of production workers are employed in the manufacturing sector, there are other employers of production workers; for instance:

- Grocery stores, in the retail sector, employ bakers;
- Dry cleaning stores, in the other services sector, employ tailors;
- Lumber wholesale stores, in the wholesale trade sector, employ team assemblers.

According to the 2000 Census and the 2006 American Community Survey, the occupational distribution of the Massachusetts manufacturing sector has remained relatively stable from 2000 through 2006.

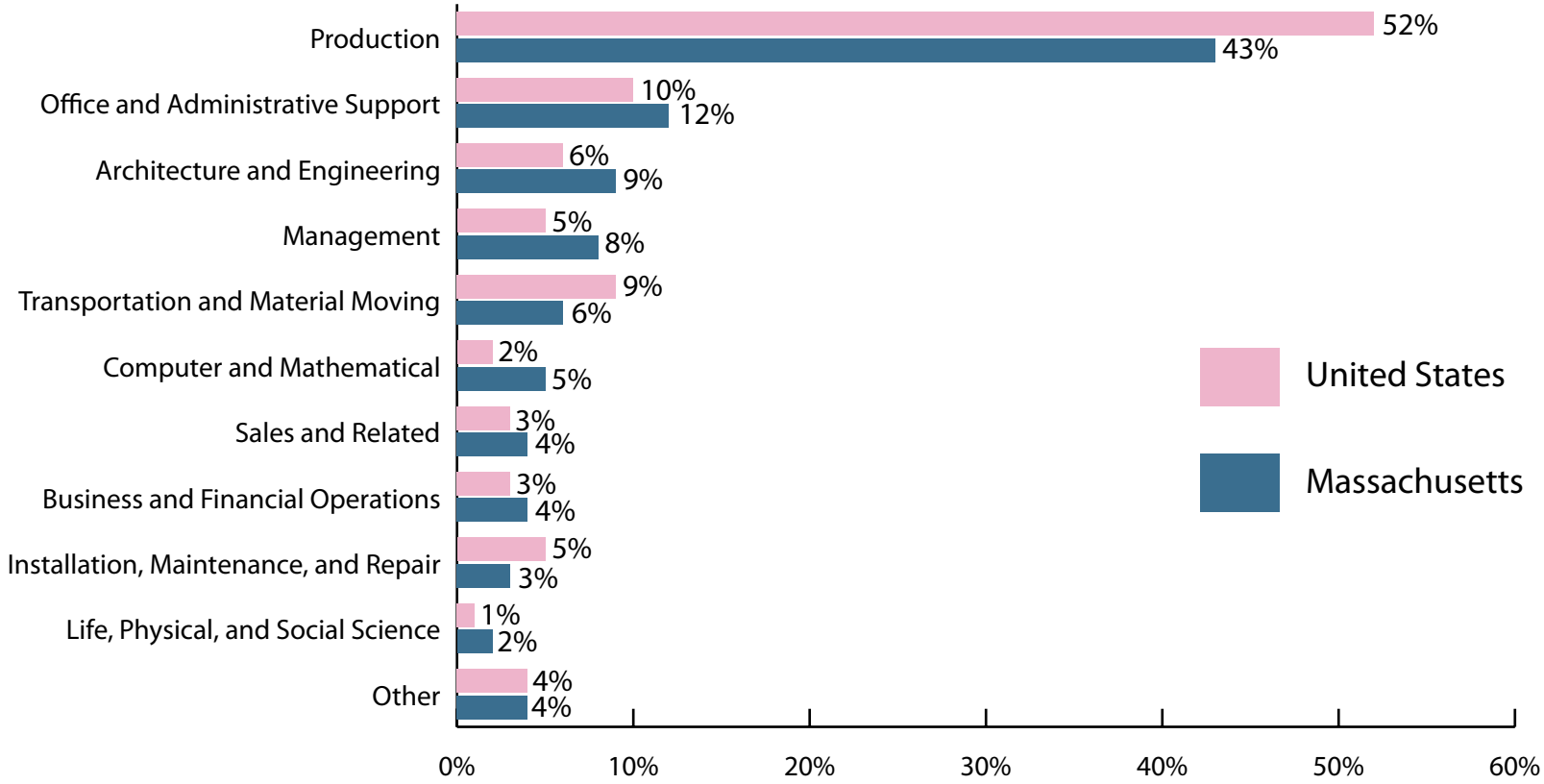
Occupations / Sectors	Production	Office and Administration	Architecture and Engineering	Management	Transportation	Business and Financial	Computer and Mathematical	Sales	Installation
Manufacturing	74%	12%	9%	8%	6%	4%	5%	4%	3%
Administrative Services	5%								
Retail Trade	4%								
Other Services	4%								
Wholesale Trade	4%								
Professional Services	2%								
Healthcare, Social Assistance	1%								
Other Sectors	6%								
Total	100%								

Source: Massachusetts Department of Workforce Development, Occupational Employment and Wage Industry Staffing Patterns, May 2005

Section 2: Current Status of the Massachusetts Manufacturing Sector

Occupational Distribution of Manufacturing in Massachusetts and Nationwide, 2005

The occupational distribution of manufacturing companies in Massachusetts is significantly different from manufacturing companies in the United States. Production workers are by the far the largest occupational group in manufacturing in both Massachusetts and the nation, representing 43% and 52% of manufacturing employees, respectively, in 2005. The state's manufacturing sector has a larger share of higher-paid and typically more educated management, business and financial operations, architecture and engineering, computer and mathematical, and life, physical, and social science occupations. Massachusetts manufacturing employs a greater share of sales and administration occupations than does the U.S. manufacturing sector.



MA Source: Massachusetts Department of Workforce Development, Occupational Employment and Wage Industry Staffing Patterns, May 2005
US Source: United States Bureau of Labor Statistics, National Industry Specific Occupational Employment and Wage Estimates, May 2005

Section 2: Current Status of the Massachusetts Manufacturing Sector

Occupational Distribution of Manufacturing Sub-Sectors in Massachusetts and the United States, 2005

An analysis of occupational employment of the ten largest manufacturing sub-sectors, which together employ over 250,000 of the 300,000 employees in Massachusetts, shows clearly how manufacturing in Massachusetts and the U.S. are different. Massachusetts manufacturing companies employ more professional workers and fewer blue-collar workers. Professional workers in manufacturing are predominantly architects and engineers; computer and mathematical; life, physical and social science; and business and financial occupations. Blue-collar workers include production workers, as well as construction trade, installation, maintenance and repair workers, and transportation and material moving workers.

In Massachusetts manufacturing, 19% of the workforce comprises professional occupations while in the U.S., that number is 11%. Some of the difference can be explained by the higher concentration of computer and electronic products, which is 24% of manufacturing employment in the state but only 9% in the U.S. Computer and electronic product employs a much higher share of professional workers, especially engineers and computer occupations. In certain sub-sectors, such as computer and electronic product; chemical (which includes pharmaceutical and biotechnology); machinery; and electrical equipment, appliance, and component; the proportion of professional workers in Massachusetts is much higher than the U.S. Sub-sectors with lower employment (not listed here) tended to have a much lower share of professional workers, likely due to the smaller scale of operations.

Similarly, Massachusetts manufacturing has a lower (55%) share of blue-collar workers compared to the U.S. (63%). At the sub-sector level there is a similar pattern, with all of the sub-sectors shown here having a significantly smaller share of blue-collar employment than the same sub-sector in the U.S.

Largest

Smallest

	Share of Professional Occupations (%)		Share of Blue Collar Workers (%)	
Sub-Sector	Massachusetts	US	Massachusetts	US
Manufacturing, All Sub-Sectors	19%	11%	55%	63%
Computer and Electronic Product	45%	40%	29%	36%
Fabricated Metal Product	8%	7%	70%	74%
Miscellaneous	13%	11%	56%	63%
Food	3%	3%	65%	78%
Machinery	24%	14%	48%	65%
Chemical	30%	22%	41%	56%
Printing and Related Support Activities	8%	7%	55%	62%
Plastics and Rubber Products	6%	5%	74%	80%
Paper	5%	5%	74%	79%
Electrical Equipment, Appliance, and Component	22%	13%	53%	68%

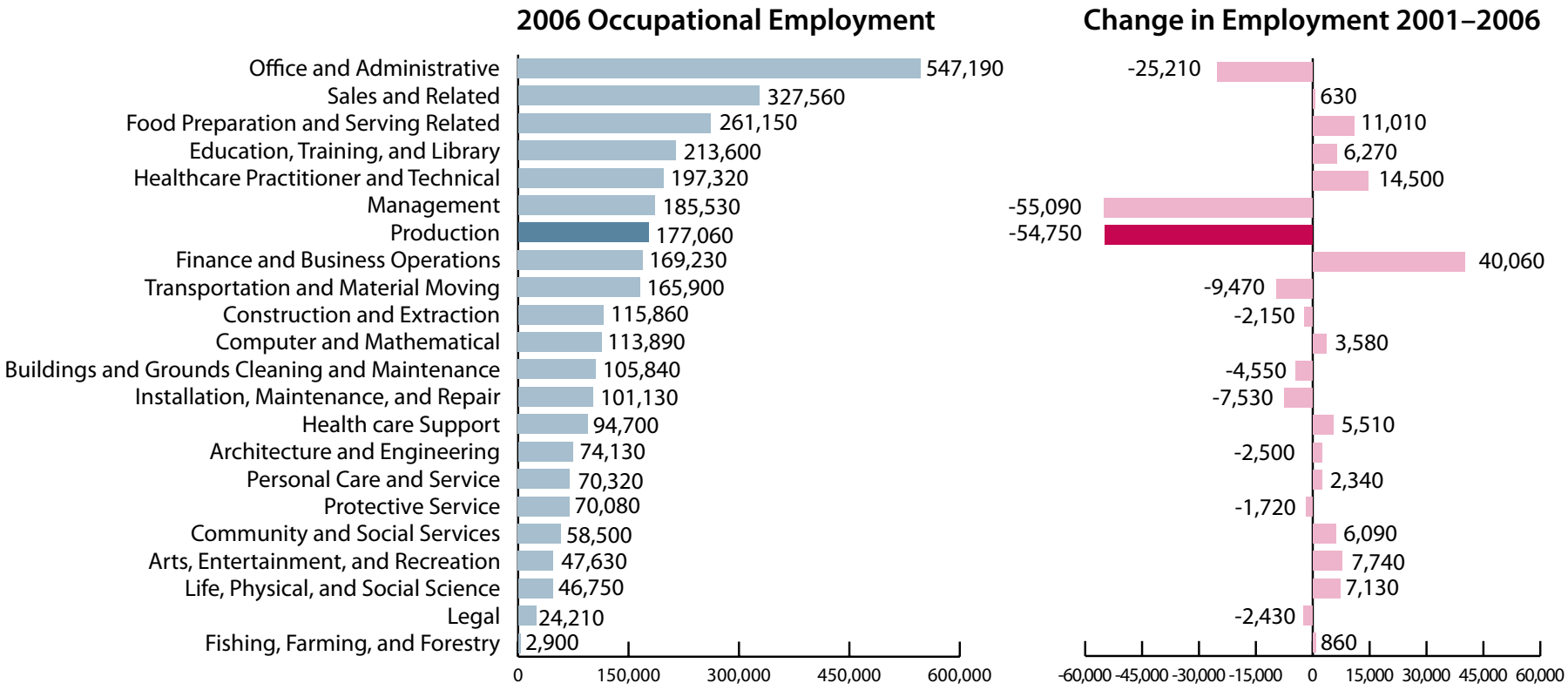
MA Source: Massachusetts Department of Workforce Development Occupational Employment and Wage Industry Staffing Patterns, May 2005
US Source: United States Bureau of Labor Statistics, National Industry Specific Occupational Employment and Wage, Estimates, May 2005

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Massachusetts Employment by Occupation, 2001–2006

Production occupations are the seventh largest major occupational group in Massachusetts and the largest occupational group in manufacturing.

The number of production workers in all sectors declined by 54,750 from 2001 to 2006.

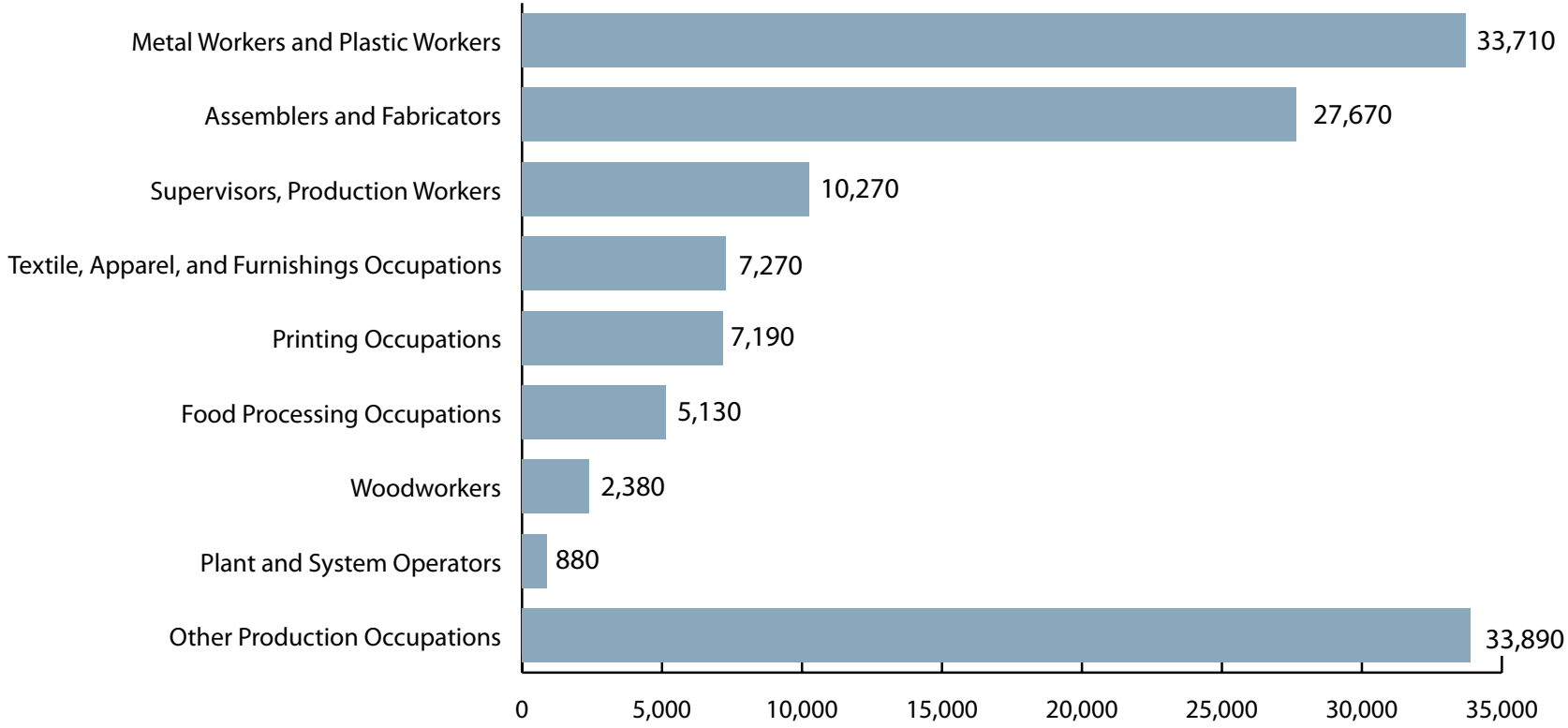


Source: United States Bureau of Labor Statistics, Occupational Employment Statistics, 2001 and 2006

Section 2: Current Status of the Massachusetts Manufacturing Sector

Employment of Production Occupations in the Massachusetts Manufacturing Sector, 2005

Production occupations are by far the largest group in manufacturing, nearly four times larger than the next largest occupational category, and encompass 110 individual production job titles. In order to better understand these occupations, they are grouped into nine sub-categories. The two largest production sub-categories (aside from the "other" category) are metal and plastic workers and assemblers and fabricators. These two categories account for 41% of all production workers in Massachusetts in 2005. Metal and plastic workers include machinists who operate tools to make precision parts. Team assemblers who rotate through the entire assembly process rather than repeating one task are typical of the assemblers and fabricators occupational sub-category.

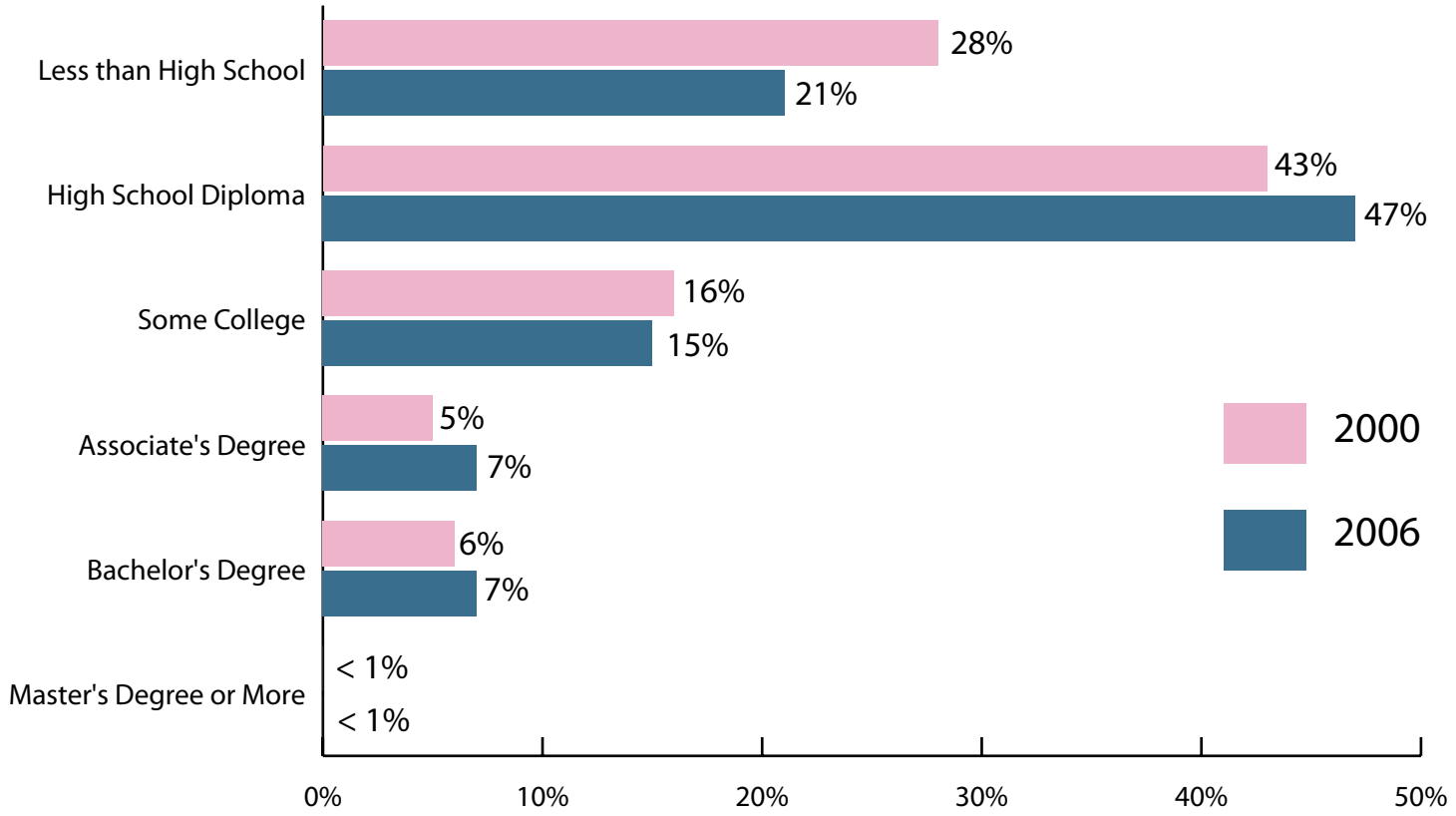


Source: Massachusetts Department of Workforce Development, Occupational Employment and Wage Industry Staffing Patterns, May 2005

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Educational Attainment of Workers in Production Occupations in Massachusetts, 2000–2006

Production workers are less educated than workers in other occupational categories in the Massachusetts manufacturing sector, but have become more educated since 2000. There was an increase in the proportion of production workers to hold a high school diploma from 2000 to 2006, and a decrease in the proportion of production workers with less than a high school diploma. Among production workers there were modest increases in the proportion to hold an associate's or higher college degree over this same period, from 11% in 2000 to 14% in 2006.



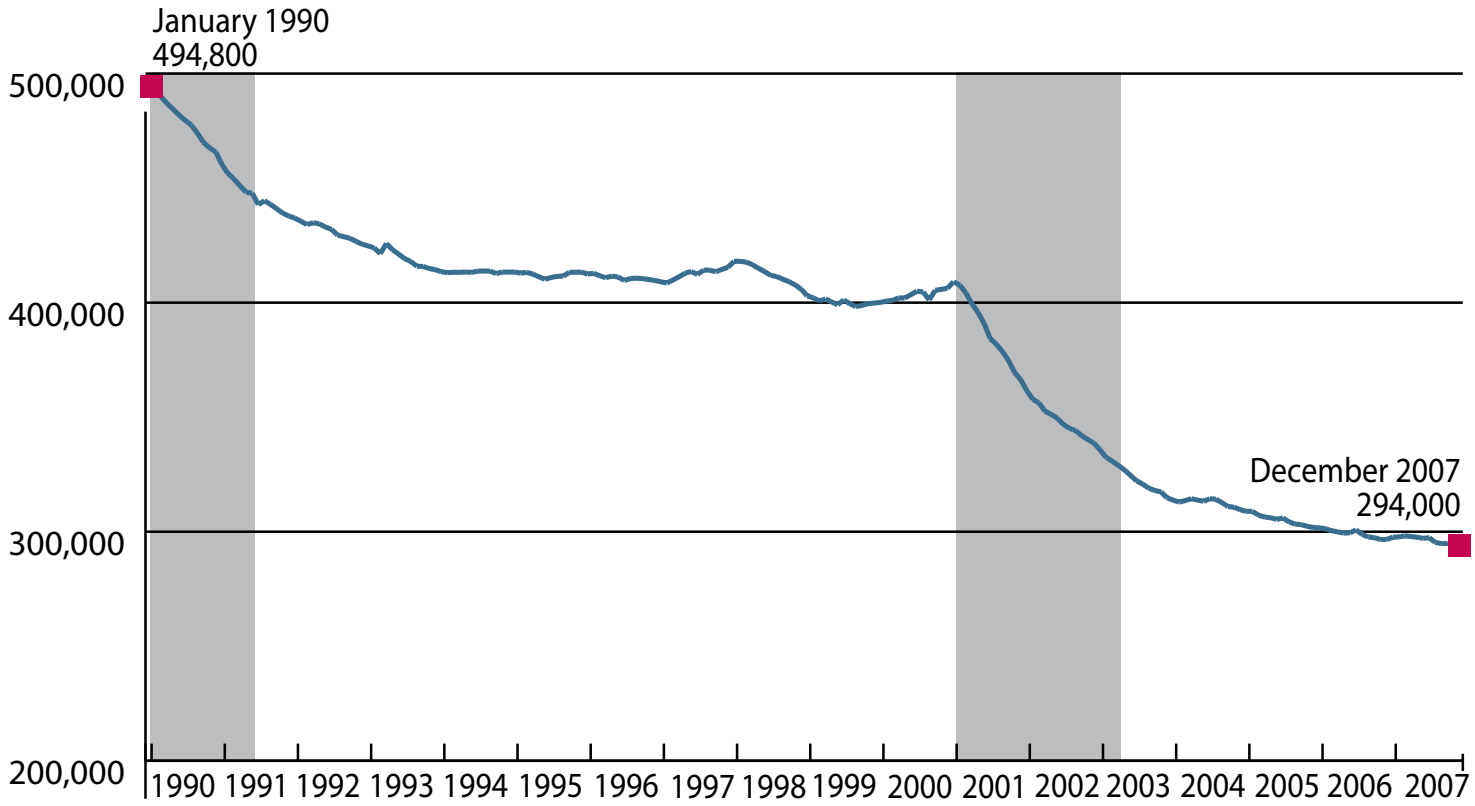
Source: Census 2000 PUMS Data, 5% Sample, 2006 American Community Survey PUMS Data
Note: Population aged 25 or older

Section 2: Current Status of the Massachusetts Manufacturing Sector

Massachusetts Employment Trends in Manufacturing, 1990–2007

The manufacturing sector has been consistently losing jobs since 1990. Between January 1990 and December 2007, employment in manufacturing decreased by 39%, from 494,800 in 1990 to 294,000 in 2007.

During the two recessions in the early parts of the 1990s and 2000s (see gray shading), the employment decline was steeper than during the rest of the seventeen-year period pictured here. Manufacturing employment has historically been hard-hit by recessions. Until 1990 manufacturing employment fell during recessions but recovered subsequently so that the sector did not suffer a net loss of jobs. In the two recent recessions, however, manufacturing employment did not rebound during the recovery. Job losses continued, although at a slower rate.



Source: United States Bureau of Labor Statistics, Current Employment Statistics, Seasonally Adjusted, 1990–2007
Recession Source: Alan Clayton-Matthews. FY2006 Consensus Revenue Estimate Hearings.

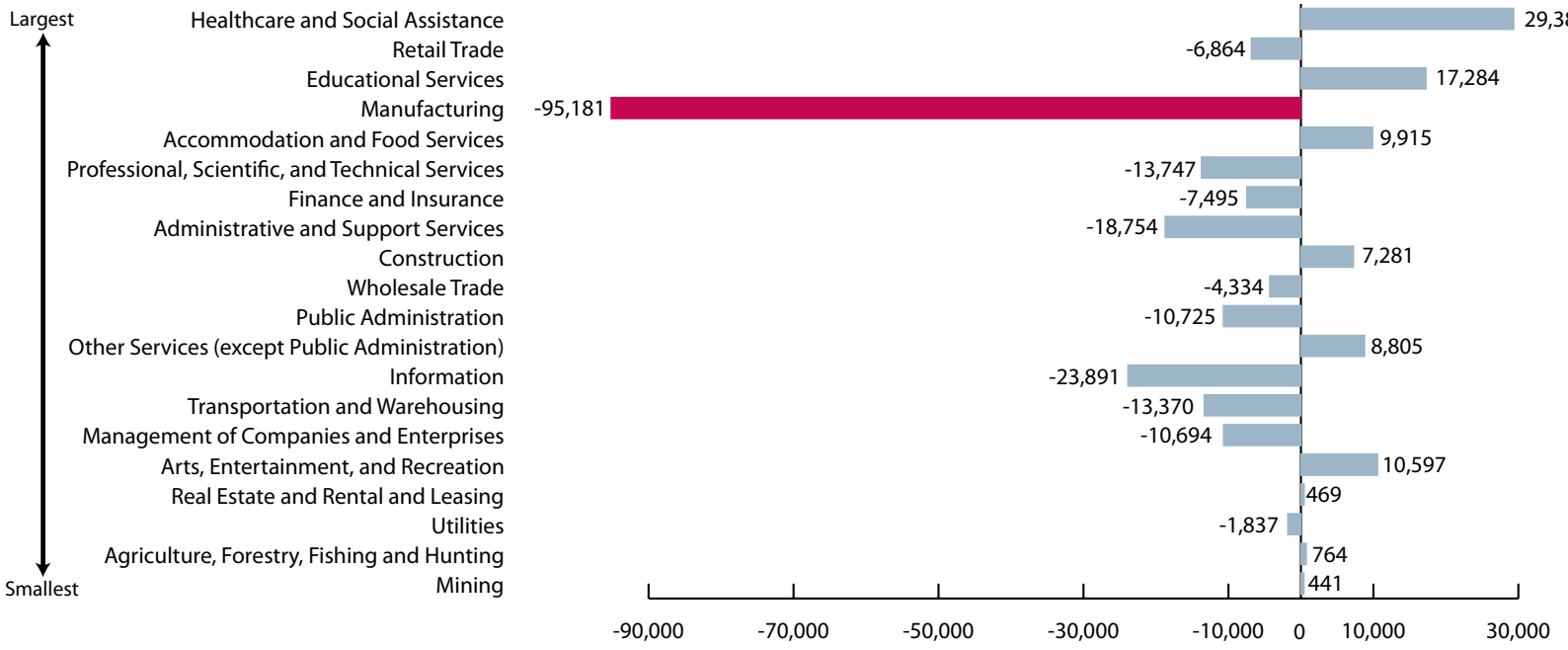
Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Massachusetts Employment by Sector, 2000–2004

From 2000 to 2004, the manufacturing sector in Massachusetts lost 95,181 jobs, or 23% of total manufacturing employment in 2000. The manufacturing employment decline was more than three times as high as any other single sector and 46% of the total job loss during this period.

Among the five largest sectors, which together account for more than half of all jobs, only manufacturing and retail trade suffered job losses during this period: the retail trade sector lost 6,864 jobs (2%). Healthcare, the largest sector in Massachusetts, expanded employment by 29,383 (7%).

Other sectors that experienced significant employment declines include: information (23,891 or 20% decline), management of companies (10,694 or 14%), administrative and waste services (18,754 or 10%), transportation and warehousing (13,370 or 12%), and professional, scientific and technical services (13,747 or 6%).



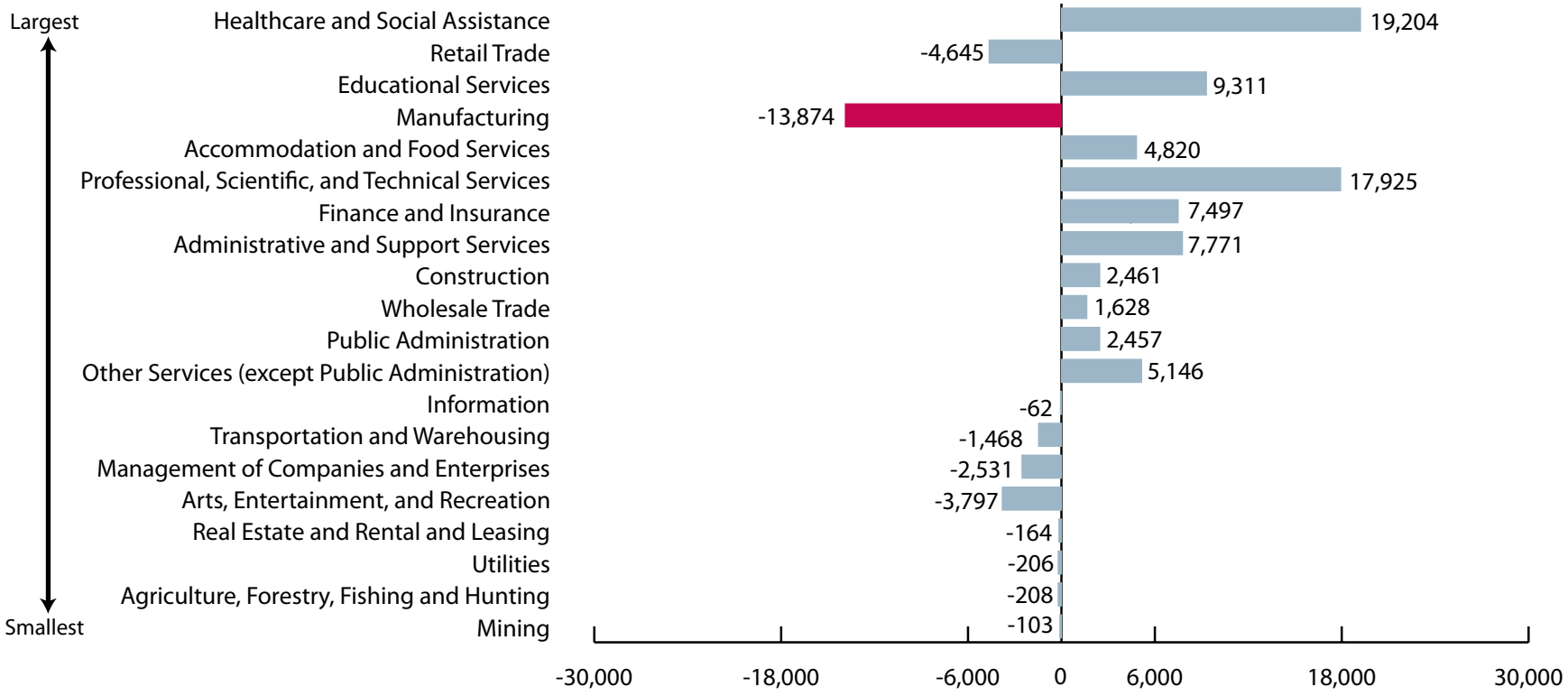
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2000 and 2004

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Massachusetts Employment by Sector, 2004–2006

During the two-year recovery period, 2004 to 2006, the Massachusetts manufacturing sector continued to lose jobs, albeit more slowly than during the downturn. There were 13,874 fewer manufacturing employees in 2006 than there had been in 2004 for a decline of 4%.

According to the New England Economic Partnership (NEEP), the manufacturing sector is projected to shed another 8,798 jobs from its workforce in the next five years, from 2006 to 2011. The 3% rate of decline expected between 2006 and 2011 is relatively low compared to the 23% rate of decline from 2001 to 2006.

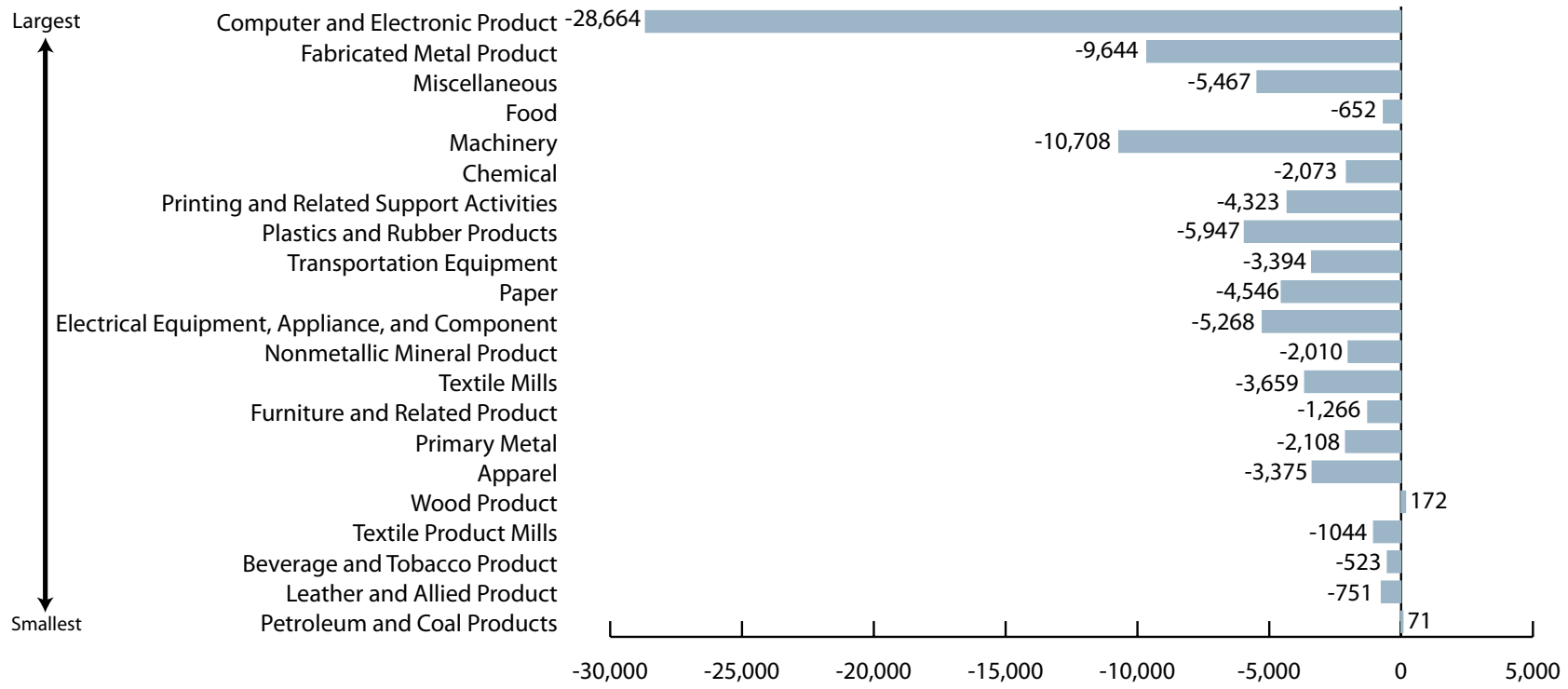


Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2004 and 2006
Note: New England Economic Partnership, Fall 2007, Economic Outlook Report

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Massachusetts Employment by Manufacturing Sub-Sector, 2000–2004

From 2000 to 2004, almost all manufacturing sub-sectors lost employment. The computer and electronic product sub-sector, the largest sub-sector, shed 28,664 jobs over these four years, losing more than twice as many jobs as the next hardest hit sub-sector, machinery, which lost 10,708 jobs. Only wood product and petroleum and coal products showed small increases.



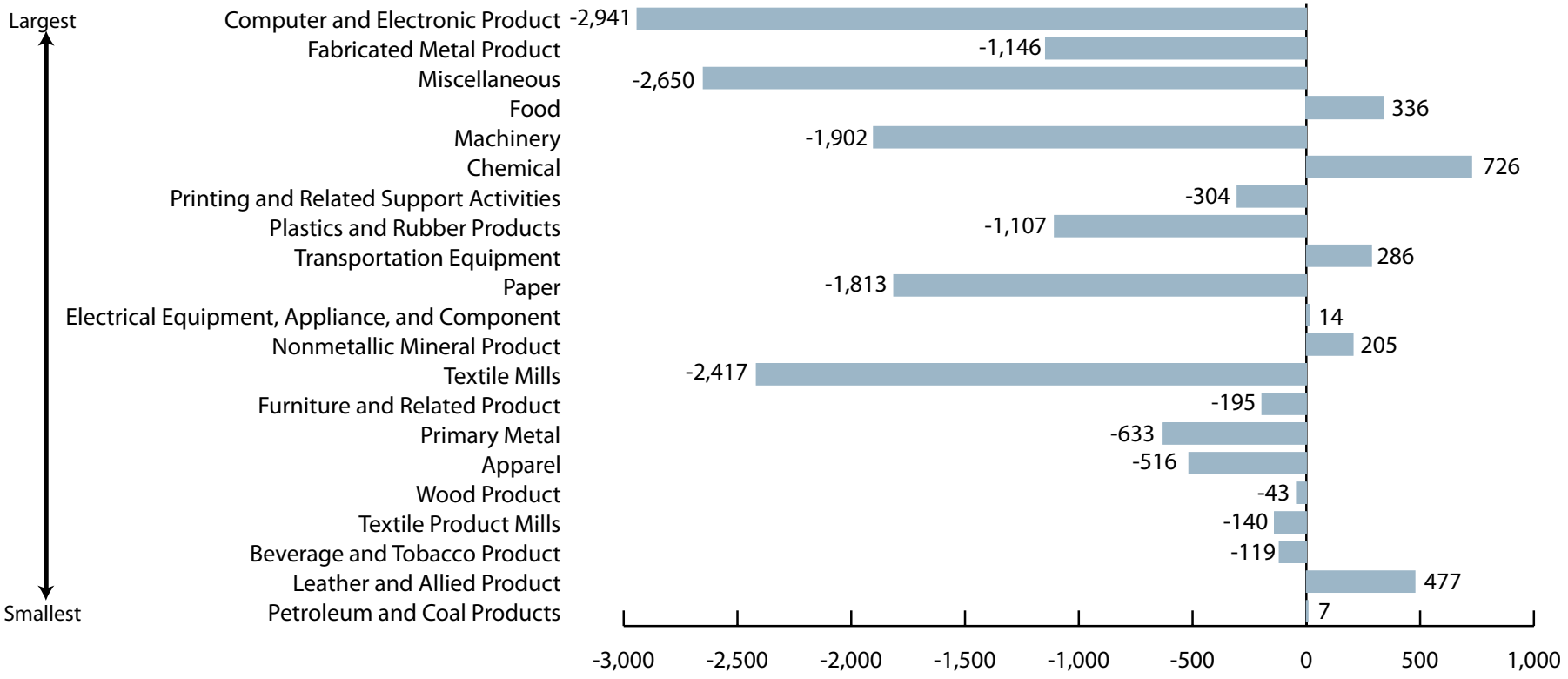
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2000 and 2004

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Massachusetts Manufacturing Employment by Sub-Sector, 2004–2006

Between 2004 and 2006, many of the manufacturing sub-sectors, including the three largest, computer and electronic product, fabricated metal product, and miscellaneous, continued losing jobs and together lost a combined 6,737 jobs.

A few sub-sectors, including chemical, leather and allied product, food, and transportation equipment, made modest employment gains. Chemical, which includes the pharmaceutical and medicine industry group, led the group with 726 new jobs during this period. The leather and allied product sub-sector gained 477 jobs while food added 336 jobs.

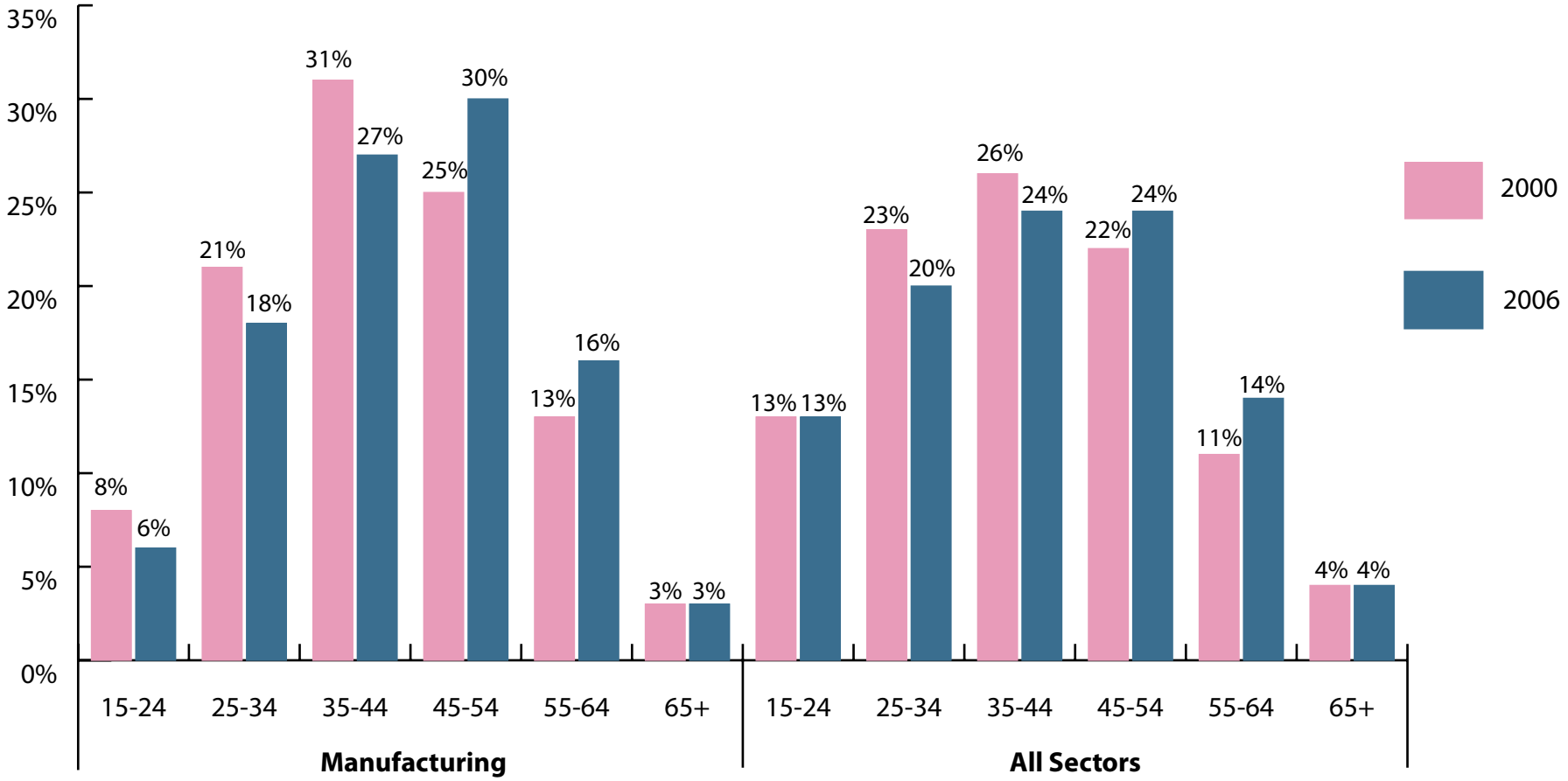


Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2004 and 2006

Section 2: Current Status of the Massachusetts Manufacturing Sector

Age Profile of the Massachusetts Manufacturing Workforce, 2000–2006

Manufacturing has an older workforce than the state as a whole. Forty-nine percent (49%) of those employed in manufacturing in 2006 were 45 years or older, compared to only 42% of all workers. Fewer than a quarter (24%) of manufacturing workers are between the ages of 15 and 34; statewide, almost a third (33%) are in this age group. Just six years earlier in 2000, only 41% of manufacturing workers were over 45 and 29% were between 15 and 34. As older workers retire, there will be a need for replacement workers to ensure that knowledge and skills are transferred and there are sufficient workers to accomplish essential functions.

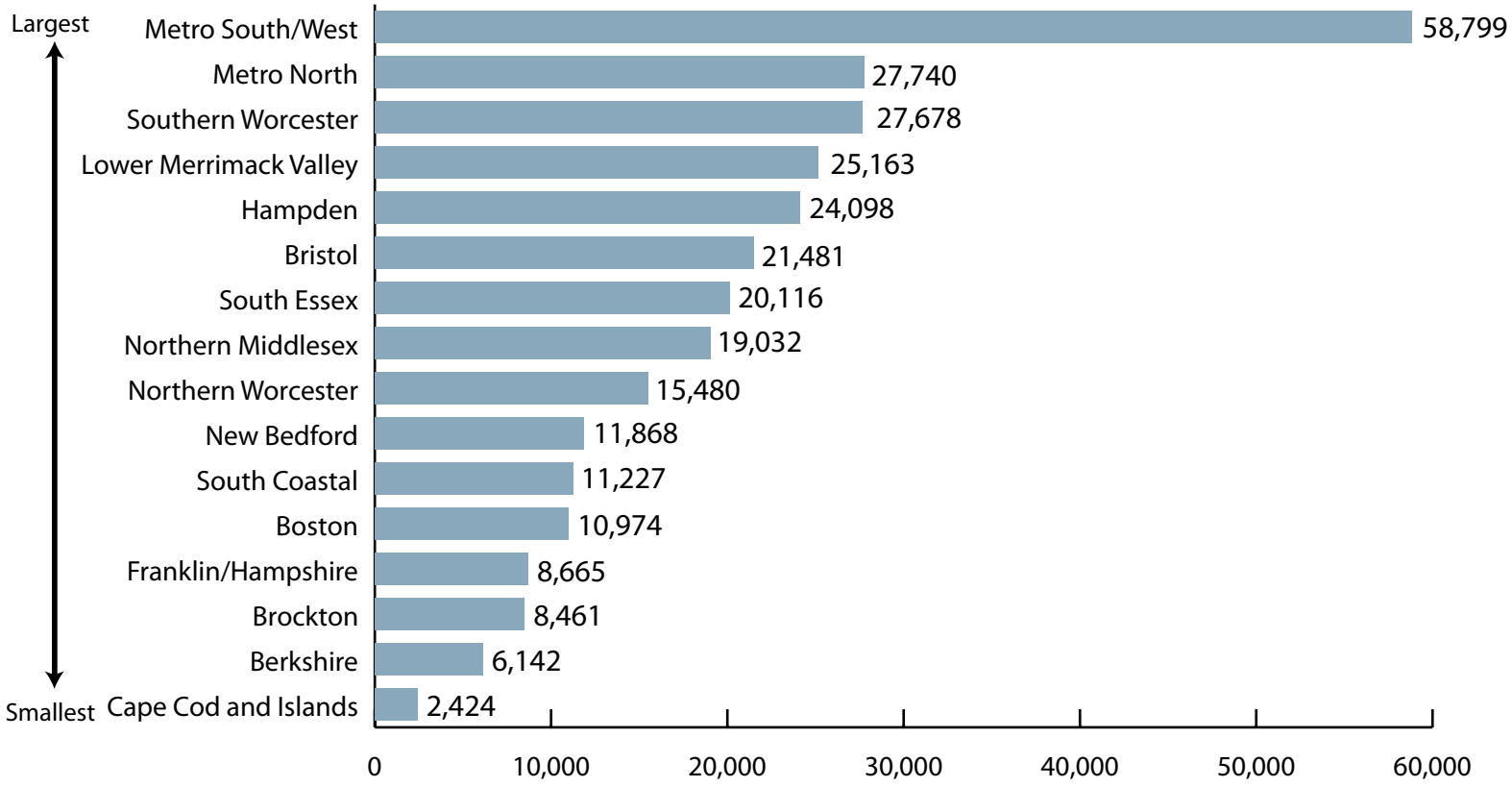


Source: Census 2000 PUMS Data, 5% Sample, 2006 American Community Survey PUMS Data

Section 2: Current Status of the Massachusetts Manufacturing Sector

Employment in Manufacturing by Massachusetts Workforce Region, 2006

Manufacturing jobs are distributed unevenly across the state. In 2006, one-fifth (20%) of the state's manufacturing workers, 58,799, worked in the Metro South/West Workforce Region alone, more than twice as many as in any other workforce region. Seven of the 16 regions had more than 20,000 manufacturing workers, while another four (Franklin/Hampshire, Brockton, Berkshire, and Cape Cod and Islands) had fewer than 10,000 each.

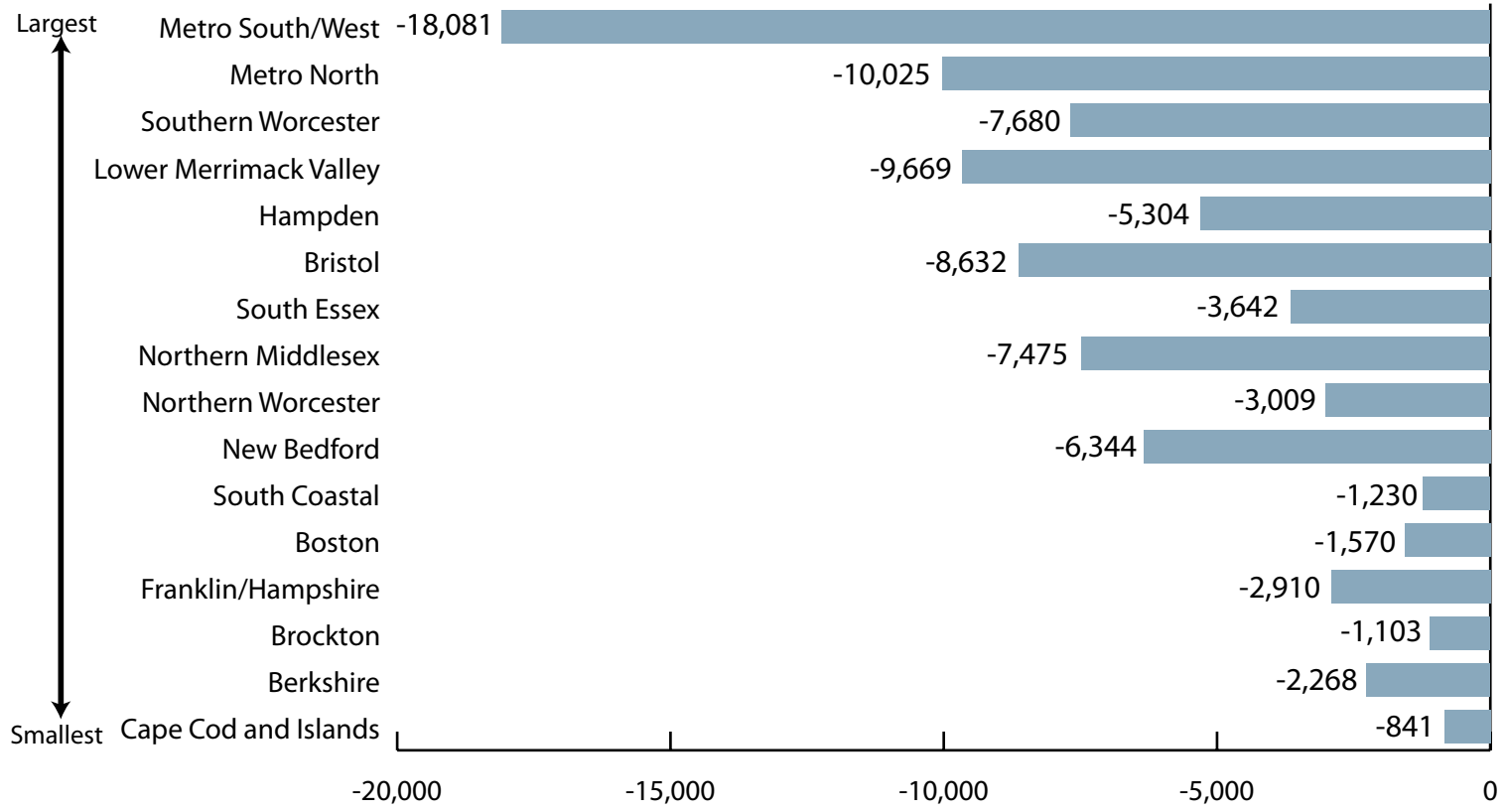


Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages, 2006
Note: Please see Appendix for a list of cities and towns in each workforce region.

Section 2: Current Status of the Massachusetts Manufacturing Sector

Change in Manufacturing Employment by Massachusetts Workforce Region, 2001–2006

Each of the 16 workforce regions lost manufacturing jobs from 2001 to 2006. The Metro South/West region, which had the most manufacturing jobs in 2001, lost the largest number of jobs, 18,081, from 2001 to 2006. After Metro South/West, the Metro North, Lower Merrimack Valley, and Bristol regions lost the greatest numbers of manufacturing jobs.

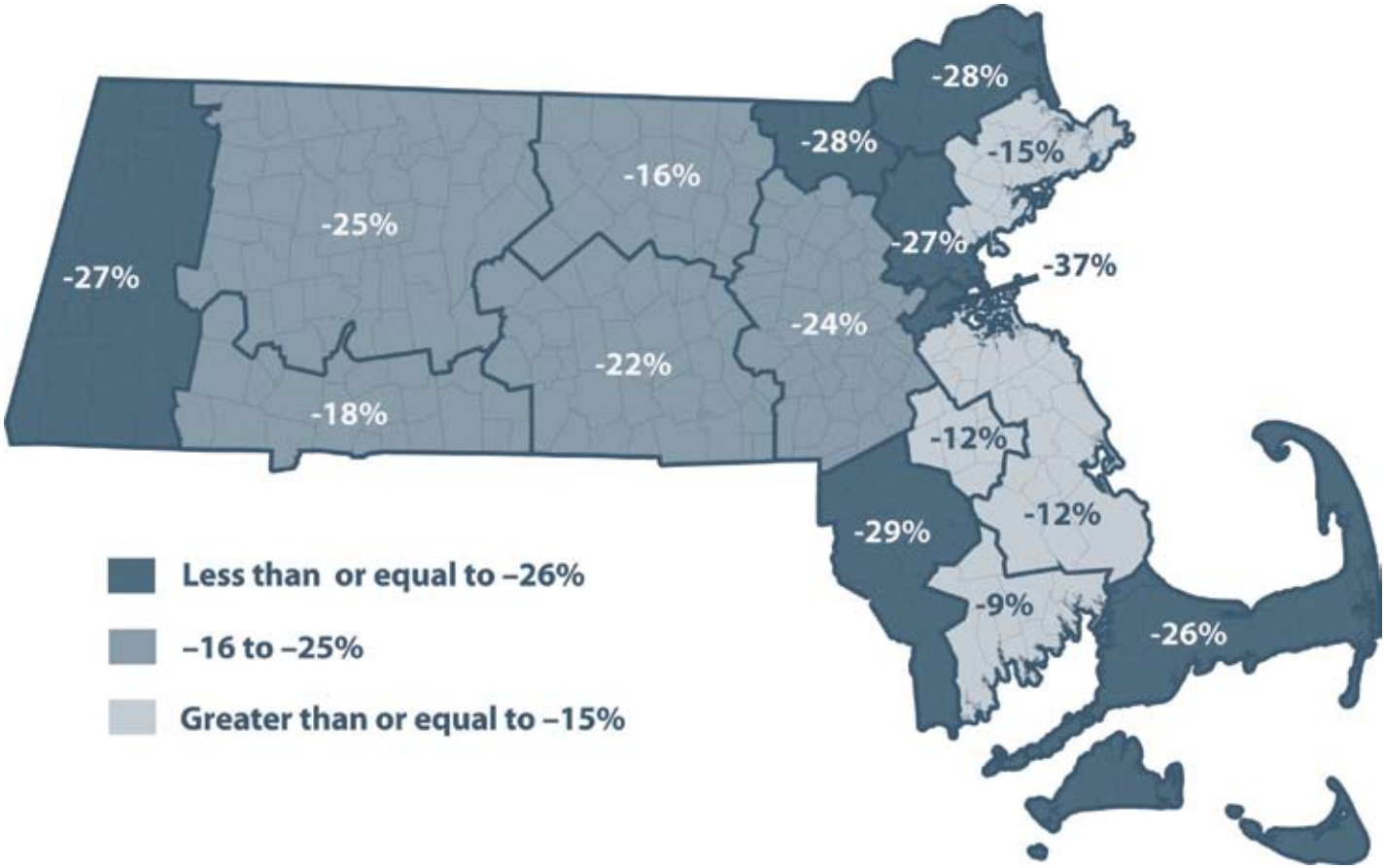


Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages, 2001 and 2006
Note: Please see Appendix for a list of cities and towns in each workforce region.

Section 2: Current Status of the Massachusetts Manufacturing Sector

Percent Change in Manufacturing Employment by Massachusetts Workforce Region, 2001–2006

Massachusetts' regions were not equally hard hit by manufacturing job losses between 2001 and 2006. Job loss varied from 9% in the New Bedford region to 37% in the Boston region. Many of the regions with the largest declines actually had few manufacturing jobs to begin with, such as Boston (37%), Berkshire (27%), and Cape Cod and Islands (26%). However, regions with a large number of manufacturing jobs also had large declines, such as Metro South/West (24% decline), Metro North (27% decline), the Lower Merrimack Valley (28% decline), and Bristol (29% decline).



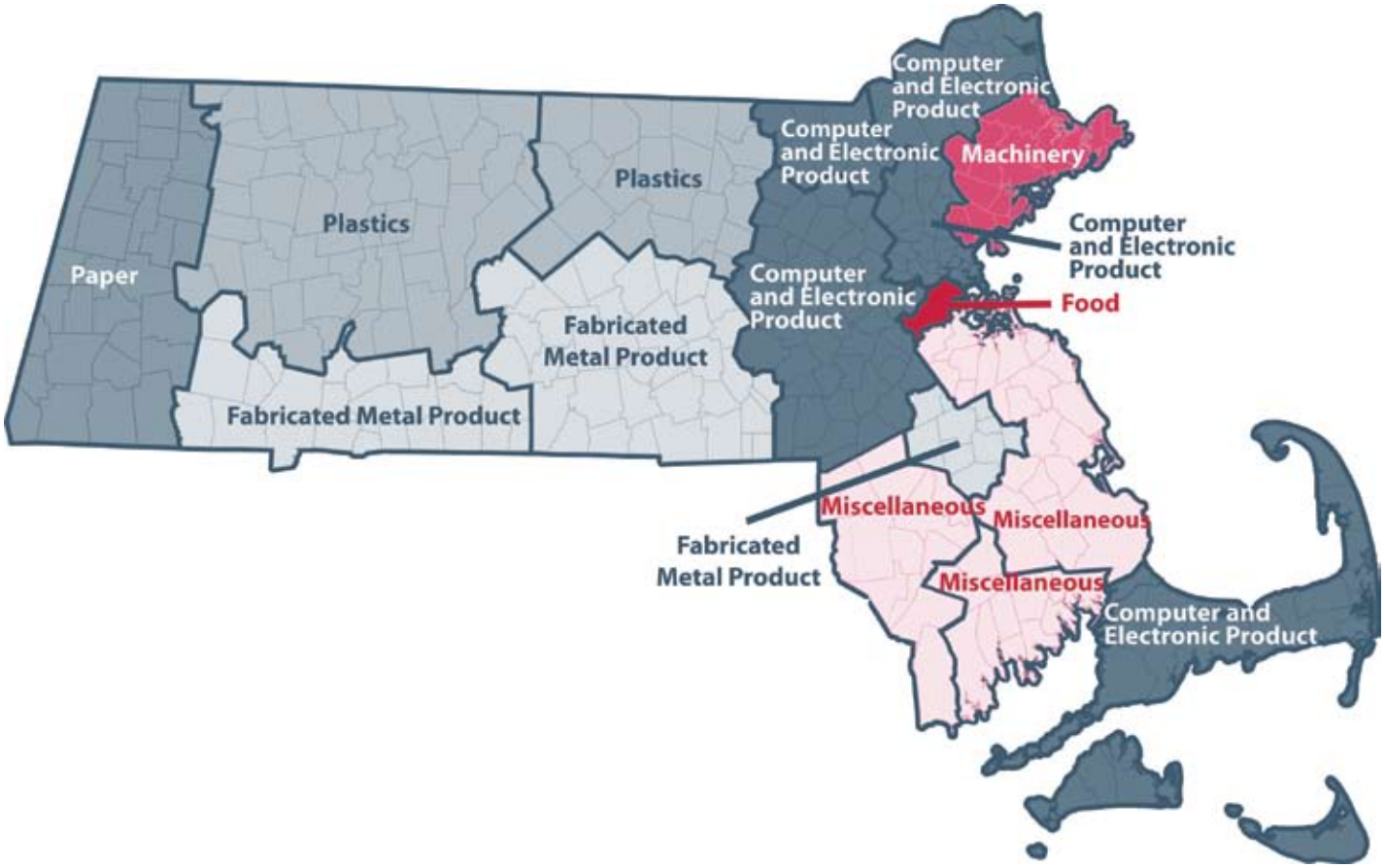
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages, 2001 and 2006
Note: Please see Appendix for a list of cities and towns in each workforce region.

Section 2: Current Status of the Massachusetts Manufacturing Sector

Concentration of Manufacturing Sub-Sectors by Massachusetts Workforce Region, 2006

Adjacent regions of the state, or those that share geographical features such as forests or seacoasts, often manufacture similar types of goods. For example, the computer and electronic product sub-sector is the largest sub-sector in four regions located in the north-eastern part of the state. Companies within this industry group produce items such as radar systems and laboratory instruments.

The largest industry group in three regions located in the southeast part of the state is the miscellaneous manufacturing sub-sector, which includes the manufacture of medical and surgical supplies; jewelry and silverware; and toys and sporting goods. Plastics is the largest sub-sector in the two north central workforce regions while fabricated metal product is the largest sub-sector in the two south central workforce regions.



Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages, 2006

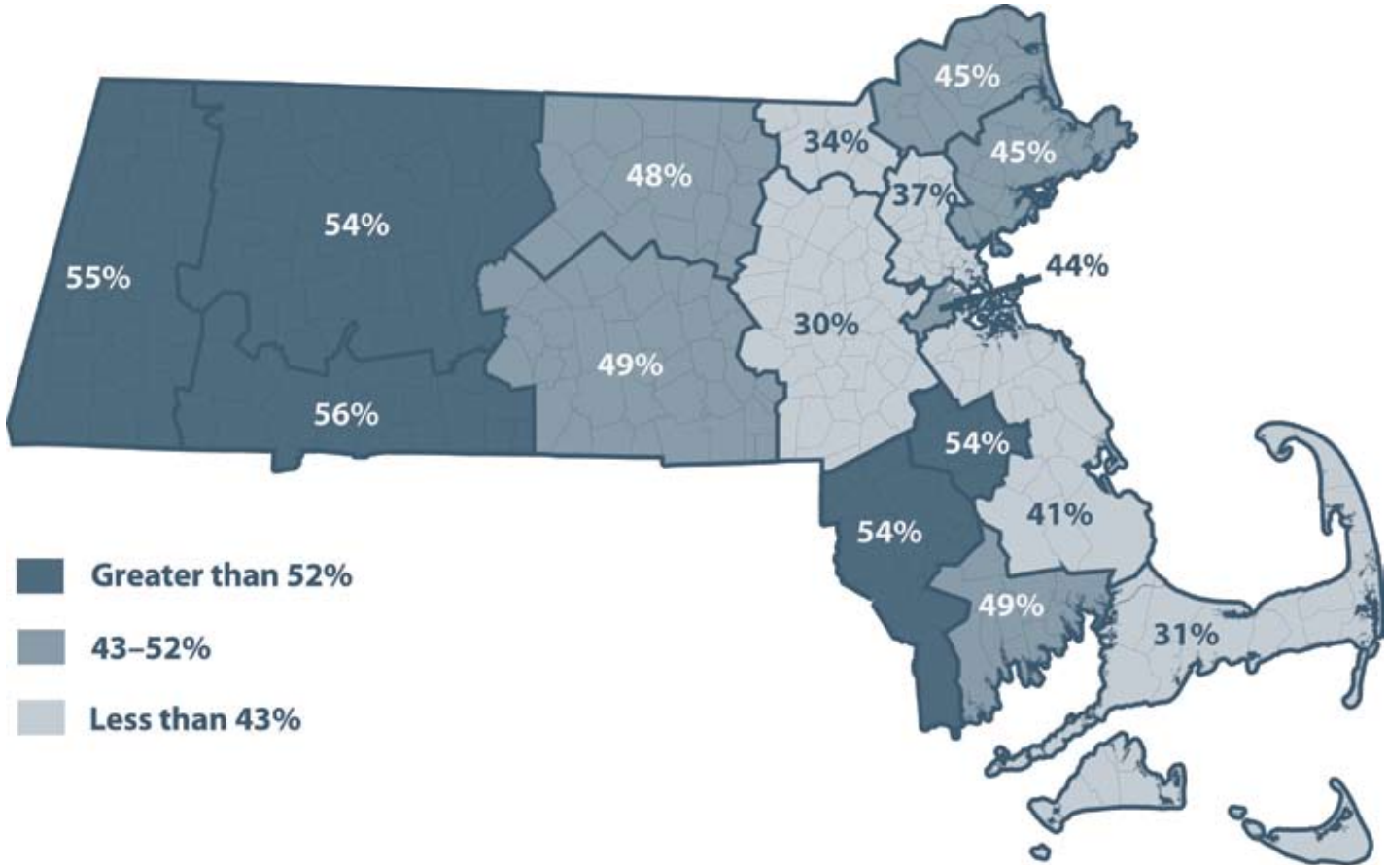
Section 2: Current Status of the Massachusetts Manufacturing Sector

Share of Production Workers by Workforce Regions, 2005

Production workers include occupations responsible for the manufacture of goods. The map below shows the percentage of production workers in the manufacturing sector by workforce regions. It is labeled using the share of production workers in Massachusetts (43%) and the United States (52%) as guides.

The share of manufacturing workers who are production workers varies from a low of 30% in Metro South/West to a high of 56% in Hampden. The share of production workers depends upon the type of manufacturing and the relative importance of production compared to other functions such as research and development, sales, etc.

Metro South/West is dominated by computer and electronic products, which typically has a lower share of production workers.



Source: Massachusetts Department of Workforce Development, Division of Career Services, Occupational Employment and Wage Industry Staffing Patterns, May 2005
Note: Please see Appendix for a list of cities and towns in each workforce region.

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

Vacancies in the Massachusetts Manufacturing Sector by Occupation, 2nd Quarter 2007

Of the 5,005 vacancies reported during the second quarter of 2007 in the manufacturing sector in Massachusetts, more than one fifth (22%) are for production occupations. Another half (55%) are for management and professional occupations. Professional occupations include architecture and engineering; computer and mathematical; and life, physical and social science occupations. Architecture and engineering occupations account for 20% of all vacancies in the manufacturing sector. About one third (35%) of all architecture and engineering vacancies are in the manufacturing sector.

Occupational Categories	# of Vacancies in the Manufacturing Sector	% of Vacancies in the Manufacturing Sector
Manufacturing Sector	5,005	100%
Production	1,124	22%
Architecture and Engineering	989	20%
Management	639	13%
Computer and Mathematical	531	11%
Business and Financial	379	8%
Office and Administrative Support	366	7%
Life, Physical, and Social Science	195	4%
Other	739	15%

Source: Massachusetts Department of Workforce Development, Division of Career Services, Job Vacancy Survey, 2nd Quarter, 2007

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

Massachusetts Manufacturing Industry Groups with Employment Growth, 2004–2006

The 21 sub-sectors are divided into 86 industry groups. From 2004 to 2006, 18 manufacturing industry groups with at least 1,000 employees in 2006 in Massachusetts added jobs.

Office furniture had the fastest rate of growth at 32%. Other industry groups with a high rate of growth are fruit and vegetable preserving and specialty food (29%) and audio and video equipment (26%).

Pharmaceutical and medicine added the most jobs (1,129). Other industry groups adding a large number of jobs were audio and video equipment (789), other electrical equipment and component (525) and aerospace product and parts (477).

Industry Group	2006 Employment	2004–2006	
		Employment Change	Percent Change
Office Furniture (including Fixtures)	1,953	468	32%
Fruit and Vegetable Preserving and Specialty Food	2,126	475	29%
Audio and Video Equipment	3,816	789	26%
Footwear	1,553	239	18%
Pharmaceutical and Medicine	8,106	1,129	16%
Other Food	2,523	338	16%
Other Electrical Equipment and Component	4,021	525	15%
Cement and Concrete	2,367	308	15%
Electric Lighting Equipment	2,524	309	14%
Resin, Synthetic Rubber, Artificial Synthetic Fibers, Filaments	2,269	184	9%
Glass and Glass Product	1,441	77	6%
Aerospace Product and Parts	11,730	477	4%
Dairy	2,903	111	4%
Engine, Turbine, and Power Transmission Equipment	1,379	40	3%
Coating, Engraving, Heat Treating, and Allied Activities	4,201	69	2%
Machine Shops; Turned Product; and Screw, Nut, and Bolt	10,528	81	1%
Textile Furnishings Mills	1,397	8	1%
Petroleum and Coal	1,246	7	1%

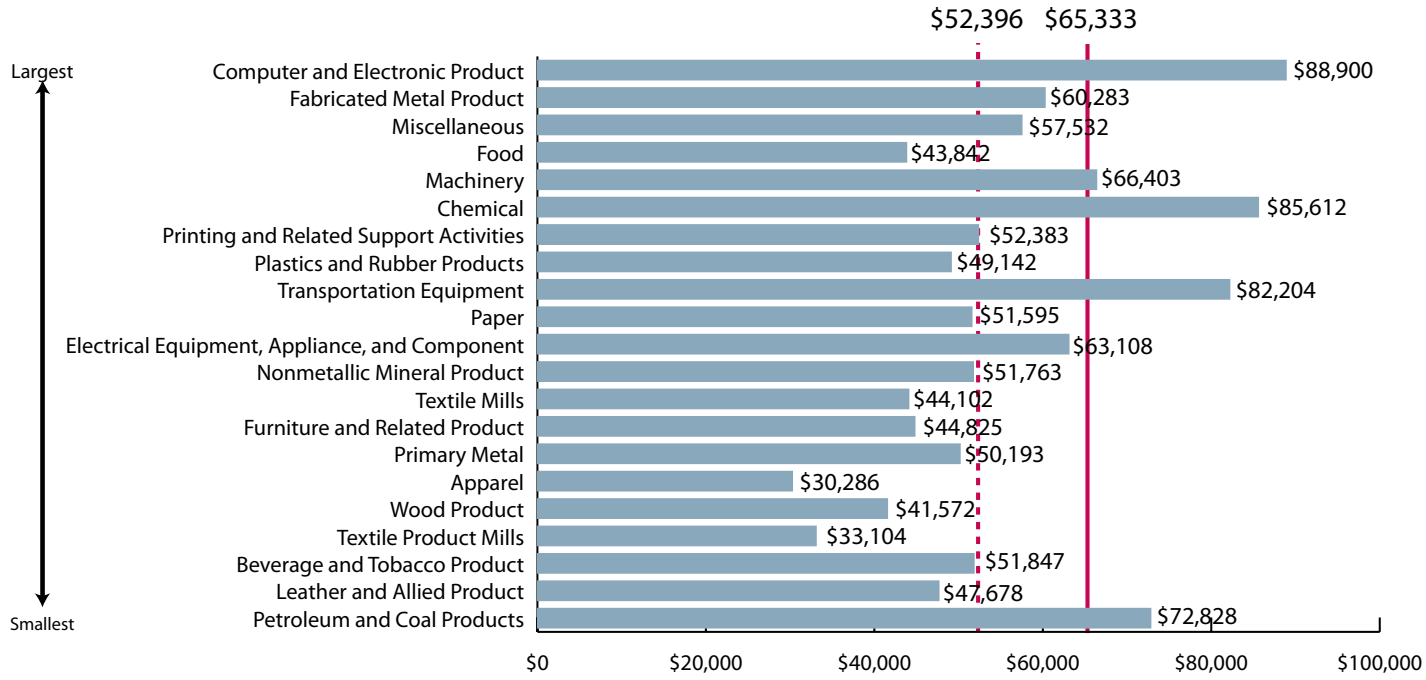
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2004 and 2006

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

Massachusetts Manufacturing Sub-Sector Average Total Annual Wages, 2006

In 2006, eight of the 21 manufacturing sub-sectors paid more than the state average total annual wages of $52,396. Four of the top five sub-sectors by employment, computer and electronic product, fabricated metal, miscellaneous, and machinery, pay above this average.

Five sub-sectors, computer and electronic product, chemical (including pharmaceutical and medicine), transportation equipment, petroleum and coal, and machinery, have average annual wages above the statewide manufacturing average of $65,333. The highest paying sub-sector, computer and electronic product, with average annual wages of $88,900, is also the largest Massachusetts manufacturing sub-sector by employment.



Red dotted line indicates the Massachusetts average total annual wages in 2006 for all sectors.
Red solid line indicates the Massachusetts manufacturing average total annual wages in 2006.

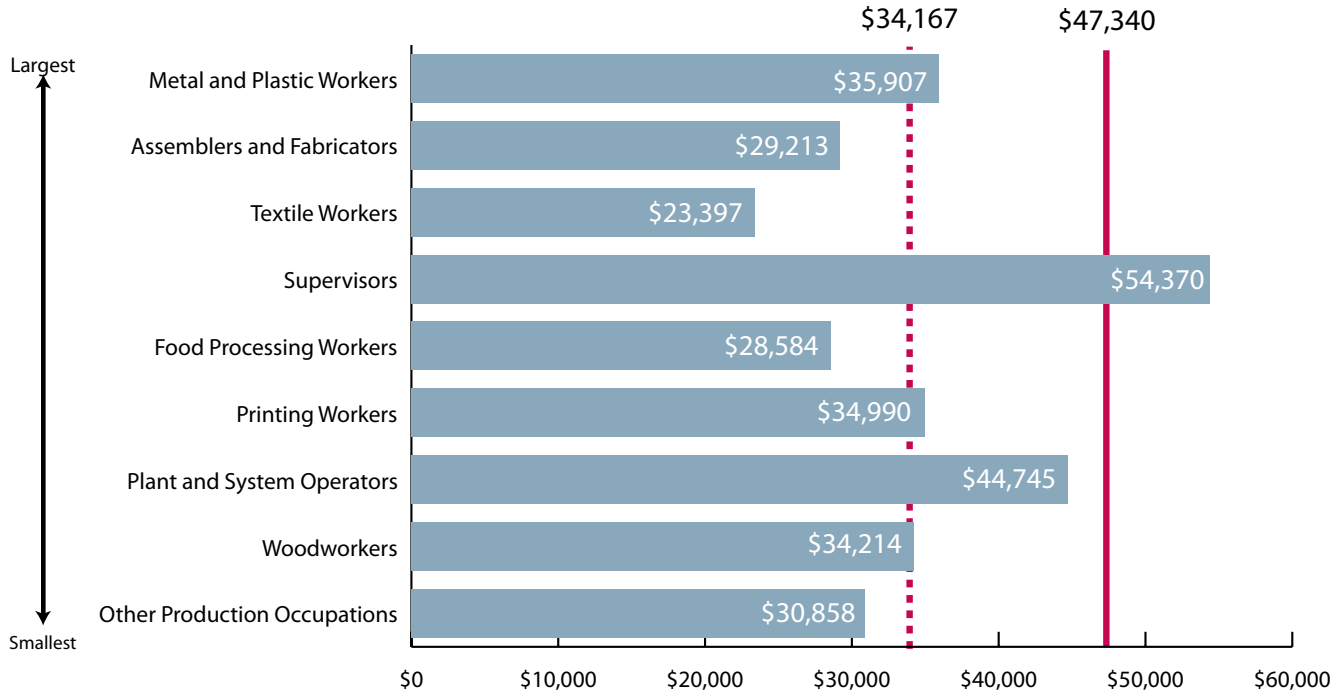
Source: United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2006

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

Average Total Annual Wages for Production Occupations in Massachusetts, 2006

Total wages for production occupations were lower than the state average in 2006. Most production workers earned between 49% (textile workers) and 95% (plant and system operators) of the state average of $47,340. Only supervisors of production workers had total wages exceeding the state average.

More than two-thirds (69%) of production workers have as their highest educational credential a high school diploma or less. Not surprisingly, the state average total annual wages for workers with a high school diploma or less is close to the average pay for production workers.



Red dotted line indicates the total annual average wages for all Massachusetts occupations with a high school diploma or less.
Red solid line indicates the total annual average wages for all Massachusetts occupations.

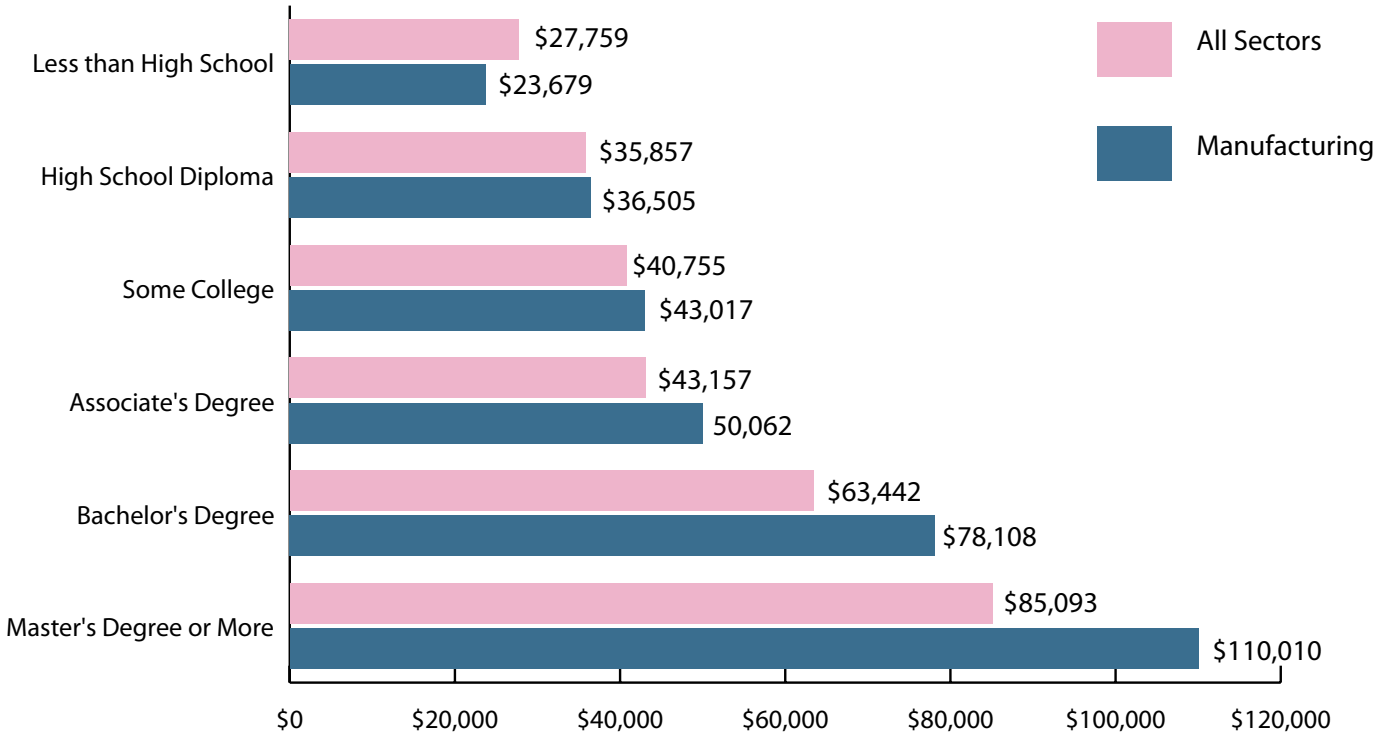
Source: United States Bureau of Labor Statistics, Occupational Employment Statistics, 2006
Red dotted line: 2006 American Community Survey PUMS data

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

Average Total Annual Wages by Educational Attainment in Massachusetts, 2006

Manufacturing workers tend to earn more than workers in all sectors for the same level of education. The higher the level of educational attainment, the greater the advantage for manufacturing workers.

The only exception is for the least educated; the average wages for manufacturing workers who have not completed high school are less than the average wages for all workers who have not completed high school.



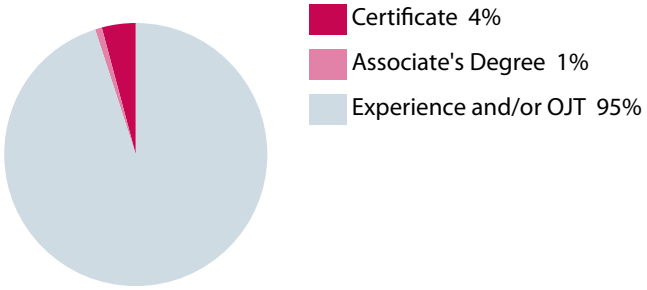
Source: 2006 American Community Survey PUMS data
Note: Populations aged 25 or older

Section 3: Employment and Advancement Opportunities in the Massachusetts Manufacturing Sector

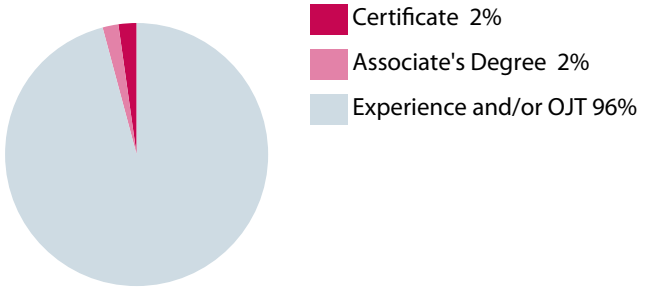
Educational Requirements for Production and Administrative Occupations Nationwide, 2006

The four largest occupational categories in manufacturing are production, administration, management and engineering. The barrier to entry for production and administrative occupations is relatively low. Fully 95% of production occupations and 96% of administrative occupations nationwide do not require any educational credential for hire, but rather related experience and/or on-the-job training (OJT).

Educational Requirement for Production Occupations



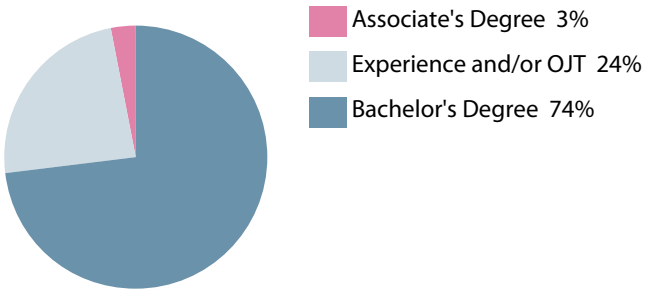
Educational Requirement for Administrative Occupations



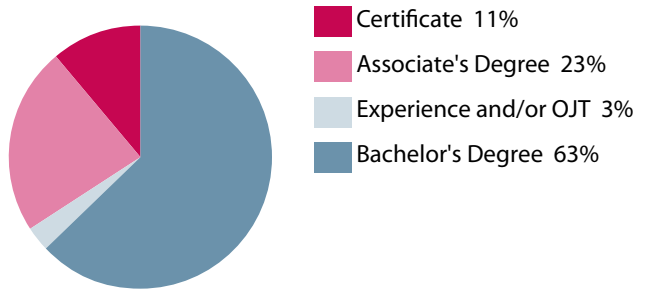
Educational Requirements for Engineering and Management Occupations Nationwide, 2006

The majority of engineering and management occupations in the United States require that the job applicant has attained a bachelor's degree. A small proportion (3%) of engineering occupations require only related experience and/or on-the-job training (OJT). This proportion is higher among management occupations where 24% demand only related experience and/or OJT.

Educational Requirement for Management Occupations



Educational Requirement for Engineering Occupations



Source: United States Bureau of Labor Statistics, Occupational Statistics and Employment Projections, 2006

Notes on Sources and Method

The manufacturing chartbook uses data from multiple sources to provide a comprehensive picture of the manufacturing sector in Massachusetts. Following are all of the data sources used, in order of their appearance in the chartbook, with pertinent information about the organizations gathering the data, variable definitions, data collection techniques, limitations of the data, etc., regarding each source.

1. **Massachusetts Employment by Sector, 2006**
   Page: 7
   Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2006
   Type of Data: employment and wages
   Date Data Downloaded: 2000 through 2004 records were downloaded on March 3, 2006; 2005 and 2006 records were downloaded on November 2, 2007.
   Website: http://www.bls.gov/cew
   Definitions and Considerations Specific to This Dataset:

   Industry employment and total wages data is derived from the QCEW, which is "a virtual census of employment in the United States, covering 99.7% of wage and salary civilian employment...[it] is an employer-reported measure and therefore associated with filled jobs, whether full- or part-time, and place of work. If a person holds two jobs, the person would be counted twice in QCEW data. The QCEW program, by definition, measures employment covered by Unemployment Insurance laws."

   BLS QCEW data is available in a series from 1990 onward and uses the North American Industry Classification System (NAICS). BLS QCEW data provides detailed, 6-digit NAICS industry code-level data. There may be differences between industry employment (ES-202) numbers from the BLS and those available from Massachusetts Department of Workforce Development (DWD). When there are differences, they are quite small, less than 0.1%. (See note 2 for discussion of DWD QCEW data.) A complete listing of NAICS is available at http://www.bls.gov/bls.naics.htm.

   Total Annual Wages
   QCEW wages are defined as "[including] bonuses, stock options, profit distributions, the cash value of meals and lodging, tips and other gratuities, and, in some states, employer contributions to certain deferred compensation plans such as 401(k) plans." Similarly, OES wages are defined as, "straight-time, gross pay, exclusive of premium pay."

   This chartbook references total annual average wages many times throughout the document. However, depending on the source, different figures are stated for the same information. For example, depending on whether the information detailed is referring to industries or occupations, the total annual average wage for Massachusetts is either $52,396 or $47,340. The reason for the discrepancy has to do with the source of this information. QCEW data is a virtual census of employment and wages by industry while Occupation Employment Statistics (OES) data is a survey of employment and wages by occupation. (Note: the details of OES are described in more detail later in note 16.) The DWD produces a dataset called Occupational Employment and Wage Industry Staffing Patterns (see note 9) which uses OES data to calculate the median wages of occupations within particular industries.

   However, the difference is not so much in the definition of wages as it is in what method is used to derive the data. In this document those surveys are described briefly in their respective sections, but the main difference has to do with the number of businesses included in the survey; QCEW covers 99.7% of all businesses while OES covers 70%.

When average total annual wages refers to data from the American Community Survey (ACS) as it does on pg. 40 and pg. 41, income is the amount reported for wage or salary income (variable: WAGEP) from a Massachusetts resident's primary job. It does not include other types of income such as self-employment, Social Security, public assistance, etc. ACS data comes from a 1% sample of Massachusetts's residents. This distinguishes it from both the OES and QCEW, which include information from individuals employed in Massachusetts, but who may not necessarily live here. (Note: ACS is described in more detail in Note 12.)

For more information about this data source, see website: http://www.bls.gov/cew/cewfaq.htm

2. **Manufacturing Employment in Massachusetts Workforce Regions, 2006**
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages (QCEW), 2006
Page: 8
Type of Data: sector employment
Date Data Downloaded: November 2, 2007
Website: http://lmi2.detma.org/Lmi/lmi_es_a.asp
Definitions and Considerations Specific to This Dataset:

The Massachusetts Department of Workforce Development (DWD) provides state-level employment and wage data based upon industry and wage data (ES-202) on flat files obtained from the United States Bureau of Labor Statistics (BLS). DWD employment and wage data is available from 2001 on and offers industry-specific data down to the 4-digit North American Industry Classification System (NAICS) level.

Where possible, data from BLS data was used as it provides a series from 1990 onward using North American Industry Classification System (NAICS). BLS data also provides detailed, 6-digit NAICS industry code-level data. There may be differences between industry employment (ES-202) numbers from the BLS and those available from Massachusetts DWD. When there are differences, they are quite small, less than 0.1%.

Industry employment and total wages data is derived from the QCEW, which is "a virtual census of employment in the United States, covering 99.7% of wage and salary civilian employment…[it] is an employer-reported measure and therefore associated with filled jobs, whether full- or part-time, and place of work. If a person holds two jobs, the person would be counted twice in QCEW data. The QCEW program, by definition, measures employment covered by Unemployment Insurance laws."

BLS determines data definitions and methods, but DWD collects and reports state and regional data, which are then sent to BLS and aggregated for the whole country.

3. **Massachusetts Average Total Annual Wages, 2006**
Page: 9
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2006
(See note 1.)

4. **Change in Massachusetts Manufacturing Sub-Sector Average Total Annual Wages, 2001–2006**
Page: 10
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2001–2006
(See note 1.)

5. **Vacancies in the Massachusetts Manufacturing Sector, 2nd Quarter 2007**
Page: 11
Source: Massachusetts Department of Workforce Development, Job Vacancy Survey (JVS), 2nd Quarter 2007
Type of Data: job vacancy data
Date Data Downloaded: data provided to Commonwealth Corporation on an ongoing basis since 2004
Website: http://www.lmi2.detma.org/Lmi/LMIjobvacancy.asp
Definitions and Considerations Specific to This Dataset:

The JVS is an ongoing semi-annual survey that provides information about the number and types of positions open for immediate hire. The survey collects data about education and training requirements and the average pay and benefits offered. Six thousand, one hundred (6,100) employers across the state were surveyed with a response rate of 76%. A job vacancy is a position listed by an employer for immediate hire.

6. **Manufacturing and Massachusetts Gross Domestic Product (in Billions of Dollars), 1997–2006**
Page: 12
Source: United States Bureau of Economic Analysis (BEA), Gross Domestic Product by State, 2006
Type of Data: Gross Domestic Product (GDP) by state
Date Data Downloaded: January 30, 2008
Website: http://www.bea.gov/regional/gsp/
Definitions and Considerations Specific to This Dataset:

According to the BEA, "GDP by state is the state counterpart of the nation's gross domestic product (GDP), the Bureau's featured and most comprehensive measure of U.S. economic activity. GDP by state is derived as the sum of the GDP originating in all the industries in the state."

The BEA further explains, "An industry's GDP by state, or its value added, in practice, is calculated as the sum of incomes earned by labor and capital and the costs incurred in the production of goods and services. That is, it includes the wages and salaries that workers earn, the income earned by individual or joint entrepreneurs as well as by corporations, and business taxes such as sales, property, and federal excise taxes—that count as a business expense... GDP is calculated as the sum of what consumers, businesses, and government spend on final goods and services, plus investment and net foreign trade."

For more information about this data source, see website: http://www.bea.gov/regional/gsp/help/

7. **Massachusetts Total Annual Exports (in Billions of Dollars), 1996–2006**
Page: 13
Source: Harmonized Tariff Schedule of the United States, acquired from the World Institute of Strategic Economic Research (WISER), 1996–2006
Type of Data: state export data
Date Data Downloaded: WISER export data was provided to Jonathan Latner by Oner Tulum on June 6, 2007, in an email courtesy of William Lazonick, Department of Regional Economic and Social Development at University of Massachusetts, Lowell. This data was originally used for a report published by William Lazonick, Edward March, and Oner Tulum entitled, "Boston's Biotech Boom: A 'New Massachusetts Miracle'?" in May, 2007.
Website: https://www.wisertrade.org/naics/ftbegin
Definitions and Considerations Specific to This Dataset:

Massachusetts exports represent the value of worldwide exports of shipments where Massachusetts is the "origin of movement (OM)." According to WISER, "This is the only state export data currently being released by Census. State export data comes from export documentation filed by the exporter with U.S. Customs. According to WISER, the State of Origin of Movement is defined as:

1. The state where the product began its journey to the point of export, or
2. The state of consolidation of shipments, or
3. The state of greatest value in the case of consolidation, or
4. The state of a foreign trade zone.

For more information about this data source, see website: http://www.wisertrade.org/home/index.jsp?content=/data/dataseries.jsp#stexp

8. **Massachusetts Manufacturing Sub-Sector Employment, 2006**
Page: 14
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2006
(See note 1.)

9. **Massachusetts' Top Export Categories, 2006**
Page: 15
Source: Harmonized Tariff Schedule of the United States, acquired from the World Institute of Strategic Economic Research (WISER), 1996–2006
(See note 7.)

10. **Occupational Distribution of Massachusetts Manufacturing Sub-Sectors, 2005**
Page: 17
Source: Massachusetts Department of Workforce Development (DWD), Occupational Employment and Wage Industry Staffing Patterns, May 2005
Type of Data: occupational employment by sector, wages by occupation
Date Data Downloaded: provided to Commonwealth Corporation March, 2007 by the Division of Unemployment Assistance, DWD
Website: http://lmi2.detma.org/Lmi/FPlmiforms1.asp
Definitions and Considerations Specific to This Dataset:

This dataset describes the industry staffing patterns and the occupational employment distribution by industry as well as the respective median and average annual wages for stated occupations for Massachusetts and each of its 16 workforce investment areas. BLS determines data definitions and methods, but DWD collects and reports state and regional data, which is then sent to BLS and aggregated for the whole country.

According to the Bureau of Labor Statistics (BLS):

- "Cross-industry estimates are calculated with data collected from establishments in all the industries in which a particular occupation is reported. (Not every occupation is surveyed in every industry.) For example, the cross-industry occupational employment estimate for mechanical engineers is the sum of all the industry-specific estimates for mechanical engineers. Likewise, cross-industry occupational wage estimates for mechanical engineers are calculated from data collected from establishments in all the industries where mechanical engineers are reported.

- Industry-specific estimates are calculated with data collected from establishments in a particular industry. Industry-specific occupational employment
  estimates estimate the number of people employed in that occupation in a particular industry. Similarly, the industry-specific occupational wage estimates are calculated with data from establishments in one particular industry."

There are 824 occupations placed into 22 major occupational categories details of which are available at http://www.bls.gov/soc/homt.htm. These categories may then be placed into 6 super occupational categories: Management, Professional, Sales, Service (with Farming, Fishing, and Forestry), Blue Collar, and
Administration.

Occupational Category		Occupational Category	
Super	**Major**	**Super**	**Major**
Management	Management	Service	Healthcare Support
Professional	Business and Financial Operations	Service	Protective Service
Professional	Computer and Mathematical	Service	Food Preparation and Serving Related
Professional	Architecture and Engineering	Service	Building and Grounds Cleaning and Maintenance
Professional	Life, Physical, and Social Science	Service	Personal Care and Service
Professional	Community and Social Services	Service	Farming, Fishing, and Forestry
Professional	Legal	Blue Collar	Construction and Extraction
Professional	Education, Training, and Library	Blue Collar	Installation, Maintenance, and Repair
Professional	Arts, Design, Entertainment, Sports, and Media	Blue Collar	Production
Professional	Healthcare Practitioner and Technical	Blue Collar	Transportation and Material Moving
Sales	Sales and Related	Administration	Office and Administrative Support

11. Share of Total Employment in Manufacturing in Massachusetts and United States, 1990–2006
Page: 18
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 1990, 1995, 2000, and 2006 (See note 1.)

12. Change in Educational Attainment of Manufacturing Workers in Massachusetts, 2000–2006
Page: 19
Source: United States Bureau of Census, Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey (ACS) PUMS Data
Type of Data: educational attainment by occupation and industry, age by industry, wages by educational attainment
Date Data Downloaded: January 26, 2004 (Census 2000 Public Use Micro Statistics (PUMS) file); September 18, 2007 (2006 ACS PUMS file)
Website: http://factfinder.census.gov/home/saff/main.html?_lang=en
Definitions and Considerations Specific to This Dataset:

The Census 2000 PUMS file is a 5% sample size of the 2000 Census or 318,565 individual cases, while the 2006 ACS PUMS file represents about a 1% sample size or 64,673 individual cases.

Relevant cases included for analysis were individuals coded as "Civilian Employed," using the variable, "Employment Status Recode." This includes individuals "employed at work" or "employed, with a job, but not at work," but does not include individuals who are unemployed, but looking for work; these individuals are normally considered as part of the labor force.

According to the Bureau of Census, jobs of employed people are recorded as the person's "job during the previous week." For those who worked two or more jobs, the data refer to "the job where the person worked the greatest number of hours."

Charts detailing educational attainment only include employed individuals in the stated occupation or industry over the age of 25. This age cutoff is commonly used because, by the age of 25, most individuals have completed what education they will receive over their lifetime.

According to the Bureau of Census, using the 2006 ACS and the Census 2000 to compare the educational status of populations in 2000 and 2006 is appropriate, but they caution against comparing industry and occupational categories along with age categories from the two surveys due to coding changes, as follows: "The 2006 ACS codes are based on the 2002 North American Industry Classification System (NAICS) and are 4-digit codes, whereas Census 2000 codes are based on the 1997 NAICS and were 3-digit codes. Codes and descriptions, particularly within the Electronic Shopping, Internet Services, and Wholesale categories, changed."

For more information about how both of these data sources may be compared, see website: http://www.census.gov/acs/www/UseData/compACS.htm

13. Occupational Distribution of the Massachusetts Manufacturing Sector, 2005
Page: 20
Source: Massachusetts Department of Workforce Development (DWD), Occupational Employment and Wage Industry Staffing Patterns, May 2005
(See note 9.)

14a. Occupational Distribution of Manufacturing in Massachusetts and Nationwide, 2005
Page: 21
Source 1 (MA): Massachusetts Department of Workforce Development (DWD), Occupational Employment and Wage Industry Staffing Patterns, May 2005
(For Massachusetts source, see note 9.)

14b. Occupational Distribution of Manufacturing in Massachusetts and Nationwide, 2005
Page: 21
Source 2 (U.S.): United States Bureau of Labor Statistics, National Industry Specific Occupational Employment and Wage Estimates, May 2005
Type of Data: occupational employment by sector, wages by occupation
Date Data Downloaded: 2007
Website: http://www.bls.gov/oes/oes_dl.htm
Definitions and Considerations Specific to This Dataset:

The information detailed in this dataset is the same as described on note 9, but for the United States, not Massachusetts

15a. Occupational Distribution of Manufacturing Sub-Sectors in Massachusetts and the United States, 2005
Page: 22
Source 1 (MA): Massachusetts Department of Workforce Development (DWD), Occupational Employment and Wage Industry Staffing Patterns, May 2005
(For Massachusetts source, see note 9.)

15b. Occupational Distribution of Manufacturing Sub-Sectors in Massachusetts and the United States, 2005
Page: 22
Source 2 (U.S.): United States Bureau of Labor Statistics, National Industry Specific Occupational Employment and Wage Estimates, May 2005
(See note 14b.)

16. Change in Massachusetts Employment by Occupation, 2001–2006
Page: 23
Source: United States Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES), 2001 and 2006
Type of Data: occupational employment and wages
Date Data Downloaded: May 21, 2007 (2006 records); December 8, 2004 (2001 records)
Website: http://www.bls.gov/oes
Definitions and Considerations Specific to This Dataset:

According to the BLS, "the OES program produces estimates of the number of people employed and estimates of the wages paid to them for 824 occupations placed in 22 major occupational categories.

The BLS reports that "The May 2006 employment and wage estimates were calculated using data collected in the May 2006, November 2005, May 2005, November 2004, May 2004, and November 2003 semi-annual panels. The November 2005, May 2005, November 2004, May 2004, and November 2003 wage data have been adjusted to the May 2006 reference period using the over-the-year wage change in the most applicable Employment Cost Index series."

According to the BLS, "Significant reductions in sampling error can be achieved by taking advantage of a full three years of data, covering 1.2 million establishments and over 70 percent of the employment in the United States. This feature is particularly important in improving the reliability of estimates for detailed occupations in small geographical areas. Combining multiple years of data is also necessary to obtain full coverage of establishments with 250 or more workers. In order to reduce respondent burden, the OES survey samples them only once every three years. While there are significant advantages, there are also limitations associated with this estimation procedure in that it requires "updating" for the earlier years of data."

For more information about this data source, see website: http://www.bls.gov/oes/current/oes_tec.htm

17. Employment of Production Occupations in Massachusetts, 2006
Page: 24
Source: United States Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES), 2006
(See note 16.)

18. Change in Educational Attainment of Workers in Production Occupations in Massachusetts, 2000–2006
Page: 25
Source: United States Bureau of Census, Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey (ACS) PUMS Data
(See note 12.)

19a. Massachusetts Employment Trends in Manufacturing, 1990–2007
Page: 26
Source 1: United States Bureau of Labor Statistics (BLS), Current Employment Statistics (CES), Seasonally Adjusted, 1990–2007
Type of Data: monthly industry employment data
Date Data Downloaded: February 26, 2008

Website: http://www.bls.gov/sae/home.htm
Definitions and Considerations Specific to This Dataset:

According to the BLS, "employment is the total number of persons on establishment payrolls employed full- or part-time who received pay for any part of the pay period that includes the 12th day of the month. Temporary and intermittent employees are included, as are any workers who are on paid sick leave, on paid holiday, or who work during only part of the specified pay period. Data exclude proprietors, self-employed, unpaid family or volunteer workers, farm workers, and domestic workers. Persons on layoff the entire pay period, on leave without pay, on strike for the entire period or who have not yet reported for work are not counted as employed. Government employment covers only civilian workers."

The BLS defines a sample establishment as follows: "A sample establishment in the CES survey is an economic unit, such as a factory, which produces goods or services. It is generally at a single location and engaged predominantly in one type of economic activity. Establishments reporting on the schedule (form BLS 790) are classified into industries based on their principal product or activity determined from information on annual sales volume. This industry classification, based on the 2002 North American Industry Classification System (NAICS) Manual, is collected on a supplement to the quarterly unemployment insurance tax reports filed by each employer. For an establishment making more than one product, the entire employment is included under the industry of the principal product or activity."

For more information about this data source, see website: http://www.bls.gov/sae/790faq2.htm

19b. Massachusetts Employment Trends in Manufacturing, 1990–2007
Page: 26
Source 2: Clayton-Matthews, Alan. FY 2006 Consensus Revenue Estimate Hearing. December 6, 2004. Massachusetts Executive Office for Administration and Finance.
Type of Data: dates of recessions
Date Data Downloaded: N/A
Website: http://www.mass.gov/Eeoaf/docs/rev_hearing_acm_dec_04.doc
Definitions and Considerations Specific to This Dataset:

In the chart titled "Massachusetts Employment Trends in Manufacturing, 1990–2007," there is a reference to two recessions in the state since 1987. Clayton-Matthews states in the above cited paper, "the recession in Massachusetts began in December 2000 and ended in March 2003, lasting 27 months. This was much longer than the national recession from March through November 2003, which lasted only 8 months, and almost as long as the prior recession in Massachusetts that lasted 30 months, from December 1988 to June 1991." Clayton-Matthews notes that, "these recessions are dated, for Massachusetts, by the Massachusetts Current Economic Index, and for the U.S., by the National Bureau of Economic Research's Business Cycle Dating Committee."

20. Change in Massachusetts Employment by Sector, 2000–2004
Page: 27
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2000–2004
(See note 1.)

21a. Change in Massachusetts Employment by Sector, 2004–2006
Page: 28
Source 1: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2004 and 2006
(See note 1.)

21b. Change in Massachusetts Employment by Sector, 2004–2006
Page: 28
Source 2: New England Economic Partnership (NEEP). Fall 2007 Economic Outlook Report. October 18, 2007.
Type of Data: employment projections
Date Data Downloaded: October 30, 2007
Website: http://www.neepecon.org/
Definitions and Considerations Specific to This Dataset:

In the chart titled "Change in Massachusetts Employment by Sector, 2004–2006," there is a reference to the New England Economic Partnership's (NEEP) projection of manufacturing employment in Massachusetts through 2011. NEEP, according to their website, "publish[es] macroeconomic forecasts [for] the New England region and its six individual states. In addition to providing historical data, these projections forecast quarterly data over a five-year horizon and include information on employment, income, labor force, net interstate migration, as well as population estimates. Prepared by resident economic experts, NEEP's forecasts are based on econometric models prepared by Moody's Economy.com, a leader in analyzing the U.S. economy, financial markets, and regions. NEEP provides a detailed report with each of its state projections."

22. Change in Massachusetts Employment by Manufacturing Sub-Sector, 2000–2004
Page: 29
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2000–2004
(See note 1.)

23. Change in Massachusetts Manufacturing Employment by Sub-Sector, 2004–2006
Page: 30
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2004 and 2006
(See note 1.)

24. Age Profile of the Massachusetts Manufacturing Workforce, 2000–2006
Page: 31
Source: United States Bureau of Census, Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey (ACS) PUMS Data
(See note 12.)

25. Employment in Manufacturing by Massachusetts Workforce Region, 2006
Page: 32
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages (QCEW), 2006
(See note 2.)

26. Change in Manufacturing Employment by Massachusetts Workforce Region, 2001–2006
Page: 33
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages (QCEW), 2001–2006
(See note 2.)

27. Percent Change in Manufacturing Employment by Massachusetts Workforce Region, 2001–2006
Page: 34
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages (QCEW), 2001–2006
(See note 2.)

28 Concentration of Manufacturing Sub-Sectors by Massachusetts Workforce Region, 2006
Page: 35
Source: Massachusetts Department of Workforce Development, Quarterly Census of Employment and Wages (QCEW), 2006
(See note 2.)

29. Share of Production Workers by Workforce Region, 2005
Page: 36
Source: Massachusetts Department of Workforce Development (DWD), Occupational Employment and Wage Industry Staffing Patterns, May 2005
(See note 9.)

30. Vacancies in the Massachusetts Manufacturing Sector by Occupation, 2nd Quarter 2007
Page: 37
Source: Massachusetts Department of Workforce Development, Job Vacancy Survey (JVS), 2nd Quarter 2007
(See note 5.)

31. Massachusetts Manufacturing Industry Groups with Employment Growth, 2004–2006
Page: 38
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2004 and 2006
(See note 1.)

32. Massachusetts Manufacturing Sub-Sector Average Total Annual Wages, 2006
Page: 39
Source: United States Bureau of Labor Statistics (BLS), Quarterly Census of Employment and Wages (QCEW) or ES-202, 2006
(See note 1.)

33a. Average Total Annual Wages for Production Occupations in Massachusetts, 2006
Page: 40
Source 1: United States Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES), 2001 and 2006
(See note 16.)

33b. Average Total Annual Wages for Production Occupations in Massachusetts, 2006
Page: 40
Source 2: United States Bureau of Census, Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey (ACS) PUMS Data
(See note 12.)

34. Average Total Annual Wages by Educational Attainment in Massachusetts, 2006
Page: 41
Source: United States Bureau of Census, Census 2000 PUMS Data, 5% Sample and 2006 American Community Survey (ACS) PUMS Data
(See note 12.)

35. Educational Requirements for Production and Administrative Occupations Nationwide, 2006
Page: 42
Source: United States Bureau of Labor Statistics (BLS), Occupational Statistics and Employment Projections, 2006
Type of Data: educational requirements of occupations by industry
Date Data Downloaded: February 26, 2008
Website: http://www.bls.gov/emp/empeted1.htm
Definitions and Considerations Specific to This Dataset:

This dataset provides information about the education and/or training necessary to fill a particular occupation. Information is based on national data and a Massachusetts' employer might require more or less education. For example, hospitals in Boston typically require a registered nurse to have at least a bachelor's degree, while hospitals in the less populated, Western part of the state might require a registered nurse to have at least an associate's degree.

According to the BLS, "occupations are classified into one of eleven educational categories on analysis of the occupation's most significant source of postsecondary-education or training according to these principles:

- An occupation is placed into the category that best describes the postsecondary-education or training needed by most workers to become fully qualified.
- Postsecondary awards, if generally needed for entry into the occupation, take precedence over work-related training even though additional skills or experience may be needed for a worker to become fully qualified.
- The length of time an average worker generally needs to become fully qualified through a combination of on-the-job training and experience is used to categorize occupations in which a postsecondary award generally is not needed for entry."

Educational Requirement Key	
Bachelors:	Bachelors Degree
Bachelors+:	Bachelors Degree Plus Experience
Associates:	Associates Degree
Certificate:	Postsecondary Vocational Award
Experience:	Work Experience in a Related Occupation
Masters:	Masters Degree
Ph.D.:	Doctorate
First Professional Degree:	Two year degree, the minimum required to practice law, medicine, or dentistry, or to enter the clergy.
Short-term OJT	Less than one month on-the-job training
Moderate-term OJT	One month to one year on-the-job training
Long-term OJT	More than one year on-the-job training

For more information about this data source, see website: http://www.bls.gov/emp/noeted/empnumb.htm

Appendix: Workforce Regions in Massachusetts

Berkshire	Boston	Bristol	Brockton	Cape Cod and Islands	Southern Worcester	Franklin/Hampshire	Franklin/Hampshire
Adams	Boston	Attleboro	Abington	Aquinnah (Gay Head)	Auburn	Amherst	Shelburne
Alford		Berkley	Avon	Barnstable	Blackstone	Ashfield	Shutesbury
Becket		Dighton	Bridgewater	Bourne	Boylston	Athol	South Hadley
Cheshire		Fall River	Brockton	Brewster	Brookfield	Belchertown	Southampton
Clarksburg		Mansfield	East Bridgewater	Chatham	Charlton	Bernardston	Sunderland
Dalton		North Attleborough	Easton	Chilmark	Douglas	Buckland	Ware
Egremont		Norton	Hanson	Dennis	Dudley	Charlemont	Warwick
Florida		Raynham	Stoughton	Eastham	East Brookfield	Chesterfield	Wendell
Great Barrington		Rehoboth	West Bridgewater	Edgartown	Grafton	Colrain	Westhampton
Hancock		Seekonk	Whitman	Falmouth	Hardwick	Conway	Whately
Hinsdale		Somerset		Gosnold	Holden	Cummington	Williamsburg
Lanesborough		Swansea		Harwich	Hopedale	Deerfield	Worthington
Lee		Taunton		Mashpee	Leicester	Easthampton	
Lenox		Westport		Nantucket	Mendon	Erving	Northern Middlesex
Monterey				Oak Bluffs (Martha's Vineyard)	Milford	Gill	
Mount Washington				Orleans	Millbury	Goshen	Billerica
New Ashford				Provincetown	Millville	Granby	Chelmsford
New Marlborough				Sandwich	New Braintree	Greenfield	Dracut
North Adams				Tisbury	North Brookfield	Hadley	Dunstable
Otis				Truro	Northborough	Hatfield	Lowell
Peru				Wellfleet	Northbridge	Hawley	Tewksbury
Pittsfield				West Tisbury	Oakham	Heath	Tyngsborough
Richmond				Yarmouth	Oxford	Huntington	Westford
Sandisfield					Paxton	Leverett	
Savoy					Rutland	Leyden	
Sheffield					Shrewsbury	Middlefield	
Stockbridge					Southbridge	Monroe	
Tyringham					Spencer	Montague	
Washington					Sturbridge	New Salem	
West Stockbridge					Sutton	Northampton	
Williamstown					Upton	Northfield	
Windsor					Uxbridge	Orange	
					Warren	Pelham	
					Webster	Petersham	
					West Boylston	Phillipston	
					West Brookfield	Plainfield	
					Westborough	Rowe	
					Worcester	Royalston	

New Bedford	Hampden	Lower Merrimack Valley	Metropolitan North	Metropolitan South/West	Metro. South/West	South Essex	South Coastal
Acushnet	Agawam	Amesbury	Arlington	Acton	Wayland	Beverly	Braintree
Dartmouth	Blandford	Andover	Belmont	Ashland	Wellesley	Danvers	Carver
Fairhaven	Brimfield	Boxford	Burlington	Bedford	Weston	Essex	Cohasset
Freetown	Chester	Georgetown	Cambridge	Bellingham	Westwood	Gloucester	Duxbury
Lakeville	Chicopee	Groveland	Chelsea	Boxborough	Wrentham	Hamilton	Halifax
Marion	East Longmeadow	Haverhill	Everett	Brookline		Ipswich	Hanover
Mattapoisett	Granville	Lawrence	Malden	Canton	Northern Worcester	Lynn	Hingham
New Bedford	Hampden	Merrimac	Medford	Carlisle		Lynnfield	Holbrook
Rochester	Holland	Methuen	Melrose	Concord	Ashburnham	Manchester	Hull
Wareham	Holyoke	Newbury	North Reading	Dedham	Ashby	Marblehead	Kingston
	Longmeadow	Newburyport	Reading	Dover	Ayer	Middleton	Marshfield
	Ludlow	North Andover	Revere	Foxborough	Barre	Nahant	Middleborough
	Monson	Rowley	Somerville	Framingham	Berlin	Peabody	Milton
	Montgomery	Salisbury	Stoneham	Franklin	Bolton	Rockport	Norwell
	Palmer	West Newbury	Wakefield	Holliston	Clinton	Salem	Pembroke
	Russell		Watertown	Hopkinton	Fitchburg	Saugus	Plymouth
	Southwick		Wilmington	Hudson	Gardner	Swampscott	Plympton
	Springfield		Winchester	Lexington	Groton	Topsfield	Quincy
	Tolland		Winthrop	Lincoln	Harvard	Wenham	Randolph
	Wales		Woburn	Littleton	Hubbardston		Rockland
	West Springfield			Marlborough	Lancaster		Scituate
	Westfield			Maynard	Leominster		Weymouth
	Wilbraham			Medfield	Lunenburg		
				Medway	Pepperell		
				Millis	Princeton		
				Natick	Shirley		
				Needham	Sterling		
				Newton	Templeton		
				Norfolk	Townsend		
				Norwood	Westminster		
				Plainville	Winchendon		
				Sharon			
				Sherborn			
				Southborough			
				Stow			
				Sudbury			
				Walpole			
				Waltham			

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