

**Annual Earnings Levels and Trends in the Real
Annual Earnings of Workers in Biopharmaceutical
Industries in Massachusetts and the U.S.**

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Introduction

One of the key measures of the economic well-being of workers is their annual earnings. The annual earnings of workers adjusted for inflation are key determinants of their purchasing power of goods and services. The level of the annual earnings of workers in a given export-oriented industries, such as biopharmaceutical industries, also are key determinants of the value of the overall output and job multipliers of these industries.¹

We have used data from the U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) in our analysis to identify the annual wages of workers in biopharmaceutical industries in Massachusetts, other states, and the nation as a whole in recent years. The wage data reported by employers who are covered by the federal and state unemployment insurance laws are based on a comprehensive measure of wage and salary compensation, including "gross wages and salaries, bonuses, stock options, tips and other gratuities, and the value of meals and lodging where supplied (by employers)"². Our analysis is based on the findings for private sector establishments, and the mean annual wages of workers in these industries are used in our analysis.³

How well have biopharmaceutical industry workers in Massachusetts fared in annual wages compared to those of workers in all other states and other industries in the Commonwealth? To answer this question, we compared the annual earnings of each of these groups in 2005. The annual average earnings of wage and salary workers in 2005 in biopharmaceutical industries of Massachusetts was \$92,728, which was \$42,303 higher than the mean annual earnings of all private sector wage and salary workers in the Commonwealth during 2005. (Chart 1). In relative term, workers in biopharmaceutical industries in Massachusetts had average annual wages that were 84% higher than the annual average wages of all private sector workers in formal payroll employment. The average annual wages of workers in the three biopharmaceutical industries in Massachusetts varied widely, ranging from a low of \$62,667 in the medical equipment and supplies manufacturing industry to slightly over \$100,000 in pharmaceutical and medicine manufacturing industries, and to a high of \$101,329 in the physical, engineering and biological research services industry. In

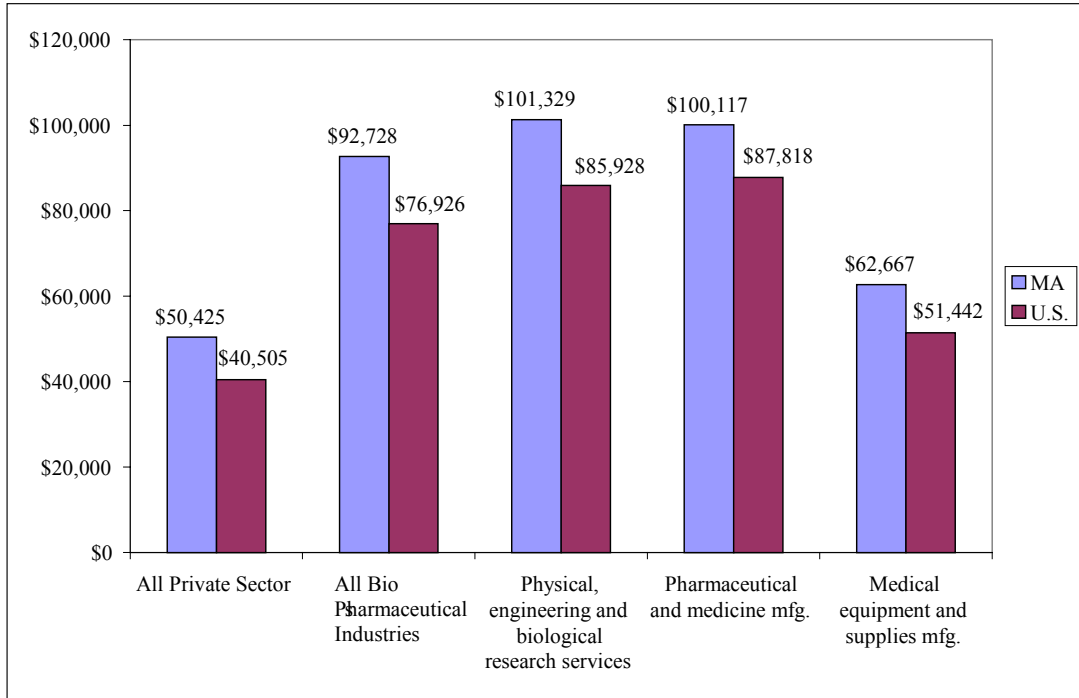
¹ The induced local spending of workers and owners in an export industry help determine the value of the Type-II multipliers. As will be revealed in a forthcoming paper by the authors, the jobs multipliers of the biopharmaceutical industries are quite high.

² See: U.S. Bureau of Labor Statistics, BLS Handbook of Methods, Chapter 5, "Employment and Wages Covered by Unemployment Insurance", Washington, D.C. 2003.

³ From the QCEW survey data, we can estimate the mean level of annual wages, not the median. Median wages are sometimes seen as a better measure of the earnings of the "average workers" since the median is not influenced by skewness of the wage distribution.

each of the three biopharmaceutical industries in Massachusetts, workers' average annual wages were \$12,000 to \$51,000 higher than the average annual wages of workers in all private sector industries of the state in 2005.

Chart 1:
The Annual Average Wages of Workers in All Private Sector Industries and Biopharmaceutical Industries in Massachusetts and the U.S., 2005



Source: Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

The annual average wage of workers in biopharmaceutical industries of Massachusetts was nearly \$16,000 higher than that of their counterparts nationwide in the same set of industries. (Table 1). Massachusetts workers in biopharmaceutical industries had annual wages in 2005 that were slightly more than 20% higher than those of their peers in the U.S. Overall, Massachusetts' workers in each of the three biopharmaceutical industries had annual average wages that were 14% to 22% higher than those of their counterparts in the same industries nationwide, a strong relative performance. (Table 1).

Table 1:
The Absolute and Relative Differences Between the Annual Earnings of Wage and Salary Workers in All Private Sector Industries and Biopharmaceutical Industries of Massachusetts and the U.S., 2005

Industry	Absolute Difference in Annual Earnings (In \$)	Relative Difference in Annual Earnings (In %)
All Private Sector	\$9,920	25.3
All Biopharmaceutical Industries	\$15,802	20.3
Physical, Engineering, Biological Research	\$15,401	18.0
Pharmaceutical and Medicine Mfg.	\$12,299	14.0
Medical Equipment and Supplies Mfg.	\$11,225	21.8

Source: Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

Workers in biopharmaceutical industries in Massachusetts also are characterized by higher annual wages compared to the vast majority of their peers in the other states.⁴ The annual average earnings of \$92,728 in 2005 in biopharmaceutical industries in Massachusetts ranked fourth highest among the 44 states for whom earnings data were available. (Table 2). Our state was nearly tied with both the 2nd and the 3rd highest ranked states (Illinois and California). The annual average wage difference between Massachusetts and the 2nd highest ranked state (Illinois) was less than \$400. New Jersey with an annual wage of \$101,726 was the national leader on this annual average wage measure, exceeding the annual average wages of biopharmaceutical industries workers in Illinois, California, and Massachusetts by more than \$8,000. The higher annual average wages of biopharmaceutical industry workers in New Jersey is understandable given the presence of many large global pharmaceutical companies in the state. The other 6 states in the top 10 ranking with the highest annual average wages of biopharmaceutical industry workers were Delaware, which was ranked 5th (\$88,956) followed by Connecticut (\$87,506), Pennsylvania (\$80,086), Michigan (\$79,916), Colorado (\$79,039) and Virginia (\$78,135). The unweighted annual average wages of workers in these top ten states was \$87,409, which was more than two times higher than the annual average wages of biopharmaceutical industry workers in the bottom 10 states in the annual wage distribution. (Table 2).

⁴ We have excluded seven states in our analysis of 2005 rankings due to missing data. These states are Alaska, D.C, Hawaii, North Dakota, South Dakota, West Virginia, and Wyoming. Biopharmaceutical employment in these states was quite low and dominated by a few firms, thus complicating release of the employment and earnings data to public.

Table 2:
Mean Annual Wages of Private Sector Workers in Biopharmaceutical
Industries in the Top Ten and Bottom Ten States in the U.S., 2005

Rank	Top 10 States	Annual Average Wage	Rank	Bottom 10 States	Annual Average Wage
1	New Jersey	\$101,726	35	Kansas	\$46,895
2	Illinois	\$93,070	36	Maine	\$46,870
3	California	\$92,931	37	Nebraska	\$46,163
4	Massachusetts	\$92,728	38	Iowa	\$45,591
5	Delaware	\$88,956	39	Oklahoma	\$45,052
6	Connecticut	\$87,506	40	South Carolina	\$44,018
7	Pennsylvania	\$80,086	41	Vermont	\$40,978
8	Michigan	\$79,916	42	Louisiana	\$40,620
9	Colorado	\$79,039	43	Mississippi	\$36,262
10	Virginia	\$78,135	44	Arkansas	\$35,068
Simple Average of Top 10 States		\$87,409	Simple Average of Bottom 10 States		\$42,752

Source: Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

The annual average wages of workers in the three biopharmaceutical industries also varied widely across the states. Table 3 displays the annual average wages of workers in each of the biopharmaceutical industries in the ten states with the highest annual average wages for workers. In pharmaceutical and medicine manufacturing industries, Massachusetts' ranking was 5th highest among the other states on this measure. Massachusetts was outranked by the District of Columbia, California, Connecticut and New Jersey. The annual average wages of workers in this particular industry in the Commonwealth was \$12,000 higher than the national average. In medical instrument and supplies manufacturing industries, Massachusetts ranking was 3rd highest among the states. Only New Jersey and California had higher annual average wages for workers in the medical instrument and supplies manufacturing industry. The annual average wages of \$62,667 for workers in this industry in Massachusetts was more than \$11,000 higher than the national average. In 2005, physical, engineering and biological research service industry in Massachusetts also had a very high annual average wage for its workers (\$101,329), and Massachusetts ranked 3rd highest among the states. Only two states- New Jersey and Illinois had annual average wages that were higher than those in Massachusetts for this biopharmaceutical industry.

Table 3:
Top 10 States with the Highest Annual Average Wages in Medical Instrument and Supplies Manufacturing, Pharmaceutical and Medicine Manufacturing and Physical, Engineering and Biological Research Services Industries, 2005

	State*	NAICS 3254	State**	NAICS 3391	State	NAICS 51417
1	DC	\$153,610	New Jersey	\$69,653	New Jersey	\$113,626
2	California	\$122,209	California	\$63,474	Illinois	\$110,782
3	Connecticut	\$107,750	Massachusetts	\$62,667	Massachusetts	\$101,329
4	New Jersey	\$103,401	Illinois	\$61,239	Delaware	\$100,954
5	Massachusetts	\$100,117	Minnesota	\$59,956	Missouri	\$98,537
6	Texas	\$96,886	Indiana	\$58,617	Connecticut	\$97,499
7	Indiana	\$89,155	Connecticut	\$52,996	California	\$94,986
8	Idaho	\$89,091	Pennsylvania	\$52,296	Michigan	\$93,642
9	Pennsylvania	\$88,142	Colorado	\$51,618	Colorado	\$92,930
10	Illinois	\$87,070	Michigan	\$49,187	Pennsylvania	\$91,400
	U.S. Average	\$87,818	U.S. Average	\$51,442	U.S. Average	\$85,928

Note: * Four states were excluded due to missing wage data- Alaska, Hawaii, South Dakota and West Virginia

** The District of Columbia was excluded due to missing wage data.

How did the earnings of biopharmaceutical industry workers in Massachusetts compare to those of workers in the other major 20 industries of the state? To answer this question, we first identified the annual average 2005 wages of workers in 20 major industries in Massachusetts and then ranked them from highest to lowest. Among the twenty major industries in Massachusetts, the annual wages of workers in biopharmaceutical industries was the second highest. Only the finance and insurance industry had annual wages that were higher than the annual wages of workers in biopharmaceutical industries. (Table 4). The annual average wages of workers in biopharmaceutical industries in Massachusetts was only 6% below the average wages of workers in finance and insurance industries. The industrial pattern of annual wages in Massachusetts was quite similar to that for the entire U.S. In 2005, biopharmaceutical industry workers in the U.S. had the second highest annual average wages (\$75,208) with management of companies and enterprises occupying the first place (\$85,280).

Table 4:
Annual Average Wages of Private Sector Workers in Massachusetts by
Selected Two-Digit NAICS Industries, 2005

Rank	Industry	Annual Average Wage
1	NAICS 52 Finance and insurance	\$98,564
2	NAICS 3254, 3391 and 54171 Biopharmaceutical Industries	\$92,728
3	NAICS 22 Utilities	\$87,227
4	NAICS 54 Professional and technical services	\$83,587
5	NAICS 55 Management of companies and enterprises	\$81,009
6	NAICS 51 Information Services	\$76,441
7	NAICS 42 Wholesale trade	\$67,229
8	NAICS 31-33 Manufacturing	\$62,472
9	NAICS 23 Construction	\$53,477
10	NAICS 21 Mining	\$50,387
11	NAICS 53 Real estate and rental and leasing	\$50,300
12	NAICS 61 Educational services	\$47,467
13	NAICS 11 Agriculture, forestry, fishing and hunting	\$44,039
14	NAICS 62 Health care and social assistance	\$43,095
15	NAICS 48-49 Transportation and warehousing	\$38,539
16	NAICS 56 Administrative and waste services	\$34,242
17	NAICS 71 Arts, entertainment, and recreation	\$30,349
18	NAICS 44-45 Retail trade	\$27,479
19	NAICS 81 Other services, except public administration	\$26,104
20	NAICS 72 Accommodation and food services	\$17,653
Total, all industries		\$50,425

Source: Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

Trends in the Annual Average Wages of Workers in Biopharmaceutical Industries in Massachusetts and the U.S., 2001-2005

Formal payroll employment in the private sector of Massachusetts has deteriorated substantially since its peak level in the first quarter of 2001. In 2005, formal payroll employment in Massachusetts was still below its peak 2001 employment level by more than 100,000. Between the first quarters of 2001 and 2005, Massachusetts lost nearly 5 percent of all private sector formal payroll jobs. However, as discussed in our earlier research papers for the PhRMA group, payroll job growth in all biopharmaceutical industries combined in Massachusetts has been robust over the same period. The real annual wages (inflation adjusted) of private sector workers in Massachusetts also has been stagnant over the 2001-2005 period. The real annual average wages of workers in the private sector of Massachusetts grew by only 0.4 percent during the 2001-2005 period. (Table 5). A similar trend held true

for the nation as well. In contrast to the absence of growth in the annual average wages of workers in the private sector in Massachusetts, annual average wages for workers in biopharmaceutical industries experienced a robust gain over this four-year period. Between 2001 and 2005, the annual average wages of workers in biopharmaceutical industries in Massachusetts increased from \$81,688 to \$92,728, an absolute increase of \$11,040 representing a relative increase of 13.5%. (Table 5). This growth rate of annual average wages of workers in biopharmaceutical industries in Massachusetts outpaced the growth rate of wages for workers in the same set of industries in the U.S. by 3.5 percentage points (13.5% versus 10.0%).

Among the three biopharmaceutical industries in Massachusetts, two of them experienced substantial wage growth between 2001 and 2005. The medical equipment and supplies manufacturing industry was the only biopharmaceutical industry in Massachusetts that failed to experience any wage growth. The wages of workers in this sector declined by nearly 5 percent between 2001 and 2005. In contrast, this same industry in the U.S. experienced a growth rate of nearly 6 percent in annual wages during the same time period. The real annual average wages of workers in pharmaceutical and medicine manufacturing industries in Massachusetts were characterized by a growth rate of nearly 7 percent while those of workers in the physical/engineering/biological research service industry grew by 17 percent over the same time period. Massachusetts' growth rate in the real wages of its workers was nearly 7 percentage points higher than that of the nation in the physical/engineering/biological research services industry (17.1% versus 9.8%); however, wage growth rate in the pharmaceutical and medicine manufacturing industry in Massachusetts lagged slightly behind the nation's growth rate (6.6% versus 10.0%).

Table 5:
Trends in the Annual Average Real Wages of Workers in the Private Sector and
Biopharmaceutical Industries in Massachusetts and the U.S., 2001-2005 (In 2005 CPI-U
Adjusted Dollars)

	2001	2005	Absolute Change	Relative Change
Massachusetts				
Pharmaceutical and medicine manufacturing	\$93,881	\$100,117	\$6,236	6.6
Medical equipment and supplies manufacturing	\$65,791	\$62,667	-\$3,124	-4.7
Physical, engineering and biological research	\$86,567	\$101,329	\$14,762	17.1
All Biopharmaceutical Industries	\$81,688	\$92,728	\$11,040	13.5
All Private Sector	\$50,243	\$50,425	\$182	0.4
United States				
Pharmaceutical and medicine manufacturing	\$79,834	\$87,818	\$7,985	10.0
Medical equipment and supplies manufacturing	\$48,577	\$51,442	\$2,865	5.9
Physical, engineering and biological research	\$78,254	\$85,928	\$7,673	9.8
All Biopharmaceutical Industries	\$69,908	\$76,926	\$7,017	10.0

All Private Sector	\$39,873	\$40,505	\$632	1.6
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Source: Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

Weekly earnings data from the U.S. Census Bureau’s monthly Current Population Survey (CPS) also showed a similar trend in the growth rate of real weekly earnings of workers in biopharmaceutical industries in Massachusetts. The average real weekly wages of Massachusetts’ workers in biopharmaceutical industries increased from \$1,125 in 2000 to \$1,226 in 2005. This represented an increase of nearly 9 percent in the real weekly wages of biopharmaceutical industry workers in Massachusetts.

Data on the mean annual earnings of workers in each major two-digit NAICS industry in Massachusetts in 2001 and 2005 were analyzed to generate estimates of real annual earnings growth over this four-year period. No other industry in Massachusetts experienced growth rate in the real annual wages of workers that was comparable to the growth rate of real earnings in biopharmaceutical industries. The growth rate of 13.5 percent in annual earnings between 2001 and 2005 in biopharmaceutical industries in Massachusetts was the highest among 18 major private sector industries. (Table 6). Management of companies and enterprises was the only other industry where workers experienced double-digit growth in their real annual average wages during the 2001-2005 period. A very similar earnings pattern held true for the entire U.S.; however, the 9.7 percent growth rate in the real annual wages of workers in biopharmaceutical industries in the U.S. was second highest, only trailing the growth rate of annual earnings in the management of companies and enterprises (12.1%).

Table 6:
Percent Change in Real Annual Average Wages of Private Sector Workers in
Biopharmaceutical Industries Compared to Those of Other Major Industries in Massachusetts
and the U.S., 2001-2005

Industry	Massachusetts	United States
Biopharmaceutical industries	13.5	10.0
Management of companies and enterprises	10.4	12.1
Health care and social assistance	8.6	4.6
Real estate and rental and leasing	5.5	8.7
Educational services	5.2	3.1
Manufacturing	4.0	4.0
Information Services	3.5	-0.5
Utilities	3.0	4.0
Administrative and waste services	2.4	4.4
Finance and insurance	2.1	4.5
Professional and technical services	1.6	0.7
Retail trade	0.5	-0.3
Transportation and warehousing	0.5	-1.0
Accommodation and food services	-1.1	0.6
Wholesale trade	-1.5	2.7
Arts, entertainment, and recreation	-2.0	0.7
Mining	-3.0	9.7
Other services, except public administration	-4.3	1.1
Construction	-4.5	-0.6
All private industries	0.4	1.6

How did Massachusetts double-digit growth rate in the annual average wages of workers in biopharmaceutical industries compare to that of workers in the same industries in other states? We ranked 44 states for whom payroll wage data were available for biopharmaceutical industries. Massachusetts growth rate of the real annual wages of workers during 2001 and 2005 in biopharmaceutical industries ranked 14th highest among these 44 states. (Table 7). Montana, Texas, Rhode Island, Wisconsin and Virginia were the top five performers on this wage growth measure.

Table 7:
Top 20 States⁵ Rankings With Respect to the Growth Rate in the Real Annual Wages of
Workers in Biopharmaceutical Industries Between 2001-2005

Rank	State	Growth Rate, 2001- 2005 (In %)
1	Montana	24.5
2	Texas	22.7
3	Rhode Island	21.8
4	Wisconsin	18.5
5	Virginia	17.9
6	Colorado	17.4
7	Nevada	17.3
8	California	15.9
9	Tennessee	15.7
10	New Jersey	15.4
11	Missouri	14.8
12	South Dakota	14.0
13	Iowa	13.8
14	Massachusetts	13.5
15	Illinois	12.7
16	Kentucky	12.6
17	Washington	11.1
18	Kansas	10.8
19	Michigan	10.5
20	Pennsylvania	10.5

Trends in the Annual Earnings of Workers in Biopharmaceutical Industries in Massachusetts and the U.S. From the Economic Censuses of 1997 and 2002

We also analyzed somewhat older historical data on the annual average wages of workers in biopharmaceutical industries over the 1997 and 2002 period based on the Economic Censuses conducted by the U.S. Census Bureau.⁶ The definition of payrolls in the Economic Censuses differs by industry and is not identical with that from the QCEW survey. The QCEW survey payrolls include stock options whereas the Economic Census payrolls do not. For this reason, wages of workers from the Economic Censuses are lower than wages of workers from the QCEW survey. Between 1997 and 2002, biopharmaceutical industries in Massachusetts were characterized by very strong wage growth. The real wage growth for

⁵ Alaska, the District of Columbia, Hawaii, Idaho, North Dakota, West Virginia and Wyoming are excluded due to missing earnings data in 2001 and 2005.

⁶From the Economic Censuses of the U.S. Census Bureau, data on the annual aggregate payroll and number of employees are available for each individual industry. Dividing the aggregate annual payroll by the number of employees yields an average annual wage per employee in that industry.

workers in these biopharmaceutical industries was 30 percent in Massachusetts over this five year period, outpacing the growth rate of annual wages of workers in the same sets of industries of the U.S. by 10 percentage points (30% versus 20%). (Table 8). Of the three biopharmaceutical industries, growth in real annual wages for workers in Massachusetts' medical equipment and supplies manufacturing industries was flat between 1997-2002; however, the U.S. experienced an earnings growth rate of 6.4 percent in this sector over the same 5 year period. In the other two biopharmaceutical industries in Massachusetts, the growth rates in real annual average wages for workers was highest in the physical, engineering and biological research service industry (41%), which was more than twice the annual earnings growth rate (20%) in this particular industry nationwide. Massachusetts' pharmaceutical and medicine manufacturing industry also experienced a growth rate of 8.4 percent in real annual wages of its workers between 1997-2002. In contrast, there was no growth in the real annual average wages of workers in pharmaceutical and medicine manufacturing industries in the U.S. during the same time period.

Table 8:
Trends in the Real Annual Wages of Workers in Biopharmaceutical Industries in
Massachusetts and the U.S., 1997-2002 (In 2002 CPI-U Adjusted Dollars)

<u>Massachusetts</u>	1997	2002	Absolute Change	Relative Change
Pharmaceutical and medicine mfg.	\$53,369	\$57,858	\$4,489	8.4
Medical equipment and supplies mfg.	\$45,316	\$45,321	\$5	0.0
Physical, engineering and biological research	\$54,190	\$76,356	\$22,166	40.9
All Biopharmaceutical Industry	\$50,374	\$65,439	\$15,065	29.9
<u>United States</u>				
Pharmaceutical and medicine mfg.	\$54,758	\$54,544	-\$214	-0.4
Medical equipment and supplies mfg.	\$38,480	\$40,957	\$2,477	6.4
Physical, engineering and biological research	\$49,095	\$58,926	\$9,831	20.0
All Biopharmaceutical Industry	\$49,095	\$58,926	\$9,831	20.0

Source: 1997 and 2002 Economic Censuses, U.S. Census Bureau, tabulations by authors.

Summary and Conclusions

This research report has provided both a description and a comparative analysis of the annual earnings of workers in biopharmaceutical industries in Massachusetts, other states, and the nation as a whole. In calendar year 2005, mean annual earnings of wage and salary workers in the state's biopharmaceutical industries were nearly \$93,000, or 84% higher than the average annual earnings of workers in all private sector industries of the Commonwealth. The mean annual earnings of these workers in Massachusetts also exceeded the national average for all biopharmaceutical industries combined, and the state ranked near the top of

the earnings distribution for such workers across all states. These high earnings of Massachusetts workers help boost spending and job creation in a wide array of service, retail, and construction-related industries, generate a substantial jobs multiplier, and provide a stream of states and local tax revenues (state income tax, sales taxes, property taxes).

The biopharmaceutical industries in Massachusetts were characterized by strong annual earnings growth over the 1997-2002 period and over the more recent 2001-2005 period. The industry was one of the few private sector industries providing both job and earnings growth over the 2001-2005 period and helped prevent a further deterioration in the state's payroll job base, both directly and indirectly through the local spending of workers and managers on goods and services produced by Massachusetts firms.