

December 01, 2006

Data Sources and Methodologies Used in Conducting the Economic and Labor Market Analyses of Biopharmaceutical Industries in Massachusetts

Ishwar Khatiwada

Northeastern University - Center for Labor Market Studies

Andrew Sum

Northeastern University - Center for Labor Market Studies

Recommended Citation

Khatiwada, Ishwar and Sum, Andrew, "Data Sources and Methodologies Used in Conducting the Economic and Labor Market Analyses of Biopharmaceutical Industries in Massachusetts" (2006). *PhRMA Research Reports*. Paper 3. <http://hdl.handle.net/2047/d10015449>

This work is available open access, hosted by Northeastern University.

**Data Sources and Methodologies Used in
Conducting the Economic and Labor Market
Analyses of Biopharmaceutical Industries in
Massachusetts**

PhRMA Research Paper No. 1

**Prepared by:
Ishwar Khatiwada
Andrew Sum
Center for Labor Market Studies
Northeastern University**

**Prepared for:
The Pharmaceutical Research and Manufacturers of America
(PhRMA)**

December 2006

Introduction

The Center for Labor Market Studies has been engaged in a diverse array of research activities on the economic and labor market activities and impacts of biopharmaceutical industries in Massachusetts in recent years together with comparisons with the operations and performance of these industries in other states and the nation as a whole.¹ A wide array of data sources were used in conducting the labor market, output, income and fiscal impact analyses. The specific data sources used in preparing the research papers are the following:

1. The 2000 Decennial Census of Population and Housing public use data files of the U.S. Census Bureau
2. 2004 and 2005 American Community Surveys of the U.S. Census Bureau
3. 1997 and 2002 Economic Censuses of the U.S. Census Bureau
4. County Business Patterns (CBP), U.S. Census Bureau
5. Quarterly Census of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics and Massachusetts Department of Workforce Development
6. Monthly Current Population Surveys (CPS), a household survey conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics
7. The Occupational Employment Statistics program (OES), U.S. Bureau of Labor Statistics and Massachusetts Department of Workforce Development
8. The Gross Domestic Product (GDP) data of the Bureau of Economic Analysis (BEA), U.S. Department of Commerce
9. U.S. Securities and Exchange Commission (SEC)
10. National Science Foundation
11. Thompson Financial
12. HooversTM

Every 10 years, the U.S. Census Bureau conducts a *Census of Population and Housing*. The long form Census questionnaire in the 2000 Census was administered to nearly 1 of every 6 households. It collected information on the demographic characteristics, employment status, annual earnings, industry of employment, occupations, annual weeks worked, and average weekly hours of all working-age individuals. We used the 5% public use micro samples (PUMS 5%) released by the U.S. Census Bureau for our analysis. Data on the

¹ The final section of this paper is devoted to an analysis of the specific industries in which PhRMA member firms do operate in Massachusetts. The identification of the NAICS industry codes of these industries is also provided since the analyses of output, employment, earnings, and occupational data are dependent on the availability of the NAICS codes.

annual earnings, occupational areas of job attachments, and demographic and socioeconomic characteristics of workers in biopharmaceutical industries in Massachusetts are based on the 2000 Census data. Similar findings are available for each other state and the nation as a whole.

The *American Community Survey (ACS)* is a national household survey that has been conducted by the U.S. Census Bureau since 2000. The annual ACS survey which utilizes a close variant of the long form questionnaire used in conducting the decennial censuses will replace the decennial Census long form questionnaire in 2010. The sample of households in Massachusetts interviewed as part of the ACS has increased substantially in recent years, rising from 13,000-14,000 in 2003 and 2004 to 34,000 in 2005. Public use data samples from the ACS surveys are available on the U.S. Census Bureau's web site. The demographic and social characteristics of workers, occupations of workers, and annual earnings of workers in PhRMA related industries appearing in the papers are frequently based on ACS data.

The *Economic Censuses* conducted by the U.S. Census Bureau profile American businesses every five years at both the state and national level. A wealth of information is collected from this Census, including the specific line of business, number of employees, total annual payroll, and total value of shipments/receipts. The data are available companies classified under the North American Industry Classification System (NAICS). We have used these data to identify trends in the number of workers, the payrolls and revenues of firms in the PhRMA related industries of Massachusetts and the U.S.

Data from the *County Business Patterns (CBP)* program are available from the U.S. Census Bureau on an annual basis. The data in the CBP data base are extracted from the Business Register, and the U.S. Census Bureau collects additional data for CBP from its various survey programs, including the Annual Survey of Manufacturers, and Current Business Surveys, and from administrative records of the Internal Revenue Service, the Social Security Administration, and the U.S. Bureau of Labor Statistics. Some of the data on the distribution of employees by establishment size, number of employees, and annual payroll appearing in the papers prepared for PhRMA are based on CBP data.

The *Quarterly Census of Employment and Wage Statistics (QCEW)*. This survey formerly known as the ES-202 Survey, is conducted by the U.S. Bureau of Labor Statistics and state employment agencies, covers 99.7% of all wage and salary civilian employment

data on the formal payrolls of private sector firms and government agencies. As part of their operation under the Unemployment Insurance (UI) program, every employer who is covered by the provisions of the law required to file quarterly tax reports to State Employment Security Agencies. The QCEW employment and earnings data are derived from quarterly tax reports filed by these employers. The QCEW data include information on the size of establishment, number of employees, quarterly payroll, and weekly average wages for detailed NAICS industries at the local, state and the national level. Annual wage and employment data based on the QCEW data base are presented in a number of research papers in this series. Inter state comparisons on employment and wage trends also can be made with this data set

The U.S. Census Bureau also conducts the monthly *Current Population Survey*, a household survey typically known by its acronym CPS, for the U.S. Bureau of Labor Statistics. This monthly survey of nearly 60,000 households nationwide collects information on labor force and employment status of all sample household members 16 and older. Information on the demographic characteristics of individual workers, their weekly earnings, industry of employment, and the occupations of their jobs are also collected. Data on taxes paid and income transfers received by workers in biopharmaceutical industries and other industries across the state are based on the March CPS Supplement work experience and income data.

The *Occupational Employment Statistics (OES)* program is conducted semi-annually for a sample of non-farm establishments by the U.S. Bureau of Labor Statistics. It is designed to produce employment and wage estimates for more than 800 occupations at the national and local level for specific industries. The OES survey is a Federal-State cooperative program between the U.S. Bureau of Labor Statistics and State Workforce Development Agencies, including the Massachusetts Division of Unemployment Assistance. Data on the occupational staffing patterns of biopharmaceutical industries in Massachusetts and the U.S. are based on the OES data.

The *Bureau of Economic Analysis (BEA)*, is an agency of the U.S. Commerce Department. It produces core macroeconomic data on the U.S. economy, including the national and regional industry accounts, and international accounts. Among the most widely cited data produced by the BEA is the national income and product accounts data (NIPA) that include gross domestic product by industry, per capita income by industry, and regional/state input-output multipliers for individual industries. In our study, we have analyzed the BEA

data on the real outputs of biopharmaceutical industries in Massachusetts, their productivity levels, and their links with other state industries. We selected industry multipliers produced by the BEA to estimate the economic impacts of selected biopharmaceutical industries in Massachusetts. These multipliers capture the direct, indirect, and induced effects of outputs in the biopharmaceutical industries.

Assignment of the NAICS Codes in Massachusetts for PhRMA Member Firms

In order to successfully undertake our labor market and economic analyses, it was essential to obtain NAICS codes for each PhRMA member firm in Massachusetts. Without specific information on the NAICS codes associated with these PhRMA companies, we could not perform any analysis on the labor market operations or economic impacts of biopharmaceutical industries in Massachusetts. There is no public source of information on the NAICS codes under which each PhRMA member company is listed. The Massachusetts Department of Unemployment Assistance records the NAICS code of each individual company for use in the operations of the Unemployment Insurance system; however, it would not reveal the codes assigned to a specific company due to legal constraints. The PhRMA group provided CLMS staff a listing of PhRMA companies in Massachusetts and the nature of their businesses, and CLMS staff visited each PhRMA company's web site in Massachusetts to determine the exact nature of their business and assign a proper NAICS codes for each PhRMA company.

There are a few private research agencies that provide NAICS/SIC codes for individual companies across the nation. However, we found that the NAICS codes assigned by these private agencies to individual companies were not very consistent with one another. The CLMS also obtained NAICS codes from the Analysts Resource Center's (ARC) 2006 Employer Database. Some of the NAICS codes for PhRMA members in the ARC's directory were incorrectly assigned. In addition, the NAICS codes assigned by ARC sometimes differ from the state's or Census Bureau's assigned NAICS code for these same companies. To assign a proper NAICS code, CLMS staff used information that was provided by PhRMA, information available at each PhRMA company web site, and ARC's 2006 Employer Directory. (See Table 1 for a listing of the PhRMA companies in Massachusetts and the CLMS assigned NAICS code). After an extensive review of various information bases, and talking with economists at state agencies in charge of disseminating such data, we determined that the PhRMA companies in Massachusetts fall under one of the three NAICS codes:

1. **3254-** Pharmaceutical preparation manufacturing (includes pharmaceutical preparation manufacturing, in-vitro diagnostic substance manufacturing, biological products except diagnostic manufacturing)
2. **3391** - Surgical and medical instrument manufacturing (includes laboratory apparatus and furniture manufacturing, surgical and medical instrument manufacturing, surgical appliance and supplies manufacturing, dental equipment and supplies manufacturing, ophthalmic goods manufacturing and dental laboratories).
3. **54171** – Physical, engineering and biological research (includes only physical, engineering and biological research).

Two PhRMA companies were found to have multiple NAICS codes. Abbott Labs in Worcester and Astra Zeneca in Westborough fall under NAICS codes, 3254, 3391 and 5417, respectively. Out of 16 PhRMA companies in Massachusetts, 11 were assigned the NAICS code for physical, engineering and biological research, 9 fall under pharmaceutical preparation and manufacturing, and only two PhRMA companies (Bayer in East Walpole and Astra Zeneca in Westborough) fall under surgical and medical instrument manufacturing.

In the CPS, Census and ACS surveys, only 4-digit aggregations of NAICS codes are available. There are no 5-digit aggregation of NAICS codes. The NAICS codes 3254 and 3391 closely match the line of business of PhRMA member firms in Massachusetts and the U.S. However, the four-digit NAICS code 5417 represents an aggregation of scientific research and development activities, which include research and development in physical, engineering and life sciences as well as in social sciences and humanities. Our analysis of the wages and salary employment data from the QCEW survey show that in 2005 only 8% of jobs in NAICS industry code 5417 in Massachusetts involved research and development jobs in social science and the humanities versus 11% of the jobs in the U.S. in the same industry.

Table 1:
A Listing of 16 PhRMA Companies and Their NAICS Codes in Massachusetts

Company	Location	NAICS- Line of Business/Description
Abbott	Worcester	5417- Physical, engineering and biological research 3254- Other biological product mfg.
Alkermes	Cambridge	3254- Pharmaceutical preparation mfg.
Astra Zeneca	Westborough	3254-Medicinal and botanical mfg 3391- Surgical & medical instrument/appliances mfg
Astra Zeneca	Waltham	5417- Physical, engineering and biological research
Bayer	E Walpole	3391- Surgical and medical instrument mfg.
Bristol-Myers Squibb	Billerica	3254- Pharmaceutical preparation mfg.
Genzyme	Cambridge	3254- Pharmaceutical preparation mfg. 5417- Physical, engineering and biological research
Johnson & Johnson	Lexington	5417- Physical, engineering and biological research
Idenix	Cambridge	3254- Pharmaceutical preparation mfg.
Merck	Boston	5417- Physical, engineering and biological research
Millennium	Cambridge	3254- Pharmaceutical preparation mfg. 5417- Physical, engineering and biological research
Pfizer	Cambridge	5417- Physical, engineering and biological research
Sanofi-Aventis	Cambridge	5417- Physical, engineering and biological research
Schering-Plough	Cambridge	5417- Physical, engineering and biological research
Serono	Rockland	3254- Pharmaceutical preparation mfg.
Sepracor	Marlborough	3254- Pharmaceutical preparation mfg. 5417- Physical, engineering and biological research
Wyeth	Andover	3254- Pharmaceutical Preparation Manufacturing
Wyeth	Cambridge	5417- Physical, Engineering and Biological Research

The definitions of the biotechnology and pharmaceutical industries are overlapping over time as a result of changes in product mixes of industries and inter-industry linkages between them. In the past, biotechnology industries pursued R&D based largely on biological processes to develop drugs whereas the pharmaceutical industry primarily used chemical syntheses to develop new drugs. However, over the years, pharmaceutical companies are increasingly using biological processes and biotechnology companies also are using synthesis

chemistry to develop new drugs. In addition, the big pharmaceutical firms have acquired many biotechnology firms. For these reasons, the distinctions between the biotechnology industries and pharmaceutical industries have blurred over time.² Since, PhRMA member companies cut across both of these two types of drug development industries, we will use the term “biopharmaceutical” industry in all of our research papers to refer to PhRMA-related companies.

² For discussion of this issue, see: Gary P. Pisano, Science Business: The Promise and the Reality of the Future of Biotech, Harvard Business School Press, Boston, Massachusetts, 2006.