

THE ECONOMIC CONTRIBUTIONS OF THE BIOTECHNOLOGY INDUSTRY TO THE U.S. ECONOMY

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Abstract

This report estimates the contributions of the biotechnology industry to the U.S. economy and provides detail on the nature and magnitude of the various economic and tax revenue contributions. The analysis here is limited to the financial contributions (revenues, jobs, compensation and taxes generated). It does not include the significant nonfinancial contributions of the industry, from factors such as increased longevity and productivity from health improvements, increased quality of life and increased agricultural productivity.

Key words: *economic contribution, tax revenue contribution*

INTRODUCTION

The biotechnology industry has grown rapidly in recent years, doubling in size between 1993 and 1999. Much attention is given to the potential of the biotechnology industry, from drugs, agricultural and environmental products currently in the pipeline. These products have the potential to generate tremendous opportunities for society, by improving the quality of health care, increasing agricultural production and producing a cleaner environment. No less significant, however, is the fact that the industry clearly makes substantial *current* economic and fiscal contributions to the U.S. economy.

This report presents the estimates of the significant financial contributions of the biotechnology industry to the U.S. economy and to revenues collected by the federal, state and local governments.

The analysis also estimated the contributions generated by publicly traded and private companies and by the agricultural biotechnology sector.

Given the rapid growth of the biotechnology industry, and its relative infancy, much existing analysis focuses on the future potential of the industry - the products in the pipeline, and potential benefits from improved health care, increased agricultural production and improvement in the environment.

While these potential benefits will be enormously important, the industry makes significant current contributions to the U.S. economy despite its lack of overall profits. Even biotechnology companies that have yet to bring a product to market contribute to national income by engaging in research and development and purchasing inputs from companies such as contract research organizations and equipment manufacturers. Biotechnology firms employ workers, who purchase goods and services in the general economy. The industry also generates significant tax revenues for federal, state and local governments from property taxes, sales and use taxes, income taxes and other taxes.

MATERIAL AND METHODS

The biotechnology industry was defined for this study as U.S. companies that are primarily engaged in biotechnology activities. A list of U.S. public and private companies with a Standard Industrial Classification (SIC) code of 2833, 2834, 2835, 2836 or 8731 was generated. Table 1 lists these industries. This list of companies was then refined as described below. Firms whose primary business was pharmaceuticals were excluded. In many cases, these firms are known to have biotechnology divisions; however, if separate data for these divisions was not located, the entire company was excluded. In addition, equipment manufacturing and contract research organizations (CROs) were excluded. While these companies may be conducting activities in support of the biotechnology industry, their activities are included in the indirect impact estimates.

Table 1

INDUSTRIES USED IN GENERATING LIST OF BIOTECHNOLOGY COMPANIES

SIC Code	Industry
2833	Medicinal Chemicals and Botanical Products
2834	Pharmaceutical Preparations
2835	In Vitro and In Vivo Diagnostic Substances
2836	Biological Products, Except Diagnostic Substances
8731	Commercial Physical and Biological Research

Source: 1999 Ernst & Young report and the BIOScan database

The primary data sources for the list of biotechnology companies and their employment were the 1999 Ernst & Young report and the BIOScan database. This data was supplemented by industry information from OneSource, Dun & Bradstreet, BioCentury, *Signals* and Standard & Poor's industry reports.

The economic contribution of the biotechnology industry was estimated using the IMPLAN model. IMPLAN is an economic impact assessment modeling system that estimates the national, private-sector impacts of economic changes. This input-output model captures all the relationships between various industries and sectors in the U.S. economy. The economic contribution of the biotechnology industry was estimated by identifying the biotechnology industry, and measuring the reduction in economic activity if there were no biotechnology industry. The contributions of the agricultural biotech, public and private segments were estimated by apportioning the contributions based on their share of employees.

Since biotechnology firms are different from the other (i.e., pharmaceutical and research) companies in these SIC codes, several adjustments were made. All of these adjustments were made based on empirically observed relationships from available data. Sales per worker was reduced to reflect the lower sales per worker ratio in the biotechnology industry (since many biotechnology companies have not yet brought products to market). Profitability was reduced to account for lower sales and higher investment in research and development. Finally, the industry's research and development expenditures were increased, and its advertising

expenditures were decreased, since biotechnology companies spend differently on these items relative to pharmaceutical companies.

The tax revenue contribution impacts were estimated using the most recently available information on the relationship between U.S. personal income and tax collections by major tax source for each level of government. These ratios were applied to the estimated biotechnology industry's contribution to personal income to estimate tax collections.

Federal Taxes

The ratios of federal taxes to personal income were estimated by dividing 1999 U.S. tax revenues by Bureau of Economic Analysis (BEA) personal income figures. Total federal tax collections were obtained from the *Fiscal Year 2001 Budget of the United States Government, Analytical Perspectives*. Tax impacts were calculated for corporate and individual income taxes, social security taxes, excise taxes and other taxes.

State and Local Taxes

The relationship of state and local taxes to personal income were calculated using state and local government tax collections from the most recent annual edition of the U.S. Bureau of the Census, *Intergovernmental Finances* and BEA personal income figures. The ratios were then applied to the estimated personal income attributable to the biotechnology industry.

RESULTS AND DISCUSSIONS

As shown in Table 2, biotechnology companies directly employed 150,800 employees, but their purchases from other companies and the spending of their employees generated an additional 287,000 jobs, so that the total job generation attributable to the biotechnology industry is 437,000. In other words, there is an employment *multiplier* of 2.9, so that each job directly created in the biotechnology industry creates a total of 2.9 jobs, after factoring in the indirect and induced impacts. Similarly, while

biotechnology companies directly produce \$20.2 billion in revenues and \$14.8 billion in personal income, their total impact on revenues and personal income in the U.S. economy are \$46.5 billion and \$28.8 billion, respectively.

Table 2.

Economic Contribution of the Biotechnology Industry to the U.S.
Economy, 1999

Employment	
Direct Impact on Employment	150,800 Jobs
Multiplier	2.9
Total Impact on Employment	437,400 Jobs
Revenues	
Direct Impact on Revenues	\$20.2 Billion
Multiplier	2.3
Total Impact on Revenues	\$46.5 Billion
Personal Income	
Direct Impact on Personal Income	\$14.8 Billion
Multiplier	2.0
Total Impact on Personal Income	\$28.8 Billion

Source: Estimates calculated by Ernst & Young LLP using the IMPLAN model.

Public and Private Companies

As shown in Table 3, publicly traded companies generated most of these contributions. Public companies generated 105,200 jobs, \$14 billion in revenues and \$10 billion in personal income, while their total impact was 305,100 jobs, \$32 billion in revenues and \$20 billion in personal income. By contrast, private firms generated 45,600 jobs, \$6 billion in revenues and \$5 billion in personal income, and their total impact was 132,300 jobs, \$14 billion in revenues and \$9 billion in personal income.

Table 3

Economic Contributions of Public and Private Biotechnology Firms

		Public Firms	Private Firms
Employment:	Direct Impact	105,200 Jobs	45,600 Jobs
	Total Impact	305,100 Jobs	132,300 Jobs
Revenues:	Direct Impact	\$14.1 Billion	\$6.1 Billion
	Total Impact	\$32.4 Billion	\$14.1 Billion
Personal Income:	Direct Impact	\$10.3 Billion	\$4.5 Billion
	Total Impact	\$20.1 Billion	\$8.7 Billion

Source: Estimates calculated by Ernst & Young LLP using the IMPLAN model.

Agricultural Biotechnology

The contributions of the agricultural biotechnology industry are separately identified in Table 4. In 1999, agricultural biotechnology firms generated 21,900 jobs, \$2.3 billion in revenues and \$1.4 billion in personal income for employees and owners. These estimates include the contributions of biotechnology companies (direct contributions) and those of companies supplying inputs to biotech firms or supplying goods and services to their employees and owners (indirect and induced contributions).

Table 4

Total Contributions of the Agricultural Biotechnology Industry to the U.S. Economy, 1999

Employment	21,900 Jobs
Revenues	\$2.3 Billion
Personal Income	\$1.4 Billion

Source: Estimates calculated by Ernst & Young LLP using the IMPLAN model and data from Standard & Poors.

Tax Revenue Contribution

As shown in Table 5, the biotechnology industry generated \$10 billion in tax revenues in 1999, including \$6.8 billion in federal taxes, \$1.9 billion in state taxes and \$1.2 billion in local taxes.

Table 5

**Taxes Generated by the Biotechnology Industry,
1999**

Type of Tax	Taxes Collected (\$ Millions)
Federal taxes	\$6,843
State taxes	\$1,900
Local taxes	\$1,215
Total taxes	\$9,958

CONCLUSIONS

The biotechnology industry has grown rapidly in recent years, essentially doubling in size between 1993 and 1999. The findings of this study document the already significant contribution of this relatively new industry to the overall U.S. economy. In 1999, the combined direct, indirect and induced activities of the biotechnology industry contributed a total of 437,400 jobs and \$47 billion in business revenues to the U.S. economy. The public sector is also benefiting significantly from the biotechnology industry through additional federal, state and local taxes, estimated to be \$10 billion in 1999. With continued advances in genomics research and the accelerating pace of new drug development and approval, the biotechnology industry's economic and fiscal contribution should increase in pace with the expected contributions of biotechnology to the human sciences, agricultural production and environmental quality.

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