Secretariat

BioPharma Economic Impact on the US Economy

by Robert Stoner, Ph.D. and Jéssica Dutra, Ph.D.

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Executive Summary

BioPharma Economic Impact in the US Economy demonstrates that the BioPharma industry in the United States provides significant value added to Gross Domestic Product (GDP), a significant "multiplier" effect on employment and earnings, and a major R&D presence in the United States and worldwide. All monetary values in this report are shown in 2022 dollars (*i.e.*, adjusted for inflation); hence any growth can be readily interpreted as real growth.

BioPharma has experienced significant growth in recent years.

- The BioPharma industry has grown significantly in recent years, with all major measures experiencing robust growth: employment grew 16.8% and labor income grew 31.2% over 2018-2021. Such overall growth is particularly notable given the Covid-19 pandemic, which caused several other U.S. industries to experience static growth or even contract in the same time period.
- In particular, value added grew 28.7% from 2018 to 2021, and has grown faster than U.S. GDP every year since 2018, implying that BioPharma has been increasing its share of the U.S. economy in recent years. BioPharma has contributed 1.53% of all U.S. GDP in 2021, and 9.94% of Manufacturing's contribution to GDP in the same year.

BioPharma pays premium compensation compared to other industries.

- Labor income in BioPharma totaled nearly $54 billion in 2021. BioPharma industry compensates its employees at a very significant premium compared to other sectors: a 74% premium over manufacturing jobs, a 98% premium over private jobs, and a 106% premium over all U.S. jobs.

BioPharma Employment has significant multiplier effect.

- In 2021 alone, the BioPharma industry has supported over 1,490,000 total jobs in the U.S. economy, with a 5.12 multiplier in terms of the larger economy (*i.e.*, for every 1 job in BioPharma, an *additional* 4.12 jobs were supported in the larger economy).

BioPharma is a major investor in R&D.

- In 2020, U.S. BioPharma spent 16.6% of its revenue on research and development, totaling almost $91.8 billion.
- The United States has played a pre-eminent role in pharmaceutical research efforts relative to the rest of the world, with 44% of R&D companies having made the US their headquarter in 2022, while 53.4% of all drugs at the R&D stage are under development in the US, over half of all the world's R&D drugs.

BioPharma exports have reached their highest level 2021.

- In 2021, U.S. BioPharma exports registered over $92.5 billion, the highest level during the 2018-2021 period covered in this study.

1

BioPharma Industries

It would certainly be a significant understatement to say that absent the contributions of the pharmaceutical industry, life as we know it would be completely different. The pharmaceutical industry does everything from discovering drugs to developing, producing, and marketing them to patients—with the ultimate aim of disease prevention, disease cure, or alleviation of symptoms. According to the NAICS 2022 manual, the pharmaceutical and medicine manufacturing industries can be defined as:

> "This industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing biological and medicinal products; (2) processing (i.e., grading, grinding, and milling) botanical drugs and herbs; (3) isolating active medicinal principals from botanical drugs and herbs; and (4) manufacturing pharmaceutical products intended for internal and external consumption in such forms as ampoules, tablets, capsules, vials, ointments, powders, solutions, and suspensions"[1]

The economic impact analysis in this report will be targeted to biopharmaceuticals' manufacturing (*henceforth* BioPharma) rather than encompassing adjacent areas, such as wholesale distribution, and corporate administration related to BioPharma[2]. Figure 1 below shows the NAICS that identify BioPharma for the purposes of the economic impact portion of this report. This convention is consistent with several other studies in the field.[3]

[1] *See*, Office of Management and Budget, *"North American Industry Classification System"*, United States, 2022, NAICS 3254: Pharmaceutical and Medicine Manufacturing. (pp. 197-198)

[2] It is important to note that other studies have focused on broader definitions of BioPharma. *See, for example,* TEConomy Partners, LLC *"The Economic Impact of the U.S. Biopharmaceutical Industry: 2020 National and State Estimates"*, prepared for PhRMA.

[3] *See, for example,* PWC and EFPIA, *"Economic and societal footprint of the pharmaceutical industry in Europe"*, June 2019 use NACE C21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations); WifOR Berlin and IFPMA, *"The Global Economic Impact of the Pharmaceutical Industry"*, September 2020 use ISIC Rev. 4 C21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations). NACE Rev. 2 C21 is equivalent to ISIC Rev. 4 C21 and correspond to NAICS 2017 and NAICS 2022 codes 325199. 325411, 325412, 325413. 325414, and 339113, making those studies slightly broader than the present report.

Figure 1. *BioPharma Industries*

NAICS	DESCRIPTION	FULL DESCRIPTION
325411	**Medicinal and botanical manufacturing**	This U.S. industry comprises establishments primarily engaged in (1) manufacturing uncompounded medicinal chemicals and their derivatives (i.e., generally for use by pharmaceutical preparation manufacturers) and/or (2) grading, grinding, and milling uncompounded botanicals.
325412	**Pharmaceutical preparation manufacturing**	This U.S. industry comprises establishments primarily engaged in manufacturing in-vivo diagnostic substances and pharmaceutical preparations (except biological) intended for internal and external consumption in dose forms, such as ampoules, tablets, capsules, vials, ointments, powders, solutions, and suspensions.
325413	**In-vitro diagnostic substance manufacturing**	This U.S. industry comprises establishments primarily engaged in manufacturing in-vitro (i.e., not taken internally) diagnostic substances, such as chemical, biological, or radioactive substances. The substances are used for diagnostic tests that are performed in test tubes, petri dishes, machines, and other diagnostic test-type devices.
325414	**Biological product (except diagnostic) manufacturing**	This U.S. industry comprises establishments primarily engaged in manufacturing vaccines, toxoids, blood fractions, and culture media of plant or animal origin (except diagnostic).

Source: North American Industry Classification System, United States 2022

The initial sections of this report will analyze economic impact, and show that BioPharma generates significant jobs and value added, as well as fiscal income. This report will also show in later sections that the U.S. BioPharma industry invests heavily in R&D, is an important contributor of patents, and helps maintain a healthy trade balance through exports, to say nothing of the fundamental impact of BioPharma in disease prevention and cure, as well as the quality of life.

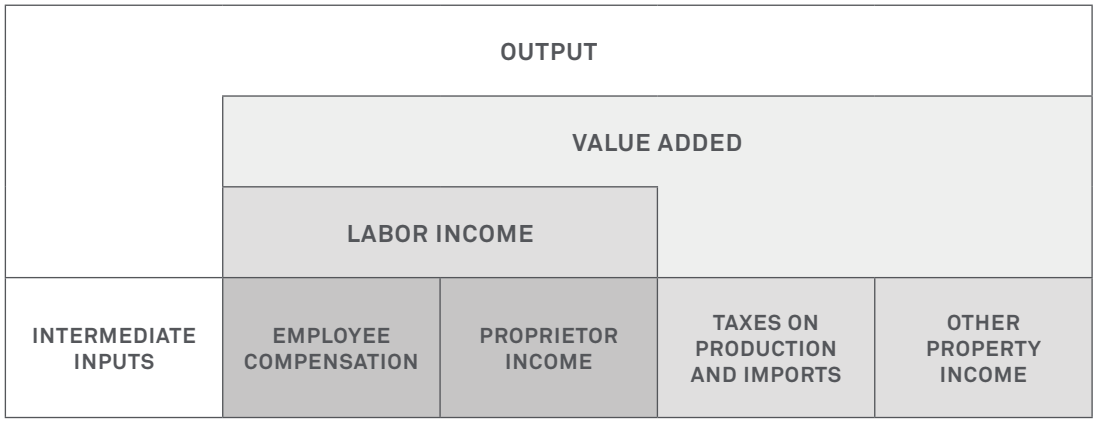
2

Determining Economic Impact

In order to determine the wider economic impact of BioPharma within the U.S. economy, we have utilized IMPLAN, an input-output model with built-in economic impact data which depicts the overall interdependence of industries and permits calculation of the contribution of a particular economic activity as it propagates in the economy. IMPLAN is a common tool utilized by economists that relies on calibrated algorithms and study-specific data inputs to measure impact of a particular industry or activity across the regional, state, or national economy.

We show economic impact of BioPharma in several measures: *Output*, *Employment*, *Labor Income*, *Value Added* (which is equivalent to GDP contribution), and *Tax Contribution*. Figure 2 shows how all these values inter-relate within the IMPLAN model, giving a more complete picture of the role that biopharmaceutical manufacturing plays in the economy. Following we explain in more detail what each of these measures portrays.

Figure 2. *Distinct Components of an Input-Output Model*



Source: IMPLAN—Understanding Value Added (VA)

Labor Income includes both BioPharma supported employee compensation (salary, wages and benefits) and proprietor income (the compensation and benefits a proprietor receives in exchange for the work put into the business).

- Similarly, **Employment** is a measure of the number of jobs tied to BioPharma economic activity.

Value Added can be thought of as contribution to GDP, as it refers to the difference between input costs and value of the output supported by BioPharma.

Total Value of Output puts a dollar value on all goods and services whose economic activity is supported by BioPharma.

The impacts listed above can thus initially be broken down into two dimensions: direct effects and ripple effects. Ripple effects, in turn, can be broken down into indirect and induced effects. These impacts and how they are related can be summarized as follows.

1. **Direct Effects** are associated with the initial production of the industry being analyzed.
2. **Ripple Effects** account for all production along the supply chain, and the additional production triggered by spending on payroll and purchases of these suppliers. These can be further broken down between Indirect and Induced.
   a. **Indirect Effects** account for the fact that each supplier of goods and services to a particular industry like BioPharma purchases its inputs from other suppliers.
   b. **Induced Effects** account for employees within the directly and indirectly affected industries spending their increased income widely and thus triggering additional production.
3. **Total Effects** are then the sum of **Direct** and **Ripple Effects**.

3

BioPharma Direct Impact and Recent Years' Growth

We begin by documenting recent years' growth in BioPharma *direct* economic activity as expressed by the several measures explained in the section above. Figure 3 documents the values for 2018 and 2021 for each of these measures, as well as the percent change/growth experienced in each measure. As we can see, there was positive growth for all indicators, showing that BioPharma industry has expanded comprehensively.

In the following subsections we go into further detail about BioPharma's substantial (and growing) contributions to the economy in terms of Employment, Labor Income, Value Added, and Output.

Regarding tax impacts, we can see in Figure 3 below that BioPharma continues to be an important source of fiscal contribution at both the federal and state/local level. Federal and State/Local Tax contributions have increased by 21.6% and 39.9% respectively within the 2018-2021 time frame. Variations in fiscal contribution come not only from changes in BioPharma economic activity, but also from any tax rate changes. The total fiscal contribution from BioPharma in 2021 was $27.4 billion, with $13.3 billion in federal taxes and $14.1 billion in state and local taxes. As indicated previously, all monetary values in this report are shown in 2022 dollars (*i.e.*, adjusted for inflation); hence any growth can be readily interpreted as real growth.

Figure 3. *U.S. BioPharma Direct Impacts, 2018 and 2021*

		USD MILLIONS				
	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT	FEDERAL TAX REVENUE	STATE/LOCAL TAX REVENUE
2018	249,165	41,156	150,148	327,766	10,935	10,119
2021	291,033	53,997	193,232	356,549	13,294	14,155
Percent Change, 2018-2021	**16.8%**	**31.2%**	**28.7%**	**8.8%**	**21.6%**	**39.9%**

Source: IMPLAN® model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Output

One of the measures of economic impact is Output, which shows the monetary value of the sum of inputs used in the production and supply of goods and services. It can be thought of as the value of production in a given year. As shown in Figure 3 above, BioPharma output totaled $356 billion in 2021. BioPharma output measures in 2018 and 2021 broken down for each of the sub-industries discussed above can be seen on Appendix Figure A1.

Employment

Employment is a very important measure of economic impact, as employment is both a significant input of production and a source of income by which households can engage in spending in the larger economy. In Figure 3 above we saw that employment overall for BioPharma represented 291,033 jobs in 2021. In Figure 4 below we show this number broken down by NAICS manufacturing sub-industry. Pharmaceutical preparation has the largest contribution, accounting for almost 190,000 jobs and over 65% of BioPharma employment in the United States.

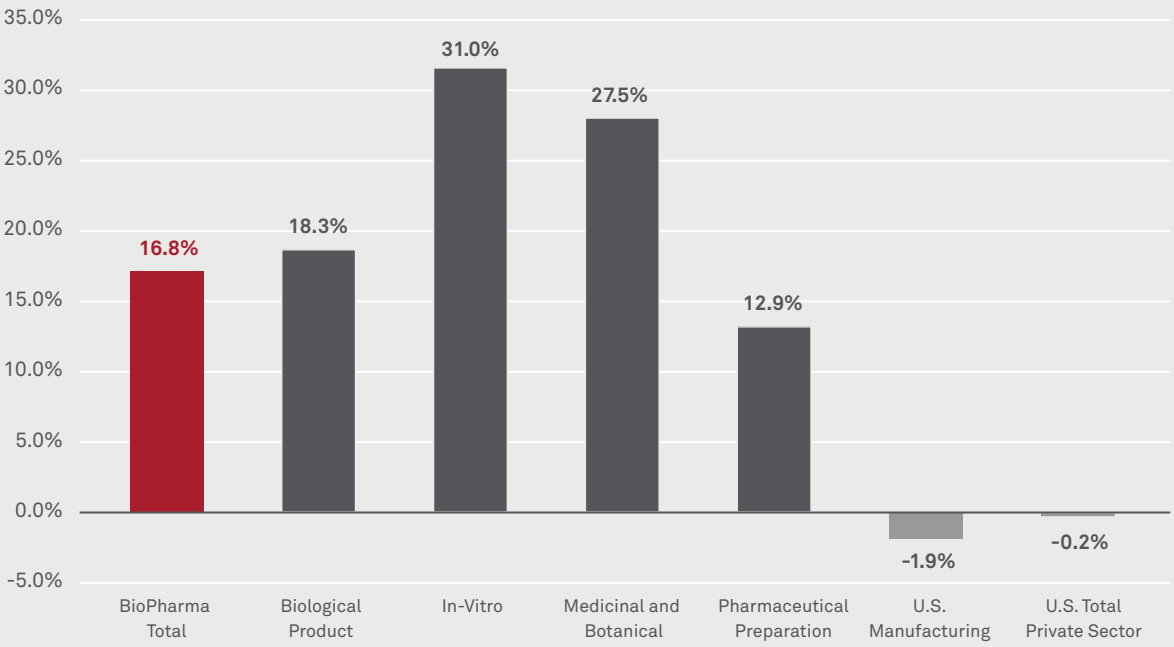
Each of these NAICS sub-industries has experienced Employment growth from 2018 to 2021 as shown in Figure 5, following. This growth appears to be driven by economic activity sector-wide, where aggregate BioPharma industry growth was 16.8%. In-vitro has shown the largest sub-industry growth, with 31%, followed by Medicinal and Botanical, with 27.5%. While there was some variation in the percentage changes in Employment for the different NAICS BioPharma sub-industries, Employment in all cases has grown in excess of 12.9% over the 2018-2021 period.

Figure 4. *U.S. BioPharma Employment by Industry, 2021*

BIOPHARMA MANUFACTURING INDUSTRY	BIOPHARMA MANUFACTURING INDUSTRY EMPLOYMENT	SHARE OF TOTAL BIOPHARMA MANUFACTURING INDUSTRY EMPLOYMENT
Medicinal and Botanical	33,964	11.7%
Pharmaceutical Preparation	189,686	65.2%
In-Vitro	29,949	10.3%
Biological Product	37,435	12.9%
Total	**291,033**	**100.0%**

Source: IMPLAN® model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

Figure 5. *BioPharma Employment Change by Sub-Sector, 2018-2021*



Source: https://data.bls.gov/timeseries/CES3000000001; https://data.bls.gov/timeseries/CES0500000001; IMPLAN 2018-2021

As Figure 5 shows, these employment growth rates are particularly notable when compared to U.S. overall manufacturing employment, that retracted 1.9% in the same time period, and U.S. private sector employment which retracted by 0.2%. BioPharma employment levels in 2018 and 2021 broken down for each of the sub-industries can be seen in Appendix Figure A2.

Labor Income

Labor Income is another important measure of economic impact. It consists of wages and salaries as well as proprietors' income. Employer contributions for health insurance are also included in this computation. Figure 3 above shows that labor income in BioPharma totaled nearly $54 billion in 2021, with a spectacular 31.2% growth rate since 2018. Labor income levels in 2018 and 2021 broken down for each of the BioPharma sub-industries can be seen in Appendix Figure A3.

Figure 6. *U.S. BioPharma Industry Compensation Ratios Compared to Other U.S. Employees (1.00=100%), 2021*

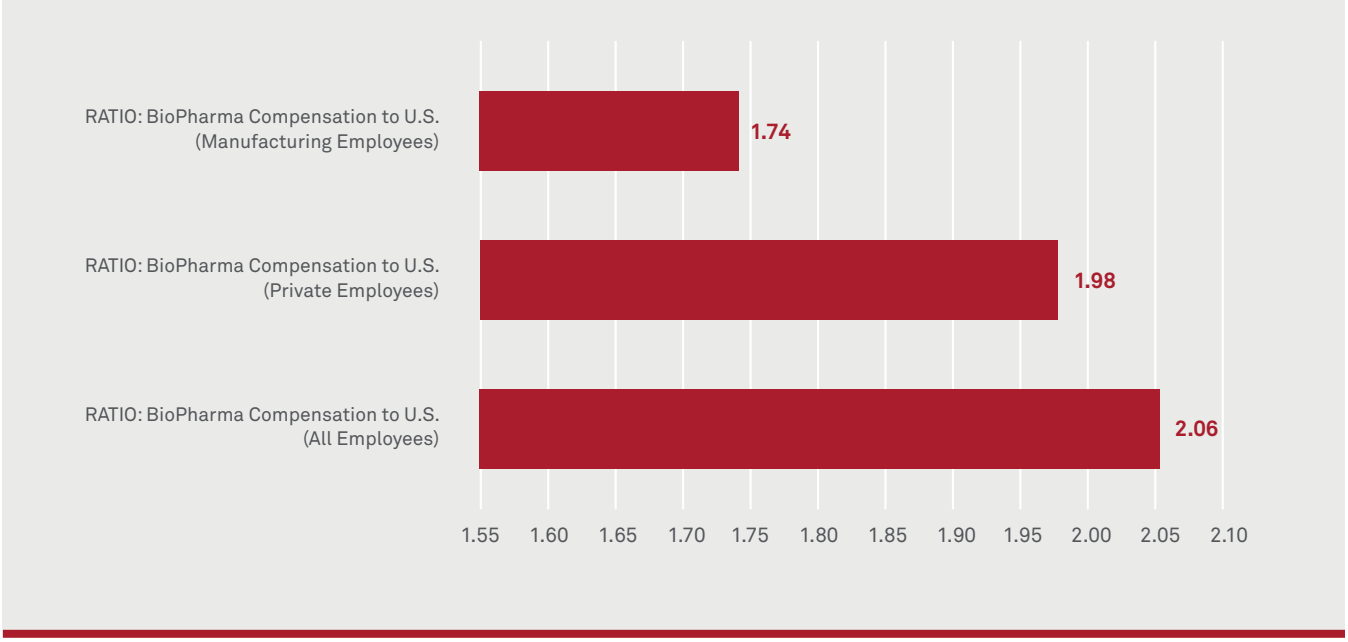


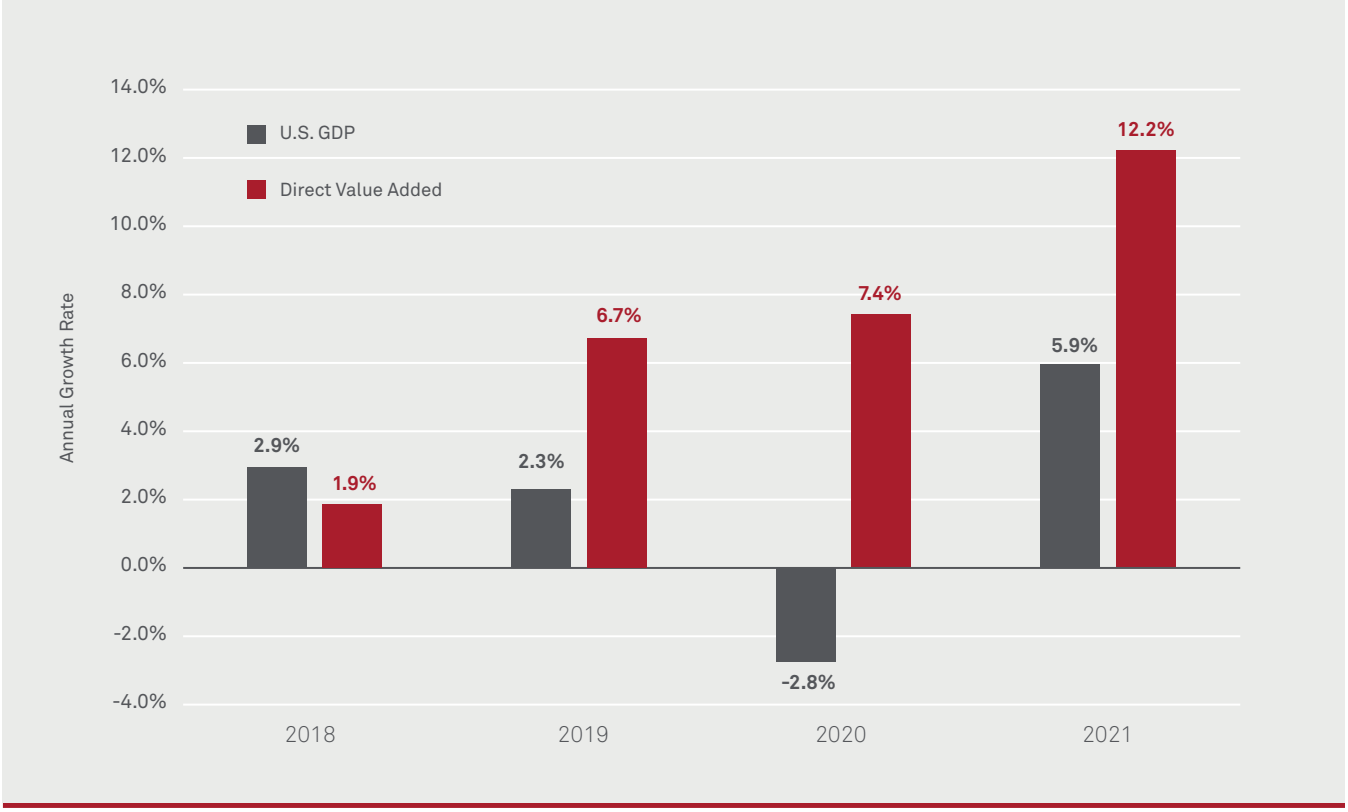
Figure 6 above compares 2021 compensation averages between BioPharma and various industries, showing that the BioPharma industry compensates its employees at a very significant premium compared to other sectors: a 74% premium over manufacturing jobs, a 98% premium over private jobs, and a 106% premium over all U.S. jobs.

Value Added

Value Added can be thought of as contribution to Gross Domestic Product (GDP), as it takes Output and deducts the value of any intermediate inputs. As shown in Figure 3 above, BioPharma's direct contribution to GDP totaled $193.2 billion in 2021, growing an impressive 28.7% from 2018 to 2021. The direct value added per employee averaged $664,000 in 2021[4] . BioPharma value added in 2018 and 2021 broken down for each of the relevant sub-industries can be seen in Appendix Figure A4.

[4] $193 billion value added / 291,000 employees ~ $664,000 value added per employee.

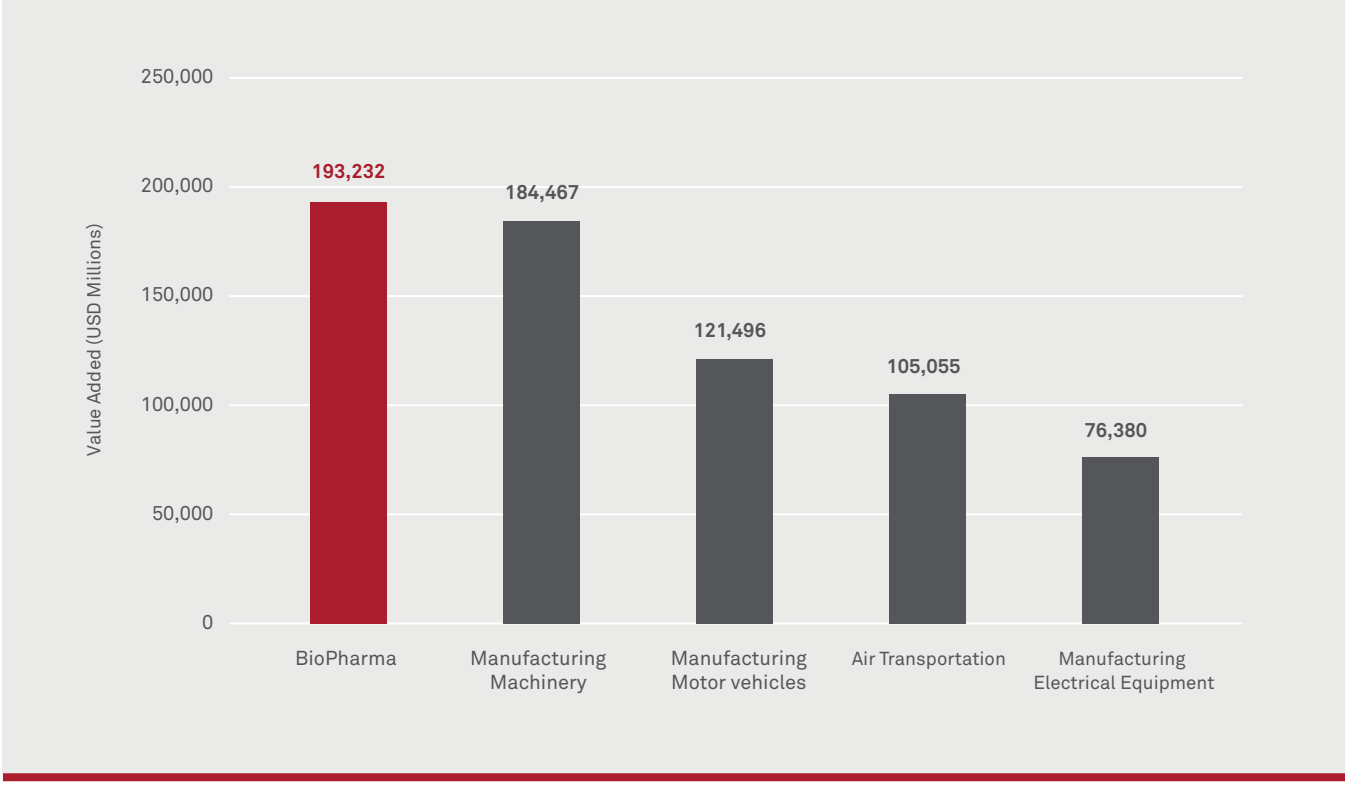
Figure 7. *Growth in U.S. BioPharma Value Added vs. U.S. Real GDP Growth, 2018-2021*



Source: https://fred.stlouisfed.org/series/GDPCA; IMPLAN 2019-2021

Since value added is equivalent to contribution to GDP, we can compare the rates of growth of BioPharma's value added and U.S. GDP, as shown in Figure 7 above. For all years since 2018, BioPharma value added has grown faster than U.S. GDP, implying that BioPharma has been increasing its share of the U.S. economy in recent years. This is particularly notable in 2020, when the economy as a whole suffered a contraction, yet BioPharma continued to grow at a healthy pace.

Figure 8. *Comparative Industry Value Added, 2021*



Source: IMPLAN 2021; U.S. Bureau of Economic Analysis, "Value Added by Industry" (accessed Tuesday, March 21, 2023); U.S. Bureau of Economic Analysis, "Chain-Type Price Indexes for Value Added by Industry" (accessed Tuesday, March 21, 2023).

Value added from BioPharma can also be compared to the value added of other major U.S. industries, as shown in Figure 8 above. In 2021, BioPharma contributed more to GDP, for example, than Machinery Manufacturing, Motor vehicles Manufacturing, Air Transportation, and Electrical Equipment Manufacturing.

4

BioPharma Economic Impact Beyond Direct Effects

In order to fully analyze economic impact, we have to go beyond the *Direct Effects* of the BioPharma industry just discussed. The economic activity in BioPharma is in fact much larger, as we can account for the economic activity it supports in other sectors of the economy. This involves the so-called *Ripple Effects* which we defined earlier.

Figure 9 below shows for 2021 the direct effects of BioPharma previously reported in Figure 3, but now adds the indirect and induced effects *supported* by BioPharma. This gives a more comprehensive view of the economic impact of BioPharma within the U.S. economy. As can be seen, the impact of BioPharma in the greater economy through indirect and induced effects is significant. Starting with employment, Biopharma supports 495,588 jobs in an indirect manner through the affected supply chain, and 703,665 jobs in an induced manner through the spending patterns of income earners who are supported by BioPharma's economic activity. Thus, for

Figure 9. *The Economic Impact of the BioPharma Industry on the U.S. Economy, 2021.*

		USD MILLIONS		
	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	291,033	53,997	193,232	356,549
Indirect	495,588	48,217	82,811	161,097
Induced	703,665	45,792	80,221	141,104
Total	1,490,286	148,006	356,264	658,749
Multiplier	**5.12**	**2.74**	**1.84**	**1.85**

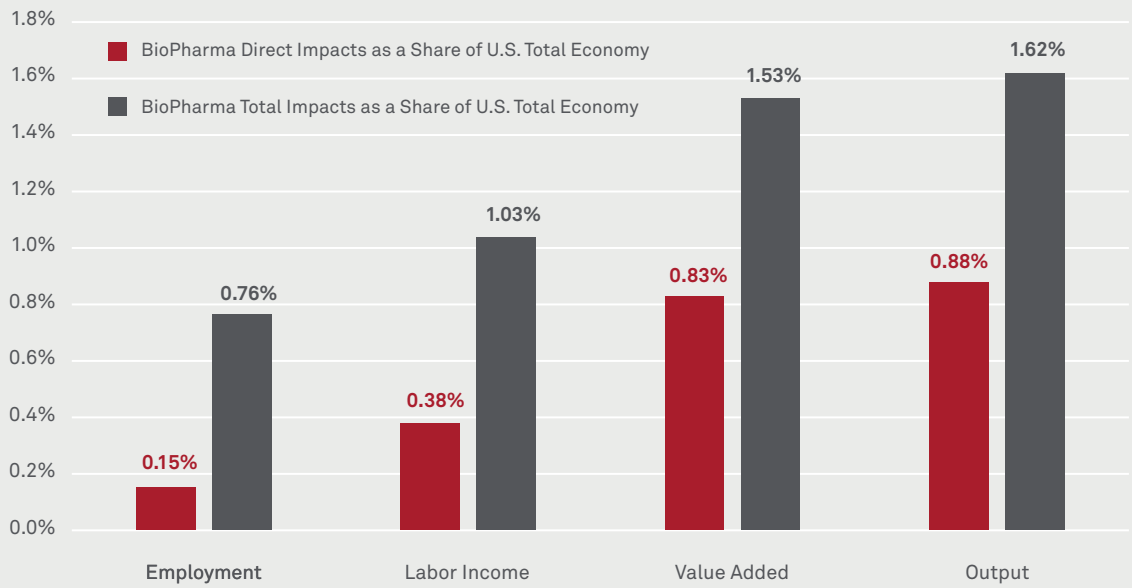
Source: IMPLAN® model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

every 1 job in BioPharma, 4.12 additional jobs are supported in the larger economy emanating from BioPharma's indirect and induced effects, which implies a 5.12 multiplier. This employment multiplier is particularly high when compared to the employment multipliers calculated in significant industries such as the U.S. Civil Aviation industry (2.63),[5] U.S. video game industry (3.00),[6] and the U.S. electronics manufacturing sector (4.04 multiplier).[7]

Labor income also brings significant indirect and induced effects, with a total BioPharma contribution to the economy of over $148 billion in 2021. The labor income multiplier is 2.74 (*i.e.*, for every $1 in direct labor income in BioPharma, an additional $1.74 is supported in other sectors of the economy). This labor multiplier is higher, for example, than labor multipliers calculated in significant industries such as the U.S. video game industry (2.03),[8] the U.S. retail industry (2.25),[9] the U.S. fresh produce and floral supply industry (2.29),[10] and the U.S. electronics manufacturing sector (2.46).[11]

Figure 10 below summarizes the share of BioPharma's contribution to U.S. value added (GDP) in 2021, both from

Figure 10. *BioPharma Industry's Contributions to the U.S. Economy, 2021*



Source: IMPLAN 2021

[5] Federal Aviation Administration, "*The Economic Impact of Civil Aviation on the U.S. Economy*", 2020

[6] TEConomy Partners, LLC. "*Video Games in the 21st Century: The 2020 Economic Impact Report*", prepared for The Entertainment Software Association. (henceforth TEConomy & ESA (2020))

[7] IPC, "*The Economic Impacts of the U.S. Electronics Manufacturing Sector*", 2020, available at www.ipc.org (henceforth IPC (2020))

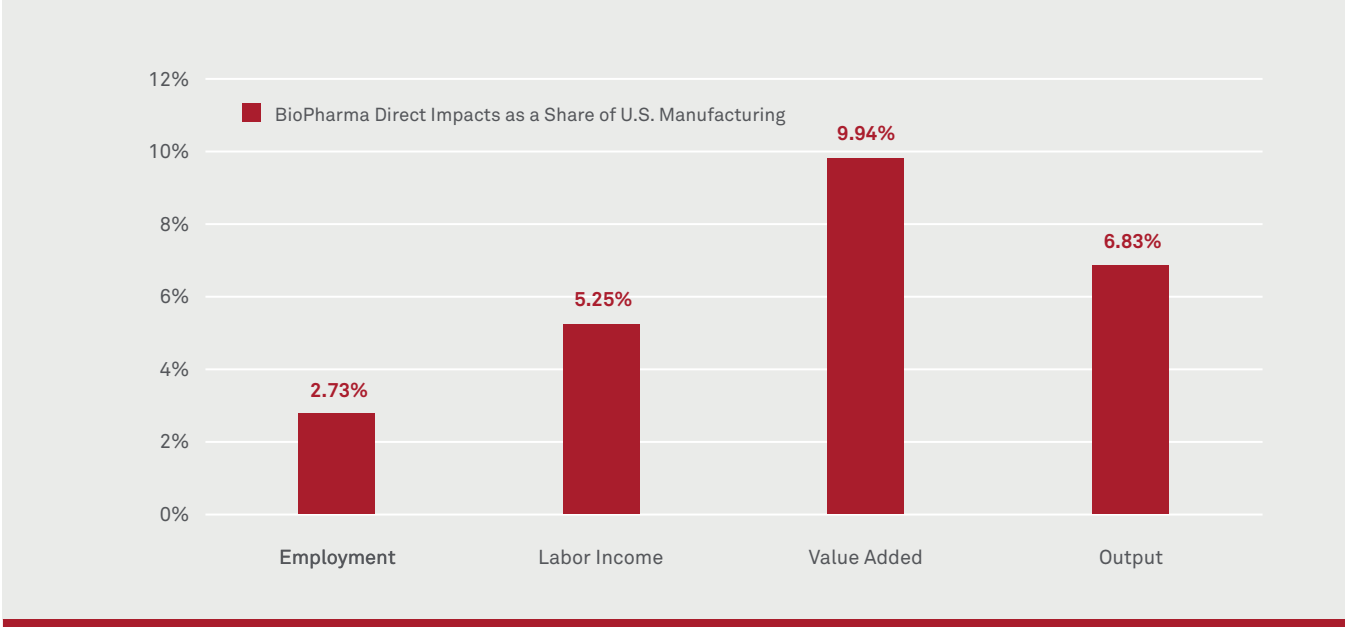
[8] *See*, TEConomy & ESA (2020), *supra* note 6.

[9] PWC and National Retail Federation, "*The Economic Impact of the US Retail Industry*" May 2020. Calculation based on Table 14a.

[10] International Fresh Produce Association, "*U.S. Economic Impact Fresh Produce & Floral Industries*" August 2022.

[11] *See*, IPC (2020), *supra* note 7.

Figure 11. *BioPharma Industry's Contributions to U.S. Manufacturing, 2021*



Source: IMPLAN 2021

direct and total (including direct and induced) impacts. We show that BioPharma's total value added, as defined in this report, represented 1.53% of U.S. GDP in 2021.

Figure 11 above shows the contribution of BioPharma to the overall U.S. manufacturing industries for 2021, where it represents 2.73% of employment but 5.25% of labor income. The disparity between BioPharma's contribution to employment and its contribution to labor income can be explained by BioPharma's 74% compensation premium over manufacturing jobs shown in Figure 6 above. BioPharma also contributed to 6.83% of output, and 9.94% of value added, showing that nearly a tenth of all U.S. manufacturing value added comes from the pharmaceutical industry as defined in this report.

5

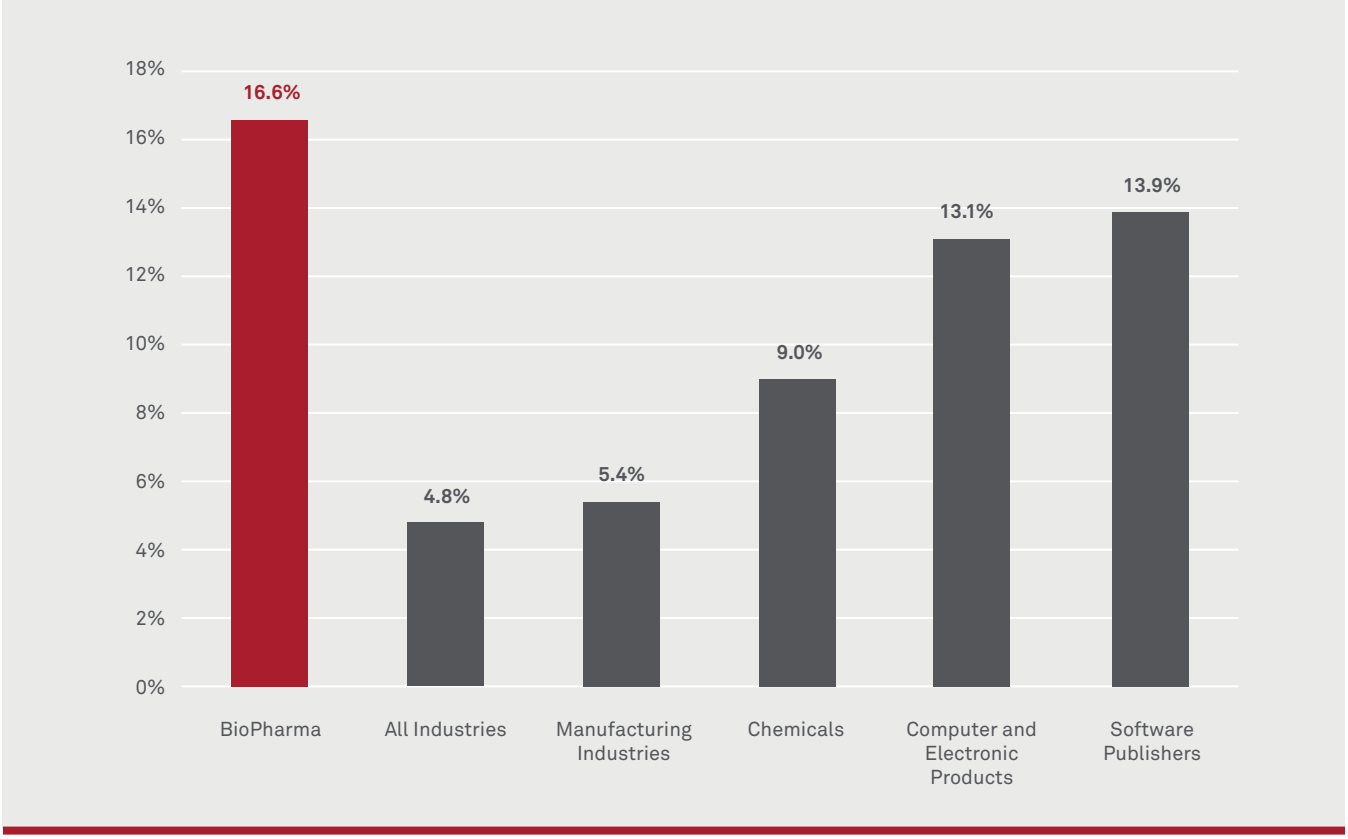
Research and Development Intensity

Research and Development (R&D) provides a fundamental force for economic growth, generating value now and in the future in any industry. But R&D in the case of pharmaceuticals has particularly beneficial societal consequences, since innovation in the field has allowed medicine to address previously incurable or unmanageable diseases, providing a better quality of life and increased life expectancy for many people around the world. BioPharma research is by its nature very expensive and highly uncertain (with many failures), and if that initial hurdle is overcome, the cost of further development and regulatory approval of saleable drugs is also very high. A relevant study estimates the investment incurred to take a representative drug to market to be just over $3.9 billion.[12]

It is worth highlighting that R&D expenditure and intensity aren't typical economic impact indicators, but BioPharma's R&D intensity is an important data point to bring to the forefront, as BioPharma spends more on research and development per dollar of revenue than almost any other American industry. As shown in Figure 12 below, in 2020, BioPharma spent 16.6% of its revenue on research and development, totaling almost $91.8 billion.

[12] DiMasi JA, Grabowski HG, Hansen RW. "*Innovation in the pharmaceutical industry: New estimates of R&D costs.*" J Health Econ, 2016 estimate $2870 million in 2013 dollars. This figure was adjusted to 2022 dollars using BEA's Chain-Type Price Indexes for Value Added by Industry (NAICS 325).

Figure 12. *U.S. Industry R&D Intensity, 2020*



Source: Businesses spent Over a Half Trillion Dollars for R&D Performance in the United States During 2020, a 9.1% Increase Over 2019, http://ncses.nsf.gov/pubs/nsf22343

Around the globe, there are over 20,000 drugs under development by pharmaceutical companies, a figure that has grown year after year since 2001, showing the commitment of BioPharma to R&D on a worldwide basis.[13] The U.S. has taken a preeminent role in these efforts: 44% of R&D companies have their headquarters in the U.S. in 2022,[14] while 53.4% of all drugs at the R&D stage worldwide are under development in this country.[15]

[13] *See*, Citeline, "*Pharma R&D Annual Review 2022: Navigating the Landscape*", at Figure 1.
[14] *Id.* at Figure 8.
[15] *Id.* at Table 3.

6

Patents

The unpredictability of discovery resulting from R&D spending described in the section above, the large fixed and sunk costs inherent in drug discovery and the relatively low marginal cost of production[16] make patent protection in BioPharma extremely important.[17] Patent protection benefits society by allowing an inventor to profit from his or her inventions, thereby promoting innovation and encouraging the development new products. In practice, patents grant the right to exclude others from making, using, or selling the invention.

Utility patents have the purpose of protecting useful processes, machines, articles of manufacture, and compositions of matter, or a new and useful improvement, and can also be referred to as "patents for invention".[18] Design patents protect the ornamental design of the product being manufactured,[19] which ultimately allows companies to further differentiate their goods or delivery mechanisms from those supplied by their competitors, increasing the likelihood of commercial success. Both types of patents are very important in an innovative and R&D- intensive industry such as BioPharma.

[16] *See, for example,* Scott Morton, Fiona, and Margaret Kyle. 2012. *"Markets for Pharmaceutical Products."* In *Handbook of Health Economics: Volume 2,* edited by Mark V. Pauly, Thomas G. McGuire, and Pedro Pita Barros, 763–823. Oxford and Waltham: Elsevier, North-Holland, at p. 772.

[17] *See, for example,* Cohen, Wesley M., Richard R. Nelson, and John P. Walsh. 2000. *"Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)."* National Bureau of Research Working Paper 7552.; Levin, R. C., Klevorick, A. K., Nelson, R. R., Winter, S. G., Gilbert, R., & Griliches, Z. *"Appropriating the returns from industrial research and development."* Brookings papers on economic activity 1987.3 (1987): 783-831.

[18] *See,* 35 U.S.C. 101: INVENTIONS PATENTABLE.

[19] *See,* 35 U.S.C. 171: PATENTS FOR DESIGNS.

The U.S. Patent and Trademark Office ("USPTO") defines a particular industry to be patent intensive if its patent count-to-employment ratio is above the average of the considered industries.[20] BioPharma—as defined in the USPTO analysis by the 4 digit NAICS 3254—is considered to be an utility patent-intensive industry, ranking 9th overall among industries classified in their study, with an average of 67.8 utility patents per thousand employees.[21] This is higher, for example, than motor vehicle manufacturing (53.9),[22] computer systems design (28.3),[23] and aerospace product and parts manufacturing (28.2).[24] BioPharma has also been found to be a design patent-intensive industry, with 1.02 design patents per thousand employees.[25] This is higher, for example, than motor vehicle parts manufacturing (0.85),[26] aerospace product and parts manufacturing (0.56),[27] and advertising and related services (0.36).[28]

[20] U.S. Patent and Trademark Office, "*Intellectual property and the U.S. economy: Third Edition*" Supplementary Material.
[21] *Id.* at Table 3.
[22] *Ibid.*
[23] *Ibid.*
[24] *Ibid.*
[25] *Id.* at Table 4.
[26] *Ibid.*
[27] *Ibid.*
[28] *Ibid.*

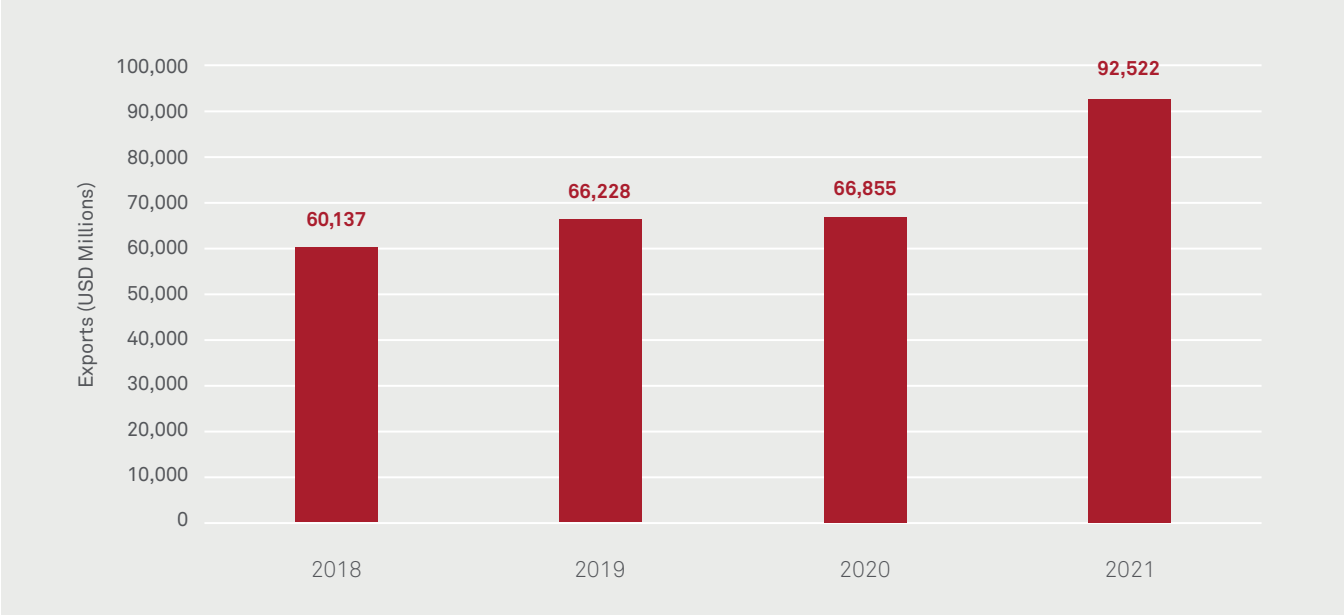
7

Exports

BioPharma exports play an important role in U.S. foreign trade, and those exports have grown significantly in recent years as shown in Figure 13 below. BioPharma exports have enjoyed an aggregate growth rate of 53.85% over the 2018-2021 time period, reaching more than $92.5 billion in 2021. This makes BioPharma an important contributor to the U.S. trade balance.[29] Figure 14 below shows the 2021 U.S. exports of BioPharma as well as some select important industries, showing that BioPharma contributed more to the U.S. trade balance than, for example Agricultural Products, Motor Vehicles, and Computer Equipment.

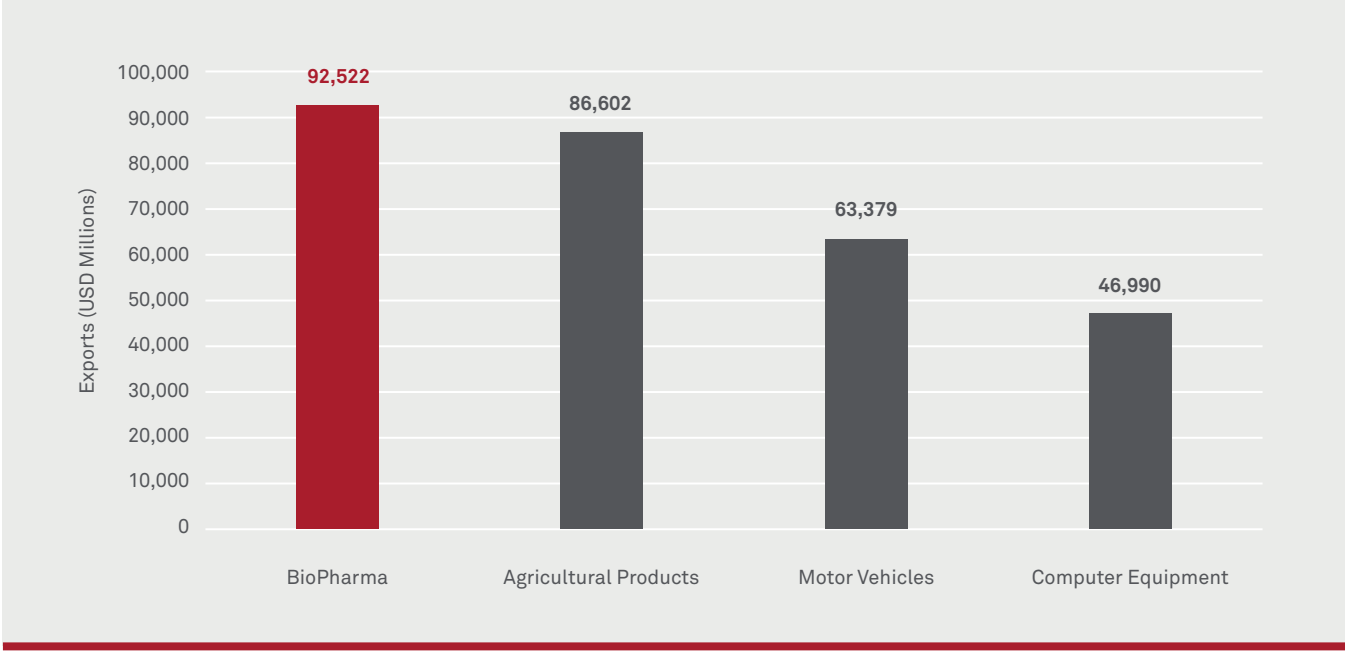
[29] U.S. BioPharma exports were estimated using the U.S. Census Bureau, U.S. International Trade in Goods and Services data for NAICS 3254.

Figure 13. *U.S. BioPharma Exports, 2018-2021*



Source: United States Census Bureau, https://usatrade.census.gov/index.php

Figure 14. *Exports for Selected Industries, 2021*



Source: United States Census Bureau, https://usatrade.census.gov/index.php

Note: BioPharma (NAICS 3254), Agricultural Products (NAICS 111), Motor Vehicles (NAICS 3361), Computer Equipment (NAICS 3341)

Conclusions

This report has analyzed the direct and total economic impact of BioPharma over the period 2018-2021 and shown that BioPharma as defined herein has grown significantly in recent years, with all major measures experiencing significant increase. For example, direct employment grew 16.8% and direct labor income grew 31.2% over the time period. This growth in direct economic impact is particularly notable given the outsized effect the Covid-19 pandemic, which has impacted several U.S. industries in a negative manner. BioPharma's direct U.S. value added grew 28.7%, faster than U.S. GDP in every year since 2018, implying that BioPharma constitutes an increasing share of the U.S. economy in recent years.

We have also shown that BioPharma casts a large economic shadow beyond its direct impacts. For example, BioPharma supported over 1,490,000 jobs in total in the U.S. economy in 2021, with a 5.12 multiplier in terms of the larger economy (*i.e.*, for every 1 job in BioPharma, an *additional* 4.12 jobs were supported in the larger economy). BioPharma also compensates its employees at a very significant premium compared to other sectors: a 74% premium over manufacturing jobs, a 98% premium over private jobs, and a 106% premium over all U.S. jobs.

BioPharma invests heavily in research and development, spending 16.6% of its revenue on R&D, more per dollar of revenue than almost any other American industry. The U.S. plays a pre-eminent role in worldwide pharmaceutical research efforts, with more than half of all drugs at the R&D stage under development in the U.S.. BioPharma is also extremely important in the balance of trade, having registered over $92.5 billion in exports in 2021.

Through all of the measures of direct and total economic impact, as well as factors beyond narrow economic impact, that are summarized in this Report, it is clear that BioPharma has an outsized importance in the U.S. economic landscape. Not only does BioPharma contribute to the curing of disease and increasing the overall quality of life, but it is also a fundamental generator of economic value.

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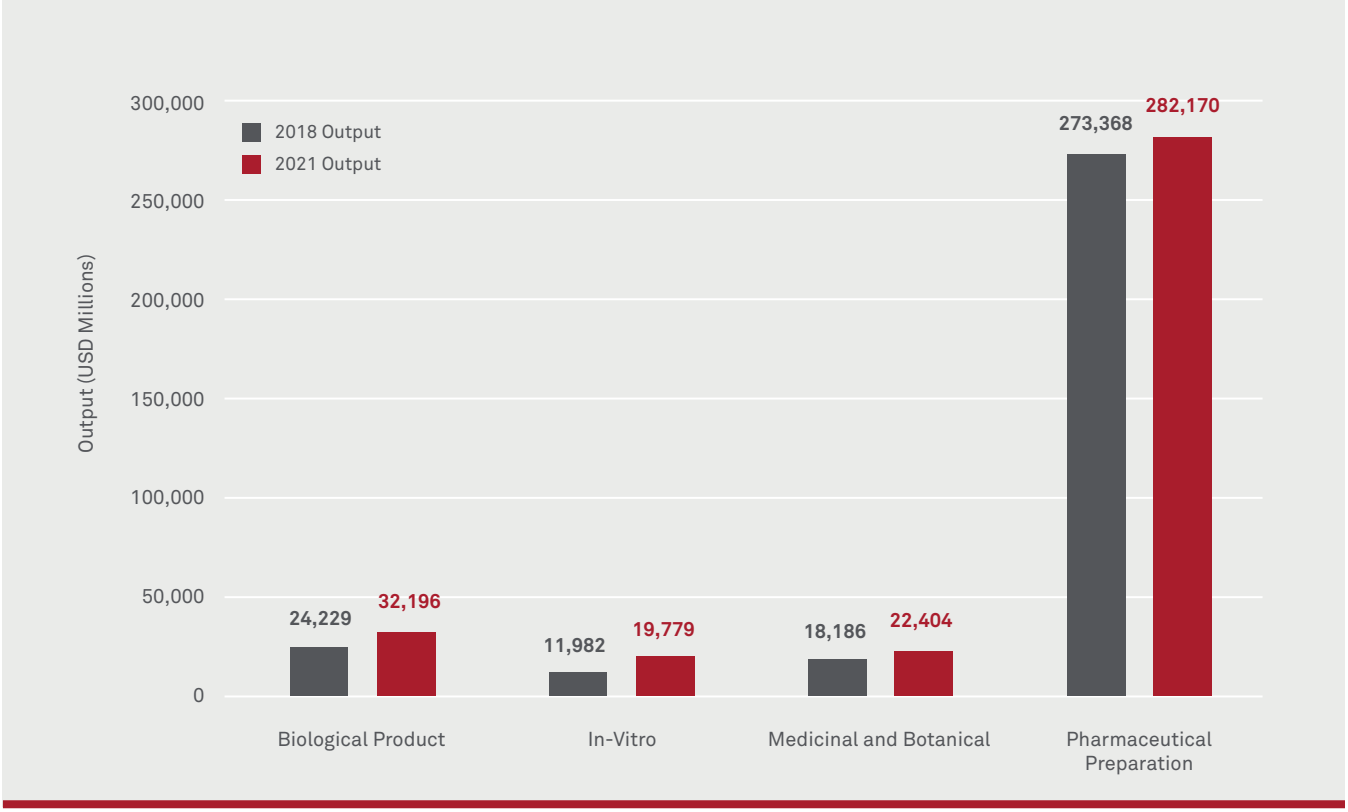
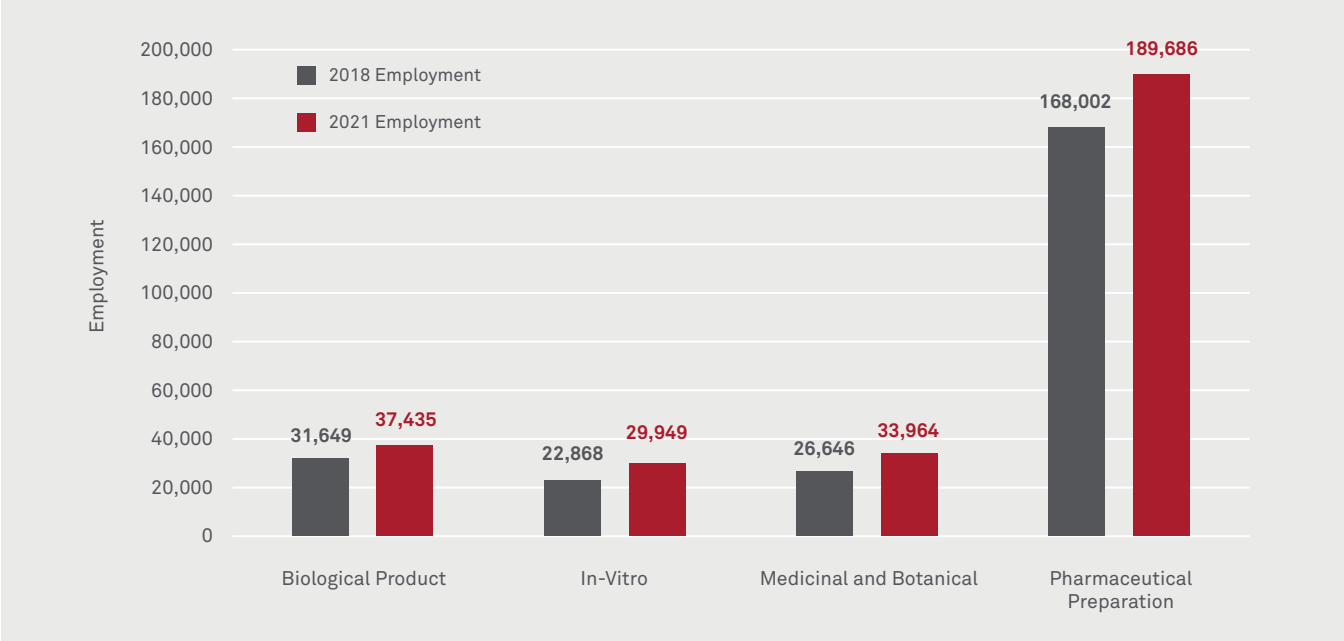
Appendix

Figure A1. *Changes in BioPharma Industry Output, 2018 - 2021*



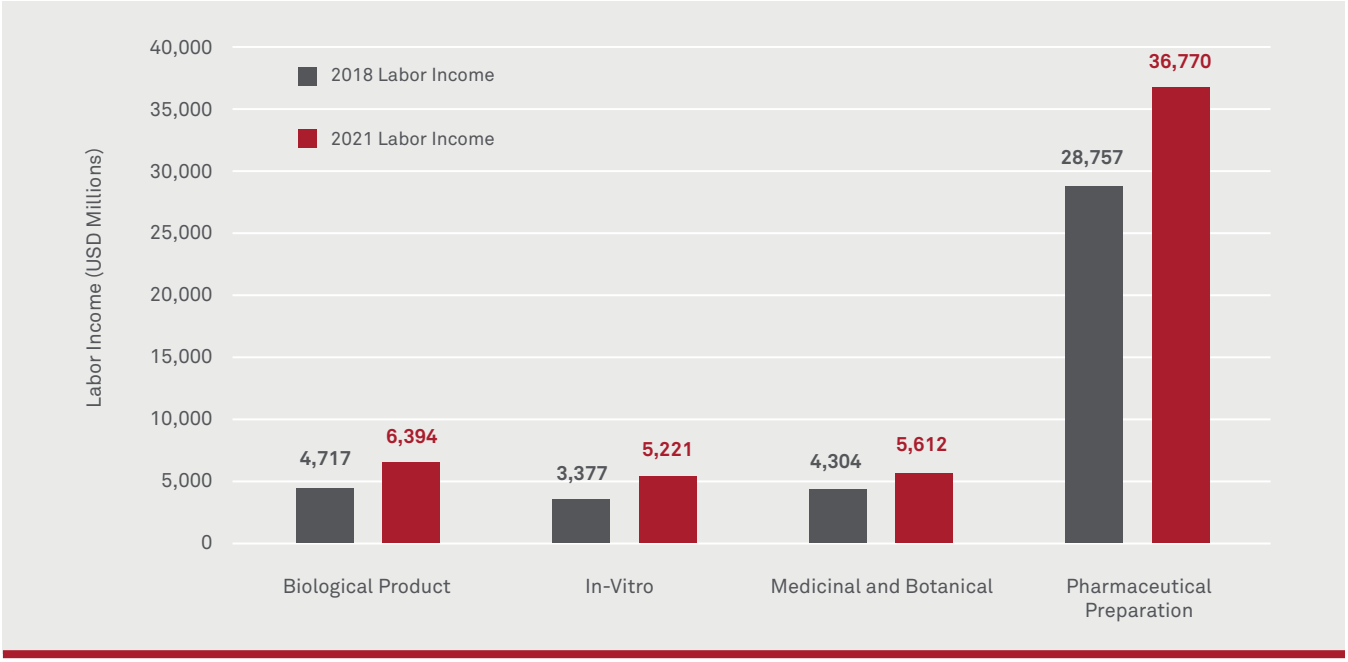
Source: IMPLAN 2018-2021

Figure A2. *Changes in BioPharma Industry Employment, 2018 - 2021*



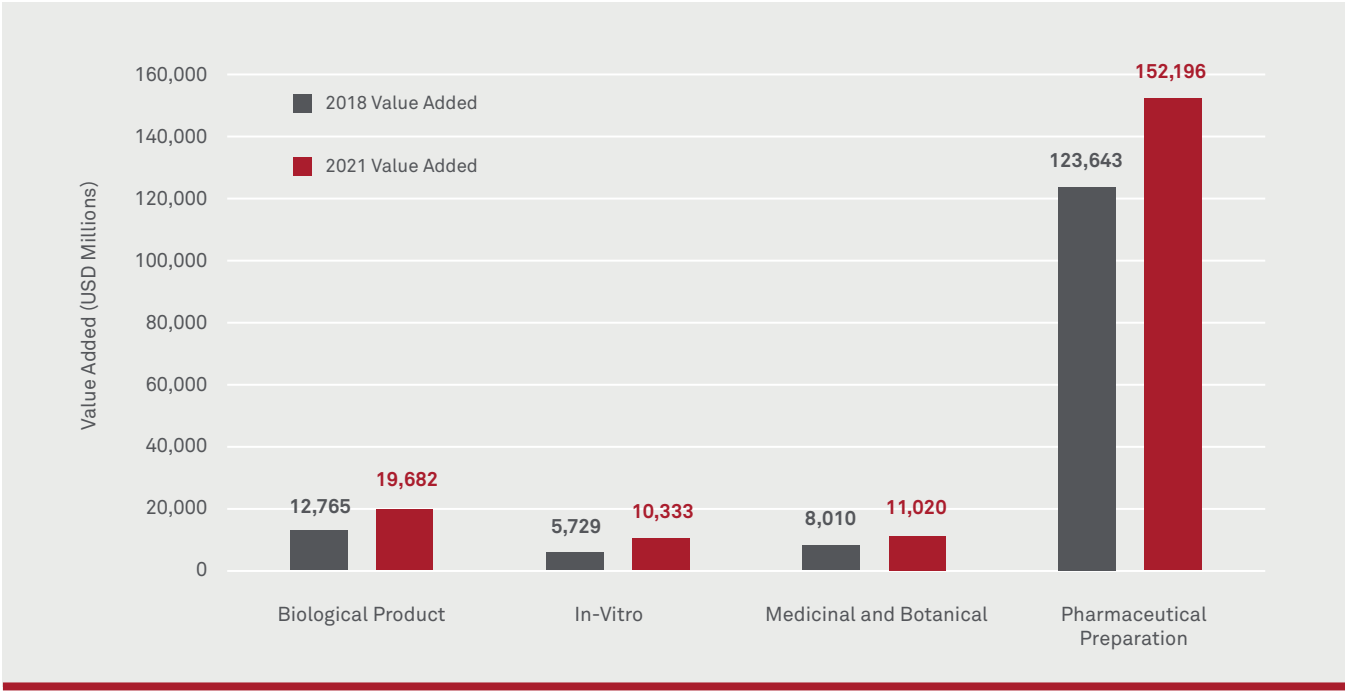
Source: IMPLAN 2018-2021

Figure A3. *Changes in BioPharma Industry Labor Income, 2018 - 2021*



Source: IMPLAN 2018-2021

Figure A4. *Changes in BioPharma Industry Value Added, 2018 - 2021*



Source: IMPLAN 2018-2021

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