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Integrated BEA-BLS Industry-Level Production Account, 1997–2023

The Sources of U.S. Economic Growth in the Aftermath of the COVID–19 Recession

By Corby Garner, Justin Harper, Matt Russell, and Jon Samuels[1] | *April 25, 2025*

In April 2025, the Integrated Industry-Level Production Account (ILPA) for the United States was updated to include new statistics for 2022 and 2023 and revised statistics for 1997–2021. In this article, the dataset is used for an analysis of the sources of economic growth in the aftermath of the COVID–19 recession.

The ILPA represents an ongoing collaboration between the National Economic Accounts of the U.S. Bureau of Economic Analysis (BEA) and the U.S. Bureau of Labor Statistics (BLS) Productivity Program. The account combines industry-level output and intermediate inputs from BEA's Gross Domestic Product (GDP) by Industry Accounts with capital input and labor data from the BLS Productivity Program to create an internally consistent production account. It contains detailed data on output and inputs in current and constant prices as well as total factor productivity (TFP) growth by industry.[2] The foundations of this account are discussed in detail by Fleck et al. (2014), with expanded discussion of sources and methods in Garner et al. (2018, 2020).

With this update to the statistics, the underlying data for gross output, intermediate inputs, and value added are now consistent with the results of the 2024 annual update of the Industry Economic Accounts, released on September 26, 2024.[3] Data on capital and labor inputs have been updated to reflect the TFP estimates released by BLS in December 2024.[4] The first year of data in the ILPA is now 1997 (in the previous release, it was 1987). This more limited time series reflects fewer years of historical data available in BEA's GDP by Industry Accounts after the release of the comprehensive update in September 2023.

An important feature of the ILPA is that it recognizes and measures different types of outputs produced and inputs used by each industry and assigns prices to each of these components of production. This approach, which originated with Jorgenson and Griliches (1967) at the aggregate level and was expanded to the industry level by Jorgenson, Gollop, and Fraumeni (1987), is important because it separately accounts for changes in the composition of inputs and changes in TFP. The early studies using these methods were focused on analyzing the long-term sources of economic growth by attributing output growth to the contributions of changes in inputs (capital and labor), quality, and TFP, but more recent studies have used these accounts for studying medium-term (and sometimes short-term) fluctuations in

the economy. For example, Jorgenson, Ho, and Stiroh (2005) identify subsample periods to analyze medium-term trends, including the information technology (IT) boom in the mid-1990s, and Garner et al. (2022) examine the Great Recession and the COVID–19 recession. In this article, the updated ILPA is employed to compare two periods of economic turmoil and recovery: the COVID–19 pandemic and the Great Recession. The accounting reveals important differences in the periods. The COVID–19 recession and recovery had faster TFP growth and an acceleration in the contribution of intangible capital assets.

The remainder of this article is divided into two main sections. The first section presents results for the entire period covered by the account, 1997–2023, including descriptive statistics on the industry origins of the sources of economic growth. The second part presents results that focus on comparing how the economy evolved in the years around the last two recessions.

The Sources of U.S. Economic Growth, 1997–2023

Table 1 presents estimates of the aggregate sources of U.S. economic growth between 1997 and 2023.[5] Productive capital accumulation accounted for the largest share of U.S. aggregate value-added growth over this period, followed by TFP growth and then the contribution of labor input. The finding that input growth (capital and labor) accounted more than 70 percent of output growth is consistent in attributing the sources of growth with the work of Jorgenson and Griliches (1967). That seminal work, along with many subsequent papers, argued that the contribution of TFP to economic growth in the United States is diminished once proper measurement techniques are used. This led Jorgenson (1996) to conclude that the preponderance of economic growth in the United States has been driven by investment in assets and human capital, not by changes in TFP.

Table 1. Growth in Aggregate Value Added and the Sources of Growth

Component	1997–2023	1997–2007	2007–2019	2019–2023
Value added	2.30	3.01	1.75	2.18
Capital	1.11	1.47	0.84	1.00
IT capital	0.22	0.36	0.16	0.11
Communications equipment	0.10	0.11	0.10	0.06
Computer hardware	0.12	0.24	0.05	0.04
R&D capital	0.13	0.12	0.11	0.22
Software capital	0.20	0.18	0.18	0.29
Entertainment originals capital	0.02	0.03	0.02	0.01
Other capital	0.53	0.78	0.37	0.37
Instruments and other office equipment	0.03	0.03	0.03	0.03
Other equipment	0.09	0.13	0.08	0.05
Structures, land, and inventories	0.35	0.53	0.22	0.31
Transportation equipment	0.06	0.10	0.05	−0.02
Labor	0.58	0.64	0.55	0.52
College labor	0.60	0.53	0.65	0.60
Noncollege labor	−0.02	0.11	−0.10	−0.08
Integrated total factor productivity growth	0.61	0.90	0.36	0.67

IT Information technology

R&D Research and development

Notes. Average annual percentange growth. A contribution is a share-weighted growth rate.

Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

The largest contributor to aggregate real value-added growth over the period was growth in capital inputs. Within capital, of the categories that are tabulated for the published ILPA, the category structures, land, and inventories was the largest contributor, followed by information technology capital, and then software capital.[6] In total, capital input accounted for almost half of U.S. economic growth over this period. The ILPA presents two categories of labor input: workers with a college degree and above and other worker .[7] Over the period as a whole, the contribution of workers without a college degree was negative; this reflects a decline in the hours worked by this group of workers between 1997 and 2023.[8] In other words, all of the contribution of labor input was accounted for by growth in workers with a college degree; in total, growth in labor input accounted for about one-quarter of aggregate economic growth. For the same period, the contribution of TFP growth to aggregate real value-added growth was marginally higher than the contribution of labor input. TFP growth also accounted for about one-quarter of U.S. economic growth over the 1997–2023 period.

The main purpose of the industry-level account is to illuminate the industry origins of these aggregate trends. Table 2 gives the sources of industry output growth for the 63 industries covered by the account. The top two fastest growing industries were IT related: data processing, internet publishing, and other information services and computer systems design and related services. The third- and fourth-fastest growing industries were warehousing and storage (which likely includes many of the activities of large platform-enabled consumer and business sales distributions) and support activities for mining. It is instructive to compare the sources of growth for these industries, in part because it illuminates some of the uses of the account. Data processing, internet publishing, and other information services and warehousing and storage were primarily driven by input growth, while computer systems design and

related services and support activities for mining were driven by growth in TFP. The industries with the fastest TFP growth over the period were computer and electronic products, computer systems design and related services, support activities for mining, and publishing industries, except internet (includes software). Because an important use of the account is to analyze how industries differ in their use of inputs, it is noted that the industries with the largest contributions of labor input growth were computer systems design and related services, warehousing and storage, social assistance, and ambulatory health care services. The account can also be used to examine industries in decline. Industries with the largest declines in real output growth were all manufacturing industries: apparel and leather and allied products, textile mills and textile product mills, printing and related support activities, and paper products. All of these sectors had large declines in labor and intermediate inputs, but three of the four had significant growth in TFP (paper products had zero TFP growth over the period). Data tables available on the BEA website include additional information on the contributions of nine types of capital (computer hardware; communications equipment; research and development; software; entertainment originals; instruments and other office equipment; "other equipment"; structures, land, and inventories; and transportation equipment) and two categories of labor input (workers with a college degree and workers without) to further analyze the industry-level sources of economic growth and transformation.

Table 2. Sources of Industry Output Growth, 1997–2023

Industry	Output growth	Capital contribution	Labor contribution	Intermediate contribution	TFP growth
Farms	0.94	0.13	−0.01	0.18	0.64
Forestry, fishing, and related activities	0.34	0.32	0.65	−0.97	0.34
Oil and gas extraction	3.08	−0.18	−0.22	1.30	2.18
Mining, except oil and gas	−0.97	0.41	−0.22	−0.67	−0.50
Support activities for mining	4.72	0.26	0.50	0.72	3.24
Utilities	0.63	0.91	0.00	−0.21	−0.07
Construction	0.60	0.25	0.49	0.60	−0.74
Wood products	0.42	0.11	−0.36	0.13	0.53
Nonmetallic mineral products	−0.64	0.24	−0.14	−0.49	−0.24
Primary metals	−0.09	0.01	−0.39	−0.88	1.16
Fabricated metal products	−0.69	0.18	−0.16	−0.32	−0.39
Machinery	−0.42	0.22	−0.25	−0.52	0.13
Computer and electronic products	3.85	0.45	−0.51	−1.21	5.12
Electrical equipment, appliances, and components	−0.90	0.11	−0.26	−0.68	−0.08
Motor vehicles, bodies and trailers, and parts	1.26	0.23	−0.11	0.48	0.67
Other transportation equipment	1.80	0.19	0.00	0.89	0.72
Furniture and related products	−1.49	0.15	−0.59	−0.73	−0.32
Miscellaneous manufacturing	0.51	0.45	−0.02	−0.69	0.76
Food and beverage and tobacco products	0.28	0.21	0.09	0.10	−0.11
Textile mills and textile product mills	−4.03	−0.11	−1.06	−3.24	0.38
Apparel and leather and allied products	−6.12	−0.06	−1.97	−5.38	1.29
Paper products	−1.55	−0.08	−0.41	−1.06	0.00
Printing and related support activities	−2.21	−0.09	−1.01	−1.90	0.80
Petroleum and coal products	0.35	0.25	−0.04	−0.01	0.15
Chemical products	0.37	1.11	−0.02	−0.37	−0.36
Plastics and rubber products	−0.29	0.19	−0.15	−0.36	0.01
Wholesale trade	2.90	0.65	0.22	1.86	0.16
Retail trade	2.63	0.57	−0.07	1.13	0.99
Air transportation	0.74	0.19	−0.12	0.03	0.64
Rail transportation	0.20	0.09	−0.74	−0.01	0.86
Water transportation	1.20	0.25	0.26	0.38	0.31
Truck transportation	1.53	0.40	0.20	1.00	−0.07
Transit and ground passenger transportation	4.39	0.60	0.53	2.44	0.82
Pipeline transportation	0.66	1.40	0.08	−1.72	0.90
Other transportation and support activities	2.34	0.19	0.74	1.51	−0.10

Industry	Output growth	Capital contribution	Labor contribution	Intermediate contribution	TFP growth
Warehousing and storage	5.43	0.35	2.38	2.49	0.21
Publishing industries, except internet (includes software)	4.55	1.41	0.22	0.57	2.36
Motion picture and sound recording industries	2.81	0.67	0.31	0.25	1.58
Broadcasting and telecommunications	3.78	1.95	−0.23	1.20	0.86
Data processing, internet publishing, and other information services	10.74	3.96	1.13	3.94	1.70
Federal Reserve banks, credit intermediation, and related activities	1.73	1.41	0.32	0.61	−0.61
Securities, commodity contracts, and investments	3.26	0.18	0.84	2.48	−0.24
Insurance carriers and related activities	3.70	1.05	0.44	1.99	0.21
Funds, trusts, and other financial vehicles	1.61	0.32	0.09	1.87	−0.68
Real estate	2.67	1.18	0.08	0.84	0.57
Rental and leasing services and lessors of intangible assets	3.78	2.34	0.03	2.06	−0.65
Legal services	0.27	0.57	0.32	0.11	−0.73
Computer systems design and related services	7.64	0.33	2.63	1.38	3.30
Miscellaneous professional, scientific, and technical services	3.39	0.76	1.16	1.18	0.28
Management of companies and enterprises	3.23	0.15	1.34	1.30	0.44
Administrative and support services	3.54	0.71	0.93	1.41	0.50
Waste management and remediation services	2.15	0.20	0.82	1.29	−0.15
Educational services	2.57	0.42	1.25	1.32	−0.42
Ambulatory health care services	3.30	0.30	1.56	0.88	0.56
Hospitals and nursing and residential care facilities	2.58	0.30	0.93	1.34	0.01
Social assistance	3.57	0.10	1.77	1.91	−0.21
Performing arts, spectator sports, museums, and related activities	3.18	0.13	0.54	1.48	1.04
Amusements, gambling, and recreation industries	2.13	0.47	0.46	1.53	−0.33
Accommodation	1.70	0.38	0.03	0.65	0.63
Food services and drinking places	2.32	0.07	0.53	1.56	0.17
Other services, except government	0.97	0.28	0.26	1.20	−0.76
Federal government	1.41	0.48	0.19	0.69	0.05
State and local government	1.49	0.46	0.28	0.69	0.05

TFP Total factor productivity

Notes. Average annual percentange growth. A contribution is a share-weighted growth rate.

Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

Table 3 shows the sources of growth originating from major sectors and allows for tracing the aggregate contributions in table 1 to these sectors and industries in table 2. The aggregate capital contribution for the 1997–2023 period can be traced to large contributions from capital services in the finance, insurance, real estate, rental, and leasing; information; and the “other services” sectors. Almost all of the aggregate labor contribution was driven by increases in labor input employed by the other services industries. The bottom portion of the table shows that about one-third of aggregate TFP growth was driven by TFP growth in manufacturing, with the next largest contributors being information and other services. The data published on BEA's website allow for the results in table 3 to be broken out for 63 industries instead of the 9 sectors displayed in table 3.

Table 3. Contribu ions to Aggregate Value-Added Growth

Component	1997–2023	1997–2007	2007–2019	2019–2023
Aggregate value-added growth	2.30	3.01	1.75	2.19
Capital input				
Aggregate	1.11	1.47	0.85	1.00
Agriculture, forestry, fishing, hunting, and mining	0.01	0.00	0.02	0.01
Transportation, warehousing, and utilities	0.04	0.03	0.05	0.05
Construction	0.02	0.05	0.00	0.02
Manufacturing	0.12	0.14	0.11	0.09
Trade	0.10	0.13	0.07	0.12
Information	0.18	0.17	0.19	0.19
Finance, insurance, real estate, and rental and leasing	0.36	0.61	0.20	0.24
Other services	0.16	0.21	0.13	0.15
Government	0.11	0.13	0.10	0.13
Labor input				
Aggregate	0.58	0.64	0.55	0.52
Agriculture, forestry, fishing, hunting, and mining	0.00	0.01	0.01	−0.02
Transportation, warehousing, and utilities	0.02	0.00	0.02	0.08
Construction	0.04	0.09	0.00	0.03
Manufacturing	−0.07	−0.17	−0.01	−0.01
Trade	0.01	0.05	−0.01	−0.01
Information	0.02	0.01	0.01	0.05
Finance, insurance, real estate, and rental and leasing	0.08	0.11	0.05	0.06
Other services	0.42	0.45	0.42	0.32
Government	0.06	0.08	0.06	0.01
Total factor productivity				
Aggregate	0.61	0.90	0.36	0.67
Agriculture, forestry, fishing, hunting, and mining	0.07	0.06	0.07	0.08
Transportation, warehousing, and utilities	0.01	0.02	0.01	−0.04
Construction	−0.07	−0.11	−0.01	−0.13
Manufacturing	0.22	0.60	−0.03	0.02
Trade	0.09	0.19	0.08	−0.11
Information	0.12	0.17	0.07	0.17
Finance, insurance, real estate, and rental and leasing	0.05	−0.05	0.05	0.26
Other services	0.12	−0.01	0.13	0.40
Government	0.01	0.04	−0.01	0.01

Notes. Average annual percentages. Aggregate value-added growth is the aggregate of share-weighed industry value-added growth. Government includes government enterprise.

Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

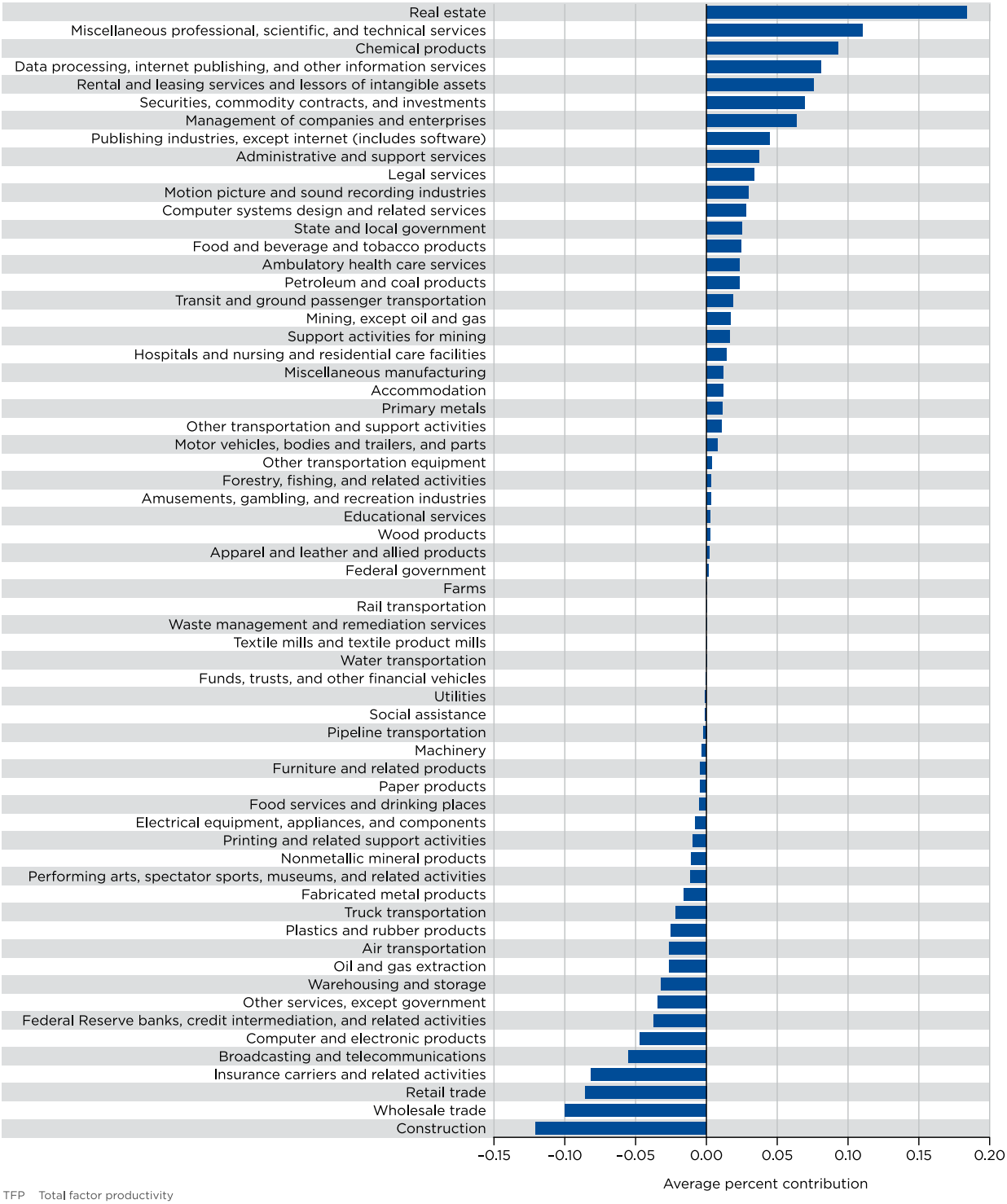
Comparing Two Periods of Recession and Recovery

The COVID–19 recession was the largest annual downturn in real GDP since the 2009 annual decline in GDP that marked the Great Recession. In this section, the ILPA is used to compare both periods of decline and recovery in order to shed light on the differences and to demonstrate the usefulness of the account. Table 1 presents the sources of real aggregate value-added growth for selected subperiods.[9] The 2007–2019 period includes the Great Recession and recovery, while the 2019–2023 period includes the COVID–19 recession and recovery. The tabulation shows that both periods exhibited slower growth than the 1997–2007 period leading up to the Great Recession, and a comparison of the 2019–2023 period to the 2007–2019 period suggests the Great Recession had a longer-lasting impact on growth than the COVID–19 recession. Growth during the 2019–2023 period was faster than the 2007–2019 period, on average. The majority of this was driven by faster TFP growth in the later period, although the contribution of

capital was larger during the later period as well. The larger capital contribution was driven primarily by the contribution of intangible capital. In the remainder of this section, the industry origins of these macro results are presented.

Table 3 shows that the faster growth in the 2019–2023 period compared to the 2007–2019 period can almost be completely accounted for by TFP increases in the finance, insurance, real estate, and leasing sector and the other services sector.[10] Chart 1 decomposes these 9 sector contributions to 63 industries.[11] Even though, at the aggregate level, TFP growth contributed more to aggregate value-added growth in 2019–2023 than in 2007–2019, the chart shows that there was a large dispersion across the 63 industries. It shows a positive bar if the TFP contribution was higher in 2019–2023 than in 2007–2019. That is, a negative value does not mean TFP growth for that industry was negative; it indicates that TFP growth was slower in the later period than in the earlier period. The largest accelerations in the contributions of TFP growth were in real estate; miscellaneous professional, scientific, and technical services; chemical products; data processing, internet publishing, and other information services; and rental and leasing services and lessors of intangible assets. It is worth noting that TFP growth in the real estate sector is challenging to measure because it involves prices for the provision of owner-occupied housing. Chart 1 shows that over half of the industries contributed to the aggregate acceleration in TFP growth. On the other end of the distribution, because TFP growth in construction, wholesale trade, retail trade, and insurance carriers and related activities, among others, slowed relative to 2007–2019, these industries contributed less to aggregate TFP growth during 2019–2023 than during 2007–2019.

Chart 1. TFP Contributions to Aggregate Value-Added Growth, 2019–2023 Less 2007–2019

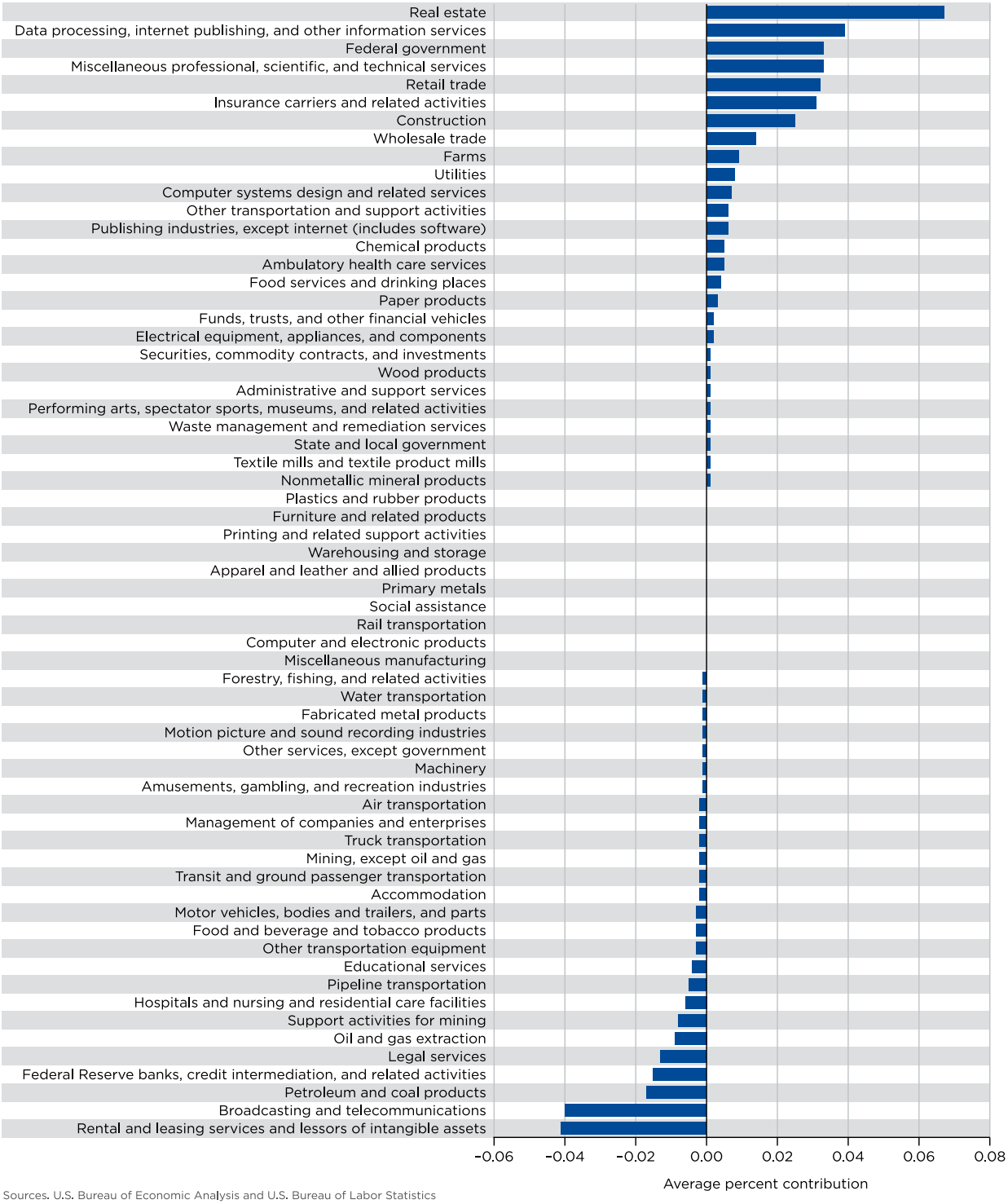


TFP Total factor productivity

Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

The acceleration in the contribution of capital input accounted for about half as much as the acceleration of TFP growth to the difference in real aggregate value-added growth between the periods. Chart 2 shows that this was driven by increasing capital contributions in many sectors, including real estate; data processing, internet publishing, and other information services; federal government; miscellaneous professional, scientific, and technical services; and retail trade, among others. On the other hand, rental and leasing services and lessors of intangible assets; broadcasting and telecommunications; and petroleum and coal led the industries in which the capital contribution decelerated. Referring back to the larger capital contribution of intangible capital (table 1) in the later period, detailed results published on the BEA website trace these contributions to accelerating intangible capital services contributions in miscellaneous professional, scientific, and technical services; federal government; data processing, internet publishing, and other information services; insurances carriers and related activities; and retail trade as the largest contributors. There were industries in which the contributions of intangible capital decelerated, including the legal services and "other transportation equipment" industries.

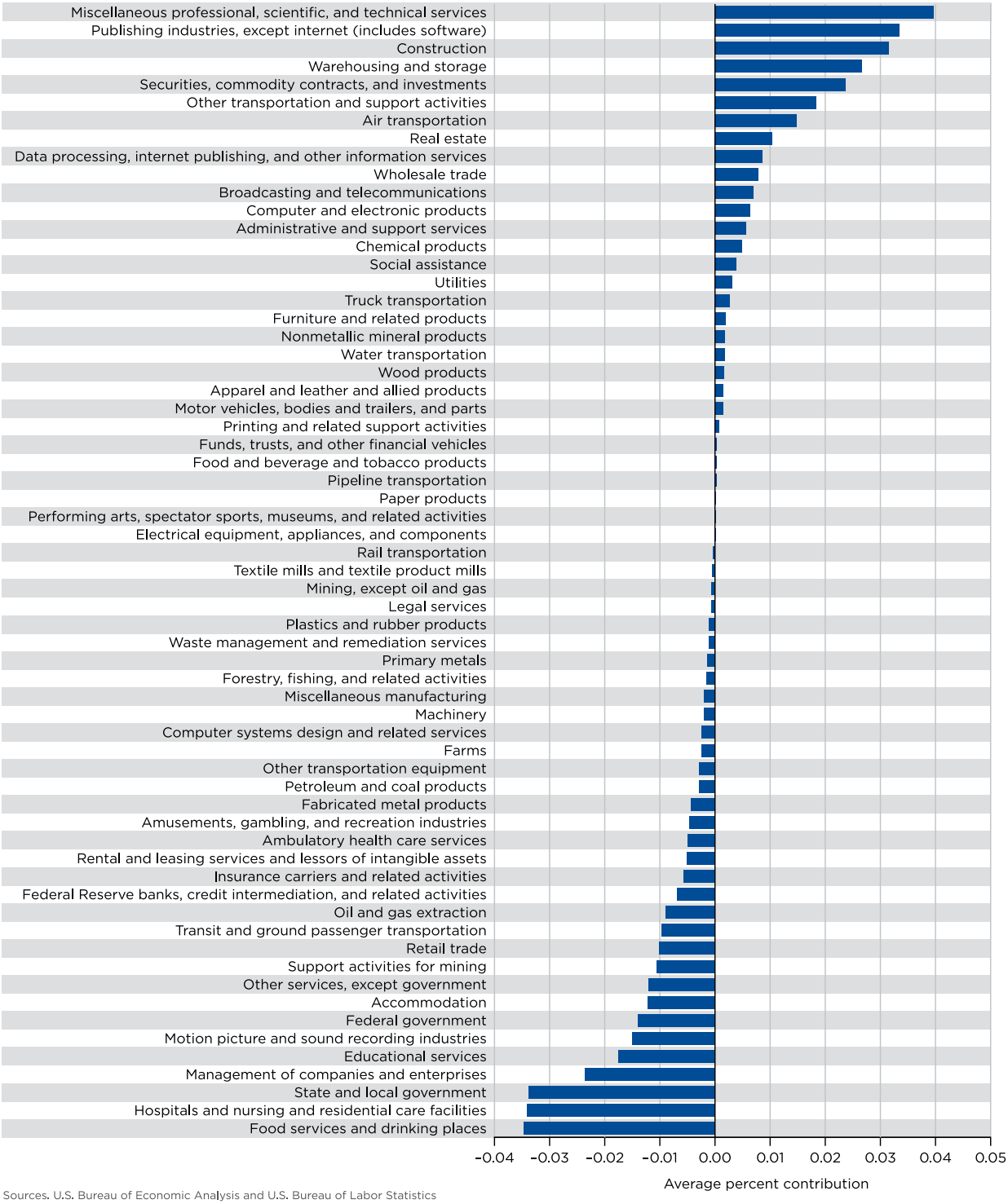
Chart 2. Capital Contributions to Aggregate Value-Added Growth, 2019–2023 Less 2007–2019



Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

Finally, while the aggregate contribution of labor services was similar in the 2007–2019 and 2019–2023 periods, chart 3 shows that, across industries, there were important changes. During the later period, labor input in miscellaneous professional, scientific, and technical services; publishing industries, except internet (includes software); construction; and warehousing and storage, for example, contributed more to real aggregate value-added growth than during the 2007–2019 period. Industries in which the contribution was larger during the 2007–2019 period compared to the 2019–2023 period included food services and drinking places, hospitals and nursing and residential care, state and local government, management of companies, and educational services. When workers are classified by level of educational attainment, industries in which the contribution of workers with a college degree was larger in 2019–2023 than in 2007–2009 include the publishing industries, except internet (includes software); miscellaneous professional, scientific, and technical services; construction; and securities, commodity contracts, and investments. The contribution of workers with a college degree was lower in 2019–2023 than in 2007–2019 in state and local government; federal government; management of companies and enterprise; and educational services. It is worth noting that this deceleration need not reflect a decline in the number of workers with a college degree in these sectors, but it does reflect less growth in the later period than in the earlier period. When sorted by workers without a college degree, the data show declining contributions, i.e., larger contributions in 2007–2019 compared to 2019–2023, in food services and drinking places; hospitals and nursing and residential care; other services; and accommodation and increasing contributions of workers without a college degree in warehousing and storage; miscellaneous professional, scientific, and technical services; “other transportation and support activities”; and construction.

Chart 3. Labor Contributions to Aggregate Value-Added Growth, 2019–2023 Less 2007–2019



Sources. U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics

The Integrated Industry-Level Production Account released in April 2025 indicates ongoing structural change in the economy, both across industries and in how industries innovate and use factors of production. Data through the end of 2023 showed that TFP growth was stronger in the last few years than it has been since the IT-related boom that began in the mid-1990s and early 2000s. The nine-sector level data presented in the production account show that transformations mainly occurred within the finance, insurance, real estate, rental, and leasing sector and the other services sector, but examination of the detailed industry data demonstrates that it is important to conduct analysis at a finer level of detail because not all industries within major sectors increased (or decreased) at the same rate. The account also demonstrates the important role of capital investment in U.S. economic growth. Over the 1997–2023 period, capital input accounted for almost half of U.S. real aggregate value-added growth. At the industry level, the largest difference between the contribution of capital input in the 2007–2019 and 2019–2023 periods was the contribution of capital services in the real estate industry. Industry-level data, within an integrated production account framework, are important for analyzing the drivers of economic growth and the sources of structural change in the economy. The full set of industry tables that can serve as a starting point for such analysis are available on BEA's website.

Data Availability

Additional data tables on the ILPA, including industry contributions to the aggregate sources of growth, and details on capital and labor by industry, can be found on the BEA website for 1997–2023. The GDP by Industry Accounts—including gross output, intermediate inputs, and value-added statistics—for 1997–2024 are available on the BEA website. The ILPA will be updated annually to be consistent with the annual revisions to the National and Industry Economic Accounts. The official statistics on total factor productivity can be accessed on the BLS website.

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1. Garner and Russell are with the U.S. Bureau of Labor Statistics Office of Productivity and Technology. Harper and Samuels are with the U.S. Bureau of Economic Analysis National Economic Accounts Directorate.
2. The ILPA and integrated TFP measures presented in this article reflect output consistent with GDP for the total economy but differ in concepts and coverage from the official U.S. TFP measures from BLS, which are available on the BLS website. With the May 2022 update, the terminology "multifactor productivity" was replaced by "total factor productivity." This was a change in terminology only, with no changes in concepts or methods, following a decision in the BLS Productivity Program.
3. See "The 2021 Annual Update of the Industry Economic Accounts: Revised Statistics for 1999–2020 and the First Quarter of 2021," *Survey of Current Business* 101 (October 2021).
4. See the release on the BLS website.
5. Aggregate results are built up from the industry-level measures contained in the account. Aggregation over industries is discussed in Jorgenson et al. (2007).
6. The underlying detail used to measure capital corresponds to the classification in BEA's fixed asset accounts (over 90 nonresidential fixed assets), plus land and inventories.
7. The college worker category includes workers with at least a Bachelor of Arts degree. The underlying detail used to measure labor cross-classifies workers by level of educational attainment, age group, sex, and industry.
8. A contribution is defined as a nominal share-weighted growth rate. Thus, a fall in hours multiplied by the group's share results in a negative contribution.
9. The choice of subperiods is to highlight differences between the years surrounding the Great Recession and the COVID–19 recession. Typically, periods are chosen to start and end with either a peak or trough of the business cycle because comparing periods of growth with periods of recession may conflate trend and cyclical movements. As noted earlier, the time series covered by the ILPA has been reduced due to data constraints, which also limits the potential choices of subperiods for analysis. For discussion of measurement issues related to the choice of subperiods, see Corby Garner, Justin Harper, Matt Russell, and Jon Samuels, "Integrated BEA/BLS Industry-Level Production Account: Statistics for 1987–2020 and a Retrospective Look at How the COVID–19 Recession Compared to the Great Recession," *Survey* 102 (June 2022).
10. Technically, these two sectors more than account for the differences, but because there are other positive and negative contributions across industries, it is not accurate to say that these two sectors alone completely account for the growth differences between the periods.
11. Note that an industry contribution to aggregate real value-added growth is not the same as the TFP contribution to industry output growth in table 2. Converting industry TFP growth rates to aggregate contributions involves Domar weights.

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