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BEA Briefing

Integrated Industry-Level Production Account for the United States and the Sources of U.S. Economic Growth Between 1987 and 2018

By Corby Garner, Justin Harper, Matt Russell, and Jon Samuels[1]

This *Briefing* describes the sources of U.S. economic growth between 1987 and 2018. The underlying data are from the Bureau of Economic Analysis (BEA)-Bureau of Labor Statistics (BLS) integrated industry-level production account that was released on March 2, 2020, and the method used to derive the contributions to economic growth is "growth accounting" (attributing aggregate economic growth to industries and factors of production).

The BEA-BLS integrated industry-level production account is an ongoing collaboration between BEA and BLS to measure disaggregated prices and quantities of industry outputs and inputs consistent with gross domestic product (GDP) by industry accounts. The account includes information on 63 industries that span the total economy. One of the main advantages of the account is that the input side of the account is based on disaggregated input measures, including about 170 different types of workers by industry (to account for skill mix across industries) and about 100 types of capital assets, including inventories and land (to account for differences in marginal productivities of capital assets), and uses all of the detail on intermediate inputs that underlie BEA annual GDP by industry accounts. This input detail allows for more accurate measures of multifactor productivity (MFP) growth by industry.

Growth accounting (Jorgenson and Griliches 1967) provides a method to use the estimates in the integrated industry-level production account to estimate the contributions of factors of production to aggregate economic growth. Jorgenson, Gollop, and Fraumeni (1987) showed how to do this at the industry level, and this account uses that basic approach. The results show that between 1987 and 2018, capital input accounted for the majority of economic growth, followed by labor input, then growth in MFP. This account breaks out these contributions by sector, and this *Briefing* presents information on 9 major sectors, although the data on BEA's website includes information on each of the 63 industries. The largest contributors to the aggregate capital input contribution over the period were the finance, insurance, real estate, and rental and

leasing sector and the other services sector. The other services sector itself accounted for over half of the aggregate contribution of labor input. Taken together, these results quantify the growing importance of services in the U.S. economy. On the other hand, most of the contributions to aggregate MFP growth originated in MFP growth within the manufacturing sector (mostly computers and electronic products) and the trade sector.

The first section of this *Briefing* contains information on the basic methodology and data sources, the following section presents summary results of the account, and the final section contains next steps.

Methodology and Data Sources

The integrated industry-level production account decomposes growth in industry gross output into contributions from growth in intermediate inputs, capital, labor, and MFP. Similarly, the account decomposes growth in aggregate economy value added into contributions from industries' growth in capital, labor, and MFP. Data on gross output and intermediate inputs by industry are drawn from BEA GDP by industry statistics, while data on capital and labor inputs come primarily from the BLS productivity program. Total capital and labor compensation by industry are controlled to match value added by industry estimates from BEA. As described below, labor, capital, and intermediate inputs are adjusted to account for changes in composition over time. Growth in MFP is defined residually as the difference between industry output growth and the sum of the share-weighted growth in industry inputs of intermediates, capital, and labor.

Gross output and intermediate inputs

BEA GDP by industry accounts provide a time series of nominal and real gross output, intermediate inputs (including a decomposition of energy, materials, and purchased services inputs), and value added by industry; the statistics are based on the 2012 North American Industry Classification System (NAICS). These data are fully integrated with expenditure-based GDP estimates from the National Income and Product Accounts (NIPAs). In addition, the data are prepared within a balanced supply-use framework that allows for simultaneous and consistent analysis of industry output, inputs, value added, and final demand.

For the years 1987–1997, revisions to industry gross output and intermediate inputs for this account reflect the comprehensive update of the historical GDP by industry accounts, which was published on October 29, 2019. These revisions reflect methodological changes to the NIPAs, including reclassification of own-account software originals from software to research and development, improvements to the measure of implicit financial services produced by credit unions and savings and loans institutions, and improved treatment of defined benefit pension plans for state and local governments. These changes are described in greater detail in Kelly and others (2018). In addition, the revisions from 1993–1997 reflect improvements in the techniques used to link the time series of historical GDP by industry accounts to the more detailed set of accounts that begin in 1997.

For the years 2014–2017, revisions to industry gross output and intermediate inputs for this account reflect the 2019 annual update of the GDP by industry accounts, also published on October 29, 2019. These revisions primarily reflect the use of newly available and more complete source data, including the Annual Wholesale Trade Survey, Annual Retail Trade Survey, and Service Annual Survey from the U.S. Census Bureau, tabulations of tax returns from the Internal Revenue Service, and farm statistics from the U.S. Department of Agriculture Economic Research Service. Additional detail is available in Barefoot and Ross (2019).

Capital services inputs

Capital services estimates reflect the price and quantity of the annual service flow into production from a capital asset over its useful life. Conceptually, "productive" capital stock represents the amount of new investment that would be required to produce the same flow of capital services that is actually produced by existing assets of all vintages. In other words, capital services are assumed to be proportional to the productive stock. Estimates of productive capital stocks are constructed by BLS as vintage aggregates of real historical investments using the perpetual inventory method (Fleck and others 2012). The price of service flows or "rental price" for each asset is constructed so that the discounted value of all future services is equal to the purchase price of the asset.

Revisions to capital services inputs reflect updated capital services data from the BLS MFP estimates first published on January 28, 2020. These, in turn, reflect estimates of investment from the NIPAs that were updated during the 2018 comprehensive update and the 2019 annual update of the NIPAs. Updated rental prices reflect updated value-added estimates resulting from the comprehensive update of the historical GDP by industry accounts and the 2019 annual update of the GDP by industry accounts. In addition, BLS made improvements to the historical estimates of information technology (IT) capital services in the federal government industry based on assignment of detailed asset source data from the BEA government accounts. These improvements did not affect the official BLS MFP estimates, as government activities are out of scope for that framework.

Labor inputs

For this account, labor input by industry is defined as the share-weighted growth in labor hours for approximately 170 different groups of workers cross-classified by sex, age, education, and class of employment (payrolled versus self-employed). Any growth in labor input that is not accounted for by the basic growth in hours is termed the "labor composition effect."

As in previous versions of this account, BLS prepared a time series of labor hours reflecting annual hours worked based on payroll employment and hours from the BLS Current Employment Statistics (CES) survey as well as data on the number of self-employed persons and their average weekly hours from the Current Population Survey (CPS) (Fleck and others 2012). The BLS National Compensation Survey (NCS) was also used to convert the hours of payrolled workers from a paid to a worked basis. Sources for industries that are not covered by CES or in which data are missing include the Department of Agriculture, the BLS Quarterly Census of Employment and Wages, and the Mine Safety and Health Administration (Rosenthal and others 2014).

In order to estimate the labor composition effect, matrices of employment, hours, and compensation were initialized using the U.S. Census 1990 and 2000 1-Percent Public Use Microdata Sample (PUMS) files. These initial estimates were iteratively adjusted using the RAS balancing technique to match a series of marginal controls developed from the March supplement to the CPS.[2] After balancing, the matrices are scaled to a sequence of employment, hours, and compensation controls from BLS and the NIPAs. In the final step, the hourly compensation of self-employed workers is replaced by the rate for payrolled workers in the same cell to avoid comingling labor and capital compensation for those workers. Additional methodological information is described in Fleck and others (2012), Rosenthal and others (2014), and Garner and others (2018).

Sources of U.S. Economic Growth Between 1987 and 2018

Industry sources of growth

The analysis of the sources of growth begins with the sources of industry gross output growth between 1987 and 2018. These estimates are presented in table 1 and are based on the industry-level growth accounting framework described in the section above. The first column presents industry gross output growth followed by the contributions of the growth in capital, labor, intermediate input, and integrated MFP growth to each industry's gross output growth.[3] These contributions are additive because MFP growth is calculated as a residual after accounting for the contributions of measured inputs; therefore, industry gross output growth is fully accounted for using these methods. The remainder of this section presents some highlights of the results to demonstrate the usefulness of the account. All of the underlying detail is posted on the BEA website and can also be accessed on the BLS website.

Table 1. Sources of Industry Output Growth 1987–2018

	Output growth	Capital contribution	Labor contribution	Intermediate contribution	MFP growth
Farms	1.59	0.06	−0.17	0.49	1.20
Forestry, fishing, and related activities	0.24	0.29	0.87	0.04	−0.97
Oil and gas extraction	2.46	−0.14	−0.19	1.06	1.73
Mining, except oil and gas	0.34	0.32	−0.20	−0.35	0.57
Support activities for mining	4.55	0.14	0.65	1.57	2.18
Utilities	0.83	0.75	0.02	0.28	−0.23
Construction	0.48	0.24	0.59	0.45	−0.79
Wood products	0.17	0.05	−0.18	0.36	−0.05
Nonmetallic mineral products	0.20	0.19	−0.04	−0.14	0.18
Primary metals	0.53	−0.03	−0.28	0.32	0.52
Fabricated metal products	1.08	0.21	0.06	0.75	0.06
Machinery	1.19	0.28	−0.01	0.96	−0.04
Computer and electronic products	6.74	0.64	−0.40	0.44	6.06
Electrical equipment, appliances, and components	0.39	0.15	−0.30	0.10	0.44
Motor vehicles, bodies and trailers, and parts	2.64	0.25	0.04	1.92	0.43
Other transportation equipment	1.16	0.26	−0.21	1.10	0.02
Furniture and related products	−0.05	0.15	−0.28	0.07	0.01
Miscellaneous manufacturing	2.03	0.38	0.17	0.40	1.08
Food and beverage and tobacco products	0.99	0.22	0.11	0.85	−0.20

	Output growth	Capital contribution	Labor contribution	Intermediate contribution	MFP growth
Textile mills and textile product mills	−1.95	−0.08	−0.79	−1.68	0.59
Apparel and leather and allied products	−5.13	0.01	−1.71	−3.83	0.40
Paper products	−0.42	0.04	−0.27	−0.06	−0.13
Printing and related support activities	−0.79	−0.01	−0.53	−0.86	0.62
Petroleum and coal products	0.93	0.23	−0.05	0.41	0.34
Chemical products	0.92	1.05	0.01	0.42	−0.55
Plastics and rubber products	1.06	0.26	0.05	0.36	0.39
Wholesale trade	3.76	1.05	0.38	1.38	0.95
Retail trade	2.95	0.88	0.36	0.91	0.81
Air transportation	1.55	0.47	0.03	−0.05	1.10
Rail transportation	1.12	0.02	−0.70	0.66	1.14
Water transportation	1.90	0.08	0.23	0.91	0.69
Truck transportation	2.78	0.33	0.46	1.76	0.23
Transit and ground passenger transportation	2.25	0.47	1.09	0.64	0.06
Pipeline transportation	0.88	1.28	0.00	−1.75	1.35
Other transportation and support activities	2.75	0.03	1.49	2.15	−0.93
Warehousing and storage	6.76	0.32	1.91	3.22	1.32
Publishing industries, except internet (includes software)	3.30	1.33	0.10	0.64	1.25
Motion picture and sound recording industries	3.26	1.10	0.71	1.49	−0.04
Broadcasting and telecommunications	4.62	2.20	−0.02	2.01	0.43
Data processing, internet publishing, and other information services	8.64	3.58	1.04	3.57	0.45
Federal Reserve banks, credit intermediation, and related activities	1.69	1.82	0.32	0.90	−1.35
Securities, commodity contracts, and investments	6.30	0.17	1.07	3.16	1.91
Insurance carriers and related activities	3.22	1.23	0.46	1.27	0.25
Funds, trusts, and other financial vehicles	2.18	0.22	0.08	2.57	−0.69
Real estate	2.84	1.35	0.07	1.04	0.37
Rental and leasing services and lessors of intangible assets	3.17	3.94	0.18	1.20	−2.15
Legal services	0.95	0.73	0.67	0.83	−1.28
Computer systems design and related services	8.78	0.20	4.20	2.58	1.80
Miscellaneous professional, scientific, and technical services	3.72	0.85	1.35	1.62	−0.11
Management of companies and enterprises	2.90	0.25	1.54	1.91	−0.81
Administrative and support services	4.70	0.79	1.73	2.14	0.05
Waste management and remediation services	2.52	0.33	0.99	1.43	−0.23
Educational services	2.93	0.44	1.42	1.17	−0.08
Ambulatory health care services	3.29	0.28	1.78	1.28	−0.06
Hospitals and nursing and residential care	2.76	0.31	1.13	1.63	−0.31
Social assistance	3.79	0.09	2.49	1.86	−0.66
Performing arts, spectator sports, museums, and related activities	3.82	0.14	1.17	1.54	0.97
Amusements, gambling, and recreation industries	3.35	0.72	0.97	1.67	−0.01
Accommodation	2.21	0.76	0.30	1.05	0.10
Food services and drinking places	2.31	0.18	0.62	1.23	0.28
Other services, except government	1.70	0.33	0.55	1.09	−0.26
Federal	0.70	0.34	−0.16	0.48	0.04
State and local	1.97	0.50	0.61	0.79	0.07

MFP Multifactor productivity

Note. Average annual percentage growth. A contribution is a share-weighted growth rate.

Over the 1987–2018 period, three of the four fastest growing industries were IT related: computer systems design and related services; data processing, internet publishing, and other information services; and computer and electronic products (the third fastest growing industry was warehousing and storage). The growth accounting reveals that the sources of growth across these industries was markedly different. For example, growth in the computer and electronic products industry was driven mainly by growth in MFP. Even though the data processing, internet publishing, and other information services industries are also IT-related, growth in this sector was mostly input driven. Growth in computer systems design and related services was more balanced between MFP growth and the accumulation of inputs.

On the other side of the spectrum, the only industries to contract over the period were in the manufacturing sector. Real output in textile mills and textile product mills, apparel and leather and allied products, paper products, printing and related support activities, and furniture and related products all fell over the period. The growth accounting results show that MFP growth helped dampen the output declines in textile mills and textile product mills, apparel and leather and allied products, and printing and related support activities. That is, the output declines would have been even more severe if these sectors had not experienced substantial MFP growth. The paper products sector and the furniture and related products sector had negative or negligible MFP growth over this period. The differences in output growth in the computer and electronic products sector compared to other industries in manufacturing that contracted over the period reinforces the usefulness of a disaggregated account and the importance of separately identifying IT-related industries in the analysis of economic growth at the sector level.

The industry-level account is useful in examining differences in factors of production across industries. As already noted, MFP growth in the computer and electronic products industry was the major driver of growth for this sector. In fact, MFP growth in this sector was the fastest of any industry in the economy. The industries with the next fastest MFP growth were support activities for mining; securities, commodity contracts, and investments; and computer systems design and related services. The legal services; Federal Reserve banks, credit intermediation, and related activities; and rental and leasing services and lessors of intangible assets industries had the slowest MFP growth over the period. In these sectors, input growth exceeded output growth, and measured MFP growth was negative.

The industries with the largest capital contributions to industry output growth were the rental and leasing services and lessors of intangible assets, data processing, internet publishing, and other information services; broadcasting and telecommunications; and Federal Reserve banks, credit intermediation, and related activities. These results indicate that accumulation of capital input was an important part of the production process for these sectors. Industries with the lowest capital contributions included the oil and gas extraction, textile mills and textile products, and primary metals industries. The contribution of capital input in these sectors was negative, indicating that over this time period, capital employed by these industries declined. When analyzing the impact of capital on the economy, it is important to recall that capital that feeds into production is based on a stock concept that reflects current and past investments. Therefore, industries with relatively large capital input contributions may not coincide with capital-intensive industries. The capital contribution in the sources of growth model reflects both the share of capital in production (its intensity) and its growth rate over time, so that industries could be capital intensive and still have a low contribution of capital to industry output growth. For

example, an industry like air transportation relies heavily on capital, but the contribution of capital to growth depends on changes in this capital over the 1987–2018 period, in addition to capital income's share in output in the sector.

The industries with the largest labor contributions to industry output growth were computer systems design and related services, social assistance, and warehousing and storage. This indicates that growth in these sectors over this time period was labor dependent relative to other sectors. Labor in apparel and leather and allied products and in textile mills and textile product mills made significant negative contributions to output growth in these sectors. This results from the number of people working in the industry declining over the period. Since the number of people working declined, the growth rate of labor input was negative. The negative contribution does not mean that each hour of work in each period produced a negative contribution to output growth.

Sources of aggregate value-added growth

The next step in the analysis of the sources of growth is the aggregation of industry sources of growth to the aggregate sources of value-added growth. This aggregation requires applying appropriate weights to each industry. Some intuition for this is that while an industry may have rapid MFP growth, if it is a small industry, its impact on the aggregate needs to be weighted to take that into account. The weights applied to the sources of growth in each industry are "Domar weights" and are discussed in detail in Jorgenson, Ho, and Stiroh (2005).

Table 2 presents the sector sources of aggregate value added growth for 1987–2018 and for subperiods that include 1987–1995 (the period before the IT boom), 1995–2000 (the IT boom), 2000–2007 (often referred to as a period of jobless growth (Jorgenson, Ho, and Samuels 2019), and the period of 2007–2018 (period including the Great Recession and recovery). The 2007–2018 period is subdivided into 2007–2009 (the Great Recession period) and the 2009–2018 period (ongoing recovery period).

Table 2 reinforces that the integrated industry-level production account is consistent with BEA GDP by industry data. Over the 1987–2018 period, growth in other services sectors accounted for the largest share of aggregate value-added growth, followed by finance, insurance, real estate, and rental and leasing. The breakout of manufacturing into computer and electronic products demonstrates that distinguishing detailed sectors is important; computer and electronic products accounted for the preponderance of growth in the manufacturing sector. The results are also useful for determining the sector sources of the relatively slow recovery by comparing the 2009–2018 period to the 1987–1995 period. The estimates show that growth during the recovery period was slower in comparison to the 1987–1995 period, mostly due to slower growth in the trade sector and in the manufacturing sector (within manufacturing, this was mostly driven by computer and electronic products).

Table 2. Sector Sources of Value-Added Growth

	1987–2018	1987–1995	1995–2000	2000–2007	2007–2018	2007–2009	2009–2018
Contributions							
Value added	2.45	2.65	4.26	2.42	1.49	−1.39	2.13
Agriculture, forestry, fishing, hunting, and mining	0.07	0.04	0.05	0.08	0.10	0.17	0.09
Transportation, warehousing, and utilities	0.09	0.15	0.11	0.02	0.07	−0.10	0.11
Construction	0.00	0.02	0.14	−0.03	−0.06	−0.53	0.05
Manufacturing	0.35	0.45	0.84	0.36	0.04	−0.68	0.20
Computer and electronic products	0.24	0.25	0.59	0.20	0.09	0.13	0.08
Trade	0.40	0.53	0.90	0.32	0.12	−0.59	0.28
Information	0.23	0.17	0.22	0.32	0.23	0.09	0.26
Finance, insurance, real estate, and rental and leasing	0.48	0.48	0.85	0.54	0.29	0.08	0.34
Other services	0.63	0.60	0.93	0.52	0.57	0.01	0.70
Government	0.20	0.21	0.21	0.29	0.12	0.16	0.11
Shares							
Shares in nominal value added	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, forestry, fishing, hunting, and mining	2.6	2.6	2.1	2.4	2.8	3.1	2.7
Transportation, warehousing, and utilities	4.6	5.3	4.8	4.3	4.5	4.3	4.5
Construction	3.9	3.8	4.0	4.6	3.7	4.2	3.6
Manufacturing	12.8	16.6	15.4	12.8	11.2	11.7	11.1
Computer and electronic products	1.6	1.9	2.1	1.6	1.4	1.5	1.4
Trade	11.6	12.4	12.6	11.8	11.2	11.2	11.1
Information	4.7	4.5	4.6	4.7	4.8	4.8	4.8
Finance, insurance, real estate, and rental and leasing	18.9	17.4	18.3	19.0	19.3	18.6	19.4
Other services	24.1	20.6	22.5	23.6	25.6	24.7	25.8
Government	16.8	16.8	15.6	16.8	17.0	17.5	17.0

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

The key results of the integrated industry-level production account presented in table 3 are divided into contributions by factor of production. Between 1987 and 2018, the growth of capital input accounted for the largest share of growth, followed by labor input and MFP growth. By sector, the largest contributor to the aggregate capital input contribution was finance, insurance, real estate, and rental and leasing, which includes owner-occupied housing. The largest contributor to the aggregate labor input contribution was labor input growth in the other services sector. Growth in aggregate MFP was concentrated in the manufacturing and trade sectors.

The contributions to the sources of growth by sector can be used to assess the origins of the slow recovery since the Great Recession. A lower contribution of capital input accounted for most of the relatively slow recovery over the 2009–2018 period. This was mostly due to a lower capital input contribution in the finance, insurance, real estate, and rental and leasing sector, reflecting the slowdown in housing related to the financial crisis. A slowdown in the growth of labor input accounted for the next largest share of the relatively weak recovery. Labor input growth in the trade, other services, and government sectors had the largest role in the relatively slow growth in labor input. Finally, MFP growth was faster in the 2009–2018 period than in the 1987–1995 period. This was due to relatively faster MFP growth in finance, insurance, real estate, and rental and leasing and in other services, which overcame relatively weak MFP growth in the manufacturing and trade sectors. It is important to note that this comparison is relative to the earlier (1987–1995) period and does not necessarily imply that MFP growth was weak in these sectors. It only signals that MFP growth was slower in the 2009–2018 period than in the 1987–1995 period for the manufacturing and trade sectors. For example, the trade sector contributed significantly to aggregate MPF growth over the 2009–2018 period, as shown in table 3; however, it contributed less than in the 1987–2009 period.

Table 3. Contributions to Aggregate Value Added Growth

	1987–2018	1987–1995	1995–2000	2000–2007	2007–2018	2007–2009	2009–2018
Capital input							
Aggregate	1.23	1.24	1.86	1.39	0.84	0.78	0.85
Agriculture, forestry, fishing, hunting, and mining	0.01	0.00	0.00	0.00	0.02	0.01	0.02
Transportation, warehousing, and utilities	0.04	0.04	0.05	0.03	0.05	0.04	0.05
Construction	0.02	0.01	0.05	0.05	0.00	−0.02	0.00
Manufacturing	0.14	0.17	0.26	0.08	0.10	0.13	0.09
Trade	0.17	0.16	0.30	0.21	0.10	−0.01	0.12
Information	0.17	0.13	0.21	0.15	0.19	0.15	0.20
Finance, insurance, real estate, rental and leasing	0.41	0.48	0.68	0.52	0.16	0.14	0.17
Other services	0.17	0.15	0.23	0.21	0.14	0.19	0.13
Government	0.10	0.11	0.08	0.14	0.08	0.15	0.07
Labor input							
Aggregate	0.76	1.09	1.33	0.42	0.49	−1.35	0.90
Agriculture, forestry, fishing, hunting, and mining	0.00	−0.01	−0.01	0.02	0.00	−0.03	0.01
Transportation, warehousing, and utilities	0.03	0.07	0.04	−0.01	0.03	−0.08	0.06
Construction	0.05	0.04	0.16	0.06	−0.01	−0.41	0.08
Manufacturing	−0.03	0.06	0.03	−0.21	−0.02	−0.41	0.07
Trade	0.07	0.13	0.12	0.04	0.01	−0.21	0.06
Information	0.01	0.04	0.11	−0.05	0.00	−0.09	0.01
Finance, insurance, real estate, and rental and leasing	0.07	0.06	0.16	0.08	0.04	−0.15	0.08
Other services	0.48	0.60	0.60	0.38	0.39	−0.09	0.50
Government	0.08	0.09	0.11	0.10	0.04	0.12	0.03
MFP							
Aggregate	0.45	0.32	1.07	0.62	0.16	−0.82	0.38
Agriculture, forestry, fishing, hunting, and mining	0.07	0.06	0.07	0.06	0.08	0.20	0.05
Transportation, warehousing, and utilities	0.01	0.04	0.02	−0.01	0.00	−0.06	0.01
Construction	−0.07	−0.03	−0.07	−0.15	−0.04	−0.10	−0.03
Manufacturing	0.24	0.22	0.55	0.49	−0.04	−0.39	0.04
Trade	0.16	0.24	0.48	0.07	0.01	−0.37	0.09
Information	0.05	0.00	−0.10	0.23	0.04	0.02	0.05
Finance, insurance, real estate, and rental and leasing	0.00	−0.07	0.01	−0.06	0.09	0.09	0.09
Other services	−0.02	−0.15	0.10	−0.07	0.04	−0.10	0.07
Government	0.01	0.00	0.02	0.04	−0.01	−0.12	0.02
Aggregate value-added growth	2.45	2.65	4.26	2.42	1.49	−1.39	2.13

MFP Multifactor productivity

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

Labor composition and the sources of aggregate growth

The final application of the integrated account that we present in this *Briefing* is information on the sources of labor input growth. As mentioned above, the growth rate of labor input reflects the growth rate of hours worked and the growth rate of labor composition. The growth rate of labor composition reflects the upgrading of the labor force over time into workers with more experience, as implied by higher educational attainment and age. Table 4 presents this decomposition over time and by sector. Over the period, increases in labor composition accounted for about 30 percent of aggregate labor input growth. These increases were concentrated in the other services and in the government sectors. Labor composition growth tends to be countercyclical because during rapid expansions, less educated workers are drawn into employment. For example, labor composition contributed significantly less during the 1995–2000 boom than during the 2000–2007 period of relatively slow hours growth. While increases in labor composition are important for long-term growth, the differences between labor composition growth in 2009–2018 and 1987–1995 did not play a major role in the relatively slow growth during the later period. To put this in perspective, Jorgenson, Ho, and Samuels (2019) find that the plateau of educational attainment has led to a slowing in the contribution of labor composition to economic growth and argue that this has important ramifications for prospects of medium-term economic growth in the United States.

Table 4. Sector Sources of the Contribution of Labor Input

	1987–2018	1987–1995	1995–2000	2000–2007	2007–2018	2007–2009	2009–2018
Labor hours							
Aggregate	0.52	0.78	1.17	0.14	0.29	−1.68	0.73
Agriculture, forestry, fishing, hunting, and mining	−0.01	−0.02	−0.01	0.01	0.00	−0.04	0.01
Transportation, warehousing, and utilities	0.03	0.06	0.03	−0.01	0.03	−0.09	0.05
Construction	0.04	0.03	0.16	0.06	−0.02	−0.46	0.07
Manufacturing	−0.08	0.00	−0.03	−0.25	−0.05	−0.51	0.05
Trade	0.04	0.10	0.11	0.01	−0.01	−0.26	0.04
Information	0.01	0.03	0.11	−0.07	−0.01	−0.07	0.00
Finance, insurance, real estate, and rental and leasing	0.05	0.03	0.14	0.04	0.02	−0.16	0.06
Other services	0.42	0.52	0.59	0.30	0.34	−0.19	0.45
Government	0.03	0.04	0.06	0.05	0.01	0.09	−0.01
Labor composition							
Aggregate	0.24	0.30	0.16	0.28	0.20	0.32	0.17
Agriculture, forestry, fishing, hunting, and mining	0.01	0.01	0.01	0.01	0.01	0.00	0.01
Transportation, warehousing, and utilities	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Construction	0.01	0.01	0.00	0.01	0.01	0.04	0.00
Manufacturing	0.04	0.06	0.05	0.04	0.03	0.09	0.02
Trade	0.03	0.03	0.01	0.03	0.03	0.05	0.02
Information	0.01	0.01	0.00	0.02	0.01	−0.02	0.01
Finance, insurance, real estate, and rental and leasing	0.03	0.04	0.01	0.04	0.02	0.01	0.02
Other services	0.06	0.07	0.01	0.08	0.06	0.10	0.05
Government	0.05	0.06	0.05	0.05	0.04	0.03	0.04
Labor input							
Aggregate	0.76	1.09	1.33	0.42	0.49	−1.35	0.90
Agriculture, forestry, fishing, hunting, and mining	0.00	−0.01	−0.01	0.02	0.00	−0.03	0.01
Transportation, warehousing, and utilities	0.03	0.07	0.04	−0.01	0.03	−0.08	0.06
Construction	0.05	0.04	0.16	0.06	−0.01	−0.41	0.08
Manufacturing	−0.03	0.06	0.03	−0.21	−0.02	−0.41	0.07
Trade	0.07	0.13	0.12	0.04	0.01	−0.21	0.06
Information	0.01	0.04	0.11	−0.05	0.00	−0.09	0.01
Finance, insurance, real estate, and rental and leasing	0.07	0.06	0.16	0.08	0.04	−0.15	0.08
Other services	0.48	0.60	0.60	0.38	0.39	−0.09	0.50
Government	0.08	0.09	0.11	0.10	0.04	0.12	0.03

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

Conclusions and Possible Next Steps

The purpose of this *Briefing* is to present updated time series growth accounting estimates of the sources of U.S. economic growth based on the integrated industry-level production account. This release of the account includes a consistent time series that spans 1987 to 2018 and was released earlier in the calendar year than any of the previous releases of this account. Future plans for this account include formalizing the release of this data around the same time each calendar year and producing additional industry detail. Results of these efforts will be reported in future BEA *Briefings*.

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2. Labor composition estimates for the published BLS MFP data are constructed using the Basic Monthly CPS data. BLS and BEA are collaborating to reconcile the labor composition measures produced by BLS for the official MFP estimates and those produced by BEA for the account presented in this article.
3. Integrated refers to the integration of industry capital and labor estimates from BLS with output measures from BEA so that industry input and output measures are on a consistent basis. The capital and labor estimates used in the integrated accounts include government enterprises and nonprofit institutions and differ from the official BLS MFP measures that are on a private business basis.

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