CES National Benchmark Article

BLS Establishment Survey National Estimates Revised to Incorporate March 2018 Benchmarks

Authors: Shane Haley and Caila Pinkleton

About the authors:
Shane Haley and Caila Pinkleton are economists in the Division of Current Employment Statistics–National, Office of Employment and Unemployment Statistics, Bureau of Labor Statistics.

Telephone: (202) 691-6555
Email: Contact CES

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Summary of the revisions

With the release of January 2019 data on February 1, 2019, the Bureau of Labor Statistics (BLS) introduced its annual revision of national estimates of employment, hours, and earnings from the Current Employment Statistics (CES) monthly survey of nonfarm establishments.

The March 2018 benchmarked seasonally adjusted employment level for total nonfarm employment is 148,279,000. The not seasonally adjusted benchmarked employment level is 147,368,000.

Compared with the sample-based, published seasonally adjusted estimate for March 2018, total nonfarm employment had a revision of -1,000, or less than -0.05 percent. The not seasonally adjusted total nonfarm employment estimate was revised by -16,000, or less than -0.05 percent.

Table 1 presents revised total nonfarm employment data on a seasonally adjusted basis for January 2018 through December 2018. The revised data for April 2018 forward incorporate the effect of applying the rate of change measured by the sample to the new benchmark employment level, as well as updated net birth/death model forecasts and new seasonal adjustment factors. Revisions to November and December also reflect incorporation of additional sample receipts.

Table 1. Differences in seasonally adjusted levels and over-the-month changes, total nonfarm employment, January to December 2018 (in thousands)

2018	Levels			Over-the-month Changes		
	As Previously Published	As Revised	Difference	As Previously Published	As Revised	Difference
January	147,801	147,767	-34	176	171	-5
February	148,125	148,097	-28	324	330	6
March	148,280	148,279	-1	155	182	27
April	148,455	148,475	20	175	196	21
May	148,723	148,745	22	268	270	2
June	148,931	149,007	76	208	262	54
July	149,096	149,185	89	165	178	13
August	149,382	149,467	85	286	282	-4
September	149,501	149,575	74	119	108	-11
October	149,775	149,852	77	274	277	3
November	149,951	150,048	97	176	196	20
December[p]	150,263	150,270	7	312	222	-90

Footnotes
[p] Preliminary

IMPORTANT Special notice regarding seasonally adjusted historical data

Due to a major reconstruction effort, some seasonally adjusted series were revised further back than usual. Total nonfarm data was revised back to 1939. For more information, see the Reconstructions section of this article.

Overview

Establishment survey benchmarking is done on an annual basis to population employment counts derived primarily from the administrative file of employees covered by Unemployment Insurance (UI). All employers covered by UI laws are required to report employment and wage information to the appropriate state Unemployment Insurance agency four times per year. Approximately 97 percent of total nonfarm employment within the scope of the establishment survey is covered by UI. The UI data are obtained and edited by each state's Labor Market Information (LMI) agency, and are tabulated and published through the BLS Quarterly Census of Wages and Employment (QCEW) program. Both the QCEW and CES are based on the North American Industry Classification System (NAICS). An employment count for the remaining 3 percent is constructed from alternate sources, primarily records from the Railroad Retirement Board (RRB), as well as County Business Patterns (CBP) and Annual Survey of Public Employment and Payroll (ASPEP) data from the Census Bureau. This 3 percent is referred to as noncovered employment (NCE). The combination of QCEW and NCE employment counts create the benchmark level and are used to replace CES sample-based estimates each March. The full benchmark level developed for March replaces the March sample-based estimate for each basic cell.

The total annual revision is the difference between the benchmark level for a given March and the published March sample-based employment estimate. Typically, the total revision is equal to the benchmark revision. The overall accuracy of the establishment survey is usually gauged by the size of the benchmark revision, which is often regarded as a proxy for total survey error. In years that are affected by historical reconstructions, however, affected CES series are re-estimated prior to benchmarking. The benchmark revision, in these cases, is the difference between the benchmark level and the newly reconstructed sample-based estimate. The benchmark revision can be more precisely interpreted as the difference between two independently derived employment counts, each subject to its own error sources.

In order to create a continuous time series between the new March benchmark level and historical sample-based data from the prior March benchmark level, employment estimates for the months between the most recent March benchmark and the previous year's benchmark are adjusted using a linear "wedge-back" procedure, which assumes that the total estimation error accumulated at a steady rate since the last benchmark. For the 9 months following the March benchmark (also referred to as the post-benchmark period), CES applies previously derived over-the-month sample changes to the revised March level to get the revised estimates. New net birth/death model forecasts are also calculated and applied during post-benchmark estimation. More information on benchmarks in the CES program is available in the Benchmarks section of the CES Technical Notes, as well as in the October 2017 Monthly Labor Review, "Benchmarking the Current Employment Statistics National Estimates."

Seasonally adjusted revisions

Table 2 presents revised employment data on a seasonally adjusted basis for March 2018 by major industry sector. The revision to seasonally adjusted total nonfarm employment is -1,000.

Table 2. Seasonally adjusted employment revisions for major industry sectors, March 2018 (in thousands)

CES Industry Code	CES Industry Title	As Revised	As Previously Published	Differences	
				Amount	Percent
00-000000	Total nonfarm	148,279	148,280	-1	[1]
05-000000	Total private	125,870	125,956	-86	-0.1
06-000000	Goods-producing	20,527	20,516	11	0.1
07-000000	Service-providing	127,752	127,764	-12	[1]
08-000000	Private service-providing	105,343	105,440	-97	-0.1
10-000000	Mining and logging	714	722	-8	-1.1
20-000000	Construction	7,201	7,164	37	0.5
30-000000	Manufacturing	12,612	12,630	-18	-0.1
31-000000	Durable goods	7,886	7,883	3	[1]
32-000000	Nondurable goods	4,726	4,747	-21	-0.4
40-000000	Trade, transportation, and utilities	27,591	27,736	-145	-0.5
41-420000	Wholesale trade	5,834.8	5,962	-127.2	-2.2
42-000000	Retail trade	15,834.3	15,930.4	-96.1	-0.6
43-000000	Transportation and warehousing	5,365.6	5,289	76.6	1.4
44-220000	Utilities	555.8	554.1	1.7	0.3
50-000000	Information	2,824	2,765	59	2.1
55-000000	Financial activities	8,537	8,548	-11	-0.1
60-000000	Professional and business services	20,816	20,817	-1	[1]
65-000000	Education and health services	23,518	23,491	27	0.1
70-000000	Leisure and hospitality	16,244	16,248	-4	[1]
80-000000	Other services	5,813	5,835	-22	-0.4
90-000000	Government	22,409	22,324	85	0.4

Footnotes

[1] Absolute revision is less than 0.05 percent.

Typically, 5 years of seasonally adjusted data are revised with each CES annual benchmark. However, reconstructed series are seasonally adjusted over their revised time spans.

For technical information on how seasonal adjustment is performed in the CES program, see the Seasonal Adjustment section of the CES Technical Notes.

For information on seasonal adjustment model specifications and special model adjustments, see the CES Seasonal Adjustment Files and Documentation page.

Not seasonally adjusted revisions

Table 3 presents the employment benchmarks for March 2018, not seasonally adjusted, by major industry sector. The revision to not seasonally adjusted total nonfarm employment is -16,000.

Table 3. Not seasonally adjusted employment benchmarks for major industry sectors, March 2018 (in thousands)

CES Industry Code	CES Industry Title	Benchmark	Estimate[1]	Differences Amount	Differences Percent
00-000000	Total nonfarm	147,368	147,384	-16	[2]
05-000000	Total private	124,601	124,705	-104	-0.1
06-000000	Goods-producing	20,195	20,177	18	0.1
07-000000	Service-providing	127,173	127,207	-34	[2]
08-000000	Private service-providing	104,406	104,528	-122	-0.1
10-000000	Mining and logging	704	712	-8	-1.1
20-000000	Construction	6,933	6,889	44	0.6
30-000000	Manufacturing	12,558	12,576	-18	-0.1
31-000000	Durable goods	7,870	7,869	1	[2]
32-000000	Nondurable goods	4,688	4,707	-19	-0.4
40-000000	Trade, transportation, and utilities	27,283	27,360	-77	-0.3
41-420000	Wholesale trade	5,812	5,867	-54.4	-0.9
42-000000	Retail trade	15,611	15,707	-96.4	-0.6
43-000000	Transportation and warehousing	5,306	5,233	72.7	1.4
44-220000	Utilities	554	553	1.8	0.3
50-000000	Information	2,814	2,755	59	2.1
55-000000	Financial activities	8,491	8,503	-12	-0.1
60-000000	Professional and business services	20,566	20,638	-72	-0.4
65-000000	Education and health services	23,656	23,651	5	[2]
70-000000	Leisure and hospitality	15,818	15,822	-4	[2]
80-000000	Other services	5,778	5,799	-21	-0.4
90-000000	Government	22,767	22,679	88	0.4

Footnotes
[1] With the 2018 benchmark, CES reconstructed several series. The effects of these reconstructions are included in this table. For more information, see the Reconstructions section in the 2018 CES Benchmark Article.
[2] Absolute revision is less than 0.05 percent.

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Benchmarks for more detailed industries can be found at www.bls.gov/ces/publications/benchmark/cesbmart18-tables.htm.

Table 4 below shows the recent history of not seasonally adjusted total nonfarm percent and level benchmark revisions. Over the prior 10 years, the annual benchmark revision at the total nonfarm level has averaged 0.2 percent (in absolute terms), with a range of -0.7 percent to 0.3 percent.

The differences listed in table 4 reflect the error due to normal benchmarking procedures after the incorporation of reconstructions. Those years are footnoted.

Table 4. Percent and level differences between nonfarm employment benchmarks and estimates by industry supersector, March 2008-2018 (in thousands)

CES Industry Code	CES Industry Title	Type	2008	2009	2010[1]	2011[2]	2012	2013[3]	2014	2015[4]	2016	2017[5]	2018[6]
00-000000	Total nonfarm	Percent	-0.1	-0.7	-0.3	0.1	0.3	-0.1	[7]	-0.1	-0.1	0.1	[7]
		Level	-89	-902	-378	162	424	-119	67	-172	-81	135	-16
05-000000	Total private	Percent	-0.1	-0.9	-0.4	0.1	0.4	-0.1	0.1	-0.2	-0.1	0.1	-0.1
		Level	-137	-933	-391	134	481	-126	105	-232	-151	133	-104
10-000000	Mining and logging	Percent	0.4	-3.5	-3.0	-0.4	1.6	-1.2	-1.8	-2.2	-3.2	-4.6	-1.1
		Level	3	-25	-20	-3	13	-10	-16	-19	-22	-30	-8
20-000000	Construction	Percent	0.7	-2.9	-1.3	-0.5	1.8	0.3	1.6	0.6	0.7	0.8	0.6
		Level	49	-171	-67	-26	93	14	90	39	47	52	44
30-000000	Manufacturing	Percent	-0.1	-0.7	-1.0	0.1	-0.2	0.2	0.4	-0.1	0.5	0.1	-0.1
		Level	-17	-84	-119	9	-25	23	43	-12	58	15	-18
40-000000	Trade, transportation, and utilities	Percent	0.2	-1.2	-0.6	0.4	0.6	-0.5	-0.1	[7]	-0.4	0.3	-0.3
		Level	65	-300	-143	95	145	-131	-31	-5	-110	75	-77
41-420000[8]	Wholesale trade	Percent	-0.7	-1.2	-2.3	-0.2	0.8	-0.4	-0.8	-0.7	-1.1	-0.4	-0.9
		Level	-43.1	-68.0	-124.5	-13.1	45.3	-20.2	-45.4	-41.3	-66.6	-21.2	-54.4
42-000000[8]	Retail trade	Percent	0.6	-1.6	-0.1	0.6	0.5	-0.8	[7]	-0.2	-0.8	0.1	-0.6
		Level	92.8	-235.6	-18.4	83.8	78.9	-110.3	5.5	-23.5	-118.2	15.4	-96.4
43-000000[8]	Transportation and warehousing	Percent	0.3	0.2	0.1	0.5	0.7	0.1	0.2	1.4	1.7	1.6	1.4
		Level	15.0	9.9	3.1	22.4	29.4	3.6	9.7	65.3	83.5	79.8	72.7
44-220000[8]	Utilities	Percent	[7]	-1.2	-0.6	0.5	-1.5	-0.8	-0.1	-0.8	-1.6	0.2	0.3
		Level	-0.2	-6.8	-3.4	2.8	-8.5	-4.6	-0.6	-4.7	-8.7	1	1.8
50-000000	Information	Percent	0.3	-1.5	-0.4	-0.4	1.8	-0.2	2.4	-1.6	-0.1	2.5	2.1
		Level	8	-42	-11	-12	47	-5	66	-44	-2	70	59
55-000000	Financial activities	Percent	-0.3	-0.1	0.4	0.9	0.6	-0.1	0.2	-0.1	[7]	0.1	-0.1
		Level	-23	-4	34	69	45	-10	19	-9	-4	7	-12
60-000000	Professional and business services	Percent	-0.4	-0.8	[7]	0.7	[7]	[7]	-0.8	-0.6	-0.6	-1.3	-0.4
		Level	-63	-137	-3	125	2	4	-147	-110	-125	-270	-72
65-000000	Education and health services	Percent	-0.1	-0.3	[7]	-0.5	[7]	-0.3	-0.1	[7]	-0.4	0.3	[7]
		Level	-17	-56	7	-108	-2	-61	-16	-7	-83	70	5
70-000000	Leisure and hospitality	Percent	-1.1	-0.6	-0.6	0.7	0.8	0.5	0.3	-0.3	0.7	0.8	[7]
		Level	-151	-72	-80	93	104	72	38	-45	102	126	-4
80-000000	Other services	Percent	0.2	-0.8	0.2	-2.0	1.1	-0.4	1.1	-0.4	-0.2	0.3	-0.4
		Level	9	-42	11	-108	59	-22	59	-20	-12	18	-21
90-000000	Government	Percent	0.2	0.1	0.1	0.1	-0.3	[7]	-0.2	0.3	0.3	[7]	0.4
		Level	48	31	13	28	-57	7	-38	60	70	2	88

Footnotes

[1] With the 2010 benchmark, CES reconstructed historical national employment levels of all employees for other federal government (91-999900) to reflect corrections to initial counts for Census temporary and intermittent workers for the 2010 Census. The reconstructions resulted in about 4,000 in employment moved out of other federal government (91-999900). For more information, see the Reconstructions section in the 2010 CES Benchmark Article.

[2] A review of industries for the possible presence of noncovered employment yielded 13 additional industries. As a result of including these industries, employment in the amount of 95,000 was added to the benchmark nonfarm level. For more information, see the Changes to noncovered employment section in the 2011 CES Benchmark Article.

[3] With the 2013 benchmark, CES reconstructed several national employment series. Each first quarter, the Quarterly Census of Employment and Wages (QCEW) program, whose data account for approximately 97 percent of the CES universe scope (see The Sample section of the CES Technical Notes), incorporates updated industry assignments. In 2013, these updates included two substantial groups of nonrandom, noneconomic code changes, one to funds, trusts, and other financial vehicles (NAICS 525), and the other, a reclassification of approximately 466,000 in employment from private households (NAICS 814), which is out of scope for CES, to services for the elderly and persons with disabilities (NAICS 62412), which is in scope. These changes also had an impact, beyond what would be considered typical for a given benchmark year, on corresponding CES series. For more information about the changes to these industries, see the QCEW First Quarter 2013 News Release or the Special notice regarding reconstructed data section in the 2013 CES Benchmark Article.

[4] With the 2015 benchmark, CES reconstructed the national employment series 65-624120, services for the elderly and persons with disabilities back to January 2000. CES previously reconstructed this series with the 2013 benchmark; however, between the 2013 and 2015 benchmark, a better source of information for the employment within NAICS 62412 for the state of California was found. The inclusion of the reconstructed series resulted in total nonfarm and total private employment that was 27,000 less than the originally published March 2015 estimate level. The difference between the benchmarked and originally published March 2015 estimate level is -199,000 or -0.1 percent. This table displays March 2015 data after accounting for the decrease of 27,000 from the reconstructed series. Similarly, for the education and health services supersector, this table displays March 2015 data after incorporating the reconstructed series. For more information, see the Reconstructions section in the 2015 CES Benchmark Article.

[5] With the 2017 benchmark, CES reconstructed the national employment series 60-561613, security guards and patrols and armored car services back to October 2016 to correct a microdata error. The inclusion of the reconstructed series resulted in total nonfarm and total private employment that was 3,000 more than the originally published March 2017 estimate level. The difference between the benchmarked and originally published March 2017 estimate level is 138,000 or 0.1 percent. This table displays March 2017 data after accounting for the increase of 3,000 from the reconstructed series. Similarly, for the professional and business services supersector, this table displays March 2017 data after incorporating the reconstructed series. For more information, see the Reconstructions section in the 2017 CES Benchmark Article.

[6] With the 2018 benchmark, CES reconstructed several national employment series. A recoding effort in the QCEW resulted in about 336,000 in employment in wholesale trade agents and brokers (41-425120) moving into other series within the wholesale trade, retail trade, transportation and warehousing, and professional and business services major industry sectors. Affected basic series were reconstructed for their entire history, generally back to January 1990. Additionally, a reclassification of a state employer to private ownership caused a shift of about 17,000 in employment from the CES series other state government (90-922999) into services for the elderly and persons with disabilities (65-624120). Affected basic series were reconstructed from March 2018 back to January 2018. For more information, see the Reconstructions section in the 2018 CES Benchmark Article.

[7] Absolute revision is less than 0.05 percent.

[8] Indented series are part of trade, transportation, and utilities.

Benchmark revision effects for other data types

The routine benchmarking process results in revisions to the series for production and nonsupervisory employees (PE) and women employees (WE). There are no benchmark employment levels for these series; they are revised by preserving ratios of employment for the particular data type to the all employee (AE) level prior to benchmarking, and then applying these ratios to the revised all employee level. These figures are calculated at the basic cell level and then aggregated to produce the summary estimates. Average weekly hours (AWH), average hourly earnings (AHE), and in manufacturing industries, average weekly overtime hours (AWOH) are not benchmarked; they are estimated solely from reports supplied by survey respondents at the basic estimating cell level. New employment benchmarks can additionally affect indirectly estimated data types. For more information on indirectly estimated data types, see the Available Data section in the CES Technical Notes.

Table 5 lists directly estimated data types and their common abbreviations. Directly estimated data types except for AE are collectively called non-AE data types.

Table 5. Directly estimated data types

Data Type	Abbreviation
All employees	AE
Production and nonsupervisory employees	PE
Women employees	WE
Average weekly hours of all employees	AE AWH
Average hourly earnings of all employees	AE AHE
Average weekly overtime hours of all employees	AE AWOH
Average weekly hours of production and nonsupervisory employees	PE AWH
Average hourly earnings of production and nonsupervisory employees	PE AHE
Average weekly overtime hours of production and nonsupervisory employees	PE AWOH

The aggregate industry levels of the hours and earnings series are derived as a weighted average. AE and PE estimates for basic cells act as weights for their respective hours and earnings estimates for broader industry groupings. Adjustments of AE estimates to new benchmarks may alter the implicit weights used for both AE and PE hours and earnings, which, in turn, may change the estimates for both AE and PE hours and earnings at higher levels of aggregation.

Generally, new employment benchmarks have little effect on hours and earnings estimates for major industry groupings. To influence the hours and earnings estimates of a broader industry group, employment revisions have to be relatively large and must affect industries that have hours or earnings averages that are substantially different from those of other industries in their broader group.

Table 6 and table 7 provide information on the not seasonally adjusted levels of major industry sector hours and earnings series resulting from the March 2018 benchmark. At the total private level, there was no change in average weekly hours estimates for both AE and PE from the previously published level. Total private average hourly earnings increased by 4 cents for AE and increased by 3 cents for PE from the previously published level.

Benchmark effects on hours and earnings for more detailed industries can be found at www.bls.gov/ces/publications/benchmark/cesbmart18-tables.htm.

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Table 6. Effect of March 2018 benchmark revisions to all employees average weekly hours and average hourly earnings estimates, major industry sectors

CES Industry Code	CES Industry Title	Average Weekly Hours			Average Hourly Earnings		
		Estimated[1]	Revised	Difference	Estimated[1]	Revised	Difference
05-000000	**Total private**	34.3	34.3	0.0	$26.83	$26.87	$0.04
06-000000	**Goods-producing**	40.2	40.2	.0	27.97	27.99	.02
08-000000	**Private service-providing**	33.1	33.1	.0	26.57	26.61	.04
10-000000	**Mining and logging**	45.2	45.2	.0	32.79	32.68	-.11
20-000000	**Construction**	38.7	38.7	.0	29.50	29.52	.02
30-000000	**Manufacturing**	40.8	40.8	.0	26.87	26.90	.03
31-000000	**Durable goods**	41.3	41.3	.0	28.12	28.15	.03
32-000000	**Nondurable goods**	40.0	40.0	.0	24.71	24.73	.02
40-000000	**Trade, transportation, and utilities**	34.2	34.2	.0	23.07	23.06	-.01
41-420000	**Wholesale trade**	38.7	38.7	.0	30.01	29.96	-.05
42-000000	**Retail trade**	30.8	30.8	.0	18.47	18.47	.00
43-000000	**Transportation and warehousing**	38.4	38.6	.2	24.30	24.25	-.05
44-220000	**Utilities**	42.0	42.1	.1	40.44	40.45	.01
50-000000	**Information**	35.7	35.7	.0	38.97	39.13	.16
55-000000	**Financial activities**	37.3	37.2	-.1	34.32	34.31	-.01
60-000000	**Professional and business services**	35.9	35.9	.0	32.26	32.33	.07
65-000000	**Education and health services**	32.8	32.7	-.1	26.79	26.85	.06
70-000000	**Leisure and hospitality**	26.0	26.0	.0	15.87	15.88	.01
80-000000	**Other services**	31.5	31.5	.0	24.41	24.59	.18

Footnotes

[1] With the 2018 benchmark, CES reconstructed several series. The effects of these reconstructions are included in this table. For more information, see the Reconstructions section in the 2018 CES Benchmark Article.

Table 7. Effect of March 2018 benchmark revisions to production and nonsupervisory employees average weekly hours and average hourly earnings estimates, major industry sectors

CES Industry Code	CES Industry Title	Average Weekly Hours			Average Hourly Earnings		
		Estimated[1]	Revised	Difference	Estimated[1]	Revised	Difference
05-000000	**Total private**	33.5	33.5	0.0	$22.48	$22.51	$0.03
06-000000	**Goods-producing**	41.2	41.2	.0	23.63	23.66	.03
08-000000	**Private service-providing**	32.2	32.2	.0	22.23	22.26	.03
10-000000	**Mining and logging**	46.5	46.4	-.1	28.05	27.99	-.06
20-000000	**Construction**	39.2	39.3	.1	27.29	27.32	.03
30-000000	**Manufacturing**	42.0	42.0	.0	21.36	21.39	.03
31-000000	**Durable goods**	42.5	42.5	.0	22.27	22.30	.03
32-000000	**Nondurable goods**	41.3	41.3	.0	19.89	19.89	.00
40-000000	**Trade, transportation, and utilities**	33.6	33.6	.0	19.65	19.65	.00
41-420000	**Wholesale trade**	38.7	38.7	.0	24.61	24.58	-.03
42-000000	**Retail trade**	30.0	30.0	.0	15.69	15.69	.00
43-000000	**Transportation and warehousing**	37.8	38.0	.2	21.76	21.71	-.05
44-220000	**Utilities**	42.7	42.7	.0	36.97	36.99	.02
50-000000	**Information**	35.5	35.5	.0	31.26	31.35	.09
55-000000	**Financial activities**	36.6	36.6	.0	26.89	26.88	-.01
60-000000	**Professional and business services**	35.0	35.1	.1	26.57	26.61	.04
65-000000	**Education and health services**	32.1	32.0	-.1	23.43	23.47	.04
70-000000	**Leisure and hospitality**	24.8	24.8	.0	13.74	13.74	.00
80-000000	**Other services**	30.5	30.5	.0	20.62	20.79	.17

Footnotes

[1] With the 2018 benchmark, CES reconstructed several series. The effects of these reconstructions are included in this table. For more information, see the Reconstructions section in the 2018 CES Benchmark Article.

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Revisions to net birth/death

The CES sample alone is not sufficient for estimating the total nonfarm employment level because each month new firms generate employment that cannot be captured through the sample. There is an unavoidable lag between a firm opening for business and its appearance on the CES sample frame. The sample frame is built from Unemployment Insurance (UI) quarterly tax records. These records cover virtually all U.S. employers and include business births, but they only become available for updating the CES sampling frame 7 to 9 months after the reference month. After the births appear on the frame, there is also time required for sampling, contacting, and soliciting cooperation from the firm, and verifying the initial data provided. In practice, BLS cannot sample and begin to collect data from new firms until they are at least a year old.

BLS has researched both sample-based and model-based approaches to measuring birth/death units that have not yet appeared on the UI universe frame. The research demonstrated that sampling for births was not feasible in the very short CES production timeframes, so the Bureau uses a model-based approach to account for this employment. This model incorporates two components; the first component is an indirect imputation for business deaths and the second component is an Autoregressive Integrated Moving Average (ARIMA) time series model designed to estimate the net birth/death employment not accounted for by the imputation from the first component. More information on the CES birth/death model is available in the Birth/Death Model section of the CES Technical Notes.

Forecasted vs. actual net birth/death

Only error from the second component is directly measurable. Error from this component is measured by comparing the actual net of births and deaths with the model-based forecast that was used in the CES sample-based estimates. Most recently, the data from April 2017 to March 2018 can be measured. As table 8 shows, the actual net birth/death for April 2017 to March 2018 was approximately 65,000 below the forecasted amount used in the CES monthly estimates for the same period.

Table 8. Differences between forecasted and actual net birth/death, total private employment, April 2017-March 2018 (in thousands)

	2017									2018			
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Total**
Actual Net Birth/Death	281	204	124	140	91	-61	279	-24	-45	-149	157	42	1,039
Forecast Net Birth/Death	264	232	110	200	115	-41	247	8	-23	-198	125	65	1,104
Difference	17	-28	14	-60	-24	-20	32	-32	-22	49	32	-23	-65
Cumulative Difference	17	-11	3	-57	-81	-101	-69	-101	-123	-74	-42	-65	

Net birth/death adjustments to the post-benchmark period

From April 2018 to December 2018, also known as the post-benchmark period, estimates were recalculated for each month based primarily on new benchmark levels and new net birth/death forecasts. Net birth/death forecasts were revised to incorporate information from the most recent year of universe employment counts. Table 9 shows the net birth/death values for the supersectors over the post-benchmark period. From April 2018 to December 2018, the net birth/death model cumulatively added 1,055,000, compared with 963,000 in the previously published April 2018 to December 2018 employment estimates.

Table 9. Net birth/death forecasts by industry supersector, April to December 2018 (in thousands)

CES Industry Code	CES Industry Title	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Cumulative Total
10-000000	**Mining and logging**	0	1	1	1	1	0	1	0	0	5
20-000000	**Construction**	35	39	23	12	10	4	22	-9	-13	123
30-000000	**Manufacturing**	0	7	6	-1	3	3	5	2	2	27
40-000000	**Trade, transportation, and utilities**	5	22	7	8	16	11	37	10	6	122
41-420000[1]	**Wholesale trade**	-3	4	-1	-2	2	-2	6	2	1	7
42-000000[1]	**Retail trade**	6	13	5	8	9	7	20	2	0	70
43-000000[1]	**Transportation and warehousing**	2	5	3	2	5	6	11	6	5	45
44-220000[1]	**Utilities**	0	0	0	0	0	0	0	0	0	0
50-000000	**Information**	4	6	0	6	5	-3	9	4	-1	30
55-000000	**Financial activities**	2	6	1	6	4	-4	21	1	9	46
60-000000	**Professional and business services**	97	22	-4	40	22	-23	97	1	-26	226
65-000000	**Education and health services**	40	16	-20	28	17	-2	62	10	-7	144
70-000000	**Leisure and hospitality**	79	88	92	73	23	-44	11	-23	0	299
80-000000	**Other services**	13	8	6	-2	4	-3	10	-1	-2	33
Total private net birth/death forecast		275	215	112	171	105	-61	275	-5	-32	1,055

Footnote
[1] Indented series are part of trade, transportation, and utilities.

Reconstructions

In addition to the regular benchmark revisions, CES employment, hours, and earnings estimates are sometimes reconstructed in order to avoid series breaks and to provide users with continuous, comparable employment time series suitable for economic analysis. Reconstructions may be necessary to correct processing errors, reporting errors, changes in scope, or to address other issues that may cause breaks in CES time series that are not economic in nature. The reconstructions that were incorporated with this year's annual benchmark are described below.

Wholesale trade recoding

During processing for the 2018 benchmark, a QCEW recoding effort for the first quarter of 2018 moved a significant amount of employment out of NAICS 425120. For CES purposes, this resulted in about 336,000 in employment in wholesale trade agents and brokers (41-425120) moving into other series within the wholesale trade, retail trade, transportation and warehousing, and professional and business services major industry sectors. This amounted to approximately 38.8 percent of the previously published March 2018 employment level of wholesale trade agents and brokers. Affected basic series were reconstructed for their entire histories, generally back to January 1990. Series for AE, PE, WE, PE AWH, and PE AHE were reconstructed back to January 1990 for all affected basic and independent series. AE AWH and AE AHE were reconstructed back to the start of those data types, March of 2006. A complete list of affected basic and independent series is available in exhibit 1. Basic series are those at the most detailed industry level that get aggregated into other series levels; independent series are detailed series estimated independently of aggregation. For more information about CES aggregation procedures, see the Aggregation Procedures section in the CES Technical Notes.

Some of the changes associated with the recoding of NAICS 425120 affected levels of NAICS detail not published by CES; therefore, only cases where CES industries were affected are discussed in detail here. Reconstructions were applied to not seasonally adjusted CES data.

Basic-level reconstruction methods

The reconstruction of data from wholesale trade agents and brokers redistributes a single NAICS (425120) that made up the entire CES industry wholesale trade agents and brokers (41-425120) to many NAICS that span industries in the CES major industry sectors wholesale trade, retail trade, transportation and warehousing, and professional and business services. Employment in wholesale trade agents and brokers was split into 69 basic series, including the portion that remained in the original series, and 6 independent series.

Ratios of employment moving out of wholesale trade agents and brokers and into other basic-level CES series were created from QCEW data for March 2018 and used to reconstruct each series. Ratios were held constant and applied to each monthly CES employment estimate for the entire history of the series, usually back to 1990, to determine the amount of employment moving from wholesale trade agents and brokers to a different CES industry. Average weekly hours and average hourly earnings were recalculated by applying the same ratios to the amount of old total hours and old total payroll to move the correct amount of hours or earnings into the new CES industry. Total hours and total earnings summed for the new industries were then

averaged using the new employment levels. More information about the calculation of CES employment, hours, and earnings estimates is available in the CES Technical Notes under Estimation Methods.

Exhibit 1 shows the ratios that were applied to 41-425120 to calculate proportions of employment, total hours, and total earnings moving to other series. AE series are sometimes published at a more detailed level than non-AE series. Furthermore, aggregate-level series for AE may be basic series for non-AE datatypes, as noted in exhibit 1.

Exhibit 1. Ratios used to move employment out of wholesale trade agents and brokers and into other industries

CES Industry Code	CES Industry Title	AE Ratio[1]	Non-AE Ratio[1]
41-423100	Motor vehicles and parts	1.0	1.0
41-423110	Motor vehicles	0.5	0.5
41-423120	New motor vehicle parts	0.4	0.4
41-423200	Furniture and furnishings	[2]	0.3
41-423210	Furniture	0.1	[3]
41-423220	Home furnishings	0.2	[3]
41-423310	Lumber and wood	0.4	0.4
41-423320	Masonry materials	0.2	0.2
41-423390	Roofing, siding, and other construction materials	0.5	0.5
41-423420	Office equipment	0.2	0.2
41-423430	Computer and software	1.2	1.2
41-423450	Medical equipment	4.3	4.3
41-423490	Miscellaneous professional and commercial equipment	1.1	1.1
41-423500	Metals and minerals	1.0	1.0
41-423610	Electrical equipment and wiring	1.1	1.1
41-423690	Electric appliances and other electronic parts	1.5	1.5
41-423710	Hardware	0.4	0.4
41-423720	Plumbing equipment	0.3	0.3
41-423740	HVAC and refrigeration equipment	0.4	0.4
41-423810	Construction equipment	0.1	0.1
41-423820	Farm and garden equipment	0.2	0.2
41-423830	Industrial machinery	1.8	1.8
41-423840	Industrial supplies	0.3	0.3
41-423850	Service establishment equipment	0.1	0.1
41-423860	Other transportation goods	0.3	0.3
41-423910	Sporting goods	0.1	0.1
41-423940	Jewelry	0.1	0.1
41-423990	Toy, hobby, and other durable goods	0.7	0.7
41-424120	Printing and writing paper and office supplies	0.7	0.7
41-424130	Industrial paper	0.6	0.6

41-424200	Druggists' goods	3.8	3.8
41-424300	Apparel and piece goods	0.5	0.5
41-424330	Women's and children's clothing	0.2	(3)
41-424400	Grocery and related products	2.9	2.9
41-424410	General line grocery	0.5	0.5
41-424480	Fruits and vegetables	0.1	0.1
41-424500	Farm product raw materials	0.1	0.1
41-424510	Grains and field beans	(4)	(4)
41-424600	Chemicals	1.7	1.7
41-424700	Petroleum	0.7	0.7
41-424800	Alcoholic beverages	(2)	0.4
41-424810	Beer and ale	0.2	(3)
41-424820	Wine and spirits	0.2	(3)
41-424900	Miscellaneous nondurable goods	(2)	1.3
41-424910	Farm supplies	0.3	0.3
41-424920	Books and periodicals	0.2	(3)
41-424930	Nursery stock and florists' supplies	0.1	0.1
41-424990	All other nondurable goods wholesalers	0.7	(3)
42-443142	Electronics stores	0.1	0.1
42-444100	Building material and supplies dealers	(2)	0.1
42-444130	Hardware stores	0.1	0.1
42-444190	Other building material dealers	0.1	(3)
42-454100	Electronic shopping and mail-order houses	0.4	0.4
42-454390	Other direct selling establishments	0.2	0.2
43-484230	Other specialized trucking, long-distance	0.1	0.1
43-493110	General warehousing and storage	0.5	0.5
43-493120	Refrigerated warehousing and storage	0.1	0.1
60-541200	Accounting and bookkeeping services	(2)	0.1
60-541214	Payroll services	0.1	0.1
60-541340	Engineering and drafting services	0.1	0.1
60-541511	Custom computer programming services	0.4	0.4
60-541512	Computer systems design services	0.4	0.4
60-541519	Other computer-related services	0.1	0.1
60-541600	Management and technical consulting services	(2)	4.1
60-541610	Management consulting services	(2)	4.1
60-541611	Administrative management consulting services	0.1	0.1
60-541613	Marketing consulting services	3.9	3.9
60-541614	Process and logistics consulting services	0.2	0.2
60-541690	Other technical consulting services	(4)	(4)
60-541714	Research and development in biotechnology, except nanobiotechnology	0.1	0.1

60-541715	Research and development in the physical, engineering, and life sciences, except nanotechnology and biotechnology	0.2	0.2
60-541800	Advertising and related services	[2]	0.3
60-541840	Media buying agencies and media representatives	[4]	[4]
60-541890	Advertising material distribution and other advertising services	0.2	0.2
60-541990	Miscellaneous professional and technical services	0.1	0.1
60-551114	Managing offices	0.7	0.7
60-561310	Employment placement agencies and executive search services	[2]	0.1
60-561311	Employment placement agencies	0.1	[3]
60-561320	Temporary help services	0.1	0.1
60-561400	Business support services	[2]	0.3
60-561410	Document preparation services	0.1	0.1
60-561420	Telephone call centers	[2]	0.2
60-561422	Telemarketing bureaus	0.2	[3]
60-561620	Security systems services	0.1	0.1
60-561990	All other support services	0.2	0.2

Footnotes
[1] Ratios will not sum to 100.0 because of the inclusion of independent series.
[2] Calculated at more detailed level for AE.
[3] Calculated at less detailed level than AE.
[4] Less than 0.05 percent.

Aggregate-level reconstruction effects

Reconstructed basic series were summed to aggregate levels using the normal CES aggregation methods (see the Aggregation Procedures section in the CES Technical Notes), and, consequently, unadjusted aggregate employment series are subject to change from the detailed aggregate series to the major industry sector levels for trade, transportation, and utilities and professional and business services. Hours and earnings series are subject to change from detailed aggregate series to aggregate major industry sectors for private service-providing, service-providing, total private, and total nonfarm. Not seasonally adjusted employment for private service-providing, service-providing, total private, and total nonfarm are unaffected.

Reconstruction methods for series that go back further than 1990

For industries that have series with earlier data than January 1990, ratios at the major industry level were created from summed reconstructed data and the originally published estimates. These pre-1990 ratios were calculated for employment and total earnings using January 1990 data for all series in exhibit 2 and applied to the pre-1990 histories for these series. Pre-1990 PE AWH did not change, but the historical PE AWH data was used to calculate PE AHE changes for pre-1990 data, which had minor changes between 1 and -2 cents for some months.

Exhibit 2. Start years of pre-1990 industries affected by recoding wholesale trade agents and brokers

CES Industry Code	CES Industry Title	AE	PE	PE AWH	PE AHE	WE
40-000000	Trade, transportation, and utilities	1939	1964	1964	1964	1964
41-420000	Wholesale trade	1939	1972	1972	1972	1972
42-000000	Retail trade	1939	1972	1972	1972	1972
43-000000	Transportation and warehousing	1972	1972	1972	1972	1972
60-000000	Professional and business services	1939	1964	1964	1964	1964
60-561300	Employment services	1985	1990	1990	1990	1990

Seasonal adjustment in reconstructed series

For all series affected by the redistribution of employment, hours, and earnings from wholesale trade agents and brokers into other industries, the corresponding seasonally adjusted series were also subject to change for the entirety of their histories. Aggregate industries as well as component series used as indirect seasonal adjustment are also subject to change, up to and including total private and total nonfarm. More information about seasonal adjustment of CES series is available in the CES Technical Notes under Seasonal Adjustment.

Ownership change in state government

A reclassification of some employers from state to private ownership caused a shift in employment of about 17,000 from the CES series other state government (90-922999) into services for the elderly and persons with disabilities (65-624120). This shift amounted to approximately 3.5 percent of the previously published March 2018 employment level of other state government. The change occurred in January 2018, necessitating a reconstruction of 3 months of CES data for January, February, and March of 2018. Exhibit 3 lists data types affected by the change in ownership. Changes include AE, PE, and WE in services for the elderly and persons with disabilities and AE and WE in other state government. Hours and earnings are not applicable for government series, so the hours and earnings for services for the elderly and persons with disabilities were not affected by the change at the most detailed industry level. Changes to employment at the most detailed level, however, can affect the hours and earnings at aggregate levels.

Exhibit 3. CES series involved in state government reconstructions

CES Industry Code	CES Industry Title	Data Type(s) Involved	Time Span
65-624120	Services for the elderly and persons with disabilities	AE, PE, WE	January 2018 – March 2018
90-922999	Other state government	AE, WE	January 2018 – March 2018

Basic-level reconstruction methods

A ratio of QCEW employment using the new ownership total to QCEW employment using the old ownership total for other state government for March 2018 was calculated. The ratio was applied to CES employment for other state government for January, February, and March of 2018 for AE and WE to determine the amount remaining in those series. The difference between the old employment and new employment for each month was added to the corresponding month for services for the elderly and persons with disabilities. For PE, the original sample ratios used to calculate PE in services for the elderly and persons with disabilities were applied to the new totals for AE.

Aggregate-level reconstruction effects

The previous employment was maintained at total nonfarm (00-000000), but aggregate levels were affected by the change in ownership. Exhibit 4 lists the affected aggregate industries. As with usual processing, 5 years of data are subject to seasonal adjustment during benchmark processing.

Exhibit 4. Aggregate series affected by the reconstruction in state government

CES Industry Code	CES Industry Title
05-000000	Total private
08-000000	Private service-providing
65-000000	Education and health services
65-620000	Health care and social assistance
65-624000	Social assistance
65-624100	Individual and family services
90-000000	Government
90-920000	State government
90-922000	State government, excluding education

Aggregation processing error for production and nonsupervisory employees hours and earnings estimates

During the 2018 benchmark, a processing error was found that caused both PE AWH and PE AHE to aggregate incorrectly, specifically between 1947 and 1989 for the total private, goods-producing, and private service-providing sectors. The maximum absolute differences in aggregation totals were 0.1 hours for PE AWH and 2 cents for PE AHE. These were corrected by re-aggregating all hours and earnings estimates between 1947 and 1989.

Changes to the CES published series

With the release of the January 2019 first preliminary estimates on February 1, 2019, CES incorporated series changes related to annual sample adequacy and disclosure review.

Series changes due to annual sample review

All CES series are evaluated annually for sample size, coverage, and response rates. The following changes result from a re-evaluation of the sample and universe coverage for CES industries, which are based on the 2017 North American Industry Classification System (NAICS). Some industries no longer have sufficient sample to be estimated and published separately and were discontinued or combined with other similar industries for estimation and publication purposes.

A list of currently published CES series is available at www.bls.gov/web/empsit/cesseriespub.htm.

Some series have new CES industry codes or titles as a result of the series changes (see table 10). These CES industry code or title changes have been applied to all data types published for the designated series. Historical data for these series with new CES industry codes or CES industry titles are affected as noted on the remainder of this page; historical data are available under the new CES industry codes or new CES industry titles.

Table 10. Series with CES industry code or title changes

NAICS Code	Previous			New		
	CES Industry Code	CES Industry Title		CES Industry Code	CES Industry Title	
335312,3,4	31-335314	Switchgears, switchboard apparatus, relays, and industrial controls		31-335314	Motors and generators, switchgears and switchboard apparatus, and relay and industrial controls	

Table 11 through table 16 reference the new CES industry codes and titles, not the previous CES industry codes and titles, as noted in table 10.

In order to more easily identify affected series and because AE series are published at a more detailed industry level than non-AE series, series changes are shown for AE and non-AE data types. The first three tables in this section reference the AE data type and the second three tables reference all non-AE data types. The three tables in each group display the discontinued, collapsed, and new series. Discontinued series tables (table 11 and table 14) display series for which the data types noted are no longer published. Collapsed series tables (table 12 and table 15) display series for which the data types noted are no longer published because the industry no longer has sufficient sample to be estimated and published separately. Affected industries have

been combined with other similar industries for estimation and publication purposes. Historical data for these series were reconstructed to provide consistent time series. Series that no longer publish AE will also no longer publish other directly estimated datatypes or derivative series. New series tables (table 13 and table 16) display series for which the data types noted are now published.

Table 11. Discontinued all employees series

NAICS Code	CES Industry Code	CES Industry Title	Next Highest Published Industry
32311	32-323110	Printing	Printing and related support activities (32-323000)
323113	32-323113	Commercial screen printing	Printing and related support activities (32-323000)
32312	32-323120	Support activities for printing	Printing and related support activities (32-323000)

Table 12. Collapsed all employees series

Previous			New		
NAICS Code	CES Industry Code	CES Industry Title	NAICS Code	CES Industry Code	CES Industry Title
335312	31-335312	Motors and generators	335312,3,4	31-335314	Motors and generators, switchgears and switchboard apparatus, and relay and industrial controls
335313,4	31-335314	Switchgears, switchboard apparatus, relays, and industrial controls			

Table 13. New all employees series
There are no new AE series published as a result of annual sample review.

Table 14. Discontinued series other than all employees

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
321911	31-321911	Wood windows and doors	PE AWOH	Millwork (31-321910)
321912,8	31-321918	Cut stock, resawing lumber, planing, and other millwork, including flooring	PE AWOH	Millwork (31-321910)
32192	31-321920	Wood containers and pallets	PE AWOH	Other wood products (31-321900)
32199	31-321990	All other wood products	PE AWOH	Other wood products (31-321900)
3271	31-327100	Clay products and refractories	WE	Nonmetallic mineral products (31-327000)
3274,9	31-327900	Lime, gypsum, and other nonmetallic mineral products	WE	Nonmetallic mineral products (31-327000)
3312	31-331200	Steel products from purchased steel	AE AWH, AE AHE, WE, AE AWOH	Primary metals (31-331000)
3314	31-331400	Other nonferrous metal production	AE AWH, AE AHE, WE	Primary metals (31-331000)
334413	31-334413	Semiconductors and related devices	PE AWOH	Semiconductors and electronic components (31-334400)
33637	31-336370	Motor vehicle metal stamping	WE	Motor vehicle parts (31-336300)
3366	31-336600	Ship and boat building	WE	Transportation equipment (31-336000)
3365,9	31-336900	Railroad rolling stock and other transportation equipment	WE	Transportation equipment (31-336000)
337215	31-337215	Showcases, partitions, shelving, and lockers	AE AWH, AE AHE, WE	Furniture and related products (31-337000)
339113	31-339113	Surgical appliances and supplies	PE AWOH	Medical equipment and supplies (31-339100)
3113	32-311300	Sugar and confectionery products	PE AWOH	Food manufacturing (32-311000)
31141	32-311410	Frozen food	PE, PE AWH, PE AHE, PE AWOH	Fruit and vegetable preserving and specialty (32-311400)

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
31142	32-311420	Fruit and vegetable canning and drying	PE, PE AWH, PE AHE, PE AWOH	Fruit and vegetable preserving and specialty (32-311400)
311611	32-311611	Animal, except poultry, slaughtering	AE AWH, AE AHE	Animal slaughtering and processing (32-311600)
311612,3	32-311613	Meat processed from carcasses, and rendering and meat byproduct processing	AE AWH, AE AHE	Animal slaughtering and processing (32-311600)
3117	32-311700	Seafood product preparation and packaging	PE, PE AWH, PE AHE	Food manufacturing (32-311000)
3221	32-322100	Pulp, paper, and paperboard mills	PE, PE AWH, PE AHE, AE AWOH	Paper and paper products (32-322000)
3222	32-322200	Converted paper products	PE, PE AWH, PE AHE, AE AWOH	Paper and paper products (32-322000)
32222	32-322220	Paper bags and coated and treated paper	AE AWH, AE AHE, WE	Converted paper products (32-322200)
32222	32-322220	Paper bags and coated and treated paper	PE, PE AWH, PE AHE, AE AWOH, PE AWOH	Paper and paper products (32-322000)
44411	42-444110	Home centers	PE, PE AWH, PE AHE, WE	Building material and supplies dealers (42-444100)
541713	60-541713	Research and development in nanotechnology	PE, PE AWH, PE AHE	Research and development in the physical, engineering, and life sciences (60-541710)
541714	60-541714	Research and development in biotechnology, except nanobiotechnology	PE, PE AWH, PE AHE	Research and development in the physical, engineering, and life sciences (60-541710)
6112	65-611200	Junior colleges	WE	Educational services (65-610000)
6116	65-611600	Other schools and instruction	WE	Educational services (65-610000)

Table 15. Collapsed series other than all employees

There are no collapsed non-AE series as a result of annual sample review.

Table 16. New series other than all employees

There are no new non-AE series published as a result of annual sample review.

Availability of revised data

LABSTAT, the BLS public database, contains all historical employment, hours, and earnings data revised as a result of this benchmark, including both not seasonally adjusted and seasonally adjusted data. The data can be accessed at www.bls.gov/ces/data/home.htm, the CES National Database page.

Previously published data are available on both a not seasonally adjusted and seasonally adjusted basis for all CES industries down to the 3-digit level from the CES Vintage Data page. CES vintage data are typically updated in late February following the annual benchmark revision.

Benchmarks for detailed industries can be found at www.bls.gov/ces/publications/benchmark/ cesbmart18-tables.htm.

Table of figures

Tables

Exhibits

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