

CES National Benchmark Article ([HTML](#))

BLS Establishment Survey National Estimates Revised to Incorporate March 2023 Benchmarks

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Summary of the revisions

With the release of January 2024 data on February 2, 2024, the Bureau of Labor Statistics (BLS) introduced its annual revision to national estimates of employment, hours, and earnings from the Current Employment Statistics (CES) monthly survey of nonfarm establishments.

The March 2023 benchmarked, seasonally adjusted employment level for total nonfarm employment is 155,206,000. The not seasonally adjusted benchmarked employment level is 154,253,000.

Compared with the sample-based, seasonally adjusted published estimate for March 2023, total nonfarm employment had a revision of -266,000 or -0.2 percent. The not seasonally adjusted total nonfarm employment estimate was revised by -187,000 or -0.1 percent.

[Table 1](#) presents revised total nonfarm employment data on a seasonally adjusted basis for January 2023 through December 2023. The revised data for April 2023 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. For more information about the methodology of benchmarking in the CES program, see [Benchmark](#) in the Calculations section of the CES Handbook of Methods.

Table 1. Differences in seasonally adjusted levels and over-the-month changes, total nonfarm employment, January to December 2023 (in thousands)

2023	Levels			Over-the-month Changes		
	As Revised	As Previously Published	Difference	As Revised	As Previously Published	Difference
January	154,773	155,007	-234	482	472	10
February	155,060	155,255	-195	287	248	39
March	155,206	155,472	-266	146	217	-71
April	155,484	155,689	-205	278	217	61
May	155,787	155,970	-183	303	281	22
June	156,027	156,075	-48	240	105	135
July	156,211	156,311	-100	184	236	-52
August	156,421	156,476	-55	210	165	45
September	156,667	156,738	-71	246	262	-16
October	156,832	156,843	-11	165	105	60
November	157,014	157,016	-2	182	173	9
December ^(p)	157,347	157,232	115	333	216	117

Footnotes

^(p) Preliminary

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Overview

Establishment survey benchmarking is done each year to align employment estimates from the survey with 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 UI agency four times per year. The UI data are obtained and edited by each state's Labor Market Information agency. They are tabulated and published through the BLS Quarterly Census of Employment and Wages (QCEW) program. Both the QCEW and CES categorize their data using the North American Industry Classification System (NAICS). About 97 percent of total nonfarm employment within the scope of the establishment survey is covered by UI and is available to the CES program via QCEW records.

An employment count for the remaining 3 percent is constructed from other sources, primarily records from the Railroad Retirement Board and U.S. Census Bureau data from County Business Patterns and the Annual Survey of Public Employment and Payroll. This 3 percent is referred to as noncovered employment. The combination of QCEW and noncovered employment data make up the benchmark level. The full benchmark employment 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. 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. Typically, the total revision is equal to the benchmark revision—as is the case for this year's benchmark revision. However, in years with historical reconstructions, 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 is the difference between two independently derived employment counts, each subject to its own error sources.

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. This procedure assumes that the total estimation error accumulated at a steady rate since the last benchmark. For the 9 months following the March benchmark (also called the post-benchmark period), BLS 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 [Benchmark](#) in the Calculation section of the CES Handbook of Methods.

Seasonally adjusted estimates

BLS seasonally adjusts 5 years of CES data with each annual benchmark for all industries and directly estimated data types. However, reconstructed series are seasonally adjusted over their revised time spans if the revised timespan is greater than 5 years. More information about seasonal adjustment of CES series is available on the [CES Seasonal Adjustment](#) webpage.

[Table 2](#) presents revised employment data on a seasonally adjusted basis for March 2023 by major industry sector. The revision to seasonally adjusted total nonfarm employment is -266,000.

Table 2. Seasonally adjusted employment revisions for major industry sectors, March 2023 (in thousands)

CES Industry Code	CES Industry Title	As Revised	As Previously Published	Differences	
				Amount	Percent
00-000000	Total nonfarm	155,206	155,472	-266	-0.2
05-000000	Total private	132,600	132,907	-307	-0.2
06-000000	Goods-producing	21,508	21,501	7	(1)
07-000000	Service-providing	133,698	133,971	-273	-0.2
08-000000	Private service-providing	111,092	111,406	-314	-0.3
10-000000	Mining and logging	635	635	0	(1)
20-000000	Construction	7,941	7,890	51	0.6
30-000000	Manufacturing	12,932	12,976	-44	-0.3
31-000000	Durable goods	8,074	8,092	-18	-0.2
32-000000	Nondurable goods	4,858	4,884	-26	-0.5
40-000000	Trade, transportation, and utilities	28,819	28,867	-48	-0.2
41-420000	Wholesale trade	6,096.2	6,047.9	48.3	0.8
42-000000	Retail trade	15,579.6	15,529.2	50.4	0.3
43-000000	Transportation and warehousing	6,571.9	6,735.1	-163.2	-2.5
44-220000	Utilities	571.6	554.3	17.3	3
50-000000	Information	3,054	3,092	-38	-1.2
55-000000	Financial activities	9,150	9,095	55	0.6
60-000000	Professional and business services	22,797	22,924	-127	-0.6
65-000000	Private education and health services	25,030	25,072	-42	-0.2
70-000000	Leisure and hospitality	16,447	16,518	-71	-0.4
80-000000	Other services	5,795	5,838	-43	-0.7
90-000000	Government	22,606	22,565	41	0.2

Footnotes

(1) Absolute revision is less than 0.05 percent.

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Not seasonally adjusted estimates

Benchmark employment levels for March are compared to CES estimates that have not been seasonally adjusted to calculate the new March employment level. Twenty-one months of not seasonally adjusted CES estimates for all data types are revised based on this new March level, prior to seasonal adjustment. Revisions to not seasonally adjusted CES estimates are described below.

Not seasonally adjusted revisions

[Table 3](#) presents the not seasonally adjusted employment benchmarks for March 2023 by major industry sector. The total revision to not seasonally adjusted total nonfarm employment is -187,000.

Table 3. Not seasonally adjusted employment benchmarks for major industry sectors, March 2023 (in thousands)

CES Industry Code	CES Industry Title	Benchmark	Estimate	Differences	
				Amount	Percent
00-000000	Total nonfarm	154,253	154,440	-187	-0.1
05-000000	Total private	131,367	131,616	-249	-0.2
06-000000	Goods-producing	21,218	21,218	(1)	(1)
07-000000	Service-providing	133,035	133,222	-187	-0.1
08-000000	Private service-providing	110,149	110,398	-249	-0.2
10-000000	Mining and logging	628	628	(1)	(1)
20-000000	Construction	7,701	7,657	44	0.6
30-000000	Manufacturing	12,889	12,933	-44	-0.3
31-000000	Durable goods	8,054	8,077	-23	-0.3
32-000000	Nondurable goods	4,835	4,856	-21	-0.4
40-000000	Trade, transportation, and utilities	28,553	28,588	-35	-0.1
41-420000	Wholesale trade	6,072.1	6,022.3	49.8	0.8
42-000000	Retail trade	15,390.8	15,348.2	42.6	0.3
43-000000	Transportation and warehousing	6,519.4	6,664.5	-145.1	-2.2
44-220000	Utilities	570.4	552.9	17.5	3.1
50-000000	Information	3,036	3,072	-36	-1.2
55-000000	Financial activities	9,094	9,039	55	0.6
60-000000	Professional and business services	22,552	22,665	-113	-0.5
65-000000	Private education and health services	25,133	25,179	-46	-0.2
70-000000	Leisure and hospitality	16,031	16,060	-29	-0.2
80-000000	Other services	5,750	5,795	-45	-0.8
90-000000	Government	22,886	22,824	62	0.3

Footnotes

⁽¹⁾ Absolute revision is less than 0.05 percent.

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Benchmarks for more detailed industries are available on the [CES detailed industry tables](#) webpage.

[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 0.1 percent (in absolute terms), with a range of -0.3 percent to 0.3 percent.

The differences listed in [table 4](#) and beyond 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 2013 to 2023 (in thousands)

CES Industry			2013 ⁽¹⁾	2014	2015 ⁽²⁾	2016	2017 ⁽³⁾	2018 ⁽⁴⁾	2019 ⁽⁵⁾	2020	2021	2022 ⁽⁶⁾	2023
Code	CES Industry Title	Type											
00-000000	Total nonfarm	Percent	-0.1	(7)	-0.1	-0.1	0.1	(7)	-0.3	-0.1	(7)	0.3	-0.1
		Level	-119	67	-172	-81	135	-16	-489	-121	-7	506	-187
05-000000	Total private	Percent	-0.1	0.1	-0.2	-0.1	0.1	-0.1	-0.4	-0.1	-0.2	0.5	-0.2
		Level	-126	105	-232	-151	133	-104	-505	-184	-256	607	-249
10-000000	Mining and logging	Percent	-1.2	-1.8	-2.2	-3.2	-4.6	-1.1	-2.1	-4	-11.5	-3.1	(7)
		Level	-10	-16	-19	-22	-30	-8	-15	-27	-63	-18	(7)
20-000000	Construction	Percent	0.3	1.6	0.6	0.7	0.8	0.6	-0.1	(7)	-0.6	0.9	0.6
		Level	14	90	39	47	52	44	-4	2	-41	70	44
30-000000	Manufacturing	Percent	0.2	0.4	-0.1	0.5	0.1	-0.1	(7)	-0.6	-0.3	0.2	-0.3
		Level	23	43	-12	58	15	-18	-4	-75	-42	22	-44
40-000000	Trade, transportation, and utilities	Percent	-0.5	-0.1	(7)	-0.4	0.3	-0.3	-0.4	0.1	1.1	0.1	-0.1
		Level	-131	-31	-5	-110	75	-77	-117	24	307	32	-35
41-420000 ⁽⁸⁾	Wholesale trade	Percent	-0.4	-0.8	-0.7	-1.1	-0.4	-0.9	-0.7	-0.8	-0.4	1.7	0.8
		Level	-20.2	-45.4	-41.3	-66.6	-21.2	-54.4	-38.6	-48	-23.6	101.1	49.8
42-000000 ⁽⁸⁾	Retail trade	Percent	-0.8	(7)	-0.2	-0.8	0.1	-0.6	-1	-0.5	0.4	-1.6	0.3
		Level	-110.3	5.5	-23.5	-118.2	15.4	-96.4	-150.8	-78.3	57.9	-252.2	42.6
43-000000 ⁽⁸⁾	Transportation and warehousing	Percent	0.1	0.2	1.4	1.7	1.6	1.4	1.4	2.6	4.5	2.6	-2.2
		Level	3.6	9.7	65.3	83.5	79.8	72.7	75.8	148.9	270.1	170.1	-145.1
44-220000 ⁽⁸⁾	Utilities	Percent	-0.8	-0.1	-0.8	-1.6	0.2	0.3	-0.7	0.2	0.5	2.4	3.1
		Level	-4.6	-0.6	-4.7	-8.7	1	1.8	-4.1	1.1	2.8	13.3	17.5
50-000000	Information	Percent	-0.2	2.4	-1.6	-0.1	2.5	2.1	1.2	0.5	3	2.7	-1.2
		Level	-5	66	-44	-2	70	59	35	14	84	80	-36
55-000000	Financial activities	Percent	-0.1	0.2	-0.1	(7)	0.1	-0.1	0.8	0.3	-0.7	1.1	0.6
		Level	-10	19	-9	-4	7	-12	68	25	-64	94	55
60-000000	Professional and business services	Percent	(7)	-0.8	-0.6	-0.6	-1.3	-0.4	-0.8	-0.6	1	1	-0.5
		Level	4	-147	-110	-125	-270	-72	-159	-123	218	230	-113
65-000000	Private education and health services	Percent	-0.3	-0.1	(7)	-0.4	0.3	(7)	-0.4	-0.2	0.5	-0.3	-0.2
		Level	-61	-16	-7	-83	70	5	-95	-47	125	-69	-46
70-000000	Leisure and hospitality	Percent	0.5	0.3	-0.3	0.7	0.8	(7)	-1.1	0.2	-4.4	1.1	-0.2
		Level	72	38	-45	102	126	-4	-170	31	-572	161	-29
80-000000	Other services	Percent	-0.4	1.1	-0.4	-0.2	0.3	-0.4	-0.8	-0.1	-3.9	0.1	-0.8
		Level	-22	59	-20	-12	18	-21	-44	-8	-208	5	-45
90-000000	Government	Percent	(7)	-0.2	0.3	0.3	(7)	0.4	0.1	0.3	1.1	-0.5	0.3
		Level	7	-38	60	70	2	88	16	63	249	-101	62

Footnotes

- (1) 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 [Frame and sample selection](#) under Design in the CES Handbook of Methods), 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](#).
- (2) 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 private education and health services supersector, this table displays March 2015 data after incorporating the reconstructed series. For more information about this reconstruction, see the Reconstruction section of the [2015 CES Benchmark Article](#).
- (3) 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](#).
- (4) With the 2018 benchmark, CES reconstructed several national employment series. A recoding effort in the QCEW resulted in about 336,000 employment in wholesale trade agents and brokers (41-425120) moved into other series within the wholesale trade, retail trade, transportation and warehousing, and professional and business services major industry sectors. Affected basic-level 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 employment from the CES series other state government (90-922999) into services for the elderly and persons with disabilities (65-624120). Affected basic-level series were reconstructed from March 2018 back to January 2018. For more information about this reconstruction, see the Reconstruction section in the [2018 CES Benchmark Article](#).
- (5) With the 2019 benchmark, BLS reconstructed some national employment series in transportation to correct an error in rail transportation (43-482000), which had resulted in 16,000 in employment being double counted. The reconstruction removed the double-counted employment and affected aggregates of rail transportation, up to and including total nonfarm, back to January 1990. While the difference between the benchmarked and originally published March 2019 estimate level is -505,000, or -0.3 percent, this table displays March 2019 data after accounting for the removal of 16,000 from the published series. For more information, see the Reconstructions section in the [2019 CES Benchmark Article](#).
- (6) With the 2022 benchmark, BLS reconstructed several national employment series. A recoding effort in the QCEW resulted in about 68,000 in employment in electronic shopping and mail-order houses (42-454100) being moved into corporate, subsidiary, and regional managing offices (60-551114). Affected series were reconstructed for their entire history going back to January 1990. Additionally, the CES program found that some QCEW employment microdata submitted for services for the elderly and persons with disabilities (NAICS 624120) was erroneously reported for the first quarter of 2022. CES imputed the March 2022 level for this industry, and the new level was approximately 83,000 greater than the originally reported QCEW level. For more information, see the Reconstructions and Adjustments to population data sections in the [2022 CES Benchmark Article](#).
- (7) Absolute revision is less than 0.05 percent or fewer than 500 employees.
- (8) Indented industries are part of trade, transportation, and utilities.

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Benchmark revision effects for other data types

Benchmarking also affects 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 [Derivative data](#) in the Calculations section of the CES Handbook of Methods.

[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

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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 2023 benchmark. At the total private level, there was no change in average weekly hours estimates for AE and PE from the previously

published level. Total private average hourly earnings increased by 10 cents for AE and 9 cents for PE from the previously published level.

Benchmark effects on hours and earnings for more detailed industries are available on the [CES detailed industry tables](#) webpage.

Table 6. Effect of March 2023 benchmark revisions to all employee average weekly hours and average hourly earnings estimates, major industry sectors

CES Industry Code	CES Industry Title	Average Weekly Hours			Average Hourly Earnings		
		Estimated	Revised	Difference	Estimated	Revised	Difference
05-000000	Total private	34.2	34.2	0.0	\$33.15	\$33.26	\$0.11
06-000000	Goods-producing	39.8	39.8	0.0	33.40	33.41	0.01
08-000000	Private service-providing	33.1	33.1	0.0	33.09	33.22	0.13
10-000000	Mining and logging	45.5	45.5	0.0	37.27	37.27	0.00
20-000000	Construction	38.5	38.5	0.0	35.88	35.89	0.01
30-000000	Manufacturing	40.3	40.2	-0.1	31.78	31.78	0.00
31-000000	Durable goods	40.8	40.8	0.0	33.27	33.28	0.01
32-000000	Nondurable goods	39.4	39.4	0.0	29.21	29.20	-0.01
40-000000	Trade, transportation, and utilities	33.6	33.6	0.0	28.56	28.63	0.07
41-420000	Wholesale trade	38.5	38.5	0.0	36.20	36.16	-0.04
42-000000	Retail trade	29.7	29.7	0.0	23.64	23.64	0.00
43-000000	Transportation and warehousing	37.6	37.6	0.0	28.47	28.69	0.22
44-220000	Utilities	42.4	42.4	0.0	49.57	49.64	0.07
50-000000	Information	35.9	36.1	0.2	47.76	47.91	0.15
55-000000	Financial activities	37.2	37.2	0.0	42.68	42.65	-0.03
60-000000	Professional and business services	36.2	36.2	0.0	39.89	39.96	0.07
65-000000	Private education and health services	33.2	33.2	0.0	32.56	32.83	0.27
70-000000	Leisure and hospitality	25.4	25.4	0.0	20.93	20.96	0.03
80-000000	Other services	32.2	32.1	-0.1	29.63	30.19	0.56

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Table 7. Effect of March 2023 benchmark revisions to production and nonsupervisory employee average weekly hours and average hourly earnings estimates, major industry sectors

CES Industry Code	CES Industry Title	Average Weekly Hours			Average Hourly Earnings		
		Estimated	Revised	Difference	Estimated	Revised	Difference
05-000000	Total private	33.6	33.6	0.0	\$28.47	\$28.56	\$0.09
06-000000	Goods-producing	40.2	40.2	0.0	28.92	28.94	0.02
08-000000	Private service-providing	32.5	32.5	0.0	28.38	28.48	0.10
10-000000	Mining and logging	47.8	47.8	0.0	33.66	33.67	0.01
20-000000	Construction	39.0	39.0	0.0	33.53	33.54	0.01
30-000000	Manufacturing	40.6	40.6	0.0	25.91	25.91	0.0
31-000000	Durable goods	40.9	40.9	0.0	27.04	27.02	-0.02
32-000000	Nondurable goods	40.2	40.2	0.0	24.07	24.08	0.01
40-000000	Trade, transportation, and utilities	33.6	33.6	0.0	24.85	24.90	0.05
41-420000	Wholesale trade	38.5	38.5	0.0	29.96	29.94	-0.02
42-000000	Retail trade	30.0	30.0	0.0	20.26	20.27	0.01
43-000000	Transportation and warehousing	37.1	37.1	0.0	27.20	27.38	0.18
44-220000	Utilities	42.6	42.6	0.0	43.77	43.78	0.01
50-000000	Information	35.6	35.7	0.1	38.76	38.92	0.16
55-000000	Financial activities	36.9	36.9	0.0	33.44	33.41	-0.03
60-000000	Professional and business services	36.0	36.0	0.0	33.78	33.81	0.03
65-000000	Private education and health services	32.5	32.4	-0.1	29.70	29.96	0.26
70-000000	Leisure and hospitality	24.1	24.1	0.0	18.50	18.50	0.00
80-000000	Other services	31.1	31.1	0.0	25.40	25.94	0.54

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Net birth-death revisions

The difference between CES estimates and the population employment results from various sources. Disaggregating it into its components is complex. Both data sources are subject to nonresponse and reporting error. Additionally, the CES estimates are subject to sampling error and business birth and death modeling error.

The CES sample alone is not sufficient for estimating the total nonfarm employment level because each month, new establishments generate employment that cannot be captured through the sample. There is an unavoidable lag between an establishment opening for business and its appearance on the CES sample frame. The sample frame is built from 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 establishments, and verifying the initial data provided. In practice, BLS cannot sample and begin to collect data from new establishments until they are at least a year old.

BLS has researched both sample-based and model-based approaches to measuring employment from business births and deaths 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 BLS 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. 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 [Business births and deaths](#) in the Calculation section of the CES Handbook of Methods.

An analysis of error in the birth-death model and the effect of those errors on CES estimation follows.

Forecasted vs. actual net birth-death

Only error from the model-based component of CES estimation 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 during the previous benchmark year. Most recently, the data from April 2022 to March 2023 can be measured. As [table 8](#) shows, the actual net birth-death from April 2022 to March 2023 was approximately 330,000 below the forecast used in the CES monthly estimates for the same period.

Table 8. Differences between forecasted and actual net birth-death, total private employment, April 2022 to March 2023 (in thousands)

Benchmark 2023	2022						2023			Total			
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar
Actual Net Birth-Death	455	202	50	236	89	-74	311	1	-32	-192	117	-31	1,132
Forecast Net Birth-Death	323	254	93	327	120	-153	511	21	-37	-144	176	-29	1,462
Difference	132	-52	-43	-91	-31	79	-200	-20	5	-48	-59	-2	-330
Cumulative Difference	132	80	37	-54	-85	-6	-206	-226	-221	-269	-328	-330	

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Net birth-death adjustments to the post-benchmark period

From April 2023 to December 2023, also called the post-benchmark period, CES 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 2023 to December 2023, the net birth-death model cumulatively added 1,356,000 jobs, compared with 1,263,000 in the previously published April 2023 to December 2023 employment estimates.

Table 9. Net birth-death forecasts by industry supersector, April to December 2023 (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	41	36	21	12	11	-2	27	-10	-17	119
30-000000	Manufacturing	3	9	4	2	5	0	10	2	1	36
40-000000	Trade, transportation, and utilities	17	29	10	36	21	2	74	17	6	212
41-420000 ⁽¹⁾	Wholesale trade	-2	6	-4	5	2	-7	16	1	0	17
42-000000 ⁽¹⁾	Retail trade	16	15	9	20	11	3	34	2	-1	109
43-000000 ⁽¹⁾	Transportation and warehousing	3	8	5	10	8	6	24	14	7	85
44-220000 ⁽¹⁾	Utilities	0	0	0	1	0	0	0	0	0	1
50-000000	Information	10	6	1	7	5	-3	8	4	2	40
55-000000	Financial activities	14	4	-3	14	3	-11	38	1	10	70
60-000000	Professional and business services	126	41	-19	92	19	-32	134	7	-26	342
65-000000	Private education and health services	43	21	-24	43	19	-21	89	12	-15	167
70-000000	Leisure and hospitality	96	88	84	81	21	-45	24	-26	-13	310
80-000000	Other services	18	9	6	7	5	-5	20	0	-5	55
Total private net birth-death forecast		368	244	81	295	110	-117	425	7	-57	1,356

Footnotes

⁽¹⁾ Indented industries are part of trade, transportation, and utilities.

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Changes to the CES published series

With the release of the January 2024 first preliminary estimates on February 2, 2024, BLS incorporated series changes related to annual sample adequacy and disclosure 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 NAICS 2022. 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. This information is also available on the [Notice of Publication Changes](#) webpage.

In addition to the annual sample review, CES series are sometimes reconstructed to avoid series breaks and to provide users with comparable time series suitable for economic analysis. Reconstructed basic series are summed to aggregate levels using the normal CES aggregation methods (see the [Aggregation procedures](#) section in the CES Handbook of Methods), and, consequently, unadjusted aggregate employment series are subject to change from the detailed aggregate series to summary level aggregates within each the major industry sector. Hours and earnings series are subject to change from summary levels to major industry sector levels. Aggregate industries as well as component series used in indirect seasonal adjustment are also subject to change.

A list of currently published CES series is available on the [CES Published Series](#) webpage.

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
33991,2	31-339910	Jewelry and silverware manufacturing	31-339920	Jewelry, silverware, and sporting and athletic goods manufacturing
33991,2	31-339920	Sporting and athletic goods manufacturing		
32511,2,3,8	32-325130	Petrochemical, industrial gas, synthetic dye, and pigment manufacturing	32-325180	Petrochemical, industrial gas, synthetic dye, pigment, and other basic inorganic chemical manufacturing
32511,2,3,8	32-325180	Other basic inorganic chemical manufacturing		
711212,9	70-711212	Racetracks	70-711219	Racetracks and other spectator sports
711212,9	70-711219	Other spectator sports		

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To identify affected series more easily and because AE series are published at a more detailed industry level than non-AE series, series changes are shown separately for AE and non-AE data types. The first two tables in this section reference collapsed and discontinued series for AE only. The third table references discontinued series for all non-AE data types. Discontinued series tables ([table 11](#) and [table 13](#)) display series for which the data types noted are no longer published. The collapsed series table ([table 12](#)) displays series for which the data types noted are published at a more aggregate level because the more detailed 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. Industries that are no longer published for AE will also no longer be published for other directly estimated data types or derivative series.

Table 11. Discontinued AE series

NAICS Code	CES Industry Code	CES Industry Title	Next Highest Published Industry
327211,2	31-327212	Flat and other pressed and blown glass and glassware manufacturing	Glass and glass product manufacturing (31-327200))
327213,5	31-327215	Glass product made of purchased glass and glass container manufacturing	Glass and glass product manufacturing (31-327200)
336211	31-336211	Motor vehicle body manufacturing	Motor vehicle body and trailer manufacturing (31-336200)
336212,3,4	31-336214	Truck trailer, motor home, travel trailer, and camper manufacturing	Motor vehicle body and trailer manufacturing (31-336200)
326113	32-326113	Unlaminated plastics film and sheet, except packaging, manufacturing	Plastics packaging materials and unlaminated film and sheet manufacturing (32-326110)
48531	43-485310	Taxi and ridesharing services	Taxi and limousine service (43-485300)
48532	43-485320	Limousine service	Taxi and limousine service (43-485300)
48831,3,9	43-488390	Port and harbor operations, navigational services to shipping, and other support activities for water transportation	Support activities for water transportation (43-488300)

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Table 12. Collapsed AE series

Previous			New		
NAICS Code	CES Industry Code	CES Industry Title	NAICS Code	CES Industry Code	CES Industry Title
33991	31-339910	Jewelry and silverware manufacturing	33991,2	31-339920	Jewelry, silverware, and sporting and athletic goods manufacturing
33992	31-339920	Sporting and athletic goods manufacturing			
32511,2,3	32-325130	Petrochemical, industrial gas, synthetic dye, and pigment manufacturing	32511,2,3,8	32-325180	Petrochemical, industrial gas, synthetic dye, pigment, and other basic inorganic chemical manufacturing
32518	32-325180	Other basic inorganic chemical manufacturing			
711212	70-711212	Racetracks	711212,9	70-711219	Racetracks and other spectator sports
711219	70-711219	Other spectator sports			

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Table 13. Discontinued non-AE series

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
23834	20-238340	Tile and terrazzo contractors	PE, PE AWH, PE AHE	Building finishing contractors (20-238300)
23839	20-238390	Other building finishing contractors	PE, PE AWH, PE AHE	Building finishing contractors (20-238300)
3212	31-321200	Veneer, plywood, and engineered wood product manufacturing	PE, PE AWH, PE AHE	Wood product manufacturing (31-321000)
3219	31-321900	Other wood product manufacturing	PE, PE AWH, PE AHE, PE AWOH	Wood product manufacturing (31-321000)
3321	31-332100	Forging and stamping	PE AWOH	Fabricated metal product manufacturing (31-332000)
33271	31-332710	Machine shops	PE AWOH	Machine shops; turned product; and screw, nut, and bolt manufacturing (31-332700)
33272	31-332720	Turned product and screw, nut, and bolt manufacturing	PE AWOH	Machine shops; turned product; and screw, nut, and bolt manufacturing (31-332700)
332811,2	31-332812	Metal heat treating, coating, engraving (except jewelry and silverware), and allied services to manufacturers	PE, PE AWH, PE AHE, PE AWOH	Coating, engraving, heat treating, and allied activities (31-332800)
332813	31-332813	Electroplating, plating, polishing, anodizing, and coloring	PE, PE AWH, PE AHE, PE AWOH	Coating, engraving, heat treating, and allied activities (31-332800)
3334	31-333400	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	AE AWOH	Machinery manufacturing (31-333000)
3336	31-333600	Engine, turbine, and power transmission equipment manufacturing	PE AWOH	Machinery manufacturing (31-333000)

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
3339	31-333900	Other general purpose machinery manufacturing	AE AWOH	Machinery manufacturing (31-333000)
334416,7,9	31-334419	Capacitor, resistor, coil, transformer, other inductor, electronic connector, and other electronic component manufacturing	PE AWOH	Semiconductor and other electronic component manufacturing (31-334400)
311615	32-311615	Poultry processing	PE, PE AWH, PE AHE, AE AWOH, PE AWOH	Animal slaughtering and processing (32-311600)
31181	32-311810	Bread and bakery product manufacturing	AE AWH, AE AHE, WE	Bakeries and tortilla manufacturing (32-311800)
311811	32-311811	Retail bakeries	AE AWH, AE AHE, WE	Bakeries and tortilla manufacturing (32-311800)
31182,3	32-311830	Cookie, cracker, pasta, and tortilla manufacturing	AE AWH, AE AHE, WE	Bakeries and tortilla manufacturing (32-311800)
315	32-315000	Apparel manufacturing	PE AWOH	Nondurable goods (32-000000)
3251	32-325100	Basic chemical manufacturing	PE AWOH	Chemical manufacturing (32-325000)
3252	32-325200	Resin, synthetic rubber, and artificial and synthetic fibers and filaments manufacturing	WE	Chemical manufacturing (32-325000)
3256	32-325600	Soap, cleaning compound, and toilet preparation manufacturing	AE AWOH, PE AWOH	Chemical manufacturing (32-325000)
32614,5	32-326150	Polystyrene, urethane, and other foam product manufacturing	AE AWH, AE AHE, PE, PE AWH, PE AHE, WE, AE AWOH	Plastics product manufacturing (32-326100)

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
42332	41-423320	Brick, stone, and related construction material merchant wholesalers	AE AWH, AE AHE	Lumber and other construction materials merchant wholesalers (41-423300)
42333,9	41-423390	Roofing, siding, insulation, and other construction material merchant wholesalers	AE AWH, AE AHE	Lumber and other construction materials merchant wholesalers (41-423300)
42342	41-423420	Office equipment merchant wholesalers	AE AWH, AE AHE	Professional and commercial equipment and supplies merchant wholesalers (41-423400)
42341,4,6,9	41-423490	Ophthalmic goods and photographic, commercial, and professional equipment and supplies merchant wholesalers	AE AWH, AE AHE	Professional and commercial equipment and supplies merchant wholesalers (41-423400)
42394	41-423940	Jewelry, watch, precious stone, and precious metal merchant wholesalers	AE AWH, AE AHE	Miscellaneous durable goods merchant wholesalers (41-423900)
42392,9	41-423990	Toy and hobby goods and supplies and other miscellaneous durable goods merchant wholesalers	AE AWH, AE AHE	Miscellaneous durable goods merchant wholesalers (41-423900)
42411,2	41-424120	Printing and writing paper, stationery, and office supplies merchant wholesalers	WE	Paper and paper product merchant wholesalers (41-424100)
42413	41-424130	Industrial and personal service paper merchant wholesalers	WE	Paper and paper product merchant wholesalers (41-424100)
4242	41-424200	Drugs and druggists' sundries merchant wholesalers	PE, PE AWH, PE AHE	Merchant wholesalers, nondurable goods (41-424000)

NAICS Code	CES Industry Code	CES Industry Title	Discontinued From Publication	Next Highest Published Industry
4245	41-424500	Farm product raw material merchant wholesalers	PE, PE AWH, PE AHE	Merchant wholesalers, nondurable goods (41-424000)
53241	55-532410	Construction, transportation, mining, and forestry machinery and equipment rental and leasing	PE, PE AWH, PE AHE	Commercial and industrial machinery and equipment rental and leasing (55-532400)
53242,9	55-532490	Office, commercial, and industrial machinery and equipment rental and leasing	PE, PE AWH, PE AHE	Commercial and industrial machinery and equipment rental and leasing (55-532400)
56174	60-561740	Carpet and upholstery cleaning services	AE AWH, AE AHE	Services to buildings and dwellings (60-561700)
56179	60-561790	Other services to buildings and dwellings	AE AWH, AE AHE	Services to buildings and dwellings (60-561700)
71395	70-713950	Bowling centers	PE, PE AWH, PE AHE	Amusement, gambling, and recreation industries (70-713000)
81231	80-812310	Coin-operated laundries and drycleaners	AE AWH, AE AHE	Drycleaning and laundry services (80-812300)
81233	80-812330	Linen and uniform supply	AE AWH, AE AHE	Drycleaning and laundry services (80-812300)

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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 from the [CES National Databases](#) webpage.

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 Information](#) webpage. CES vintage data are typically updated in early March following the annual benchmark revision.

Benchmarks for detailed industries can be found at the [CES detailed industry tables](#) webpage.

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