

Revisions in State Establishment-based Employment Estimates Effective January 2022

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Introduction

With the release of the payroll employment estimates for January 2022 in March 2022, nonfarm payroll employment, hours, and earnings data for states and areas were revised to reflect the incorporation of the 2021 benchmarks and the recalculation of seasonal adjustment factors. The revisions affect all not seasonally adjusted data from April 2020 to December 2021, all seasonally adjusted data from January 2017 to December 2021,¹ and select series subject to historical revisions before April 2020. This article provides background information on benchmarking methods, business birth/death modeling, seasonal adjustment of employment data, and details of the effects of the 2021 benchmark revisions on state and area payroll employment estimates.

Summary of benchmark revisions

The average absolute percentage revision across all states for total nonfarm payroll employment is 0.9 percent for September 2021. For September 2021, the range of the revision for total nonfarm payroll employment across all states is from -1.2 percent to 3.4 percent.

Differences in seasonality exist between the population data and the sample-based data in the nonfarm payroll series. These differences are significant enough that the Current Employment Statistics (CES) program must use a two-step seasonal adjustment process to develop its seasonally adjusted data for states and areas.

Given these differences, the benchmark revisions to the not seasonally adjusted September 2021 estimates are most appropriate to assess the reliability of the estimation process for states and areas since that month is 12 months after the latest population data used with the release of the 2020 benchmark. Over a 12-month period, the seasonal differences between the population and the sample-based data will largely be reconciled in the not seasonally adjusted data.

Benchmark methods

The CES program, also known as the payroll survey, is a federal and state cooperative program that provides timely estimates of payroll employment, hours, and earnings for states and areas by sampling the population of employers. Each month, the CES program surveys about 131,000 businesses and government agencies, representing approximately 670,000 individual worksites, to provide detailed industry level data on employment and the hours and earnings of employees on nonfarm payrolls for all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and about 450 metropolitan areas and divisions.²

As with data from other sample surveys, CES payroll employment estimates are subject to both sampling and nonsampling error. Sampling error is an unavoidable byproduct of forming an inference about a population based on a sample. A larger sample tends to reduce the size of sampling error, while high population variance and employment levels tend to increase it. These factors vary across states and industries. Nonsampling error, by contrast, includes all other sources of statistical errors, including in reporting and processing.

To control for both sampling and nonsampling error, CES payroll employment estimates are benchmarked annually to employment counts from a census of the employer population. These counts are derived primarily from employment data provided in unemployment insurance (UI) tax reports that nearly all

¹ Further information regarding the difference in historical reconstruction between not seasonally adjusted data and seasonally adjusted data is available in the seasonal adjustment section of this article and at <https://www.bls.gov/sac/overview.htm>

² Further information on the sample size for each state is available at <https://www.bls.gov/sac/additional-resources/current-employment-statistics-sample-by-state.htm>

employers are required to file with state workforce agencies. The UI tax reports are collected, reviewed, and edited as part of the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) program.³ As part of the benchmark process for benchmark year 2021, census-derived employment counts replace CES payroll employment estimates for all 50 states and the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and about 450 metropolitan areas and divisions for the period from April 2020 to September 2021.

UI tax reports are not collected on a timely enough basis to replace CES payroll estimates for the fourth quarter, October 2021 to December 2021. For this period, estimates are revised using the new September 2021 series level derived from the census employment counts. New sample-based estimates are developed from those levels that incorporate updated business birth/death factors and new or revised microdata.⁴

Net business birth/death modeling

Sample-based estimates are adjusted each month by a statistical model designed to reduce a primary source of nonsampling error: the inability of the sample to capture employment growth generated by new business formations on a timely basis. There is an unavoidable lag between an establishment opening for business and its appearance in the sample frame. Because new firm births generate a portion of employment growth each month, nonsampling methods must be used to estimate this growth.

Earlier research indicated that, while both the business birth and death portions of total employment are generally significant, the net contribution is relatively small and stable. To account for this net birth/death portion of total employment, BLS uses an estimation procedure with two components. The first component excludes employment losses due to business deaths from sample-based estimation to offset the missing employment gains from business births. This is incorporated into the sample-based estimate procedure by simply not reflecting sample units going out of business, but rather imputing to them the same employment trend as the other continuing firms in the sample. This step accounts for most of the birth and death changes to employment.⁵

The second component is an autoregressive integrated moving average (ARIMA) time series model designed to estimate the residual birth/death change to employment not accounted for by the imputation. To develop the history for modeling, the same handling of business deaths as described for the CES monthly estimation is applied to the population data. Establishments that go out of business have employment imputed for them based on the rate of change of the continuing units. The employment associated with continuing units and the employment imputed from deaths are aggregated and compared to actual population levels. The differences between the two series reflect the actual residual of births and deaths over the past five years. The historical residuals are converted to month-to-month differences and used as input series to the modeling process. Models for the residual series are then fit and forecasted using X-13 ARIMA-SEATS software.⁶ The residuals exhibit a seasonal pattern and may be negative for some months. This process is performed at the national level and for each individual state. Finally, differences between forecasts of the nationwide birth/death factors and the sum of the states' birth/death factors are reconciled through a ratio-adjustment procedure, and the factors are used in monthly estimation of payroll employment in 2022. The updated birth/death factors are also used as inputs to produce the revised estimates of payroll employment for October 2021 to December 2021.

³ Further information on the BLS Quarterly Census of Employment and Wages program is available at <https://www.bls.gov/cew/>.

⁴ Further information on the monthly estimation methods of the CES program can be found in Chapter 2 of the *BLS Handbook of Methods* and is available at <https://www.bls.gov/opub/hom/pdf/homch2.pdf>.

⁵ Technical information on the estimation methods used to account for employment in business births and deaths is available at <https://www.bls.gov/web/empsit/cesbd.htm>.

⁶ Further information on X-13 ARIMA-SEATS is available on the Census Bureau website at <https://www.census.gov/data/software/x13as.html>.

Net business birth/death model changes due to COVID-19 pandemic

Due to the COVID-19 pandemic, BLS changed CES estimation procedures. First, the relationship between business births and deaths could no longer be considered stable, so the net birth/death model was modified to incorporate current information from the sample. Although business births and deaths are normally excluded from the estimation process, the model was modified to include a portion of excess declines to zero and excess returns from zero reported by establishments in the estimation process, beginning with March 2020 final estimates.⁷ These modifications were discontinued with October 2021 preliminary estimates.

With April 2020 estimates, BLS also added a regression variable to the model for forecasting net business births and deaths at the CES national level. The regression variable incorporates recent sample information into the model, which typically relies on inputs only available at a lag of several months. The ratio adjustment procedure used to reconcile the sum of the states' birth/death factors to the national values was also modified to incorporate current sample information, although this part of the procedure was discontinued with the October 2020 re-estimates. Effective with the release of October 2021 preliminary estimates, BLS determined that adjustments to its birth/death methodology, including the addition of the regression variable, were no longer necessary.

Changes in estimation due to COVID-19 pandemic

BLS greatly expanded the adjustments to account for differences in response rates between detailed industries within a broader industry sector. For example, within accommodation and food services (NAICS 72) full-service and limited-service restaurants may have responded at different rates, with the former exhibiting larger employment changes. Adjustments were needed to ensure adequate representation of both industries and fully capture the magnitude of job loss and recovery.

In addition, during this period of unprecedented employment change, some of the methods used in CES small area models that rely on a trend component were no longer valid. Many of the models were adjusted to rely more on direct sample-based estimates and less on the trend component. Also, some series were estimated using an alternative model that relaxed some of the existing models' assumptions and used directly estimated variances.⁸

Seasonal adjustment

CES state and area payroll employment data are seasonally adjusted by a two-step process.⁹ BLS uses the X-13 ARIMA-SEATS program to remove the seasonal component of employment time series. This process uses the seasonal trends found in census-derived employment counts to adjust historical benchmark employment data while also incorporating sample-based seasonal trends to adjust sample-based employment estimates. These two series are independently adjusted and then spliced together at the

⁷ For more information on excess declines and returns see: Patrick, Caitlin and Marcus Polite (2022), "CES National Benchmark Article: BLS Establishment Survey National Estimates Revised to Incorporate March 2021 Benchmarks," Bureau of Labor Statistics, available at <https://www.bls.gov/web/empsit/cesbmart.pdf>.

⁸ For more details on the alternative small area model, see: Gershunskaya, Julie and Terrance D. Savitsky (2019), "Bayesian Nonparametric Joint Model for Point Estimates and Variances," *Proceedings of the Section on Survey Research Methods*, American Statistical Association, available at <https://www.bls.gov/osmr/research-papers/2019/st190020.htm>.

⁹ Research from the Dallas Federal Reserve has shown that CES benchmarked population data exhibits a seasonal pattern different from the sample-based estimates. Please see Berger, Franklin D. and Keith R. Phillips (1994) "Solving the Mystery of the Disappearing January Blip in State Employment Data," Federal Reserve Bank of Dallas, *Economic Review*, April, 53-62, available at <http://www.dallasfed.org/assets/documents/research/er/1994/er9402d.pdf>.

benchmark month (in this case September/October 2021).¹⁰ By accounting for the differing seasonal patterns found in historical benchmark employment data and the sample-based employment estimates, this technique yields improved seasonally adjusted series with respect to analysis of month-to-month employment change.¹¹

The aggregation method of seasonally adjusted data is based upon the availability of underlying industry data. For all 50 states, the District of Columbia, and Puerto Rico, the following series are sums of underlying industry data: total private, goods-producing, service-providing, and private service-providing. The same method is applied for the U.S. Virgin Islands except for goods producing and private service providing, which are independently seasonally adjusted because of data limitations. For all 50 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands, data for manufacturing; trade, transportation, and utilities; financial activities; education and health services; leisure and hospitality; and government are aggregates wherever exhaustive industry components are available; otherwise, these industries' employment data are directly seasonally adjusted. In a very limited number of cases, the not seasonally adjusted data for mining and logging; construction; manufacturing; trade, transportation, and utilities; financial activities; education and health services; leisure and hospitality; and government do not exhibit enough seasonality to be adjusted; in those cases, the not seasonally adjusted data are used to sum to higher level industries. The seasonally adjusted total nonfarm data for all metropolitan statistical areas (MSAs) and metropolitan divisions are not calculated through aggregation but are derived directly by applying the seasonal adjustment procedure to the not seasonally adjusted total nonfarm level.¹²

The seasonal adjustment process requires three years of sample-based employment estimates for a series to be published seasonally adjusted. The Twin Falls, ID, MSA was added to CES publication in 2019 and is therefore eligible for publication seasonally adjusted in 2022.

BLS uses concurrent seasonal adjustment for CES state and area data. This method uses all available estimates, including those for the current month, in developing sample-based seasonal factors.¹³ Concurrent sample-based seasonal factors are created every month for the current month's preliminary estimates as well as the previous month's final estimates to incorporate the real-time estimates. Outlier detection is a regular part of the monthly seasonal adjustment process.

Variable survey intervals

BLS uses special model adjustments to control for survey interval variations, sometimes referred to as the 4 vs. 5-week effect, for all nonfarm seasonally adjusted series. Although the CES survey is referenced to a consistent concept, the pay period including the 12th day of each month, inconsistencies arise because there are sometimes 4 and sometimes 5 weeks between the weeks including the 12th day in a given pair of months. In highly seasonal industries, these variations can affect the magnitude of seasonal hires or layoffs that have occurred at the time the survey is taken.¹⁴

¹⁰ The two-step seasonal adjustment process is explained in detail by Scott, Stuart; Stamas, George; Sullivan, Thomas; and Paul Chester (1994), "Seasonal Adjustment of Hybrid Economic Time Series," *Proceedings of the Section on Survey Research Methods*, American Statistical Association, available at <https://www.bls.gov/osmr/research-papers/1994/pdf/st940350.pdf>.

¹¹ A list of all seasonally adjusted employment series is available at <https://www.bls.gov/sae/additional-resources/list-of-published-state-and-metropolitan-area-series/home.htm>.

¹² A list of BLS-published areas is available at <https://download.bls.gov/pub/time.series/sm/sm.area>.

¹³ Technical information on concurrent seasonal adjustment for CES state and area data can be found at <https://www.bls.gov/sae/seasonal-adjustment/implementation-of-concurrent-seasonal-adjustment-for-ces-state-and-area-estimates.htm>.

¹⁴ For more information on the presence and treatment of calendar effects in CES data, see <https://www.bls.gov/osmr/research-papers/1996/pdf/st960190.pdf>.

Prior adjustments

BLS incorporates prior adjustments as part of the seasonal adjustment process. Unlike the use of seasonal outliers, prior adjustments remove the effect (rounded to hundreds) of a known nonseasonal event from the not seasonally adjusted data before running X-13 ARIMA-SEATS. This is done to ensure that nonseasonal events, such as Census hiring or strikes, are not included in the calculation of the seasonal factors. Once the seasonal factors are calculated, they are applied to the not seasonally adjusted data used as inputs. Then the prior adjustments that were removed before running X-13 ARIMA-SEATS are incorporated to create the seasonally adjusted estimates. Seasonal outliers will continue to be made where there is insufficient information to determine a prior adjustment.

Seasonal adjustment changes due to COVID-19 pandemic

With the release of the March 2020 data, changes were made to outlier review within seasonal adjustment. Outlier detection is a regular part of the monthly seasonal adjustment process. Given the number of potential outliers that arose during the COVID-19 pandemic, BLS implemented a rule where, for all time series, data points over a certain critical value were designated as outliers.¹⁵

Implementation of new small area model

Effective with the release of January 2022 estimates on March 14, 2022, CES implemented a new generation small area model for state and metropolitan area series. The new model will replace the CES small domain model and variants of the Fay-Herriot model in estimating private sector series with insufficient sample for direct sample-based estimation. The new model can be considered a generalization of the Fay-Herriot model. Like the Fay-Herriot models, the model uses a linear regression to link direct estimates with predictors (in this case, the same-month five-year average of relative employment change in the benchmark data). However, the new generation model loosens many of the assumptions in the Fay-Herriot, particularly the assumption that the variances are fixed and known. More information on the new model is detailed in the paper “[Bayesian Nonparametric Joint Model for Point Estimates and Variances](#)” by Julie Gershunskaya and Terrance Savitsky.

Benchmark revisions

Revisions by industry

As noted earlier, the average absolute percentage revision across all states for total nonfarm payroll employment is 0.9 percent for September 2021. For September 2021, the range of the revision for total nonfarm payroll employment across all states is from -1.2 percent to 3.4 percent. (See table 1.)

Historical and current benchmark revisions for March and current revisions for December at both the state and industry level are included in the appendix.

Absolute level revisions provide further insight on the magnitude of benchmark revisions. Absolute level revisions are measured as the absolute difference between the sample-based estimates of payroll employment and the benchmark levels of payroll employment for September 2021. A relatively large benchmark revision in terms of percentage can correspond to a relatively small benchmark revision in terms of level due to the amount of employment in the industry.

¹⁵ For a list of outliers identified during the concurrent seasonal adjustment process, see <https://www.bls.gov/sac/seasonal-adjustment/#outliers>.

Table 1. Average absolute percentage differences between state employment estimates and benchmarks by industry, not seasonally adjusted, September 2020–September 2021 (all values in percent)

Industry ¹	Sep. 2020	Sep. 2021
Total nonfarm.....	1.1	0.9
Mining and logging.....	7.7	4.5
Construction.....	3.5	3.1
Manufacturing.....	2.8	1.8
Trade, transportation, and utilities.....	2.1	1.1
Information.....	4.1	5.0
Financial activities.....	2.5	1.9
Professional and business services.....	2.5	2.4
Education and health services.....	1.6	1.7
Leisure and hospitality.....	5.2	3.4
Other services.....	5.3	3.5
Government.....	1.5	1.0
Total nonfarm:		
Range.....	-4.4 to 3.4	-1.2 to 3.4
Mean.....	-0.5	0.7
Standard deviation.....	1.4	1.0

¹ Industry summary statistics are only representative of data for those states where the industry is published at the statewide level. Benchmark data for Puerto Rico and the U.S. Virgin Islands are not included in these summary statistics.

The following example demonstrates the necessity of considering both percentage revision and level revision when evaluating the magnitude of a benchmark revision in an industry. The average absolute percentage benchmark revisions across all states for information and for professional and business services are 5.0 percent and 2.4 percent, respectively, for September 2021. However, for September 2021, the average absolute level revision across all states for the information industry is 2,200, while the average absolute level revision across all states for the professional and business services industry is 6,400. (See table 2.) Relying on a single measure to characterize the magnitude of benchmark revisions in an industry can potentially lead to an incomplete interpretation.

Table 2. Average absolute level differences between state employment estimates and benchmarks by industry, not seasonally adjusted, September 2020–September 2021 (all values payroll employment)

Industry ¹	Sep. 2020	Sep. 2021
Total nonfarm.....	27,400	24,700
Mining and logging.....	1,100	700
Construction.....	3,500	3,600
Manufacturing.....	4,400	3,100
Trade, transportation, and utilities.....	7,700	5,400
Information.....	1,600	2,200
Financial activities.....	3,100	3,200
Professional and business services.....	7,700	6,400
Education and health services.....	5,600	6,600
Leisure and hospitality.....	13,300	9,900
Other services.....	5,100	3,100
Government.....	4,600	3,900
Total nonfarm:		
Range.....	-148,000 to 63,400	-31,600 to 221,300
Mean.....	-15,400	20,300
Standard deviation.....	39,300	44,600

¹ Industry summary statistics are only representative of data for those states where the industry is published at the statewide level. Benchmark data for Puerto Rico and the U.S. Virgin Islands are not included in these summary statistics.

Revisions by state

For September 2021, nonfarm payroll employment was revised upward in 37 states and the District of Columbia, and downward in 13 states. (See table 3 or map 1.) The distribution of percent revisions for September 2021, March 2021, and December 2021 can be found in exhibit 1.

Table 3. Percent differences between nonfarm payroll employment benchmarks and estimates by state, not seasonally adjusted, September 2020–September 2021 (all values in percent)

State	Sep. 2020	Sep. 2021
Alabama.....	-1.4	-0.2
Alaska.....	-1.2	1.8
Arizona.....	-1.1	0.2
Arkansas.....	0.8	1.3
California.....	-0.9	1.3
Colorado.....	-1.2	0.9
Connecticut.....	-1.0	0.7
Delaware.....	3.4	(1)
District of Columbia.....	-2.0	0.3
Florida.....	-1.1	1.7
Georgia.....	-2.0	0.4
Hawaii.....	-4.4	2.8
Idaho.....	0.5	2.0
Illinois.....	-0.9	0.4
Indiana.....	-1.5	0.9
Iowa.....	0.1	-0.1
Kansas.....	-0.8	-1.2
Kentucky.....	0.7	1.1
Louisiana.....	-3.1	0.9
Maine.....	2.1	1.5
Maryland.....	-1.6	-0.4
Massachusetts.....	-0.2	0.6
Michigan.....	1.5	0.9
Minnesota.....	-0.4	-0.9
Mississippi.....	-1.0	0.4
Missouri.....	-0.2	0.1
Montana.....	0.8	2.8
Nebraska.....	-1.0	-1.2
Nevada.....	-3.0	3.4
New Hampshire.....	2.0	0.9
New Jersey.....	-0.6	1.4
New Mexico.....	-2.1	1.0
New York.....	-0.5	1.7
North Carolina.....	1.2	1.7
North Dakota.....	-0.2	0.4
Ohio.....	1.2	0.1
Oklahoma.....	-0.8	-0.2
Oregon.....	(1)	0.4
Pennsylvania.....	(1)	0.6
Rhode Island.....	-1.0	0.7
South Carolina.....	-1.5	-0.1
South Dakota.....	0.2	1.4
Tennessee.....	-0.2	0.8
Texas.....	-1.1	(1)
Utah.....	-1.2	-0.1
Vermont.....	0.8	0.5
Virginia.....	-0.4	0.4
Washington.....	-0.7	-0.9
West Virginia.....	0.3	-0.2
Wisconsin.....	1.7	0.3
Wyoming.....	-0.6	1.7

(1) Less than +/- 0.05 percent

The distribution of percent revisions for September 2021, March 2021, and December 2021 can be found in exhibit 1. Quintiles are representative of 20 percent of the range of state benchmark revisions. For example, 20 percent of the revisions are -0.1 or less for September 2021 while 100 percent of the revisions are equal to or less than 3.4 percent.

Exhibit 1. Distribution of state percent revisions, March 2021, September 2021, and December 2021 (all values in percent)

Percentiles of Percent Revisions	March 2021	September 2021	December 2021
20th percentile.....	(1)	-0.1	-0.1
40th percentile.....	0.5	0.3	0.3
60th percentile.....	0.8	0.8	0.7
80th percentile.....	1.1	1.4	1.5
100th percentile.....	2.0	3.4	3.5

(1) Less than +/- 0.05 percent

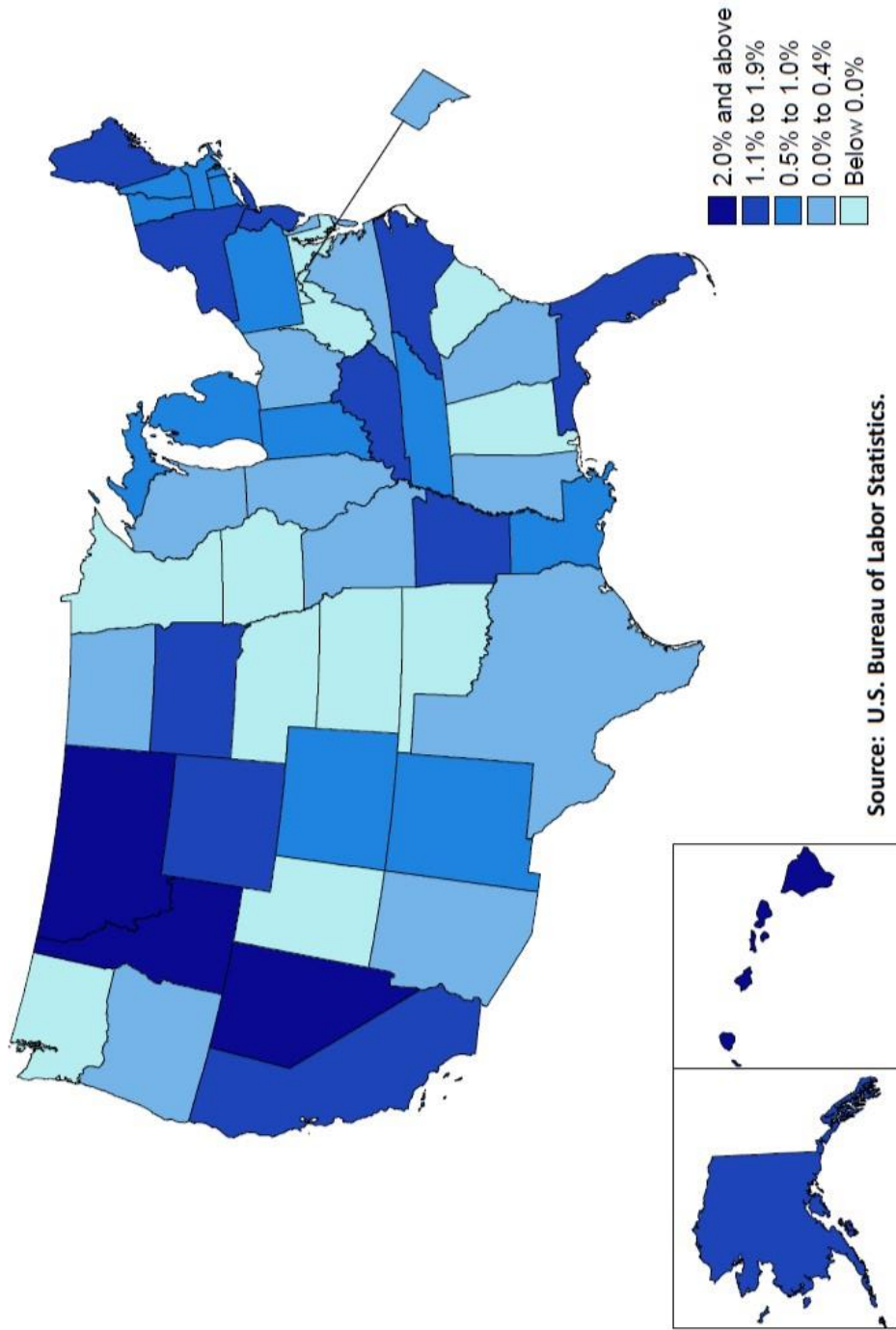
Revisions by metropolitan statistical area

For all MSAs published by the CES program, the total nonfarm percentage revision for September 2021 ranged from -5.8 percent to 11.0 percent, with an average absolute percentage revision of 1.6 percent across all published MSAs. (See table 4.) For comparison, at the statewide level, the range was from -1.2 percent to 3.4 percent, with an average absolute revision of 0.9 percent for September 2021. (See table 1.) In general, both the range of percentage revisions and the average absolute percentage revision increase as the amount of employment in an MSA decreases. Metropolitan areas with 1 million or more employees during September 2021 had an average absolute revision of 1.2 percent, while metropolitan areas with fewer than 100,000 employees had an average absolute revision of 1.8 percent. (See table 4.)

Table 1. Benchmark revisions for nonfarm employment in metropolitan areas for September 2021, not seasonally adjusted

Measure	All MSAs	MSAs grouped by level of total nonfarm employment			
		Less than 100,000	100,000 to 499,999	500,000 to 999,999	1 million or more
Number of MSAs.....	389	193	145	17	34
Average absolute percentage revision.....	1.6	1.8	1.4	1.3	1.2
Range.....	-5.8 to 11.0	-5.8 to 11.0	-5.0 to 6.6	-1.9 to 4.5	-2.3 to 4.2
Mean.....	0.5	0.3	0.7	0.7	0.8
Standard deviation.....	2.1	2.4	1.6	1.5	1.3

Map 1. Percent differences between nonfarm payroll employment benchmarks and estimates by State, September 2021



Appendix

Table A1. Average absolute percentage differences between state employment estimates and benchmarks by industry, not seasonally adjusted, March 2016–March 2021 and December 2021 (all values in percent)

Industry ¹	Mar. 2016	Mar. 2017	Mar. 2018 ²	Mar. 2019	Mar. 2020	Mar. 2021	Dec. 2021
Total nonfarm.....	0.4	0.4	0.4	0.4	0.5	0.8	0.9
Mining and logging.....	4.5	3.7	3.6	3.4	4.1	4.1	4.7
Construction.....	2.3	2.5	2.1	3.5	2.2	2.6	3.3
Manufacturing.....	1.3	1.3	1.2	1.3	1.3	1.3	2.0
Trade, transportation, and utilities.....	0.8	0.7	1.0	0.8	0.9	1.1	1.1
Information.....	3.0	2.7	2.2	2.3	3.0	3.8	5.6
Financial activities.....	2.3	1.6	1.5	1.5	1.4	1.6	2.0
Professional and business services.....	1.4	1.5	1.3	1.6	1.3	1.9	2.5
Education and health services.....	0.8	0.8	0.8	1.0	1.1	1.5	1.7
Leisure and hospitality.....	1.5	1.6	1.3	1.3	1.8	2.0	3.4
Other services.....	2.4	2.7	4.4	1.8	2.2	2.9	3.7
Government.....	0.5	0.8	0.8	0.6	0.7	0.7	1.1
Total nonfarm:							
Range.....	-1.6 to 0.9	-1.0 to 1.2	-4.4 to 1.4	-2.1 to 1.7	-1.0 to 2.1	-0.7 to 2.0	-1.1 to 3.5
Mean.....	-0.1	-0.1	-0.1	0.1	0.3	0.7	0.7
Standard deviation.....	0.6	0.5	0.8	0.6	0.6	0.7	1.0

¹ Industry summary statistics are only representative of data for those states where the industry is published at the statewide level. Benchmark data for Puerto Rico and the U.S. Virgin Islands are not included in these summary statistics.

² These summary statistics do not include revisions for South Carolina. See the changes to CES published series section in the [2019 benchmark article](#) for more information.

Table A2. Average absolute level differences between state employment estimates and benchmarks by industry, not seasonally adjusted, March 2016–March 2021 and December 2021 (all values payroll employment)

Industry ¹	Mar. 2016	Mar. 2017	Mar. 2018 ²	Mar. 2019	Mar. 2020	Mar. 2021	Dec. 2021
Total nonfarm.....	7,700	7,100	9,200	8,200	12,900	23,900	26,000
Mining and logging.....	500	500	300	300	400	500	700
Construction.....	2,700	2,200	2,300	2,900	2,500	2,600	3,500
Manufacturing.....	2,200	2,200	1,900	2,100	2,200	2,200	3,300
Trade, transportation, and utilities.....	3,300	2,600	4,900	3,100	3,500	5,400	6,000
Information.....	1,400	1,000	1,200	1,200	1,200	1,500	2,400
Financial activities.....	2,300	1,600	1,500	2,000	2,100	2,600	3,400
Professional and business services.....	4,400	3,300	4,000	4,100	4,600	6,000	6,600
Education and health services.....	3,000	3,200	3,100	3,800	4,300	6,000	6,600
Leisure and hospitality.....	2,900	3,400	3,000	2,600	5,100	4,600	9,900
Other services.....	1,800	2,200	2,400	1,500	2,700	2,500	3,500
Government.....	2,300	3,000	3,400	2,100	2,800	2,900	4,300
Total nonfarm:							
Range.....	-26,500 to 40,400	-44,900 to 16,400	-37,600 to 66,500	-35,200 to 30,400	-29,100 to 92,200	-34,500 to 193,700	-32,100 to 256,700
Mean.....	200	-2,300	1,200	1,900	8,100	20,400	21,800
Standard deviation.....	11,600	11,000	16,200	11,400	18,700	38,900	49,900

¹ Industry summary statistics are only representative of data for those states where the industry is published at the statewide level. Benchmark data for Puerto Rico and the U.S. Virgin Islands are not included in these summary statistics

² These summary statistics do not include revisions for South Carolina. See the changes to CES published series section in the [2019 benchmark article](#) for more information.

Table A3. Percent differences between nonfarm payroll employment benchmarks and estimates by state, not seasonally adjusted, March 2016–March 2021 and December 2021 (all values in percent)

State	Mar. 2016	Mar. 2017	Mar. 2018	Mar. 2019	Mar. 2020	Mar. 2021	Dec. 2021
Alabama.....	0.4	0.8	0.2	-0.2	-0.2	0.2	-0.3
Alaska.....	-1.1	0.2	-0.4	-0.6	0.6	1.1	1.9
Arizona.....	-0.3	0.5	0.4	0.4	0.2	0.8	0.2
Arkansas.....	(1)	-0.2	1.4	0.5	1.4	0.9	1.5
California.....	(1)	(1)	0.3	(1)	0.5	1.2	1.5
Colorado.....	-0.5	0.4	-0.2	0.1	0.2	0.8	1.0
Connecticut.....	-0.2	-0.2	-0.2	-0.5	0.3	0.9	0.6
Delaware.....	-1.1	0.1	0.3	0.5	-0.1	0.8	0.1
District of Columbia.....	0.9	0.3	-0.1	0.3	-0.1	-0.6	0.3
Florida.....	0.5	-0.1	(1)	-0.1	0.3	2.0	1.7
Georgia.....	-0.6	-0.8	0.3	0.1	0.5	0.5	0.4
Hawaii.....	-0.7	0.4	-0.7	-0.1	0.1	2.0	2.7
Idaho.....	(1)	0.4	-0.1	0.4	1.0	0.3	2.1
Illinois.....	0.1	0.3	0.4	-0.6	0.6	0.6	0.7
Indiana.....	0.6	-0.3	0.6	0.1	-0.3	0.9	0.9
Iowa.....	-0.3	-0.5	-0.2	-0.1	0.8	0.6	-0.3
Kansas.....	0.9	-0.4	-0.4	(1)	-0.1	-0.5	-1.1
Kentucky.....	-0.2	-0.9	0.2	-0.4	0.9	1.6	1.0
Louisiana.....	(1)	0.1	0.2	0.5	0.5	1.4	1.1
Maine.....	0.6	0.2	0.4	0.7	1.1	1.7	1.7
Maryland.....	-0.1	-1.0	0.4	0.3	-0.8	-0.5	-0.4
Massachusetts.....	0.5	-0.2	0.2	0.7	0.9	1.1	0.4
Michigan.....	-0.5	-0.2	-0.1	-0.1	-0.2	0.5	0.9
Minnesota.....	0.1	(1)	(1)	0.5	0.8	0.8	-0.8
Mississippi.....	0.1	0.5	-1.1	-0.4	(1)	0.5	0.4
Missouri.....	0.7	-0.3	-0.4	-0.3	1.1	0.2	0.3
Montana.....	0.8	-0.8	0.1	0.2	(1)	1.4	2.7
Nebraska.....	-0.2	-0.2	-0.3	-0.1	-0.2	-0.6	-0.9
Nevada.....	0.2	0.8	0.4	-0.5	2.1	1.0	3.5
New Hampshire.....	(1)	-0.3	-0.2	0.2	0.5	0.2	0.9
New Jersey.....	-0.2	(1)	-0.9	(1)	0.8	1.5	1.0
New Mexico.....	0.2	-0.8	0.1	0.3	-0.4	1.0	0.9
New York.....	0.4	0.1	0.7	0.3	0.1	0.8	2.0
North Carolina.....	0.1	(1)	(1)	0.5	0.8	1.3	1.6
North Dakota.....	-1.6	-1.0	1.2	1.2	(1)	-0.3	0.7
Ohio.....	-0.2	(1)	-0.5	-0.1	0.3	0.7	-0.1
Oklahoma.....	-0.5	-0.1	0.1	0.7	0.5	0.8	(1)
Oregon.....	0.1	0.2	(1)	-0.1	0.7	0.9	0.4
Pennsylvania.....	-0.2	(1)	(1)	0.3	0.2	0.7	0.4
Rhode Island.....	(1)	-0.7	-0.6	1.7	1.0	1.8	0.6
South Carolina.....	-0.1	0.5	0.8 ²	0.2	-0.7	0.5	0.3
South Dakota.....	-0.1	-0.6	-0.3	-1.6	-0.1	0.2	1.1
Tennessee.....	(1)	-0.5	-0.1	0.4	-0.3	0.6	0.9
Texas.....	0.1	-0.4	-0.3	0.2	-0.2	-0.3	(1)
Utah.....	0.3	-0.1	-0.1	-0.3	-1.0	0.5	0.2
Vermont.....	-1.5	-0.7	-0.1	0.6	0.6	-0.4	0.1
Virginia.....	-0.3	-0.2	0.2	0.4	(1)	0.6	0.2
Washington.....	-0.4	-0.2	-0.2	-0.7	-0.1	-0.7	-0.9
West Virginia.....	-1.2	0.2	-4.4	-2.1	0.3	(1)	-0.6
Wisconsin.....	-0.2	(1)	0.2	0.1	0.3	0.7	(1)
Wyoming.....	0.4	1.2	-0.1	0.1	0.3	0.7	1.8

(1) Less than +/- 0.05 percent

² Revisions for South Carolina are included in this table. Users are cautioned given the unusual movements in the South Carolina QCEW data. See the changes to CES published series section in the [2019 benchmark article](#) for more information.

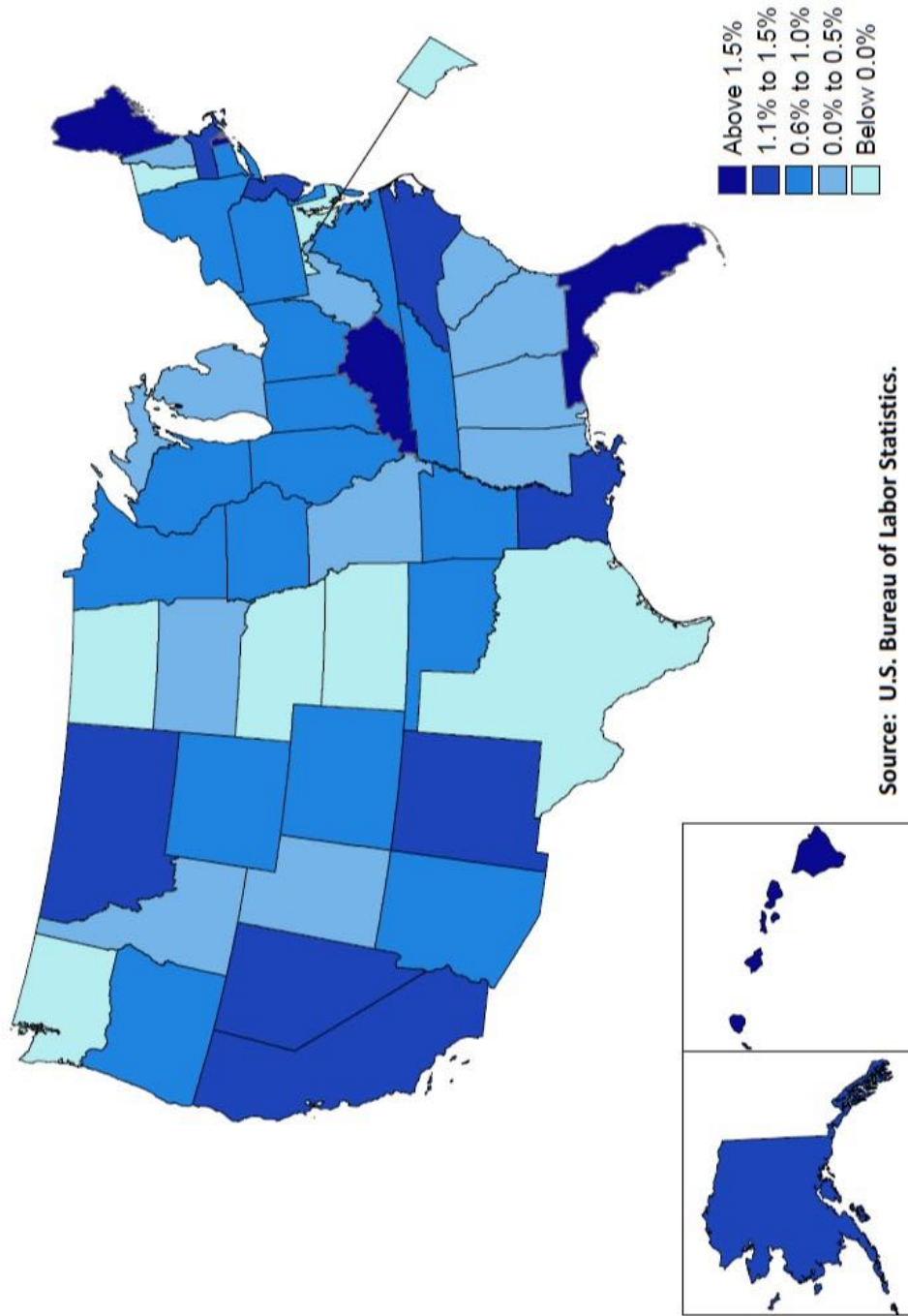
Table A4. Benchmark revisions for nonfarm employment in metropolitan areas for March 2021, not seasonally adjusted

Measure	All MSAs	MSAs grouped by level of total nonfarm employment			
		Less than 100,000	100,000 to 499,999	500,000 to 999,999	1 million or more
Number of MSAs.....	389	193	145	17	34
Average absolute percentage revision.....	1.3	1.5	1.2	1.0	1.0
Range.....	-16.9 to 8.7	-16.9 to 8.7	-3.4 to 6.0	-1.0 to 2.5	-1.8 to 4.2
Mean.....	0.6	0.5	0.7	0.8	0.8
Standard deviation.....	1.8	2.3	1.3	0.9	1.0

Table A5. Benchmark revisions for nonfarm employment in metropolitan areas for December 2021, not seasonally adjusted

Measure	All MSAs	MSAs grouped by level of total nonfarm employment			
		Less than 100,000	100,000 to 499,999	500,000 to 999,999	1 million or more
Number of MSAs.....	389	193	145	17	34
Average absolute percentage revision.....	1.6	2.0	1.3	1.2	1.3
Range.....	-8.3 to 10.8	-8.3 to 10.8	-4.8 to 6.1	-1.3 to 4.5	-2.4 to 4.9
Mean.....	0.6	0.5	0.7	0.9	0.9
Standard deviation.....	2.1	2.6	1.6	1.4	1.4

Map A1. Percent differences between nonfarm payroll employment benchmarks and estimates by State, March 2021



Map A2. Percent differences between nonfarm payroll employment benchmarks and estimates by State, December 2021

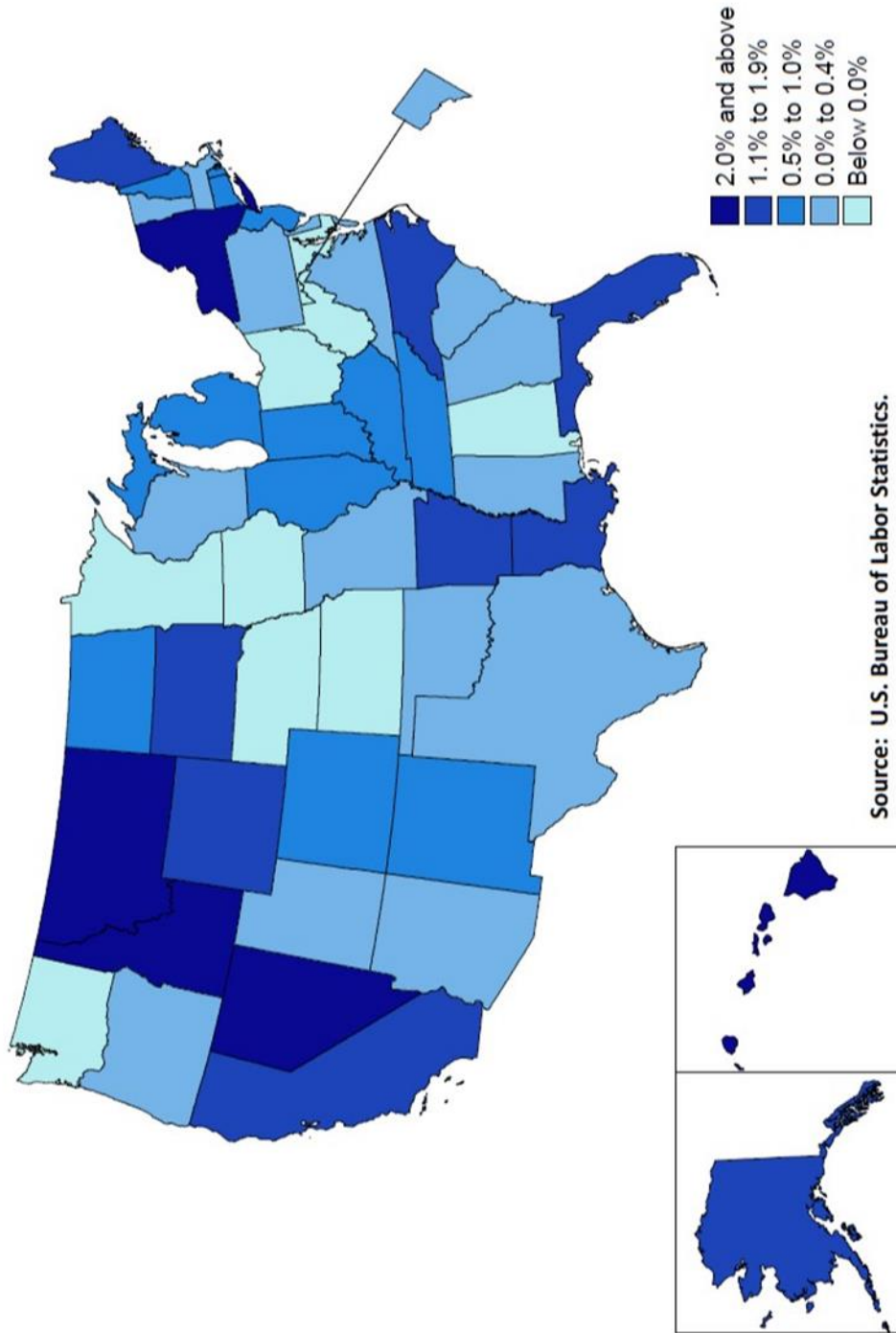


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Additional information

Historical state and area employment, hours, and earnings data are available on the BLS website at <https://www.bls.gov/sae>. Inquiries for additional information on the methods or estimates derived from the CES survey should be sent by email to sminfo@bls.gov. Assistance and response to inquiries by telephone is available Monday through Friday, during the hours of 8:30 am to 4:30 pm EST by dialing (202) 691-6559.

Previously released benchmark articles for CES state and area data are available at <https://www.bls.gov/sae/publications/benchmark-article/home.htm>.