

Revisions in State Establishment-based Employment Estimates Effective January 2021

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Introduction

With the release of the payroll employment estimates for January 2021, nonfarm payroll employment, hours, and earnings data for states and areas were revised to reflect the incorporation of the 2020 benchmarks and the recalculation of seasonal adjustment factors. The revisions affect all not seasonally adjusted data from April 2019 to December 2020, all seasonally adjusted data from January 2016 to December 2020¹, and select series subject to historical revisions before April 2019. This article provides background information on benchmarking methods, business birth/death modeling, seasonal adjustment of employment data, and details of the effects of the 2020 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 1.1 percent for September 2020. For September 2020, the range of the revision for total nonfarm payroll employment across all states is from -4.4 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 program (CES) 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 2020 estimates are most appropriate to assess the reliability of the estimation process since that month is 12 months after the latest population data used with the release of the 2019 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 144,000 businesses and government agencies, representing approximately 697,000 individual worksites, in order 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.

In order 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 employers are required to file with state workforce agencies. The UI tax reports are collected, reviewed,

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/sae/overview.htm>

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

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 2020, 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 2019 to September 2020.

UI tax reports are not collected on a timely enough basis to replace CES payroll estimates for the fourth quarter, October 2020 to December 2020. For this period, estimates are revised using the new September 2020 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

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 in order 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 2021. The updated birth/death factors are also used as inputs to produce the revised estimates of payroll employment for October 2020 to December 2020.

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/srd/www/x13as/>.

Seasonal adjustment

CES state and area payroll employment data are seasonally adjusted by a two-step process.⁷ 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 then spliced together at the benchmark month (in this case September 2020).⁸ 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.⁹

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 with the exception of goods-producing, which is 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, 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.¹⁰

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.¹¹ 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 in order to incorporate the real-time estimates.

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

⁷ 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>.

⁸ 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>.

⁹ 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>

¹⁰ A list of BLS-published areas is available at <https://download.bls.gov/pub/time.series/sm/sm.area>.

¹¹ 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>.

months. In highly seasonal industries, these variations can be an important determinant of the magnitude of seasonal hires or layoffs that have occurred at the time the survey is taken.¹²

Prior adjustments

With the release of June 2020 preliminary estimates, BLS began incorporating prior adjustments as part of the seasonal adjustment process. Unlike the use of seasonal outliers, prior adjustments remove the effect (rounded to the 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 and 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.

Changes in estimation due to the 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. This includes using a portion of business deaths and births reported by establishments in the estimation process, beginning with March 2020 final estimates. Business births and deaths are normally excluded from the estimation process. 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.

BLS greatly expanded the use of post-stratification weight adjustments to account for differential nonresponse between industries within a given state supersector. Many industries with rapid job losses and recoveries would have been underrepresented in the supersector estimates, and therefore weight adjustments were needed to fully capture the magnitude of job loss and recovery.

In addition, many of the assumptions underlying CES small area models—used to estimate employment when there is insufficient sample for direct estimates, primarily for detailed industries and metropolitan areas—were untenable in a period of unprecedentedly large and geographically varied employment change. These small area models incorporate current sample along with historical information, sometimes with an adjustment factor that corrects for nationwide trends. Many of the models were adjusted to rely more on direct sample-based estimates since historical patterns were less relevant. Finally, an alternative model¹³ that relaxes some of the existing models' assumptions was used when necessary to produce reasonable, internally coherent estimates.

¹² 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>.

¹³ 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>

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, we implemented a rule where all time series over a certain critical value were designated as outliers.¹⁴

Benchmark revisions

Revisions by industry

As noted earlier, the average absolute percentage revision across all states for total nonfarm payroll employment is 1.1 percent for September 2020. For September 2020, the range of the revision for total nonfarm payroll employment across all states is from -4.4 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 2020. 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.

Table 1. Average absolute percentage differences between state employment estimates and benchmarks by industry, not seasonally adjusted, September 2019–September 2020 (all values in percent)

| Industry ¹ | Sep. 2019 | Sep. 2020 |
|---|--------------|--------------|
| Total nonfarm..... | 0.5 | 1.1 |
| Mining and logging..... | 4.7 | 7.7 |
| Construction..... | 2.9 | 3.5 |
| Manufacturing..... | 1.4 | 2.8 |
| Trade, transportation, and utilities..... | 1.2 | 2.1 |
| Information..... | 2.8 | 4.1 |
| Financial activities..... | 1.6 | 2.5 |
| Professional and business services..... | 1.9 | 2.5 |
| Education and health services..... | 1.2 | 1.6 |
| Leisure and hospitality..... | 1.6 | 5.2 |
| Other services..... | 1.9 | 5.3 |
| Government..... | 1.0 | 1.5 |
| Total nonfarm: | | |
| Range..... | -2.1 to 0.9 | -4.4 to 3.4 |
| Mean..... | -0.3 | -0.5 |
| Standard deviation..... | 0.6 | 1.4 |

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.

¹⁴ For a list of outliers identified during the concurrent seasonal adjustment process see <https://www.bls.gov/sae/seasonal-adjustment/#outliers>

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 4.1 percent and 2.5 percent, respectively, for September 2020. However, for September 2020, the average absolute level revision across all states for the information industry is 1,600, while the average absolute level revision across all states for the professional and business services industry is 7,700. (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 2019–September 2020 (all values payroll employment)

| Industry ¹ | Sep. 2019 | Sep. 2020 |
|---|-------------------|--------------------|
| Total nonfarm..... | 13,400 | 27,400 |
| Mining and logging..... | 700 | 1,100 |
| Construction..... | 3,100 | 3,500 |
| Manufacturing..... | 2,900 | 4,400 |
| Trade, transportation, and utilities..... | 4,700 | 7,700 |
| Information..... | 1,300 | 1,600 |
| Financial activities..... | 1,900 | 3,100 |
| Professional and business services..... | 5,900 | 7,700 |
| Education and health services..... | 4,700 | 5,600 |
| Leisure and hospitality..... | 4,500 | 13,300 |
| Other services..... | 1,800 | 5,100 |
| Government..... | 3,400 | 4,600 |
| Total nonfarm: | | |
| Range..... | -85,200 to 37,300 | -148,000 to 63,400 |
| Mean..... | -8,100 | -15,400 |
| Standard deviation..... | 21,500 | 39,300 |

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 2020, nonfarm payroll employment was revised upward in 15 states and downward in 35 states and the District of Columbia. (See table 3 or map 1.) The distribution of percent revisions for September 2020, March 2020, and December 2020 can be found in exhibit 1.

Table 3. Percent differences between nonfarm payroll employment benchmarks and estimates by state, not seasonally adjusted, September 2019–September 2020 (all values in percent)

| State | Sep. 2019 | Sep. 2020 |
|---------------------------|--------------|--------------|
| Alabama..... | -1.0 | -1.4 |
| Alaska..... | 0.1 | -1.2 |
| Arizona..... | 0.3 | -1.1 |
| Arkansas..... | -0.5 | 0.8 |
| California..... | -0.5 | -0.9 |
| Colorado..... | 0.2 | -1.2 |
| Connecticut..... | -0.7 | -1.0 |
| Delaware..... | -0.7 | 3.4 |
| District of Columbia..... | -0.2 | -2.0 |
| Florida..... | -0.9 | -1.1 |
| Georgia..... | -0.2 | -2.0 |
| Hawaii..... | -1.0 | -4.4 |
| Idaho..... | 0.2 | 0.5 |
| Illinois..... | -1.2 | -0.9 |
| Indiana..... | -0.1 | -1.5 |
| Iowa..... | -0.5 | 0.1 |
| Kansas..... | -1.1 | -0.8 |
| Kentucky..... | -1.0 | 0.7 |
| Louisiana..... | -0.4 | -3.1 |
| Maine..... | 0.6 | 2.1 |
| Maryland..... | (1) | -1.6 |
| Massachusetts..... | (1) | -0.2 |
| Michigan..... | -0.4 | 1.5 |
| Minnesota..... | 0.5 | -0.4 |
| Mississippi..... | -1.0 | -1.0 |
| Missouri..... | -0.7 | -0.2 |
| Montana..... | 0.1 | 0.8 |
| Nebraska..... | -0.7 | -1.0 |
| Nevada..... | -1.0 | -3.0 |
| New Hampshire..... | -0.8 | 2.0 |
| New Jersey..... | 0.2 | -0.6 |
| New Mexico..... | -0.1 | -2.1 |
| New York..... | -0.1 | -0.5 |
| North Carolina..... | (1) | 1.2 |
| North Dakota..... | 0.6 | -0.2 |
| Ohio..... | -0.3 | 1.2 |
| Oklahoma..... | 0.7 | -0.8 |
| Oregon..... | -0.3 | (1) |
| Pennsylvania..... | 0.3 | (1) |
| Rhode Island..... | (1) | -1.0 |
| South Carolina..... | 0.7 | -1.5 |
| South Dakota..... | -1.5 | 0.2 |
| Tennessee..... | 0.3 | -0.2 |
| Texas..... | -0.2 | -1.1 |
| Utah..... | -0.3 | -1.2 |
| Vermont..... | -0.1 | 0.8 |
| Virginia..... | 0.9 | -0.4 |
| Washington..... | -0.6 | -0.7 |
| West Virginia..... | -2.1 | 0.3 |
| Wisconsin..... | -0.3 | 1.7 |
| Wyoming..... | 0.3 | -0.6 |

(1) Less than +/- 0.05 percent

Exhibit 1. Distribution of percent revisions, March 2020, September 2020, and December 2020 (all values in percent)

| Percentiles of Percent Revisions | March 2020 | September 2020 | December 2020 |
|----------------------------------|------------|----------------|---------------|
| 20th percentile..... | -0.2 | -1.4 | -1.7 |
| 40th percentile..... | 0.1 | -1.0 | -1.2 |
| 60th percentile..... | 0.3 | -0.4 | -0.7 |
| 80th percentile..... | 0.8 | 0.7 | 0.3 |
| 100th percentile..... | 2.1 | 3.4 | 2.8 |

Revisions by MSA

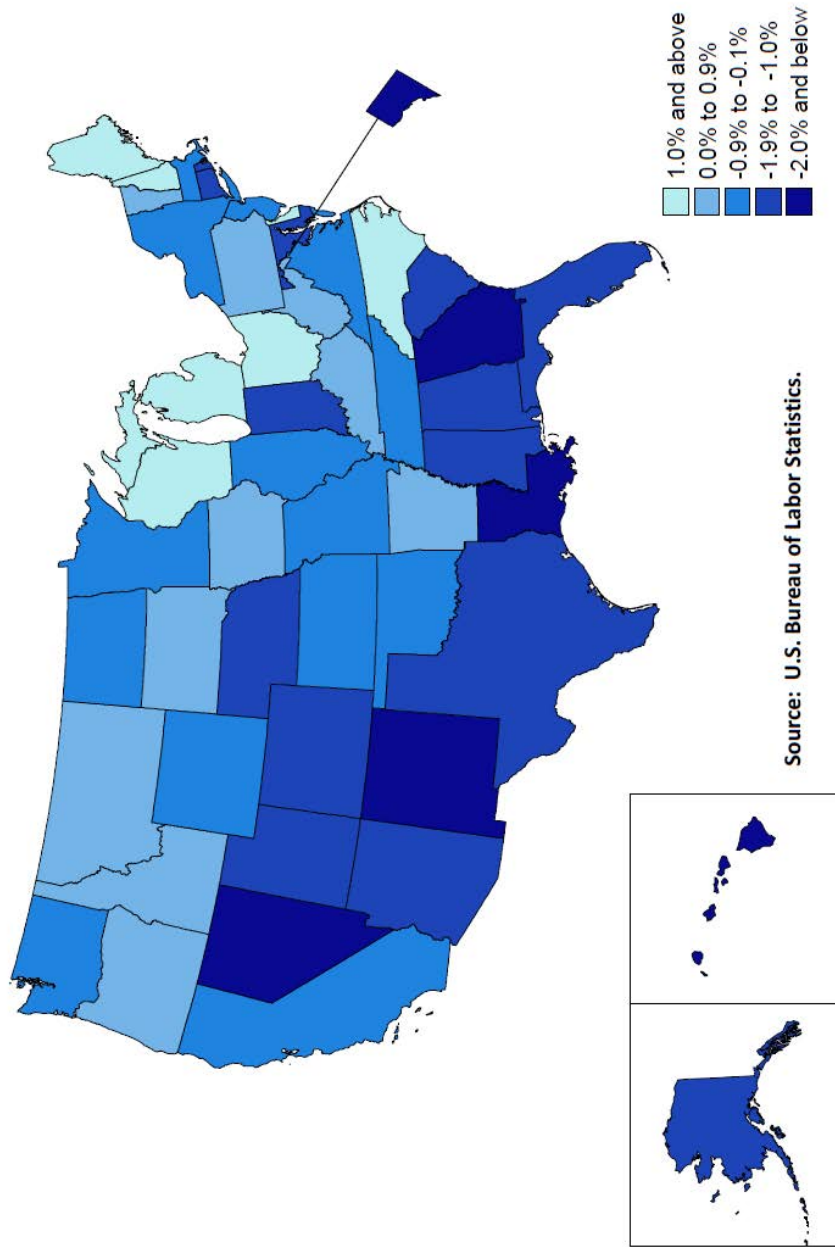
For all metropolitan statistical areas (MSAs) published by the CES program, the total nonfarm percentage revision for September 2020 ranged from -10.1 percent to 10.8 percent, with an average absolute percentage revision of 2.2 percent across all published MSAs. (See table 4.) For comparison, at the statewide level, the range was from -4.4 percent to 3.4 percent, with an average absolute revision of 1.1 percent for September 2020. (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 2020 had an average absolute revision of 1.4 percent, while metropolitan areas with fewer than 100,000 employees had an average absolute revision of 2.7 percent. (See table 4.)

Table 1. Benchmark revisions for nonfarm employment in metropolitan areas for September 2020, 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 | 185 | 151 | 17 | 36 |
| Average absolute percentage revision..... | 2.2 | 2.7 | 2.0 | 1.1 | 1.4 |
| Range..... | -10.1 to 10.8 | -10.1 to 10.8 | -10.0 to 6.0 | -2.7 to 3.0 | -3.1 to 3.6 |
| Mean..... | -0.1 | (1) | (1) | -0.5 | -0.5 |
| Standard deviation..... | 2.9 | 3.4 | 2.6 | 1.4 | 1.6 |

(1) Less than +/- 0.05 percent

Map 1. Percent differences between nonfarm payroll employment benchmarks and estimates by State, September 2020



Appendix

Table A1. Average absolute percentage differences between state employment estimates and benchmarks by industry, not seasonally adjusted, March 2015–March 2020 and December 2020 (all values in percent)

| Industry ² | Mar. 2015 | Mar. 2016 | Mar. 2017 | Mar. 2018 ³ | Mar. 2019 | Mar. 2020 | Dec. 2020 |
|---|-------------------|-------------------|-------------------|---------------------------|-------------------|-------------------|-------------------|
| Total nonfarm..... | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 1.3 |
| Mining and logging..... | 4.2 | 4.5 | 3.7 | 3.6 | 3.4 | 4.1 | 7.8 |
| Construction..... | 2.6 | 2.3 | 2.5 | 2.1 | 3.5 | 2.2 | 3.7 |
| Manufacturing..... | 1.3 | 1.3 | 1.3 | 1.2 | 1.3 | 1.3 | 2.9 |
| Trade, transportation, and utilities..... | 0.6 | 0.8 | 0.7 | 1.0 | 0.8 | 0.9 | 2.3 |
| Information..... | 2.6 | 3.0 | 2.7 | 2.2 | 2.3 | 3.0 | 4.2 |
| Financial activities..... | 1.9 | 2.3 | 1.6 | 1.5 | 1.5 | 1.4 | 2.6 |
| Professional and business services..... | 1.6 | 1.4 | 1.5 | 1.3 | 1.6 | 1.3 | 2.5 |
| Education and health services..... | 0.9 | 0.8 | 0.8 | 0.8 | 1.0 | 1.1 | 1.7 |
| Leisure and hospitality..... | 1.4 | 1.5 | 1.6 | 1.3 | 1.3 | 1.8 | 5.6 |
| Other services..... | 2.1 | 2.4 | 2.7 | 4.4 | 1.8 | 2.2 | 5.4 |
| Government..... | 0.7 | 0.5 | 0.8 | 0.8 | 0.6 | 0.7 | 1.6 |
| Total nonfarm: | | | | | | | |
| Range..... | -1.8 to 1.3 | -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 | -4.8 to 2.8 |
| Mean..... | (1) | -0.1 | -0.1 | -0.1 | 0.1 | 0.3 | -0.8 |
| Standard deviation..... | 0.5 | 0.6 | 0.5 | 0.8 | 0.6 | 0.6 | 1.4 |

(1) Less than +/- 0.05 percent

² 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.

³ 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 2015–March 2020 and December 2020 (all values payroll employment)

| Industry ¹ | Mar. 2015 | Mar. 2016 | Mar. 2017 | Mar. 2018 ² | Mar. 2019 | Mar. 2020 | Dec. 2020 |
|---|--------------------------|-------------------------|-------------------------|---------------------------|-------------------------|-------------------------|--------------------------|
| Total nonfarm..... | 9,200 | 7,700 | 7,100 | 9,200 | 8,200 | 12,900 | 32,600 |
| Mining and logging..... | 800 | 500 | 500 | 300 | 300 | 400 | 1,100 |
| Construction..... | 2,500 | 2,700 | 2,200 | 2,300 | 2,900 | 2,500 | 3,800 |
| Manufacturing..... | 2,200 | 2,200 | 2,200 | 1,900 | 2,100 | 2,200 | 4,400 |
| Trade, transportation, and utilities..... | 2,700 | 3,300 | 2,600 | 4,900 | 3,100 | 3,500 | 8,300 |
| Information..... | 1,100 | 1,400 | 1,000 | 1,200 | 1,200 | 1,200 | 1,600 |
| Financial activities..... | 1,900 | 2,300 | 1,600 | 1,500 | 2,000 | 2,100 | 3,300 |
| Professional and business services..... | 5,100 | 4,400 | 3,300 | 4,000 | 4,100 | 4,600 | 8,300 |
| Education and health services..... | 3,700 | 3,000 | 3,200 | 3,100 | 3,800 | 4,300 | 5,900 |
| Leisure and hospitality..... | 2,600 | 2,900 | 3,400 | 3,000 | 2,600 | 5,100 | 13,100 |
| Other services..... | 1,800 | 1,800 | 2,200 | 2,400 | 1,500 | 2,700 | 5,500 |
| Government..... | 2,600 | 2,300 | 3,000 | 3,400 | 2,100 | 2,800 | 5,300 |
| Total nonfarm: | | | | | | | |
| Range..... | -103,600 to 21,200 | -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 | -204,400 to 51,300 |
| Mean..... | -2,400 | 200 | -2,300 | 1,200 | 1,900 | 8,100 | -23,200 |
| Standard deviation..... | 17,400 | 11,600 | 11,000 | 16,200 | 11,400 | 18,700 | 45,500 |

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 2015–March 2020 and December 2020 (all values in percent)

| State | Mar. 2015 | Mar. 2016 | Mar. 2017 | Mar. 2018 ¹ | Mar. 2019 | Mar. 2020 | Dec. 2020 |
|---------------------------|-----------|-----------|-----------|------------------------|-----------|-----------|-----------|
| Alabama..... | -0.3 | 0.4 | 0.8 | 0.2 | -0.2 | -0.2 | -1.8 |
| Alaska..... | 0.2 | -1.1 | 0.2 | -0.4 | -0.6 | 0.6 | -1.7 |
| Arizona..... | -0.2 | -0.3 | 0.5 | 0.4 | 0.4 | 0.2 | -1.3 |
| Arkansas..... | -0.6 | (1) | -0.2 | 1.4 | 0.5 | 1.4 | 0.8 |
| California..... | -0.7 | (1) | (1) | 0.3 | (1) | 0.5 | -1.3 |
| Colorado..... | 0.7 | -0.5 | 0.4 | -0.2 | 0.1 | 0.2 | -1.4 |
| Connecticut..... | -1.0 | -0.2 | -0.2 | -0.2 | -0.5 | 0.3 | -1.2 |
| Delaware..... | 0.4 | -1.1 | 0.1 | 0.3 | 0.5 | -0.1 | 2.8 |
| District of Columbia..... | 0.4 | 0.9 | 0.3 | -0.1 | 0.3 | -0.1 | -2.2 |
| Florida..... | -0.2 | 0.5 | -0.1 | (1) | -0.1 | 0.3 | -1.5 |
| Georgia..... | -0.3 | -0.6 | -0.8 | 0.3 | 0.1 | 0.5 | -2.4 |
| Hawaii..... | 0.7 | -0.7 | 0.4 | -0.7 | -0.1 | 0.1 | -4.8 |
| Idaho..... | -0.4 | (1) | 0.4 | -0.1 | 0.4 | 1.0 | 0.3 |
| Illinois..... | 0.2 | 0.1 | 0.3 | 0.4 | -0.6 | 0.6 | -1.0 |
| Indiana..... | -0.1 | 0.6 | -0.3 | 0.6 | 0.1 | -0.3 | -1.6 |
| Iowa..... | -0.5 | -0.3 | -0.5 | -0.2 | -0.1 | 0.8 | -0.3 |
| Kansas..... | -0.2 | 0.9 | -0.4 | -0.4 | (1) | -0.1 | -1.2 |
| Kentucky..... | -0.6 | -0.2 | -0.9 | 0.2 | -0.4 | 0.9 | 0.6 |
| Louisiana..... | 0.3 | (1) | 0.1 | 0.2 | 0.5 | 0.5 | -3.6 |
| Maine..... | 0.3 | 0.6 | 0.2 | 0.4 | 0.7 | 1.1 | 1.7 |
| Maryland..... | -0.2 | -0.1 | -1.0 | 0.4 | 0.3 | -0.8 | -1.9 |
| Massachusetts..... | 0.5 | 0.5 | -0.2 | 0.2 | 0.7 | 0.9 | -0.3 |
| Michigan..... | -0.6 | -0.5 | -0.2 | -0.1 | -0.1 | -0.2 | 1.3 |
| Minnesota..... | -0.1 | 0.1 | (1) | (1) | 0.5 | 0.8 | -0.7 |
| Mississippi..... | 0.2 | 0.1 | 0.5 | -1.1 | -0.4 | (1) | -1.4 |
| Missouri..... | 0.4 | 0.7 | -0.3 | -0.4 | -0.3 | 1.1 | -0.5 |
| Montana..... | 1.3 | 0.8 | -0.8 | 0.1 | 0.2 | (1) | 0.6 |
| Nebraska..... | (1) | -0.2 | -0.2 | -0.3 | -0.1 | -0.2 | -1.3 |
| Nevada..... | 0.7 | 0.2 | 0.8 | 0.4 | -0.5 | 2.1 | -3.9 |
| New Hampshire..... | -0.1 | (1) | -0.3 | -0.2 | 0.2 | 0.5 | 1.8 |
| New Jersey..... | (1) | -0.2 | (1) | -0.9 | (1) | 0.8 | -0.7 |
| New Mexico..... | -0.4 | 0.2 | -0.8 | 0.1 | 0.3 | -0.4 | -2.4 |
| New York..... | 0.1 | 0.4 | 0.1 | 0.7 | 0.3 | 0.1 | -0.9 |
| North Carolina..... | -0.5 | 0.1 | (1) | (1) | 0.5 | 0.8 | 0.9 |
| North Dakota..... | -1.8 | -1.6 | -1.0 | 1.2 | 1.2 | (1) | -0.7 |
| Ohio..... | 0.1 | -0.2 | (1) | -0.5 | -0.1 | 0.3 | 0.7 |
| Oklahoma..... | 0.5 | -0.5 | -0.1 | 0.1 | 0.7 | 0.5 | -0.9 |
| Oregon..... | (1) | 0.1 | 0.2 | (1) | -0.1 | 0.7 | -0.3 |
| Pennsylvania..... | -0.1 | -0.2 | (1) | (1) | 0.3 | 0.2 | -0.1 |
| Rhode Island..... | 0.1 | (1) | -0.7 | -0.6 | 1.7 | 1.0 | -1.5 |
| South Carolina..... | -0.2 | -0.1 | 0.5 | 0.8 ² | 0.2 | -0.7 | -1.7 |
| South Dakota..... | (1) | -0.1 | -0.6 | -0.3 | -1.6 | -0.1 | 0.3 |
| Tennessee..... | 0.4 | (1) | -0.5 | -0.1 | 0.4 | -0.3 | -0.3 |
| Texas..... | 0.1 | 0.1 | -0.4 | -0.3 | 0.2 | -0.2 | -1.1 |
| Utah..... | -0.2 | 0.3 | -0.1 | -0.1 | -0.3 | -1.0 | -1.7 |
| Vermont..... | -0.8 | -1.5 | -0.7 | -0.1 | 0.6 | 0.6 | 0.1 |
| Virginia..... | 0.6 | -0.3 | -0.2 | 0.2 | 0.4 | (1) | -0.8 |
| Washington..... | -0.6 | -0.4 | -0.2 | -0.2 | -0.7 | -0.1 | -1.0 |
| West Virginia..... | 1.3 | -1.2 | 0.2 | -4.4 | -2.1 | 0.3 | 0.3 |
| Wisconsin..... | 0.2 | -0.2 | (1) | 0.2 | 0.1 | 0.3 | 1.6 |
| Wyoming..... | -0.4 | 0.4 | 1.2 | -0.1 | 0.1 | 0.3 | -0.9 |

(1) Less than +/- 0.05 percent

¹ 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 A4. Benchmark revisions for nonfarm employment in metropolitan areas for March 2020, not seasonally adjusted

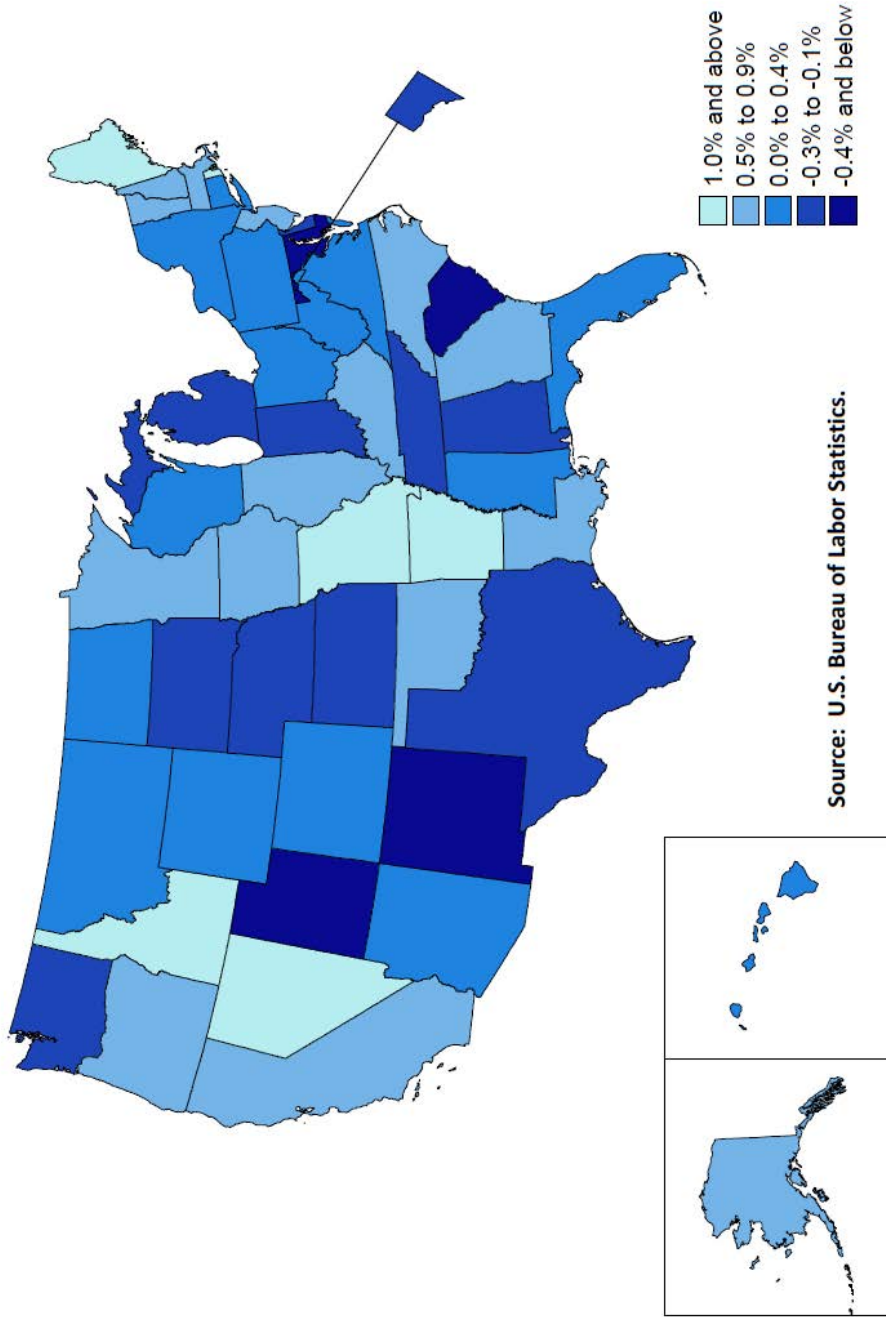
| Measure | All MSAs | MSAs grouped by level of total nonfarm employment | | | |
|--|-------------|---|--------------------|--------------------|-------------------|
| | | Less than 100,000 | 100,000 to 499,999 | 500,000 to 999,999 | 1 million or more |
| Number of MSAs | 389 | 185 | 151 | 17 | 36 |
| Average absolute percentage revision | 1.0 | 1.1 | 0.9 | 0.5 | 0.6 |
| Range | -5.2 to 4.4 | -5.0 to 3.6 | -5.2 to 4.4 | -0.9 to 1.5 | -0.8 to 2.4 |
| Mean | 0.1 | (1) | 0.1 | -0.1 | 0.4 |
| Standard deviation | 1.3 | 1.5 | 1.3 | 0.6 | 0.7 |

(1) Less than +/- 0.05 percent

Table A5. Benchmark revisions for nonfarm employment in metropolitan areas for December 2020, 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 | 185 | 151 | 17 | 36 |
| Average absolute percentage revision | 2.2 | 2.7 | 2.0 | 1.3 | 1.5 |
| Range | -10.2 to 11.1 | -9.6 to 11.1 | -10.2 to 5.6 | -2.6 to 2.3 | -3.9 to 3.5 |
| Mean | -0.3 | -0.1 | -0.3 | -0.8 | -0.8 |
| Standard deviation | 2.9 | 3.3 | 2.7 | 1.3 | 1.7 |

Map A1. Percent differences between nonfarm payroll employment benchmarks and estimates by State, March 2020



Map A2. Percent differences between nonfarm payroll employment benchmarks and estimates by State, December 2020

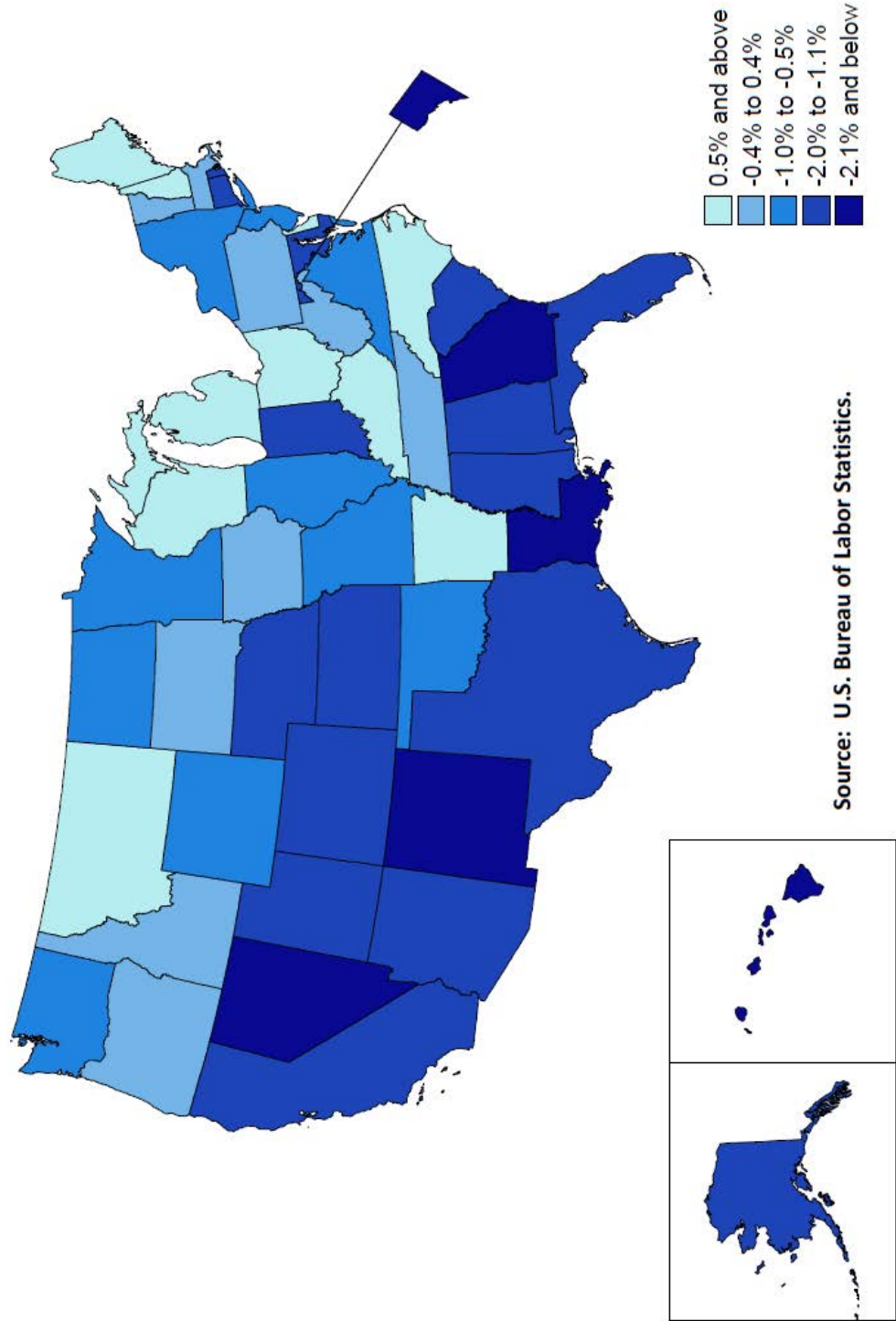


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Additional information

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>.