

Benchmark Article

BLS Establishment Estimates Revised to Incorporate March 2009 Benchmarks

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Introduction

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With the release of data for January 2010, the Bureau of Labor Statistics (BLS) introduced its annual revision of national estimates of employment, hours, and earnings from the Current Employment Statistics (CES) monthly survey of nonfarm establishments. Each year, the CES survey realigns its sample-based estimates to incorporate universe counts of employment—a process known as benchmarking. Comprehensive counts of employment, or benchmarks, are derived primarily from unemployment insurance (UI) tax reports that nearly all employers are required to file with State Workforce Agencies.

Summary of the benchmark revisions

The March 2009 benchmark level for total nonfarm employment is 131,175,000; this figure is 902,000 below the sample-based estimate for March 2009, an adjustment of -0.7 percent. [Table 1](#) shows the total nonfarm percentage benchmark revisions for the past ten years.

The twelve months ending with March 2009 experienced steep declines in employment rarely seen in the U.S. labor market, resulting in an over-the-year decrease in employment of almost 5.8 million, or -4.2 percent, as measured by the universe employment counts from the BLS Quarterly Census of Employment and Wages (QCEW). As of March 2009, this was the largest 12-month net decline in employment in the history of the CES total nonfarm series, which dates back to 1939. In percentage terms, the -4.2 percent change is the largest negative 12-month percent change since April 1958. While the latest benchmark revision to the CES total nonfarm employment estimates represents the largest divergence between CES and QCEW in many years, CES employment estimates captured 84 percent of the nonfarm payroll decline.

[Table 2](#) shows the nonfarm employment benchmarks for March 2009, not seasonally adjusted, by industry. Nearly all super sectors had downward revisions, with the exception of government. The largest downward revision occurred in trade, transportation, and utilities with a revision of -300,000, or -1.2 percent. Within this sector, the revision is concentrated in discount department stores, revised by -28,700 or -3.1 percent, all other general merchandise, revised by -24,700 or -7.7 percent, and department stores, except discount revised by -24,200 or -4.6 percent.

Construction was revised by -171,000, or -2.9 percent, while professional and business services was revised -137,000, or -0.8 percent. Within construction, the largest revision was in new single-family general contractors, which was revised downward by 19,900, or 15.3 percent. Manufacturing had a downward revision of 84,000, or 0.7 percent. The revision in manufacturing was relatively evenly spread across industries with 43,000 of the downward revision in durable goods (-0.6 percent) and 41,000 of the downward revision in nondurable goods (-0.9 percent). Leisure and hospitality had a revision of -72,000, or -0.6 percent. Within this sector, the revision was concentrated in full-service restaurants, which was revised down by 71,600, or 1.6 percent.

Education and health services had a downward revision of 56,000, or 0.3 percent. The revision in this sector was concentrated in general medical and surgical hospitals, with a downward revision of 42,800, or 1.0 percent. Both information and other services revised downward by 42,000. For information this was a -1.5 percent change, while for other services this was a -0.8 percent change. Mining and logging revised down by 25,000, or 3.5 percent. In mining and logging, the largest revision was in support activities for mining in the amount of -13,700, or -4.6 percent. Financial activities revised down by 4,000, or 0.1 percent.

Only government had an upward revision of 31,000, or 0.1 percent.

Summary of research into possible sources of the March 2009 benchmark revision

The net difference between CES estimates and QCEW-based benchmark, observed as the CES benchmark revision, results from many sources and disaggregating it into components is complex. BLS examined potential error sources in both the CES estimates and the QCEW-based employment benchmark. Both series are subject to nonresponse and imputation error, and reporting error. Additionally for the CES estimates, sampling error and the business birth/death modeling errors are a factor.

Profiling the divergence between CES and QCEW

BLS began its search for causes by studying the profile of the divergence between CES and QCEW: 1) by industry; and 2) over the benchmark year. Insights from these analyses follow.

1) CES benchmark revisions by industry

The large downward revision in employment is widespread, and is seen in all super sectors but government, although the magnitude varies by industry. Typically, percent benchmark revisions at many industry levels are larger than at the total nonfarm level, but are offsetting. Revisions at the supersector level were not offsetting this year (with the exception of government), resulting in a larger-than-normal revision at the total nonfarm level.

Percentage benchmark revisions by supersector

Industry	Year		
	2007	2008	2009
Total nonfarm	-0.2	-0.1	-0.7
Mining and logging	(1)	0.4	-3.5
Construction	0.1	0.7	-2.9
Manufacturing	-1	-0.1	-0.7
Trade, transportation, utilities	0.5	0.2	-1.2
Information	-1.8	0.3	-1.5
Financial activities	-1.3	-0.3	-0.1
Professional and business services	0.2	-0.4	-0.8

Education and health services	-0.2	-0.1	-0.3
Leisure and hospitality	-0.8	-1.1	-0.6
Other services	0.3	0.2	-0.8
Government	-0.2	0.2	0.1

⁽¹⁾Less than 0.05 percent.

The largest revisions are somewhat correlated with the over-the-year declines in the QCEW employment, as shown in the table below. For example, trade, transportation, and utilities has the largest downward benchmark revision (-300,000), and also has the largest over-the-year decline in employment (-1,457,000). Likewise, professional and business services has the third largest downward benchmark revision (-137,000) and the third largest over-the-year decline in employment (-1,179,000). This suggests that the problem is not concentrated in one particular industry or groups of industries.

Benchmark revision and over-the-month change in population employment, level and percent, for 2009 by supersector (in thousands)

Industry	2009			
	Benchmark Estimate Revision		Over-the-year Change in Population	
	Level	Percent	Level	Percent
Total nonfarm	-902	-0.7	-5769	-4.2
Mining and logging	-25	-3.5	-27	-3.6
Construction	-171	-2.9	-1097	-15.6
Manufacturing	-84	-.7	-1447	-10.7
Trade, transportation, utilities	-300	-1.2	-1457	-5.5
Information	-42	-1.5	-156	-5.2
Financial activities	-4	-.1	-357	-4.4
Professional and business services	-137	-.8	-1179	-6.6
Education and health services	-56	-.3	397	2.1
Leisure and hospitality	-72	-.6	-408	-3.1
Other services	-42	-.8	-158	-2.9
Government	31	.1	120	0.5

2) CES-QCEW tracking over the benchmark year

CES estimates and QCEW employment counts generally track within a relatively predictable range from quarter-to-quarter. The series have somewhat different seasonal patterns, and therefore it is more informative to compare them on an over-the-year change basis when examining trend differences. From the last benchmark month, March 2008, through December 2008, CES and QCEW total nonfarm employment were tracking within a normal 0.3 percent range. Substantial divergence between the two series is seen only in the first quarter of 2009, as illustrated by the table below.

Monthly over-the-year change for total nonfarm employment (CES scope) from April 2008 to March 2009, not seasonally adjusted (in thousands)

Month	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
QCEW	449	180	-373	-438	-676	-1035	-1440	-2432	-3146	-4133	-5012	-5769
CES*	208	-87	-328	-329	-486	-927	-1294	-2208	-2958	-3538	-4218	-4867
Difference	241	267	-45	-109	-190	-108	-146	-224	-188	-595	-794	-902

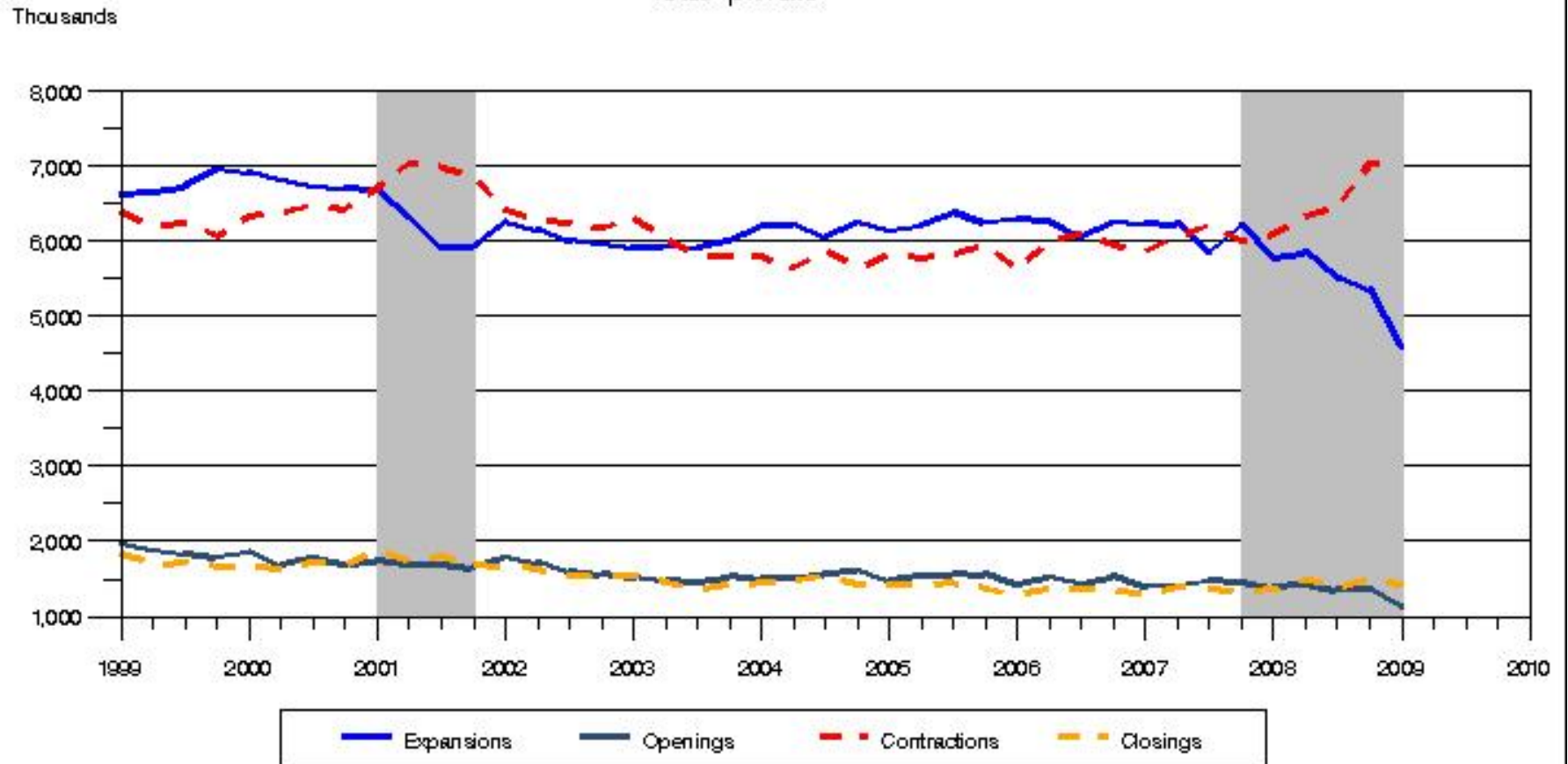
* CES estimates are pre-March 2009 benchmark revision.

Business Employment Dynamics (BED)

To gain insight into the nature of the first quarter 2009 divergences, BLS examined its Business Employment Dynamics (BED) data. The BED series disaggregate the QCEW employment data into gross job gains from business expansions and openings, and gross job losses from business contractions and closings. These series reveal which of the underlying flows are driving the net QCEW change.

The BED series indicated a decrease in gross job gains rather than an increase in gross job losses drove the net employment decline in the first quarter of 2009. The BED series illustrate the first quarter decline in gross job gains. In addition, there is a notable drop in overall openings in first quarter 2009. Nevertheless, the continuous establishments – not the opening and closing establishments – are driving the overall net change in employment.

Components of private sector gross job gains and job losses, seasonally adjusted
March 1999 – March 2009
Total private



Source: U.S. Bureau of Labor Statistics

Note: Shaded area represents NBER defined recession period.

Three-month private sector gross job gains and losses, seasonally adjusted (BED table)

Category		Levels (in thousands)				Rates (percent)					
		3 months ended	Mar-08	Jun-08	Sep-08	Dec-08	Mar-09	Mar-08	Jun-08	Sep-08	Dec-08
Gross job gains	Total	7,167	7,296	6,884	6,738	5,746	6.3	6.5	6.1	6.0	5.2
	At expanding establishments	5,781	5,869	5,520	5,363	4,603	5.1	5.2	4.9	4.8	4.2
	At opening establishments	1,386	1,427	1,364	1,375	1,143	1.2	1.3	1.2	1.2	1.0
Gross job losses	Total	7,447	7,832	7,851	8,539	8,486	6.5	6.9	6.9	7.6	7.7
	At contracting establishments	6,090	6,334	6,461	7,038	7,045	5.3	5.6	5.7	6.3	6.4
	At closing establishments	1,357	1,498	1,390	1,501	1,441	1.2	1.3	1.2	1.3	1.3
Net employment change ⁽¹⁾		-280	-536	-967	-1,801	-2,740	-0.2	-0.4	-0.8	-1.6	-2.5

⁽¹⁾The net employment change is the difference between total gross job gains and total gross job losses. For more information, visit <http://www.bls.gov/bdm/>.

Possible causes of the CES-QCEW difference

Numerous statistical error sources exist in both the CES and QCEW and are potential contributors to the larger than usual March 2009 benchmark revision as noted above. BLS research examined both:

- Whether the change in the QCEW from March 2008 to March 2009 was impacted by noneconomic data reporting or processing changes, and
- If the QCEW March 2008 to March 2009 change is taken as correct, why the CES estimation process failed to measure it within usual historical ranges.

A description of key aspects of the research follows.

QCEW imputations

Every quarter the QCEW program imputes employment for UI accounts where reports were not received or were received but contained only wage information and no employment data. Typically about 10 percent of the worksites and 5 percent of the QCEW total employment is imputed. BLS reviewed key aspects of the QCEW imputation process to see if it could be a factor in the divergence between CES and QCEW over-the-year employment trends. The review included: the functioning of processing systems and edit checks, instances of long term imputations (more than two quarters), and the number and trend of imputed accounts versus historical norms. After extensive examination, no problems or changes to the QCEW imputations were found that could help explain the large CES benchmark revision.

Possible change in payroll processing firm reporting for the QCEW

A substantial percentage of firms do not file their own Quarterly Contributions Report (QCR) with State UI agencies but rely on payroll processing firms (PPFs) to do it for them. The PPFs also derive the employment counts that are reported on the QCR and therefore become the basis for the QCEW employment series. Using the QCEW microdata file, BLS examined a number of tabulations to see whether there might be obvious issues with PPF reporting. The review was somewhat limited because most QCEW firm records do not carry a code that indicates whether the report is filed by a PPF. The analysis for the March 2009 benchmark did not reveal any issues that could be a factor in the larger than normal benchmark revision.

In addition to the QCEW review work described above, BLS examined major aspects of the CES survey process and estimation methods. Results are described below.

CES nonresponse

A review of collection rates for the January 2007-March 2009 period indicates rates have been trending higher over the past several years. Final collection rates averaged 91 percent in 2008, up from 87 percent the prior year, and averaged 93 percent during the first three months of 2009. Thus there is no indication that the large benchmark revision was caused by problems with nonresponse.

CES birth/death modeling

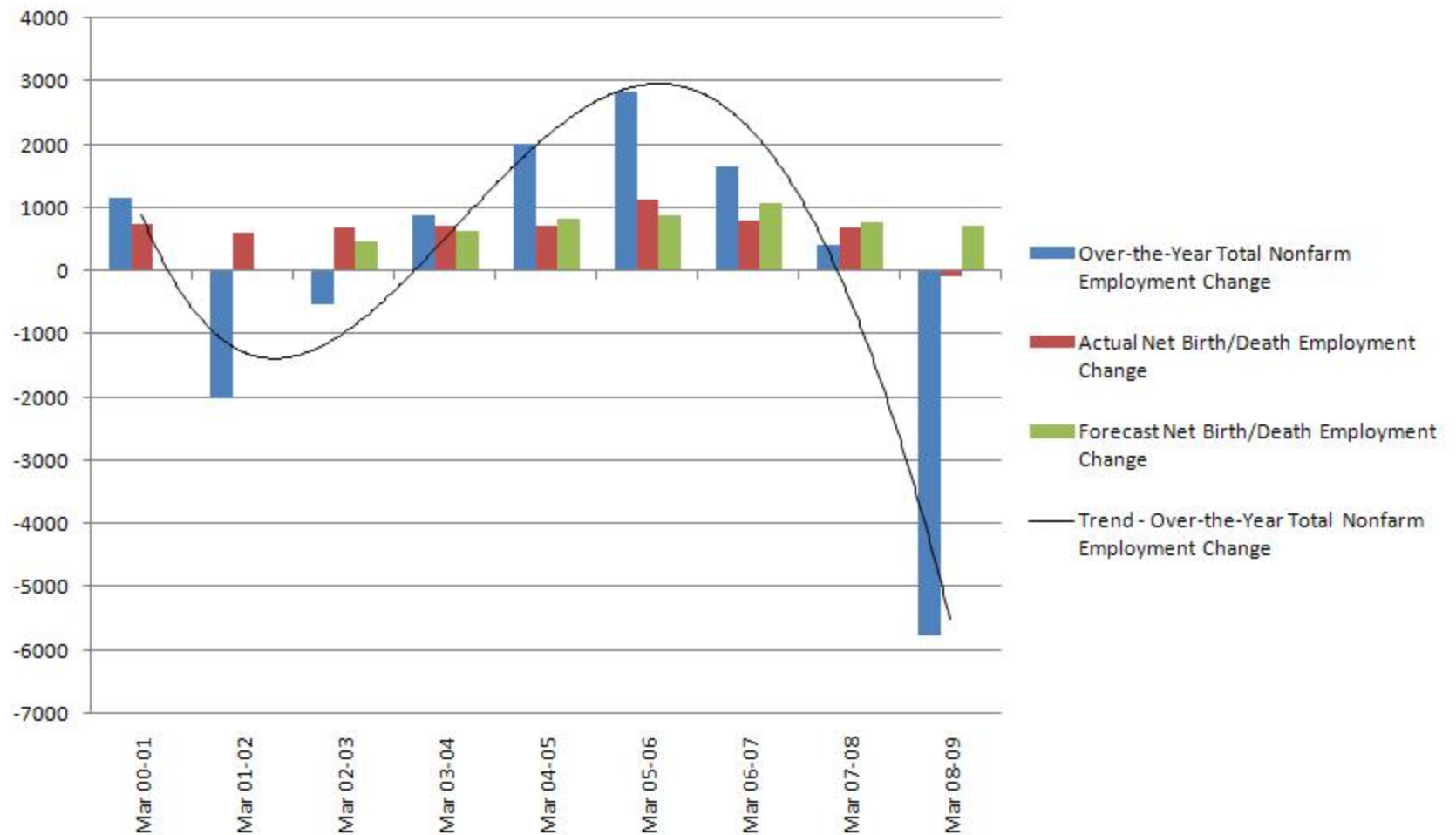
CES uses a two-step method to estimate net business birth/death employment. Step 1 excludes employment losses from business deaths from sample-based estimation in order to offset the missing employment gains from business births. This is incorporated in to the sample-based estimate procedure by simply not reflecting sample units going out of business, but imputing them by the same trend as the responding firms in the sample. Step 2 is an ARIMA-based model intended to estimate the residual net birth/death employment not accounted for by Step 1. Only the Step 2 error is directly measurable. Error from this component is measured by comparing the

actual residual from March 2008-09 once it becomes available, with the model-based estimate. As the table below shows, the actual net birth/death residual for April 2008 to March 2009 had a significant contribution to the large benchmark revision; the actual birth/death residual was approximately 779,000 below the forecasted amount used in the CES monthly estimates for the time period. These errors started to grow in the fourth quarter of 2008 and got significantly larger in the first quarter of 2009.

Differences between forecasted and actual net birth/death from April 2008 to March 2009 (in thousands)													
Benchmark 2009	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Total
Actual Net Birth/Death	46	184	108	-28	109	5	25	-48	-9	-570	59	52	-68
Forecast Net Birth/Death	174	177	164	24	93	19	95	17	59	-355	131	114	711
Difference	-128	7	-56	-52	16	-14	-70	-65	-68	-215	-72	-62	-779
Cumulative Difference	-128	-121	-177	-229	-213	-227	-297	-362	-430	-645	-717	-779	

Until this year, the contribution of the actual net birth/death component had been relatively stable over time, regardless of the business cycle. As the following chart illustrates, the pronounced recession led to a breakdown in that stability from March-08 to March-09. The graph displays the over-the-year change in total nonfarm employment, the actual net birth/death residual, and the forecasted net birth/death residual, and also includes a trend line for the over-the-year employment change. In the graph, we typically focus on the relatively stability of the actual residual, as represented by the red (or middle) bars.

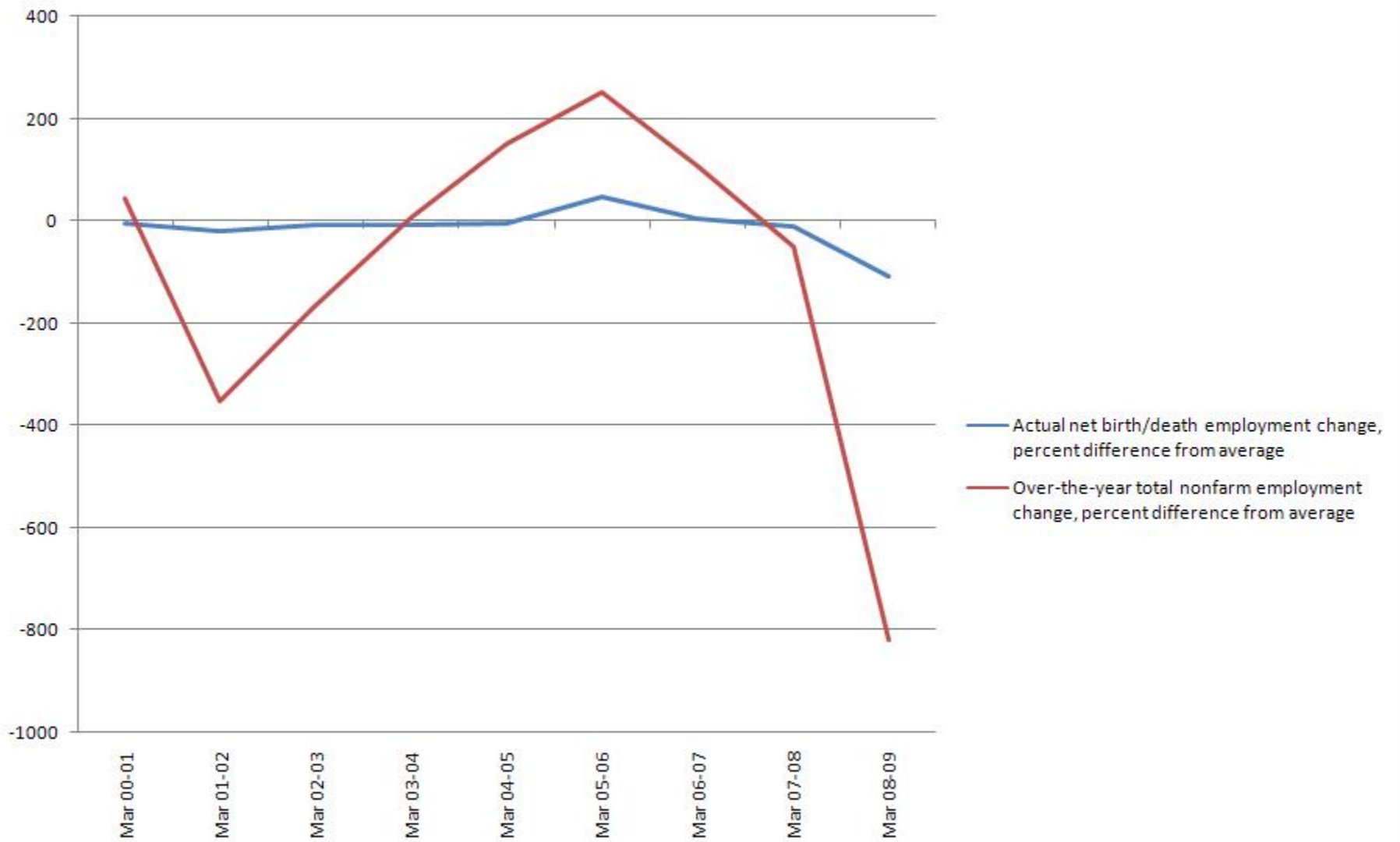
Total Nonfarm Employment Change vs. Actual Net Birth/Death Employment Change (in thousands)



Source: U.S. Bureau of Labor Statistics

The graph below underscores the historical stability of the net birth/death residual by comparing the deviation of the residual from its average level to the deviation of over-the-year total nonfarm employment change from its average level. During the 2001 recession, the annual net birth/death residual component was no more than 20 percent below its average, whereas the over-the-year total nonfarm employment change was 351 percent below its average during the corresponding year (March 2001 to 2002). At the peak of the expansionary period (March 2005 to 2006), the over-the-year employment change was 253 percent above average, while the net birth/death residual was only 48 percent above average. Mild correlation exists between the actual birth/death residual and the over-the-year change in total nonfarm employment; yet its strength is inconsistent.

**Over-the-Year Trend in Net Birth/Death Residual vs.
Total Nonfarm Employment (March 2001 - March 2009)**



Source: U.S. Bureau of Labor Statistics

This relative stability in the net birth/death component has allowed the model to perform reasonably well over the past decade. But in the past year of unprecedented steep job loss, the adjustment did not work as effectively as it traditionally has worked. In particular, it was not sensitive to the unusually large economic shock that was experienced in the last quarter of 2008 and the first quarter of 2009.

Conclusions regarding the March 2009 benchmark

BLS has researched potential sources identified for the large CES benchmark revision to the extent possible since the preliminary magnitude of the revision was announced in October 2009. Typically it is an accumulation of differences from several different error sources - sampling error, reporting error, nonresponse, net birth/death - that compose the overall benchmark revision. However, the majority of the 2009 benchmark revision is linked to error in the CES model-based estimation process for birth employment.

Research improvements to CES net birth/death modeling

BLS continues to research possible improvements to the CES net birth/death model in an effort to better understand the model's limitations and to improve its sensitivity to economic shocks. Nevertheless, the net birth/death model will likely remain a challenging component of the CES methodology. Because there is no current information available on business births, models based in part on historical information will continue to be used. The basic modeling method currently used is simple and has been in use since the first industry estimates were generated using the CES redesign methodology in 2000. However, improvements to the accuracy of the model may be possible in several areas. For example, CES is investigating the benefit of increasing the frequency with which the model is run. As the model is dependent upon QCEW data (available on a quarterly basis), CES may opt to update the model quarterly in order to incorporate more recent information. Also under investigation is the option of adding independent regression variables to the model to improve its responsiveness to business cycle changes; in particular, sample links derived from CES data are being studied as potential regressors. Several additional years of real time experience with the model are now available and can be used as a basis for additional evaluation and research testing.

Revisions in the post-benchmark period

Post-benchmark period estimates from April 2009 to December 2009 were calculated for each month based on new benchmark levels. Also, beginning in April, model-based estimates for the net of birth/death employment were revised to incorporate information from the most recent year of universe employment counts. [Text table A](#) shows the net birth/death model figures for the supersectors over the post-benchmark period. From April 2009 to December 2009, the cumulative net birth/death model added 585,000, compared with 990,000 in the previously published April to December estimates.

2009	Mining & logging	Construction	Manufacturing	Trade, transportation, & utilities	Information	Financial activities	Professional & business services	Education & health services	Leisure & hospitality	Other services	Monthly amount contributed
April	-1	22	-14	8	-4	-5	35	9	73	3	126
May	1	41	4	26	3	8	11	7	78	7	186
June	1	24	3	15	0	5	10	-11	80	6	133
July	2	-8	-14	-9	-3	-9	-4	2	38	-5	-10
August	1	12	5	17	5	4	18	10	23	3	98
September	1	7	1	15	0	3	0	13	-41	1	0
October	2	-2	-6	16	2	6	41	31	-39	-1	50
November	0	-17	1	3	1	-1	2	8	-19	-1	-23
December	0	-21	1	12	3	12	2	6	7	3	25
Cumulative total	7	58	-19	103	7	23	115	75	200	16	585

Revisions to November and December also reflect incorporation of the annual CES sample update and the routine inclusion of additional sample units not available for the respective months' preliminary estimates.

Why benchmarks differ from estimates

A benchmark revision is the difference between the benchmark employment level for a given March and its corresponding sample-based estimate. The overall accuracy of the establishment survey is usually gauged by the size of this difference. The benchmark revision often is regarded as a proxy for total survey error, but this does not take into account error in the universe data. The employment counts obtained from quarterly unemployment insurance tax forms are administrative data that reflect employer record-keeping practices and differing State laws and procedures. The benchmark revision can be more precisely interpreted as the difference between two independently derived employment counts, each subject to its own error sources.

Like all sample surveys, the establishment survey is susceptible to two sources of error: sampling error and nonsampling error. Sampling error is present any time a sample is used to make inferences about a population. The magnitude of the sampling error, or variance, relates directly to sample size and the percentage of the universe covered by that sample. The CES monthly survey captures

slightly under one-third of the universe, exceptionally high by usual sampling standards. This coverage insures a small sampling error at the total nonfarm employment level.

Both the universe counts and the establishment survey estimates are subject to nonsampling errors common to all surveys—coverage, response, and processing errors. The error structures for both the CES monthly survey and the UI universe are complex. Still, the two programs generally produce consistent total employment figures, each validating the other. Over the last decade, annual benchmark revisions at the total nonfarm level have averaged 0.3 percent, with an absolute range of 0.1 percent to 0.7 percent.

Benchmark revision effects for other data types

The routine benchmarking process results in revisions to the series for production and nonsupervisory employees and women employees. There are no benchmark employment levels for these series; they are revised by preserving ratios of employment for the particular data type to all employees employment prior to benchmarking, and then applying these ratios to the revised all employee figures. These figures are calculated at the basic cell level and then aggregated to produce the summary estimates.

Average weekly hours and average hourly earnings are not benchmarked; they are estimated solely from reports supplied by survey respondents at the basic estimating cell level.

The aggregate industry level of the hours and earnings series are derived as a weighted average. The production or nonsupervisory employment estimates for the basic cells are used as weights for the hours and earnings estimates for broader industry groupings. Adjustments of the all employee estimates to new benchmarks may alter the weights, which, in turn, may change the estimates for hours and earnings of production or nonsupervisory workers at higher levels of aggregation.

Generally, new employment benchmarks have little effect on hours and earnings estimates for major groupings. To influence the hours and earnings estimates of a broader 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 group. [Table 4](#) gives information on the levels of specific hours and earnings series resulting from the March 2009 benchmark. At the total private level, there was no change in average weekly hours from the previously published level, while average hourly earnings increased from the previously published level by 3 cents.

Methods

Benchmark adjustment procedure. Establishment survey benchmarking is done on an annual basis to a population derived primarily from the administrative file of employees covered by unemployment insurance (UI). The time required to complete the revision process--from the full collection of the UI population data to publication of the revised industry estimates--is about 10 months. The benchmark adjustment procedure replaces the March sample-based employment estimates with UI-based population counts for March. The benchmark therefore determines the final employment levels, while sample movements capture month-to-month trends.

Benchmarks are established for each basic estimating cell and are aggregated to develop published levels. On a not seasonally adjusted basis, the sample-based estimates for the year preceding and the year following the benchmark month also are then subject to revision. Employment estimates for the months between the most recent March benchmark and the previous year's benchmark are adjusted using a "wedge-back" procedure. In this process, the difference between the benchmark level and the previously published March estimate for each estimating cell is computed. This difference, or error, is linearly distributed across the 11 months of estimates subsequent to the previous benchmark; eleven-twelfths of the March difference is added to February estimates, ten-twelfths to January estimates, and so on, ending with the previous April estimates, which receive one-twelfth of the March difference. The wedge procedure assumes that the total estimation error accumulated at a steady rate since the last benchmark. Applying previously derived over-the-month sample changes to the revised March level yields revised estimates for the months following the March benchmark. New net birth/death model estimates also are calculated and applied during post-benchmark estimation, and new sample is introduced from the annual update.

Benchmark source material. The principal source of benchmark data for private industries is the Quarterly Census of Employment and Wages (QCEW). These employment data are provided to State Employment Security Agencies by employers covered by State UI laws. BLS uses several other sources to establish benchmarks for the remaining industries partially covered or exempt from mandatory UI coverage, accounting for nearly 3 percent of the nonfarm employment total.

Data on employees covered under Social Security laws, published by the U.S. Census Bureau in [*County Business Patterns*](#), are used to augment UI data for industries not fully covered by the UI scope, such as nonoffice insurance sales workers, child daycare workers, religious organizations, and private schools and hospitals. Benchmarks for State and local government hospitals and educational institutions are based on the Annual Census of Governments conducted by the Census Bureau. Benchmark data from these sources are available only on a lagged basis. Extrapolation to a current level is accomplished by applying the employment trends from the UI-covered part of the population in these industries to the noncovered part. Universe data for interstate railroads are obtained from the Railroad Retirement Board.

Business birth and death estimation. Regular updating of the CES sample frame with information from the UI universe files helps to keep the CES survey current with respect to employment from business births and business deaths. The timeliest UI universe files

available, however, always will be a minimum of 9 months out of date. The CES survey thus cannot rely on regular frame maintenance alone to provide estimates for business birth and death employment contributions. BLS has researched both sample-based and model-based approaches to measuring birth units that have not yet appeared on the UI universe frame. Since the research demonstrated that sampling for births was not feasible in the very short CES production timeframes, the Bureau is utilizing a model-based approach for this component.

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 is utilizing an estimation procedure with two components. The first component excludes employment losses from business deaths from sample-based estimation in order to offset the missing employment gains from business births. This is incorporated into the sample-based link relative estimate procedure by simply not reflecting sample units going out of business, but imputing to them the same trend as the responding firms in the sample. The second component is an ARIMA time series model designed to estimate the residual net birth/death employment not accounted for by the imputation. The historical time series used to create and test the ARIMA model was derived from the UI universe micro level database, and reflects the actual residual net of births and deaths over the past five years. The net birth/death model component figures are unique to each month and include negative adjustments in some months. Furthermore, these figures exhibit a seasonal pattern similar to the seasonal patterns of the continuing businesses.

Addition of all employee hours and earnings as official BLS series

Concurrent with the release of January 2010 data, the CES program began publishing all employee hours and earnings as official BLS series. These series were developed to measure the average hourly earnings and average weekly hours of all nonfarm private sector employees and the average overtime hours of all manufacturing employees. All employee hours and earnings were first released as experimental series in April 2007, and included National level estimates at a total private sector level and limited industry detail. Each month, new monthly estimates for the experimental estimates were released on the same date as the Employment Situation news release (typically the first Friday of the month). The experimental series were not seasonally adjusted. Now that they are official BLS series, all employee hours and earnings series will be published at the same level of industry detail as production workers hours and earnings series, and will be published on both a not seasonally adjusted and a seasonally adjusted basis.

Historically, the CES program has published average hours and earnings series for production workers in the goods-producing industries and for nonsupervisory workers in the service-providing industries. These workers account for about 80 percent of total private nonfarm employment. The all employee hours and earnings series are more comprehensive in coverage, covering 100 percent of all paid employees in the private sector, thereby providing improved information for analyzing economic trends and for constructing other major economic indicators, including nonfarm productivity and personal income.

In order to publish all employee average weekly hours, average hourly earnings, and average weekly earnings, BLS began collecting all employees total payroll and all employees total hours from survey respondents in late 2005. The definitions of these data items parallel the definitions used for the production worker payroll and hours data; the only difference is that they cover all employees rather than just production or nonsupervisory workers (for a sample collection form, see www.bls.gov/ces/idcf/forme_mp.pdf). Additionally, the same estimation formulas currently used for the published series on production and nonsupervisory workers are used for the all employee hours and earnings series. The new series start in March 2006.

For more information on the CES All Employee Hours and Earnings series, please see www.bls.gov/ces/cesaepnotic.htm.

Other changes to the CES published series

All CES series are evaluated annually for sample size, coverage, and response rates. The series changes detailed on [CES series changes for the 2009 benchmark](http://www.bls.gov/ces/cesnewseries2009.htm) webpage (www.bls.gov/ces/cesnewseries2009.htm) result from a re-evaluation of the sample and universe coverage for NAICS industries. Some small industries no longer have sufficient sample to be estimated and published separately and have been combined with other similar industries for estimation and publication purposes. Most of the collapsed and deleted series are in the manufacturing sector where employment has been declining over a number of years. Historical data for the series with changed scope were reconstructed to provide consistent time series.

Availability of revised data

[LABSTAT](http://www.bls.gov/labstat), the BLS public database on the Internet, contains all historical employment, hours, and earnings data revised as a result of this benchmark, including both unadjusted and seasonally adjusted data. The data can be accessed at <http://www.bls.gov/ces/>, the Current Employment Statistics homepage.

Small domain model

The CES Small Domain Model (SDM) is used for industries where the sample alone is insufficient for reliable estimates. The CES SDM is a Weighted Least Squares model with two employment inputs: (1) an estimate based on available CES sample for that series, and (2) an ARIMA projection based on 10 years of historical QCEW data. Further background on the SDM is provided in the [CES technical notes](#).

There are six industries estimated by using the SDM. These industries are lessors of nonfinancial intangible assets, direct health and medical insurance carriers, tax preparation services, other technical consulting services, remediation services, and recreational and vacation camps.

Seasonal adjustment procedure

BLS uses X-12 ARIMA software developed by the U.S. Census Bureau to seasonally adjust national employment, hours, and earnings series derived from the CES program. Individual series are seasonally adjusted using either a multiplicative or an additive model ([Exhibit 1](#)), and seasonal adjustment factors are directly applied to the component levels. For employment, individual 3-digit NAICS levels are seasonally adjusted, and higher level aggregates are formed by summing these components. Seasonally adjusted totals for hours and earnings are obtained by taking weighted averages of the seasonally adjusted data for the component series.

Special model adjustments

Variable survey intervals. Beginning with the release of the 1995 benchmark, BLS refined the seasonal adjustment procedures to control for survey interval variations, sometimes referred to as the 4- versus 5-week effect. Although the CES survey is referenced to a consistent concept — the pay period including the 12th of each month — inconsistencies arise because there are sometimes 4 and sometimes 5 weeks between the week including the 12th in a given pair of 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, thereby complicating seasonal adjustment.

Standard seasonal adjustment methodology relies heavily on the experience of the most recent 3 years to determine the expected seasonal change in employment for each month of the current year. Prior to the implementation of the adjustment to control for survey interval variations, the procedure did not distinguish between 4- and 5-week survey intervals, and the accuracy of the seasonal expectation depended in large measure on how well the current year's survey interval corresponded with those of the previous 3 years. All else the same, the greatest potential for distortion occurred when the current month being estimated had a 5-week interval but the 3 years preceding it were all 4-week intervals, or conversely when the current month had a 4-week interval but the 3 years preceding it were all 5-week intervals.

BLS adopted REGARIMA (regression with auto-correlated errors) modeling to identify the estimated size and significance of the calendar effect for each published series. REGARIMA combines standard regression analysis, which measures correlation among two or more variables, with ARIMA modeling, which describes and predicts the behavior of data series based on its own past history. For many economic time series, including nonfarm payroll employment, observations are auto-correlated over time; that is, each month's

value is significantly dependent on the observations that precede it. These series, therefore, usually can be successfully fit using ARIMA models. If auto-correlated time series are modeled through regression analysis alone, the measured relationships among other variables of interest may be distorted due to the influence of the auto-correlation. Thus, the REGARIMA technique is appropriate for measuring relationships among variables of interest in series that exhibit auto-correlation, such as nonfarm payroll employment.

In this application, the correlations of interest are those between employment levels in individual calendar months and the lengths of the survey intervals for those months. The REGARIMA models evaluate the variation in employment levels attributable to 11 separate survey interval variables, one specified for each month, except March. March is excluded because there are almost always 4 weeks between the February and March surveys. Models for individual basic series are fit with the most recent 10 years of data available, the standard time span used for CES seasonal adjustment.

The REGARIMA procedure yields regression coefficients for each of the 11 months specified in the model. These coefficients provide estimates of the strength of the relationship between employment levels and the number of weeks between surveys for the 11 modeled months. The X-12 ARIMA software also produces diagnostic statistics that permit the assessment of the statistical significance of the regression coefficients, and all series are reviewed for model adequacy.

Because the 11 coefficients derived from the REGARIMA models provide an estimate of the magnitude of variation in employment levels associated with the length of the survey interval, these coefficients are used to adjust the CES data to remove the calendar effect. These "filtered" series then are seasonally adjusted using the standard X-12 ARIMA software.

For a few series, REGARIMA models do not fit well; these series are seasonally adjusted with the X-12 software but without the interval effect adjustment. There are several additional special effects modeled through the REGARIMA process; they are described below.

Construction series. Beginning with the 1996 benchmark revision, BLS utilized special treatment to adjust construction industry series. In the application of the interval effect modeling process to the construction series, there initially was difficulty in accurately identifying and measuring the effect because of the strong influence of variable weather patterns on employment movements in the industry. Further research allowed BLS to incorporate interval effect modeling for the construction industry by disaggregating the construction series into its finer industry and geographic estimating cells and tightening outlier designation parameters. This allowed a more precise identification of weather-related outliers that had masked the interval effect and clouded the seasonal adjustment patterns in general. With these outliers removed, interval effect modeling became feasible. The result is a seasonally adjusted series for construction that is improved because it is controlled for two potential distortions: unusual weather events and the 4- versus 5-week effect.

Floating holidays. BLS is continuing the practice of making special adjustments for average weekly hours and average weekly overtime series to account for the presence or absence of religious holidays in the April survey reference period and the occurrence of Labor Day in the September reference period, back to the start date of each series.

Local government series. A special adjustment also is made in November each year to account for variations in employment due to the presence or absence of poll workers in the local government, excluding educational services series.

Refinements in hours and earnings seasonal adjustment. With the release of the 1997 benchmark, BLS implemented refinements to the seasonal adjustment process for the hours and earnings series to correct for distortions related to the method of accounting for the varying length of payroll periods across months. There is a significant correlation between over-the-month changes in both the average weekly hours (AWH) and the average hourly earnings (AHE) series and the number of weekdays in a month, resulting in noneconomic fluctuations in these two series. Both AWH and AHE show more growth in "short" months (20 or 21 weekdays) than in "long" months (22 or 23 weekdays). The effect is stronger for the AWH than for the AHE series.

The calendar effect is traceable to response and processing errors associated with converting payroll and hours information from sample respondents with semi-monthly or monthly pay periods to a weekly equivalent. The response error comes from sample respondents reporting a fixed number of total hours for workers regardless of the length of the reference month, while the CES conversion process assumes that the hours reporting will be variable. A constant level of hours reporting most likely occurs when employees are salaried rather than paid by the hour, as employers are less likely to keep actual detailed hours records for such employees. This causes artificial peaks in the AWH series in shorter months that are reversed in longer months.

The processing error occurs when respondents with salaried workers report hours correctly (vary them according to the length of the month), which dictates that different conversion factors be applied to payroll and hours. The CES processing system uses the hours conversion factor for both fields, resulting in peaks in the AHE series in short months and reversals in long months.

REGARIMA modeling is used to identify, measure, and remove the length-of-pay-period effect for seasonally adjusted average weekly hours and average hourly earnings series. The length-of-pay-period variable proves significant for explaining AWH movements in all the service-providing industries except utilities. For AHE, the length-of-pay-period variable is significant for wholesale trade, retail trade, information, financial activities, professional and business services, and other services. All AWH series in the service-providing industries except utilities have been adjusted from January 1990 forward. The AHE series for wholesale trade, retail trade, information, financial activities, professional and business services, and other services have been adjusted from January 1990 forward as well. For this reason, calculations of over-the-year change in the establishment hours and earnings series should use seasonally adjusted data.

The series to which the length-of-pay-period adjustment is applied are not subject to the 4- versus 5-week adjustment, as the modeling cannot support the number of variables that would be required in the regression equation to make both adjustments.

Seasonal adjustment of new all employee hours and earning series

Although the seasonal adjustment process used by CES has proven effective for many years, the limited history of the new all employees hours and earnings series estimates complicates the use of existing adjustment techniques. CES has less than four years of history for the new hours and earnings series; in contrast, CES uses 10 years of data when seasonally adjusting all other data types.

The X-12 ARIMA software requires at least 3 years of data to perform seasonal adjustment; the new series meet this requirement, consisting of 46 months of data at initial publication (March 2006 through January 2010). Nevertheless, there are several limitations and concerns associated with seasonally adjusting the new series with such a limited amount of input data. For example, the limited history is not sufficient to utilize the automatic model selection feature of X-12, which is typically used to select the ARIMA model for other data types. The CES program typically uses the automatic selection feature once a year, during the annual production processing, and keep the automatically selected model constant throughout the next year. Secondly, there is a risk of the irregular component affecting the seasonal component. But the most significant limitation is that there is insufficient history to allow the use of the existing calendar effects treatment method described above. In particular, at least 5 years of data are required to adjust for variation due to the calendar effects (4 vs. 5 week, 10 vs. 11 day). Therefore, an alternative approach has been implemented to address these concerns until sufficient history is available to use the current procedure.

ARIMA Model Selection

Unable to utilize X-12 ARIMA's automatic model selection due to the short length of the new series, CES elected to utilize an (0 1 1)(0 1 1) model for these series in the interim. This model diminishes noise in time series by using an exponentially weighted moving average of past values. As hours and earnings data tend to exhibit fluctuations around slowly-varying means, use of the exponential smoothing model is a sensible choice. Experimental results confirmed that this model is highly effective and will suffice until the all employees hours and earnings series reach the necessary length to allow the integration of automatic model selection.

Choice of Seasonal Filter

By default, X-12 ARIMA uses a 3x3 moving average to calculate the initial seasonal factors in each iteration, and a 3x5 moving average to calculate the final seasonal averages. However, the shortness of the new series imposes a technical limitation in that the only available option is to utilize a stable seasonal filter. A stable seasonal filter computes a single seasonal factor for each month by

first calculating the average of all the values for each month, which reduces the chance of the irregular component affecting the seasonal component -- a concern with short series.

Treatment of Calendar Effects

The existing seasonal adjustment method for production employees' hours and earnings relies on the REGARIMA modeling approach described earlier that implicitly treats each month; the alternate technique treats only the months for which calendar effects impact the data. Affected months are manually treated as outliers when defining parameters for X-12 ARIMA. This treatment dampens the calendar effects, but spikes from the 10 versus 11 day effect are still present in the adjusted series.

Based on manually-designated outliers, X-12 ARIMA produces a prior adjusted series by imputing for outlier observations based on the trend of the non-outlier observations. By default, X-12 ARIMA relies upon this prior-adjusted series when decomposing seasonality and estimating seasonal factors for time series; however, it then applies those factors to the original time series rather than the prior-adjusted series. Under normal circumstances, application of seasonal factors to the original time series is sensible, as the original time series consists of the series true values.

In the context of CES' efforts to eliminate calendar effects from these estimates, it is undesirable to apply the seasonal factors to the original time series. Because the calendar effects are part of the original series - and because we cannot remove these effects with standard treatment procedures - it is therefore necessary that we apply the seasonal factors to the prior-adjusted series.

An additional problem is that the series' average for seasonally adjusted data is not preserved relative to the unadjusted average, because the adjustment is applied outside of X-12 ARIMA. A common goal when performing seasonal adjustment is to eliminate series' seasonality without altering series' levels. This goal is accomplished by smoothing seasonal fluctuations across the given time span such that some observations are elevated while others are diminished depending on the direction of the seasonality such that the net change is offsetting. Therefore, application of seasonal factors to prior-adjusted series - series which often exhibit lower means than their unadjusted analogues - may result in seasonally adjusted series with lower means than those of corresponding unadjusted series. Such outcomes are contradictory to established CES practices in that CES takes series' true levels to be defined by those of the unadjusted data. Therefore, a second step is required to preserve the series' average.

A correction factor forces the average of each series adjusted for calendar effects to the average of the corresponding unadjusted series. The factor is defined as:

$$\text{Correction Factor} = \frac{\sum_{t=1}^n X_t}{\sum_{t=1}^n \hat{X}_t}$$

X_t = Unadjusted value of series at month t

\hat{X}_t = Adjusted, calendar-effect-treated value of series at month t

The factor is applied multiplicatively to all observations in the seasonally-adjusted series. Testing has shown that this method effectively reconciles level shifts introduced by the modified calendar effects treatment procedure, thereby maintaining consistency between series' unadjusted and seasonally-adjusted levels.

See [Exhibit 1](#) for series that have the calendar effects modeling described above.

Table 1. Percent differences between nonfarm employment benchmarks and estimates by industry supersector, March 2000-2009 ⁽¹⁾

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	0.4	-0.1	-0.2	-0.1	0.2	-0.1	0.6	-0.2	-0.1	-0.7
Total private	.3	-.2	-.4	-.2	.2	-.2	.7	-.2	-.1	-.9
Mining and logging				.9	.7	-.3	1.2	⁽²⁾	.4	-3.5
Construction				-.8	.6	.5	2.6	.1	.7	-2.9
Manufacturing				-1.1	-.4	-.3	-.1	-1.0	-.1	-.7
Trade, transportation, and utilities				⁽²⁾	.2	.3	.6	.5	.2	-1.2
Information				-2.6	-1.0	-2.1	-.5	-1.8	.3	-1.5
Financial activities				.2	.1	-.8	.4	-1.3	-.3	-.1

Professional and business services										
Education and health services										
Leisure and hospitality										
Other services										
Government										

(1) Differences are based on comparisons of final published March estimates and benchmark levels, as originally published.

(2) Less than 0.05 percent.

Table 2. Nonfarm employment benchmarks by industry for March 2009 (in thousands)

Industry	Benchmark	Estimate	Difference	
			Amount	Percent
Total nonfarm	131,175	132,077	-902	-0.7
Total private	108,215	109,148	-933	-0.9
Goods-producing	18,776	19,056	-280	-1.5
Mining and logging	714	739	-25	-3.5
Logging	48	49	-1	-2.1
Mining	666	689	-23	-3.5
Oil and gas extraction	161	165	-4	-2.5
Mining, except oil and gas	208	214	-6	-2.9
Coal mining	85	83	2	2.4
Support activities for mining	297	311	-14	-4.7
Construction	5,950	6,121	-171	-2.9
Construction of buildings	1,364	1,421	-57	-4.2
Heavy and civil engineering construction	808	827	-19	-2.4
Specialty trade contractors	3,778	3,874	-96	-2.5
Manufacturing	12,112	12,196	-84	-0.7
Durable goods	7,532	7,575	-43	-0.6

Wood products	365	377	-12	-3.3
Nonmetallic mineral products	394	404	-10	-2.5
Primary metals	381	386	-5	-1.3
Fabricated metal products	1,360	1,363	-3	-0.2
Machinery	1,075	1,069	6	0.6
Computer and electronic products	1,173	1,185	-12	-1
Computer and peripheral equipment	175	173	2	1.1
Communications equipment	123	128	-5	-4.1
Semiconductors and electronic components	394	396	-2	-0.5
Electronic instruments	429	431	-2	-0.5
Electrical equipment and appliances	386	388	-2	-0.5
Transportation equipment	1,407	1,403	4	0.3
Furniture and related products	400	405	-5	-1.3
Miscellaneous manufacturing	591	597	-6	-1
Nondurable goods	4,580	4,621	-41	-0.9
Food manufacturing	1,423	1,435	-12	-0.8
Beverages and tobacco products	184	186	-2	-1.1
Textile mills	128	127	1	0.8
Textile product mills	128	129	-1	-0.8
Apparel	174	172	2	1.1
Leather and allied products	30	32	-2	-6.7
Paper and paper products	412	415	-3	-0.7
Printing and related support activities	539	539	0	⁽¹⁾
Petroleum and coal products	113	112	1	0.9
Chemicals	812	821	-9	-1.1
Plastics and rubber products	638	654	-16	-2.5
Service-providing	112,399	113,021	-622	-0.6
Private service-providing	89,439	90,092	-653	-0.7
Trade, transportation, and utilities	24,873	25,173	-300	-1.2
Wholesale trade	5,638	5,706	-68	-1.2

Electronic markets and agents and brokers	814	837	-23	-2.8
Retail trade	14,405	14,640	-235	-1.6
Motor vehicle and parts dealers	1,641	1,684	-43	-2.6
Automobile dealers	1,029	1,059	-30	-2.9
Furniture and home furnishings stores	452	490	-38	-8.4
Electronics and appliance stores	485	514	-29	-6
Building material and garden supply stores	1,152	1,169	-17	-1.5
Food and beverage stores	2,814	2,802	12	0.4
Health and personal care stores	982	980	2	0.2
Gasoline stations	817	821	-4	-0.5
Clothing and clothing accessories stores	1,327	1,379	-52	-3.9
Sporting goods, hobby, book, and music stores	605	591	14	2.3
General merchandise stores	2,945	3,014	-69	-2.3
Department stores	1,446	1,499	-53	-3.7
Miscellaneous store retailers	771	788	-17	-2.2
Nonstore retailers	415	410	5	1.2
Transportation and warehousing	4,267	4,258	9	0.2
Air transportation	466	472	-6	-1.3
Rail transportation	224	219	5	2.2
Water transportation	63	57	6	9.5
Truck transportation	1,268	1,275	-7	-0.6
Transit and ground passenger transportation	436	420	16	3.7
Pipeline transportation	42	43	-1	-2.4
Scenic and sightseeing transportation	21	21	0	⁽¹⁾
Support activities for transportation	556	550	6	1.1
Couriers and messengers	547	555	-8	-1.5
Warehousing and storage	644	647	-3	-0.5
Utilities	562	569	-7	-1.2
Information	2,860	2,902	-42	-1.5
Publishing industries, except Internet	819	826	-7	-0.9

Motion picture and sound recording industries	360	393	-33	-9.2
Broadcasting, except Internet	307	298	9	2.9
Telecommunications	990	997	-7	-0.7
Data processing, hosting and related services	251	255	-4	-1.6
Other information services	134	134	0	(1)
Financial activities	7,814	7,818	-4	-0.1
Finance and insurance	5,826	5,827	-1	(1)
Monetary authorities - central bank	21	21	0	(1)
Credit intermediation and related activities	2,624	2,635	-11	-0.4
Depository credit intermediation	1,766	1,780	-14	-0.8
Commercial banking	1,324	1,332	-8	-0.6
Securities, commodity contracts, investments	826	807	19	2.3
Insurance carriers and related activities	2,265	2,277	-12	-0.5
Funds, trusts, and other financial vehicles	89	88	1	1.1
Real estate and rental and leasing	1,988	1,990	-2	-0.1
Real estate	1,412	1,399	13	0.9
Rental and leasing services	550	563	-13	-2.4
Lessors of nonfinancial intangible assets	27	28	-1	-3.7
Professional and business services	16,554	16,691	-137	-0.8
Professional and technical services	7,652	7,749	-97	-1.3
Legal services	1,131	1,139	-8	-0.7
Accounting and bookkeeping services	1,041	1,038	3	0.3
Architectural and engineering services	1,339	1,356	-17	-1.3
Computer systems design and related services	1,417	1,452	-35	-2.5
Management and technical consulting services	984	1,006	-22	-2.2
Management of companies and enterprises	1,882	1,850	32	1.7
Administrative and waste services	7,021	7,092	-71	-1
Administrative and support services	6,678	6,739	-61	-0.9
Employment services	2,412	2,448	-36	-1.5
Temporary help services	1,754	1,736	18	1

Business support services	833	805	28	3.4
Services to buildings and dwellings	1,634	1,657	-23	-1.4
Waste management and remediation services	342	353	-11	-3.2
Education and health services	19,230	19,286	-56	-0.3
Educational services	3,233	3,223	10	0.3
Health care and social assistance	15,998	16,063	-65	-0.4
Ambulatory health care services	5,718	5,763	-45	-0.8
Offices of physicians	2,260	2,302	-42	-1.9
Outpatient care centers	539	537	2	0.4
Home health care services	1,003	992	11	1.1
Hospitals	4,661	4,705	-44	-0.9
Nursing and residential care facilities	3,060	3,035	25	0.8
Nursing care facilities	1,633	1,618	15	0.9
Social assistance	2,559	2,560	-1	⁽¹⁾
Child day care services	874	874	0	⁽¹⁾
Leisure and hospitality	12,748	12,820	-72	-0.6
Arts, entertainment, and recreation	1,778	1,776	2	0.1
Performing arts and spectator sports	375	378	-3	-0.8
Museums, historical sites, zoos, and parks	120	121	-1	-0.8
Amusements, gambling, and recreation	1,282	1,277	5	0.4
Accommodation and food services	10,970	11,044	-74	-0.7
Accommodation	1,709	1,673	36	2.1
Food services and drinking places	9,260	9,371	-111	-1.2
Other services	5,360	5,402	-42	-0.8
Repair and maintenance	1,160	1,164	-4	-0.3
Personal and laundry services	1,281	1,294	-13	-1
Membership associations and organizations	2,919	2,944	-25	-0.9
Government	22,960	22,929	31	0.1
Federal	2,779	2,787	-8	-0.3
Federal, except U.S. Postal Service	2,061	2,069	-8	-0.4

U.S. Postal Service	718	718	0	(1)
State government	5,320	5,323	-3	-0.1
State government education	2,511	2,525	-14	-0.6
State government, excluding education	2,809	2,798	11	0.4
Local government	14,861	14,819	42	0.3
Local government education	8,471	8,445	26	0.3
Local government, excluding education	6,390	6,375	15	0.2

(1) Less than 0.05 percent.

Table 3. Differences in seasonally adjusted levels and over-the-month changes, total nonfarm employment, January 2009-December 2009

2009	Levels			Over-the-month changes		
	As previously published	As revised	Difference	As previously published	As revised	Difference
January	134,333	133,549	-784	-741	-779	-38
February	133,652	132,823	-829	-681	-726	-45
March	133,000	132,070	-930	-652	-753	-101
April	132,481	131,488	-993	-519	-582	-63
May	132,178	131,141	-1,037	-303	-347	-44
June	131,715	130,637	-1,078	-463	-504	-41
July	131,411	130,293	-1,118	-304	-344	-40
August	131,257	130,082	-1,175	-154	-211	-57
September	131,118	129,857	-1,261	-139	-225	-86
October	130,991	129,633	-1,358	-127	-224	-97
November	130,995	129,697	-1,298	4	64	60
December^(p)	130,910	129,547	-1,363	-85	-150	-65

(p) Preliminary

Table 4. Effect of March 2009 benchmark revisions on hours and earnings estimates, selected industries

Industry	Average weekly hours			Average hourly earnings		
	As previously published	As revised	Difference	As previously published	As revised	Difference
Total private	33.1	33.1	0	\$18.57	\$18.60	\$0.03
Goods-producing	38.7	38.7	0	19.74	19.75	.01
Mining and logging	42.9	42.9	0	23.40	23.45	.05
Construction	37.3	37.2	-0.1	22.45	22.49	.04
Manufacturing	39.2	39.2	0	18.09	18.12	.03
Durable goods	39.2	39.2	0	19.17	19.21	.04
Wood products	36.2	36.2	0	14.67	14.65	-.02
Nonmetallic mineral products	39.2	39.2	0	17.19	17.18	-.01
Primary metals	40.3	40.3	0	19.69	19.72	.03
Fabricated metal products	38.8	38.8	0	17.29	17.30	.01
Machinery	40.0	40.0	0	18.26	18.25	-.01
Computer and electronic products	39.8	39.8	0	21.71	21.73	.02
Electrical equipment and appliances	38.6	38.6	0	15.95	15.95	0
Transportation equipment	40.0	40.0	0	24.80	24.89	.09
Furniture and related products	37.5	37.5	0	15.02	15.00	-.02
Miscellaneous manufacturing	38.3	38.3	0	16.02	16.04	.02
Nondurable goods	39.2	39.2	0	16.43	16.44	.01
Food manufacturing	39.6	39.5	-0.1	14.24	14.25	.01
Beverages and tobacco products	35.8	35.8	0	20.40	20.40	0
Textile mills	36.2	36.2	0	13.88	13.88	0
Textile product mills	37.0	37.1	0.1	11.34	11.34	0
Apparel	36.2	36.2	0	11.26	11.25	-.01
Leather and allied products	33.1	33.1	0	14.21	14.21	0
Paper and paper products	40.7	40.7	0	18.90	18.93	.03
Printing and related support	37.6	37.6	0	16.69	16.69	0

activities							
Petroleum and coal products	43.3	43.3	0	29.80	29.62		-.18
Chemicals	40.9	40.9	0	19.93	19.96		.03
Plastics and rubber products	39.3	39.3	0	16.20	16.20		0
Private service-providing	32.1	32.1	0	18.31	18.35		.04
Trade, transportation, and utilities	32.7	32.7	0	16.45	16.48		.03
Wholesale trade	37.9	37.9	0	20.64	20.62		-.02
Retail trade	29.5	29.5	0	13.02	13.00		-.02
Transportation and warehousing	35.7	35.7	0	18.64	18.79		.15
Utilities	42.2	42.2	0	29.42	29.38		-.04
Information	36.8	36.9	0.1	25.40	25.43		.03
Financial activities	36.5	36.5	0	20.67	20.72		.05
Professional and business services	34.9	34.9	0	22.52	22.48		-.04
Education and health services	32.4	32.4	0	19.23	19.31		.08
Leisure and hospitality	24.8	24.8	0	11.00	11.02		.02
Other services	30.5	30.5	0	16.33	16.61		.28

Exhibit 1. Seasonal Adjustment - AE

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	Other adj
1011330000	Logging	MULT	X	
1021100000	Oil and gas extraction	MULT	X	
1021200000	Mining, except oil and gas	-	X	Indirect ⁽¹⁾
1021210000	Coal mining	MULT	X	
1021300000	Support activities for mining	MULT	X	
2023610000	Residential building	-	X	Raked ⁽²⁾
2023620000	Nonresidential building	-	X	Raked
2023700000	Heavy and civil engineering construction	ADD	X	

2023800000	Specialty trade contractors	-	X	Indirect
2023800100	Residential specialty trade contractors	ADD	X	
2023800200	Nonresidential specialty trade contractors	ADD	X	
3132100000	Wood products	ADD	X	
3132700000	Nonmetallic mineral products	ADD	X	
3133100000	Primary metals	ADD	X	
3133200000	Fabricated metal products	ADD	X	
3133300000	Machinery	ADD	X	
3133400000	Computer and electronic products	-	X	Indirect
3133410000	Computer and peripheral equipment	MULT	X	
3133420000	Communications equipment	MULT	X	
3133440000	Semiconductors and electronic components	MULT	X	
3133450000	Electronic instruments	MULT	X	
3133500000	Electrical equipment and appliances	MULT	X	
3133600000	Transportation equipment	ADD		
3133600100	Motor vehicles and parts	ADD		
3133700000	Furniture and related products	ADD	X	
3133900000	Miscellaneous manufacturing	MULT	X	
3231100000	Food manufacturing	MULT	X	
3231200000	Beverages and tobacco products	MULT	X	
3231300000	Textile mills	MULT	X	
3231400000	Textile product mills	MULT	X	
3231500000	Apparel	MULT	X	
3231600000	Leather and allied products	MULT	X	
3232200000	Paper and paper products	MULT	X	
3232300000	Printing and related support activities	ADD	X	
3232400000	Petroleum and coal products	MULT	X	
3232500000	Chemicals	MULT	X	
3232600000	Plastics and rubber products	ADD	X	
4142300000	Durable goods	MULT	X	
4142400000	Nondurable goods	MULT	X	
4142500000	Electronic markets and agents and brokers	MULT	X	
4244100000	Motor vehicle and parts dealers	-	X	Indirect

4244110000	Automobile dealers	ADD	X	
4244200000	Furniture and home furnishings stores	ADD	X	
4244300000	Electronics and appliance stores	MULT	X	
4244400000	Building material and garden supply stores	MULT	X	
4244500000	Food and beverage stores	MULT	X	
4244600000	Health and personal care stores	MULT	X	
4244700000	Gasoline stations	MULT	X	
4244800000	Clothing and clothing accessories stores	MULT	X	
4245100000	Sporting goods, hobby, book, and music stores	MULT	X	
4245200000	General merchandise stores	-	X	Indirect
4245210000	Department stores	MULT	X	
4245300000	Miscellaneous store retailers	MULT	X	
4245400000	Nonstore retailers	MULT	X	
4348100000	Air transportation	MULT	X	
4348200000	Rail transportation	MULT	X	
4348300000	Water transportation	MULT	X	
4348400000	Truck transportation	ADD	X	
4348500000	Transit and ground passenger transportation	ADD		
4348600000	Pipeline transportation	MULT	X	
4348700000	Scenic and sightseeing transportation	MULT	X	
4348800000	Support activities for transportation	MULT	X	
4349200000	Couriers and messengers	MULT	X	
4349300000	Warehousing and storage	ADD	X	
4422000000	Utilities	MULT	X	
5051100000	Publishing industries, except Internet	ADD	X	
5051200000	Motion picture and sound recording industries	MULT	X	
5051500000	Broadcasting, except Internet	MULT	X	
5051700000	Telecommunications	MULT	X	
5051800000	Data processing, hosting and related services	MULT	X	
5051900000	Other information services	MULT	X	
5552100000	Monetary authorities - central bank	MULT	X	
5552200000	Credit intermediation and related activities	-	X	Indirect
5552210000	Depository credit intermediation	MULT	X	

5552211000	Commercial banking	MULT	X	
5552300000	Securities, commodity contracts, investments	MULT	X	
5552400000	Insurance carriers and related activities	MULT	X	
5552500000	Funds, trusts, and other financial vehicles	MULT	X	
5553100000	Real estate	MULT	X	
5553200000	Rental and leasing services	ADD	X	
5553300000	Lessors of nonfinancial intangible assets	MULT	X	
6054000000	Professional and technical services	-	X	Indirect
6054110000	Legal services	MULT	X	
6054120000	Accounting and bookkeeping services	ADD	X	
6054130000	Architectural and engineering services	MULT	X	
6054150000	Computer systems design and related services	ADD	X	
6054160000	Management and technical consulting services	MULT	X	
6055000000	Management of companies and enterprises	MULT	X	
6056100000	Administrative and support services	-	X	Indirect
6056130000	Employment services	ADD	X	
6056132000	Temporary help services	ADD	X	
6056140000	Business support services	ADD	X	
6056170000	Services to buildings and dwellings	MULT	X	
6056200000	Waste management and remediation services	ADD	X	
6561000000	Educational services	ADD	X	
6562100000	Ambulatory health care services	-	X	Indirect
6562110000	Offices of physicians	MULT	X	
6562140000	Outpatient care centers	MULT	X	
6562160000	Home health care services	ADD	X	
6562200000	Hospitals	MULT	X	
6562300000	Nursing and residential care facilities	-	X	Indirect
6562310000	Nursing care facilities	MULT	X	
6562400000	Social assistance	-	X	Indirect
6562440000	Child day care services	ADD	X	
7071100000	Performing arts and spectator sports	MULT	X	
7071200000	Museums, historical sites, zoos, and parks	MULT	X	
7071300000	Amusements, gambling, and recreation	ADD	X	

7072100000	Accommodation	MULT	X	
7072200000	Food services and drinking places	ADD	X	
8081100000	Repair and maintenance	MULT	X	
8081200000	Personal and laundry services	MULT	X	
8081300000	Membership associations and organizations	ADD		
9091100000	Federal, except U.S. Postal Service	MULT	X	
9091912000	U.S. Postal Service	MULT	X	
9092161100	State government education	ADD	X	
9092200000	State government, excluding education	MULT	X	
9093161100	Local government education	ADD	X	
9093200000	Local government, excluding education	ADD	X	Election adjustment ⁽³⁾

Seasonal Adjustment - AE AWH

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj	Easter/Labor Day adj
1000000000	Mining and logging	MULT			X
2000000000	Construction	MULT			X
3132100000	Wood products	MULT			
3132700000	Nonmetallic mineral products	MULT			
3133100000	Primary metals	MULT			X
3133200000	Fabricated metal products	MULT			X
3133300000	Machinery	MULT			X
3133400000	Computer and electronic products	MULT			X
3133500000	Electrical equipment and appliances	MULT			X
3133600000	Transportation equipment	MULT			X
3133600100	Motor vehicles and parts	MULT			X
3133700000	Furniture and related products	MULT			X
3133900000	Miscellaneous manufacturing	MULT			X
3231100000	Food manufacturing	MULT			X
3231200000	Beverages and tobacco products	MULT			X
3231300000	Textile mills	MULT			X
3231400000	Textile product mills	MULT			X
3231500000	Apparel	MULT			X

3231600000	Leather and allied products	MULT		X
3232200000	Paper and paper products	MULT		X
3232300000	Printing and related support activities	MULT		X
3232400000	Petroleum and coal products	MULT		
3232500000	Chemicals	MULT		
3232600000	Plastics and rubber products	MULT		X
4142000000	Wholesale trade	MULT	X	
4200000000	Retail trade	MULT	X	
4300000000	Transportation and warehousing	MULT	X	
4422000000	Utilities	MULT		
5000000000	Information	MULT	X	
5500000000	Financial activities	MULT	X	
6000000000	Professional and business services	MULT	X	X
6500000000	Education and health services	MULT	X	
7000000000	Leisure and hospitality	MULT	X	
8000000000	Other services	MULT	X	

Seasonal Adjustment - AE AHE

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj
1000000000	Mining and logging	MULT		
2000000000	Construction	MULT		
3100000000	Durable goods	MULT		
3200000000	Nondurable goods	MULT		
4142000000	Wholesale trade	MULT		X
4200000000	Retail trade	MULT		X
4300000000	Transportation and warehousing	MULT		X
4422000000	Utilities	MULT		
5000000000	Information	MULT		X
5500000000	Financial activities	ADD		X
6000000000	Professional and business services	ADD		X
6500000000	Education and health services	ADD		
7000000000	Leisure and hospitality	MULT		

8000000000	Other services	MULT	X
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Seasonal Adjustment Comparison - AE AOH

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj	Easter/Labor Day adj
3100000000	Durable goods	MULT			X
3200000000	Nondurable goods	MULT			X

Seasonal Adjustment - PE

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	Other adj
1000000000	Mining and logging	MULT	X	
2000000000	Construction	ADD	X	
3132100000	Wood products	ADD	X	
3132700000	Nonmetallic mineral products	ADD	X	
3133100000	Primary metals	ADD	X	
3133200000	Fabricated metal products	ADD	X	
3133300000	Machinery	ADD	X	
3133400000	Computer and electronic products	MULT	X	
3133500000	Electrical equipment and appliances	MULT	X	
3133600000	Transportation equipment	ADD		
3133600100	Motor vehicles and parts	ADD		
3133700000	Furniture and related products	ADD	X	
3133900000	Miscellaneous manufacturing	ADD	X	
3231100000	Food manufacturing	MULT	X	
3231200000	Beverages and tobacco products	ADD	X	
3231300000	Textile mills	MULT	X	
3231400000	Textile product mills	ADD	X	
3231500000	Apparel	MULT	X	
3231600000	Leather and allied products	MULT	X	
3232200000	Paper and paper products	MULT	X	
3232300000	Printing and related support activities	ADD	X	
3232400000	Petroleum and coal products	MULT	X	

3232500000	Chemicals	ADD	X
3232600000	Plastics and rubber products	ADD	X
4142000000	Wholesale trade	MULT	X
4200000000	Retail trade	MULT	X
4300000000	Transportation and warehousing	MULT	X
4422000000	Utilities	MULT	X
5000000000	Information	MULT	X
5500000000	Financial activities	MULT	X
6000000000	Professional and business services	MULT	X
6500000000	Education and health services	ADD	X
7000000000	Leisure and hospitality	ADD	X
8000000000	Other services	MULT	X

Seasonal Adjustment - PE AWH

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj	Easter/Labor Day adj
1000000000	Mining and logging	MULT	X		X
2000000000	Construction	ADD	X		X
3132100000	Wood products	MULT	X		X
3132700000	Nonmetallic mineral products	MULT	X		X
3133100000	Primary metals	MULT	X		X
3133200000	Fabricated metal products	MULT	X		X
3133300000	Machinery	MULT	X		X
3133400000	Computer and electronic products	MULT	X		X
3133500000	Electrical equipment and appliances	MULT	X		X
3133600000	Transportation equipment	MULT	X		X
3133600100	Motor vehicles and parts	ADD	X		X
3133700000	Furniture and related products	MULT	X		X
3133900000	Miscellaneous manufacturing	MULT	X		X
3231100000	Food manufacturing	MULT	X		X
3231200000	Beverages and tobacco products	MULT	X		X
3231300000	Textile mills	ADD	X		X

3231400000	Textile product mills	MULT	X		X
3231500000	Apparel	MULT	X		X
3231600000	Leather and allied products	ADD	X		X
3232200000	Paper and paper products	MULT	X		X
3232300000	Printing and related support activities	MULT	X		X
3232400000	Petroleum and coal products	MULT	X		X
3232500000	Chemicals	MULT	X		
3232600000	Plastics and rubber products	MULT	X		X
4142000000	Wholesale trade	MULT		X	X
4200000000	Retail trade	MULT		X	
4300000000	Transportation and warehousing	MULT		X	X
4422000000	Utilities	MULT	X		
5000000000	Information	MULT		X	
5500000000	Financial activities	MULT		X	
6000000000	Professional and business services	MULT		X	X
6500000000	Education and health services	MULT		X	
7000000000	Leisure and hospitality	MULT		X	
8000000000	Other services	MULT		X	X

Seasonal Adjustment - PE AHE

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj
1000000000	Mining and logging	MULT	X	
2000000000	Construction	MULT	X	
3100000000	Durable goods	ADD	X	
3200000000	Nondurable goods	MULT	X	
4142000000	Wholesale trade	MULT		X
4200000000	Retail trade	MULT		X
4300000000	Transportation and warehousing	MULT	X	
4422000000	Utilities	ADD	X	
5000000000	Information	MULT		X
5500000000	Financial activities	MULT		X
6000000000	Professional and business services	MULT		X

6500000000	Education and health services	ADD	X	
7000000000	Leisure and hospitality	MULT	X	
8000000000	Other services	MULT		X

Seasonal Adjustment Comparison - PE AOH

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	10/11 day adj	Easter/Labor Day adj
3100000000	Durable goods	MULT	X		X
3200000000	Nondurable goods	ADD	X		X

Seasonal Adjustment - WE

NAICS Tabcode	Tabcode title	Mode	4/5 week adj	Other adj
1000000000	Mining and logging	MULT	X	
1021000000	Mining	MULT	X	
2000000000	Construction	MULT	X	
3100000000	Durable goods	ADD	X	
3200000000	Nondurable goods	MULT	X	
4142000000	Wholesale trade	MULT	X	
4200000000	Retail trade	MULT	X	
4300000000	Transportation and warehousing	MULT	X	
4422000000	Utilities	MULT	X	
5000000000	Information	MULT	X	
5552000000	Finance and insurance	MULT	X	
5553000000	Real estate and rental and leasing	MULT	X	
6054000000	Professional and technical services	ADD	X	
6055000000	Management of companies and enterprises	MULT	X	
6056000000	Administrative and waste services	MULT	X	
6561000000	Educational services	ADD	X	
6562000000	Health care and social assistance	ADD	X	
7071000000	Arts, entertainment, and recreation	MULT	X	
7072000000	Accommodation and food services	ADD	X	

800000000	Other services	MULT	X	
909100000	Federal	MULT	X	
909200000	State government	ADD	X	
909300000	Local government	ADD	X	Election adjustment ⁽³⁾

⁽¹⁾ Seasonal adjustment occurs at the lowest available industry level.

⁽²⁾ Residential and nonresidential specialty trade estimates are raked to the specialty trade estimates to ensure consistency.

⁽³⁾ Special adjustment for the presence/absence of poll workers in local government.

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