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A Working Paper Presenting a Profile of Revisions in the Current Employment Statistics program

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Abstract

The Current Employment Statistics (CES) survey, conducted by the U.S. Bureau of Labor Statistics, is a large monthly survey of businesses that produces timely estimates of employment, hours, and earnings by industry and geographic area. The survey produces estimates about three weeks after the week that includes the 12th of the month, and then produces revised estimates for the same reference period as additional responses for that reference period are collected over the next two months. This paper examines the distribution of response by several characteristics, and provides profiles of monthly revisions at the national, state, and metropolitan area level.

Key words: Bureau of Labor Statistics, Current Employment Statistics, response, revisions

1. Background

The U.S. Bureau of Labor Statistics' (BLS) Current Employment Statistics (CES) survey¹ is a monthly business survey that produces timely estimates of employment, hours, and earnings, by industry, for the nation and for states and metropolitan areas. Participating businesses provide data monthly for the pay period that includes the 12th day of the month. Preliminary estimates are published about 3 weeks after the week that includes the 12th of the month, with revised estimates published the following two months. These data are among the first indicators of the health of the U.S. economy at the national, state, and local levels. These statistics are highly valued because preliminary estimates are available very close to the reference period. In order to provide the best estimates possible, the BLS continues to collect data for a reference period for two months following its initial release, and publishes revised estimates that incorporate those additional reports.

Revisions are a design feature of the CES program. There are three sources of revisions for seasonally adjusted data. First, the national data for a particular reference period are revised twice in succession because more responses for that reference period have been collected. State and metropolitan area data are revised in a similar manner, although only once. The second source of revisions to national estimates is due to the use of a concurrent seasonal adjustment process. That is, each month the data are seasonally adjusted with all of the data collected to date. So, for example, the first release of January data is produced using all the data up to and including the preliminary January data. In February, the seasonal adjustment uses the February first release data, and includes revised January data, to calculate (not seasonally adjusted) estimates and new seasonal factors for December, January, and February. Finally, in March, seasonal adjustment is rerun to include preliminary March data, revised February data, and the final January data, to calculate new seasonal factors for January, February, and March. Concurrent seasonal adjustment is being considered for state and metropolitan area data, but it is not yet implemented; therefore, seasonal factors are not recalculated on a monthly basis for these data. Instead, seasonal factors for state and area data are generated once per year using an ARIMA X-12 forecast.

¹ See the end of the paper for references to additional information about the CES survey.

The third reason for revisions to the CES data is the annual benchmarking process. Once a year the estimates are adjusted so that the March data align with population totals. These totals are derived primarily from aggregated Unemployment Insurance reports collected in a federal/state cooperative program by the BLS' Quarterly Census of Employment and Wages (QCEW) program. Along with updates to the population totals, seasonally adjusted estimates are updated for the past 5 years for both national and state data. This paper focuses on revisions of the first type – revisions caused by the collection of additional data for a particular reference period. Note, however, that in some months these effects are commingled. For example, the December 2nd release of state estimates of over-the-month change includes benchmark effects while the 1st release estimates do not.

This document first presents an analysis of revisions at the national level by various characteristics and time periods, for not seasonally adjusted data, and provides a profile of national revisions. It then compares revisions to state estimates over several time periods, and provides a profile of recent revisions at the state and metropolitan area levels.

2. Response Characteristics

This section presents an analysis of response by several characteristics that might lead to revisions. The analyses compare the distribution of collection rates² at National 1st, 2nd, and 3rd closing by various characteristics. The term 'closing' refers to the cutoff of data collection associated with a particular release of estimates. Therefore, 1st closing is associated with the first release of data for a reference period, while the 2nd closing is associated with the 2nd release of data for that reference period. The state 2nd (final) closing typically falls after the national 2nd closing and before the 3rd. Since very little microdata are collected between 2nd and 3rd closing, the characteristics examined below for national closings are a good proxy for state and area closings. A response analysis based on unweighted sample reports would treat each report as equally important, regardless of the impact it may have on an estimate, while an analysis by weighted employment highlights the *potential* impact the report may have on the estimate. Note, however, that a report with a large *potential* impact on a revision may have little to no impact if it reports the same over the month trend as reported in aggregate by other responding units at a prior close. The response analyses in this paper are based on weighted employment.

The analysis examines method of collection, industry, employment size, geography, length of pay period, and single or multiple payrolls as characteristics that might potentially impact collection rates, and hence revisions. In the following tables, the collection rates at 1st closing (or publication) pertain only to the reports collected up to that point; over the last five years the survey has collected about 71 percent of the data by the 1st closing. The collection rates presented in the 2nd closing column portray only the responses received after the 1st closing up to the 2nd closing; this has averaged about 20 percent of the data, for a total of about 91 percent collected by this closing. The collection rates presented in the 3rd closing column represent only the responses received after the 2nd closing up to the 3rd closing; this has averaged about 2.4 percent over the last five years. The collection rates presented in the "All Closings" column represent the responses received for all closings, 1st through 3rd, and provide a final response distribution to compare the partial-response distributions against. Data from 2003 – 2012 were used. In 2003 probability sampling was fully implemented in the program, and the data were converted from a Standard Industrial Classification basis to the North American Industry Classification System; older data are not fully comparable.

² Collection rate is similar to response rate, except that it excludes businesses in the sample that are permanent refusals.

Method of Collection

CES data collection is multi-modal, that is, multiple methods of collection are used to facilitate the respondent's ease of reporting. The first analysis examines the distribution of response by method of collection.

Based on weighted employment there is a substantial shift in the distribution of collection rates by Collection Method at second closing. This shift is caused by a proportionally large increase in the weighted employment reported by Touchtone Data Entry (TDE) & State Collected units and by Electronic Data Interchange (EDI) units at second close, and by a decrease in employment reported by Computer Assisted Telephone Interviews (CATI). At third close the weighted employment reported by EDI drops, and the proportion of employment reported by CATI increases.

We have no reason to believe that revisions in over the month trends are associated specifically with the method of data collection. If a large company, such as those associated with EDI, report differently than other businesses then they can contribute to revisions; however, this is due to the size of the company, rather than the method used to collect the data.

**Table 1. Distribution of Collection Rates by Collection Method and Closing
Based on Weighted Employment**

Collection Method	1st Closing	2nd Closing	3rd Closing	All Closings
CATI	22.9%	12.1%	22.0%	20.9%
EDI	8.5%	15.1%	4.2%	9.6%
Web	43.9%	40.4%	41.2%	43.2%
TDE & State Collected	11.9%	19.0%	18.8%	13.4%
Other	12.8%	13.4%	13.8%	12.9%
	100.0%	100.0%	100.0%	100.0%

Industry

The next analysis examines response by industry.

Based on weighted employment and industry, the distribution of collection rates at first, second, and third release do exhibit differences. This is primarily due to substantial proportional increases in response in all sectors of the government.

**Table 2. Distribution of Collection Rates by Industry and Closing
Based on Weighted Employment**

Industry	1st Closing	2nd Closing	3rd Closing	All Closings
Natural Resources and Mining	0.5%	0.2%	0.1%	0.4%
Construction	4.5%	1.4%	0.4%	3.1%
Manufacturing	9.7%	4.2%	1.1%	6.9%
Wholesale Trade	4.5%	1.8%	0.6%	3.2%
Retail Trade	12.2%	5.8%	1.0%	8.7%
Transportation & Warehousing	3.2%	1.2%	0.3%	2.3%

Utilities	0.4%	0.3%	0.1%	0.3%
Information	1.8%	0.9%	0.2%	1.3%
Financial Activities	6.2%	2.4%	0.6%	4.3%
Professional & Business Services	12.0%	5.7%	1.6%	8.7%
Education & Health Services	15.9%	8.6%	2.0%	11.8%
Leisure & Hospitality	8.5%	4.5%	1.1%	6.3%
Other Services	3.1%	1.1%	0.3%	2.1%
Federal Government	2.4%	9.9%	14.3%	6.2%
State Government	3.6%	15.8%	23.9%	9.9%
Local Government	11.5%	36.2%	52.6%	24.4%
Totals	100.0%	100.0%	100.0%	100.0%

In general, the distribution itself does not provide any real evidence to support a proposition that differing collection rates by industry would lead to revisions. This is particularly the case because the sample is weighted at the industry level, and estimates are produced by industry and aggregated to summary levels. As shown above, however, a large proportion of government employment comes in after the initial release. Government education units can cumulatively have very large over the month changes, on the order of about a million jobs in certain months nationally. This is because of seasonal increases and decreases due to the opening and closing of schools. We impute for the largest of these units at the initial release when they don't arrive in time for a closing, and utilize the reported data in later releases when they arrive. If imputed changes differ substantially from reported changes for these imputed reports, this can lead to large revisions in this industry.

Employment Size Class

The next analysis is by employment size class.

Table 3. Distribution of Collection Rates by Employment Size Class and Closing Based on Weighted Employment

Size	1st Closing	2nd Closing	3rd Closing	All Closings
0-4	10.0%	4.6%	7.4%	8.9%
5-9	6.7%	3.9%	5.2%	6.1%
10-19	10.2%	6.5%	8.2%	9.5%
20-49	8.2%	6.1%	7.4%	7.8%
50-99	10.8%	8.8%	10.3%	10.4%
100-249	8.3%	7.6%	8.0%	8.2%
250-499	7.9%	8.0%	7.8%	7.9%
500-999	23.6%	26.8%	21.6%	24.2%
1000+	10.2%	24.6%	19.4%	13.0%
Blank	4.1%	3.0%	4.7%	3.9%
	100.0%	100.0%	100.0%	100.0%

The distributions of collection rates by employment size class, based on weighted employment, are somewhat different after the first closing. The largest size class (1,000+) has a substantial increase in proportional response at 2nd and 3rd closing, and that leads to a downward shift in the proportional response for other size

classes. There is no indication that a change in the size class response distribution by closing would lead to employment revisions. Furthermore, we have no reason to believe that late reporters in a particular size class would systematically report differently than earlier reporters in that size class. Note, however, that much of the employment in the largest size class is government employment. If these large establishments exhibit economic behavior different from the smaller establishments, then the smaller establishments may not do a good job of representing larger ones that don't report in time for the first release of estimates. Because of these issues, the imputation issues noted for the industry distribution are relevant here as well.

Geographic Region

The next analysis is by geographic region. Note that the regions are defined as shown in the table below.

Midwest Region	North Region	South Region	West Region
Illinois	Connecticut	Arkansas	Alaska
Indiana	Maine	Delaware	Arizona
Iowa	Massachusetts	District of Columbia	California
Kansas	New Hampshire	Florida	Colorado
Michigan	New Jersey	Georgia	Hawaii
Minnesota	New York	Kentucky	Idaho
Missouri	Pennsylvania	Louisiana	Montana
Nebraska	Rhode Island	Maryland	Nevada
North Dakota	Vermont	Mississippi	New Mexico
Ohio	Alabama	North Carolina	Oregon
South Dakota		Oklahoma	Utah
Wisconsin		South Carolina	Washington
		Tennessee	Wyoming
		Texas	
		Virginia	
		West Virginia	

Table 4. Distribution of Collection Rates by Geographic Region and Closing Based on Weighted Employment

Region	1st Closing	2nd Closing	3rd Closing	All Closings
Midwest	23.2%	20.9%	20.0%	22.7%
North	18.5%	14.5%	16.8%	17.7%
South	35.7%	36.6%	36.8%	35.9%
West	22.5%	28.0%	26.4%	23.6%
	100.0%	100.0%	100.0%	100.0%

The response distributions by geographic region, based on weighted employment, are very similar at each closing. There is no indication that these minor changes in distribution by closing would lead to over the month revisions. Further, we have no reason to believe that reporters in different regions would have different trends at later releases than they would for the initial release.

Length of Pay Period

The next analysis is by length of pay period³.

Table 5. Distribution of Collection Rates by Length of Pay Period and Closing Based on Weighted Employment

Length of Pay Period	1st Closing	2nd Closing	3rd Closing	All Closings
Each Week	40.8%	42.1%	42.2%	41.8%
Every Two weeks	41.5%	40.3%	40.3%	40.6%
Twice a Month	13.7%	12.8%	12.8%	13.0%
Once a Month	4.1%	4.8%	4.8%	4.6%
	100.0%	100.0%	100.0%	100.0%

The distributions by length of pay period, based on weighted employment, are very similar at each closing. Therefore, there is no indication that response differences based on this characteristic lead to over the month revisions.

Single or Multiple Payrolls

The final analysis is by single and multiple payrolls; some businesses keep separate payroll reports, for example, for salaried and hourly workers.

Table 6. Distribution of Collection Rates by Multi-Pay and Closing Based on Weighted Employment

Multiple Payrolls	1st Closing	2nd Closing	3rd Closing	All Closings
No	95.2%	95.2%	95.1%	95.2%
Yes	4.8%	4.8%	4.9%	4.8%
	100.0%	100.0%	100.0%	100.0%

The distributions of collection rates for single and multiple payroll reporters, based on weighted employment, are very similar at each closing. Therefore, there is no indication that response differences based on this characteristic lead to revisions in employment estimates.

In summary, this response analysis does identify substantial differences in the distribution of late responders by method of collection and by industry. Minor differences are identified for the other variables included in this response analysis; employment size class, geographic region, length of pay period, and single / multiple payrolls. The differences in distribution by method of collection, except for Electronic Data Interchange (EDI), are not known to be associated with revisions. The EDI units are very large multi-state multi-worksite companies. Given their size they may have a substantial influence on an industries employment change if their over-the-month change is different from the industry average. Differences in response by industry are mostly caused by later responses in the government sector. In both cases, if a large business reports at a later closing differently than the imputed value for that report, then that difference can lead to revisions.

³ Note that a subset of businesses provide CES with the length of the pay period; this is businesses that also provide hours and earnings data to the program.

3. Profile of National Revisions

This section presents a profile of national revisions, using data from January 2003 through November 2012.

3.1 General Profile of National Revisions

The revisions for national Total Nonfarm (TNF) employment, from 1st to 3rd release, are typically small and are centered near zero. At the 75th percentile, the absolute size of revisions is 66,000 which is 0.05 percent of TNF employment. Therefore, 75 percent of the national revisions to TNF employment are 0.05 percent of TNF employment or less. At the 95th percentile, the absolute revision is 129,000, which is about 0.10 percent of TNF employment⁴. For most surveys this would be an astonishing level of accuracy – but the statistic of most interest is not the level of TNF, but rather the over-the-month (OTM) change to that level. The OTM change to the level is, of course, much smaller; it has ranged in absolute value from 0 to 830,000 (seasonally adjusted) from January 2003 through November 2012.

Table 7. National Distribution of Absolute Revision (from 1st to 3rd release) of Total Nonfarm (TNF) employment, as a Percentage of TNF employment

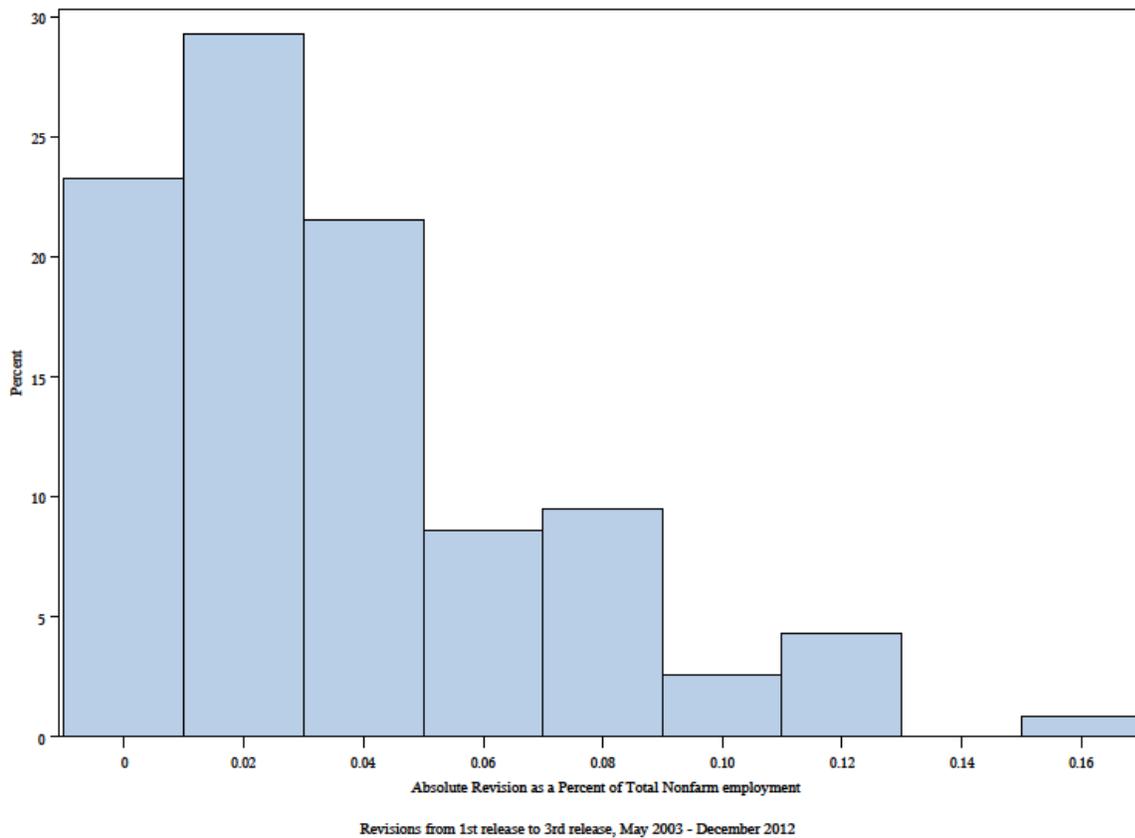
Percentile	Absolute Revision (in thousands)	%TNF
25	15	0.01%
50	38	0.03%
75	66	0.05%
90	115	0.09%
95	129	0.10%
99	169	0.13%

Another way to display this is with a histogram of the distribution of absolute revisions as a percent of Total Nonfarm employment.

As seen in the charts below, about 96 percent of the absolute revisions from 1st to 3rd release are less than 0.1 percent of Total Nonfarm employment.

⁴ National Total Nonfarm (TNF) annual average employment for 2012, not seasonally adjusted, was 133,739,000.

Chart 1. Distribution of National absolute revisions



Another way to characterize revisions is to present the revisions as they relate to the standard error of the 1-month change. Note that this is not a measure of the standard error of the revision, but rather how the revision relates proportionally to a measure of reliability for the survey-based estimate. The ratio of the revision to the standard error can serve as a measure of relative importance of the size of a revision – if a revision is about the size of a significant OTM change at a high level of confidence, then the revision might be characterized as ‘large’. A ‘large’ revision is one that substantively changes the picture of the state of the economy for a reference period, after considering the reliability of the estimate.

Table 8. National data – proportion of revisions compared to standard error of OTM change

Standard Errors	OTM employment change significant at the specified level of confidence	Proportion of revisions ≤ this value
1.282 (80% Confidence Interval)	71,000	60.7%
1.645 (90% Confidence Interval)	92,000	78.6%
1.960 (95% Confidence Interval)	109,000	93.2%
2.576 (99% Confidence Interval)	144,000	95.7%

As shown in Table 8, if we were to use a 95 percent level of confidence as a yardstick, we would identify a revision of 109,000 or greater as ‘large’. About 93 percent of the revisions during the period studied would not be classified as large under this definition. If we were to set the measure using a 90 percent level of confidence,

then we would identify a revision of 92,000 or greater as ‘large’; about 79 percent of the revisions during this period would not be classified as large using this definition.

3.2 Profile of National Revisions for selected time periods

This section presents a profile of national revisions, using data from January 2003 through November 2012, for time periods defined as expansions and contractions by the CES Total Nonfarm series. The time periods examined are defined as follows.

Time Period	Dates	Expansion or Contraction
1	September 2003 – January 2008	Expansion
2	February 2008 – February 2010	Contraction
3	March 2010 – December 2012	Expansion

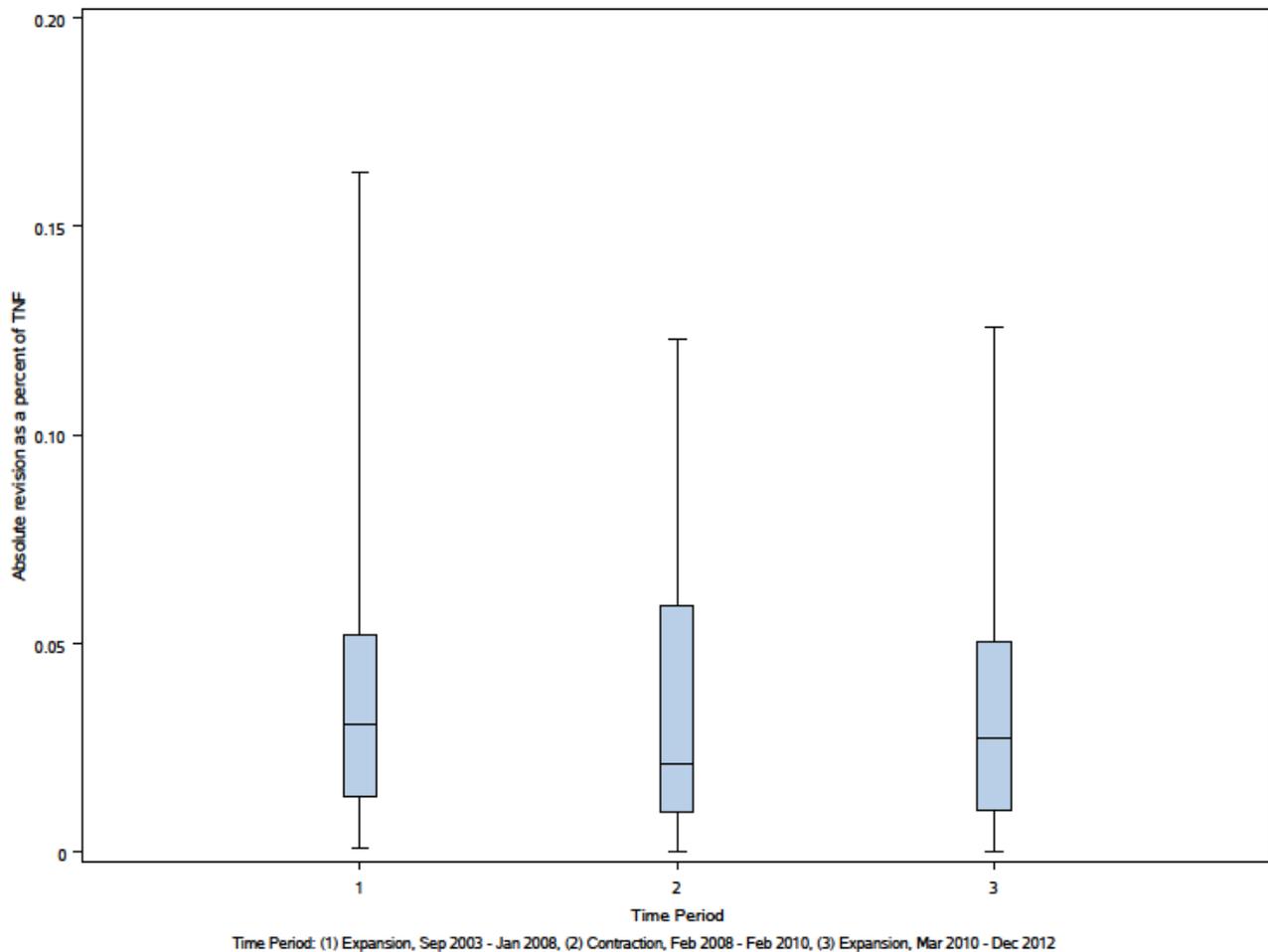
December 2012 is not the end of the final expansion period; rather it is the endpoint of the data for this analysis.

Table 9. Percentile distribution of national absolute revisions to Total Nonfarm employment as a percent of TNF, by Time Period

Time Period	Percentiles					Max
	25th	50th	75th	90th	95th	
1	0.01	0.03	0.05	0.08	0.12	0.16
2	0.01	0.02	0.06	0.09	0.09	0.12
3	0.01	0.03	0.05	0.09	0.13	0.13

The information in Table 9 can also be depicted as boxplots; see below.

Chart 2. Distribution of revisions to Total Nonfarm (TNF) as a percent of TNF employment



As shown in the table and by the boxplots above, the absolute revisions for these time periods are similar. The middle period – from February 2008 through February 2010 – has a bit broader inter-quartile range for the over-the-month revisions than the two expansionary periods.

4. State Revisions

4.1 A Comparison of State Revisions Over Time

State CES estimates are produced using the same sample reports as the national estimates; however, the data collection period for state estimates is a few days longer than it is for the national estimates. State CES revisions include the same revision sources as national CES data, except for the use of a concurrent seasonal adjustment procedure.

The state and metropolitan area part of the CES program has undergone a number of substantive procedural changes in the past few years, so we evaluate whether those changes had a substantial impact on the average size

of revisions. Prior to April 2011 these CES estimates were produced by state government staff in State Workforce Agency offices in cooperation with the BLS⁵. There were several procedural changes in the estimates production and review process that led up to the transition of production responsibility to BLS. In December 2008, the program implemented a more rigorous estimates review procedure, which required states to document and obtain approval for an estimate that deviated significantly from an independently developed, un-reviewed sample-based estimate. In November 2009, BLS implemented a refined version of that process, implemented within the estimation software. In April 2011, BLS assumed responsibility for the production of state and metropolitan area CES data.

The first analysis of these state data examines revisions across these different periods. For the analysis we take as the baseline the revisions produced by state staff from January 2003 through November 2008.

Table 10. Absolute revisions from 1st release to 2nd release for State’s Total Nonfarm (TNF) employment, as a percentage of TNF

Median of State’s median absolute percent revisions		Absolute Percentage Revision
State Estimates: Original Procedures	Jan 2003 - Nov 2008	0.06
Simulated Estimates (1)	Jan 2003 - Nov 2008	0.09
New Review Procedures (2)	Dec 2008 - Oct 2009	0.08
New Procedures in ACESWeb (3)	Nov 2009 - Feb 2011	0.08
BLS Producing Estimates (4)	Mar 2011 - Mar 2013	0.07
Simulated Estimates (1)	Mar 2011 - Mar 2013	0.08

(1) Simulated estimates are for Total Private industries, others are for Total Nonfarm

(2) Implementation of new review procedures began outside of the (ACESweb) processing system with the November 2008 final estimates

(3) Implementation of refined robust procedures in ACESweb implemented with October 2009 final estimates

(4) Estimates production transitioned from states to BLS with the production of March 2011 preliminary estimates

Table 10 provides a comparison of the median of the state’s median absolute revisions⁶ for different time periods. The first two rows compare state published revisions with a set of simulated revisions. The simulated revisions include an automated procedure to identify outliers, compared to a manual procedure utilized at this time by the states. The simulated estimates also include an imputation for key non-respondents, which was informally and manually utilized in the estimates during this period. For industry super-sectors where it is currently used, the Faye-Herriot estimator was used to produce the simulated estimates. The simulated estimates exclude adjustments for local events not captured in the sample (e.g. a strike); however, while these adjustments would impact the quality of the estimate, they would have little if any effect on the revision to the over-the-month change. The causes of differences between the published and simulated revisions during the first time period are not fully understood, but there are several potential issues. The data sets used to create the simulated estimates are unlikely to be exactly what the states used – different data may have been included or excluded. Also, the set of reports identified as atypical may have been different in each case; atypical reports are reweighted to account only for themselves. In many cases, states applied ad-hoc adjustments in an effort to improve the estimates – these ad-hoc adjustments were not included in the simulated estimates.

⁵ For more information see *References*, item [4].

⁶ For Table 10, first each State’s median revision was calculated, and then the median of that set of median revisions was identified. The result is very close to an overall median, but ensures that each state median is part of the final calculation.

Simulated estimates were also prepared for the more recent time period being reviewed. Simulations for the more recent period, in addition to the adjustments and models mentioned above, include an adjustment to account for differential response rates. This procedure reweights reports to account for differences in industry response rates. The inclusion of this adjustment is expected to have a minor impact on the overall results. Simulated estimates for the most current period are closer to the published estimates than simulated estimates for the earlier period. This is not surprising, as both the published and the simulated estimates utilize an automated procedure to identify and reweight outliers, both use an imputation for key non-respondents, both utilize the Faye-Herriot estimator for smaller super-sectors, and both utilize an adjustment to account for differential response rates.

During the periods when the estimation process was being modified, BLS worked closely with state staff to identify the types of ad-hoc adjustments that states had periodically incorporated into the estimation process to account for unusual events and results. BLS now has standardized procedures that account for the adjustments that were found to be statistically sound and that state staff believed were most important. BLS continues to work with state staff via the Workforce Information Council and the CES Policy Council to explore additional improvements to the estimation process.

The data in Table 10 show that there was a noticeable increase in the median of the state's median absolute revisions for the set of statewide Total Nonfarm estimates, from the base time period to the following time periods. This is most noticeable during the periods when the procedures were evolving – the revisions are now similar in size to those made during the use of the original procedures.

It is also informative to examine these distributions in graphical form. The boxplots in Chart 3 below show that these are distributions with long tails. In the first time period, we see the tail extends to an absolute revision of about 4.5 percent and in the latest period it extends to a value near 4 percent. These values represent outliers. In order to better see the main body of the distribution, the absolute values of the revisions were censored at a value of 0.2 percent; the censored distributions are presented in Chart 4.

Chart 3. Distribution of absolute revisions from 1st to 2nd release of Statewide Total Nonfarm employment

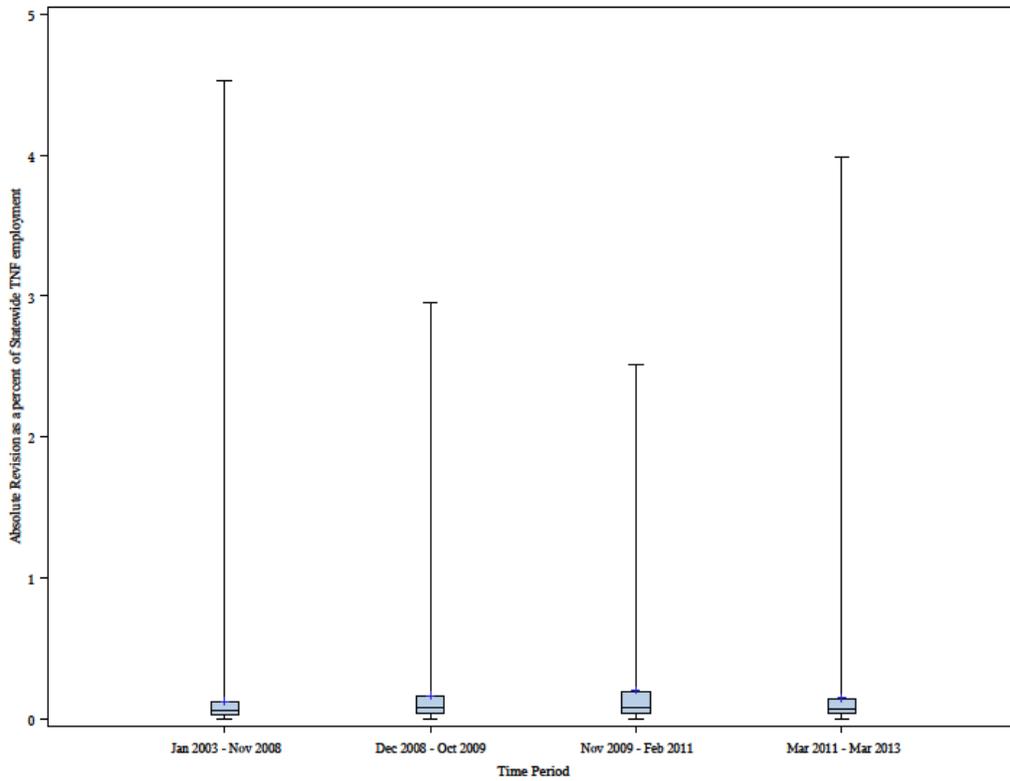
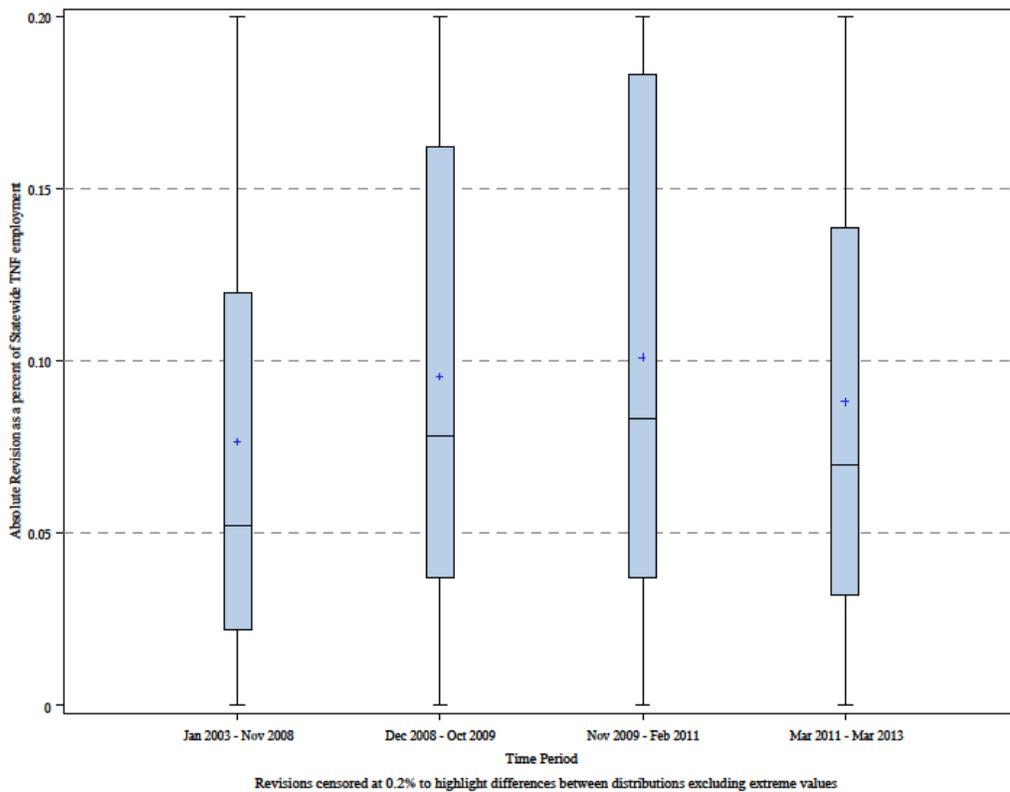


Chart 4. Distribution of absolute revisions from 1st to 2nd release of Statewide Total Nonfarm employment



The censored distributions in Chart 4 make it is easier to see the major features of these distributions, including the mean, and the 25th, 50th, and 75th percentiles. The mean is represented by the “+”, the 25th percentile is the lower edge of the box, the median is the line inside the box, and the 75th percentile is the upper edge of the box. The distribution for the current period is shifted to marginally higher values for these key percentiles than is the distribution for the base time period, but the values are similar, and are lower than the values observed during the two periods where procedures were being actively developed. The improvement can be attributed in large part to incorporation of estimation features to account for nonresponse of key sample members (who may then report in time for the second estimate) and to account for extreme macro outliers. In the latter procedure, if the over-the-month (OTM) employment change exceeds pre-determined parameters and is unlike similar OTM estimates in other areas, a composite (sample plus model) estimate is used in place of the sample-based estimate.

Given the marginal increase in TNF revisions between the first time period and the current period, an examination of the distributions by industry super-sector might help to identify if any particular super-sector is the major source of the increased size of revisions at the total nonfarm level.

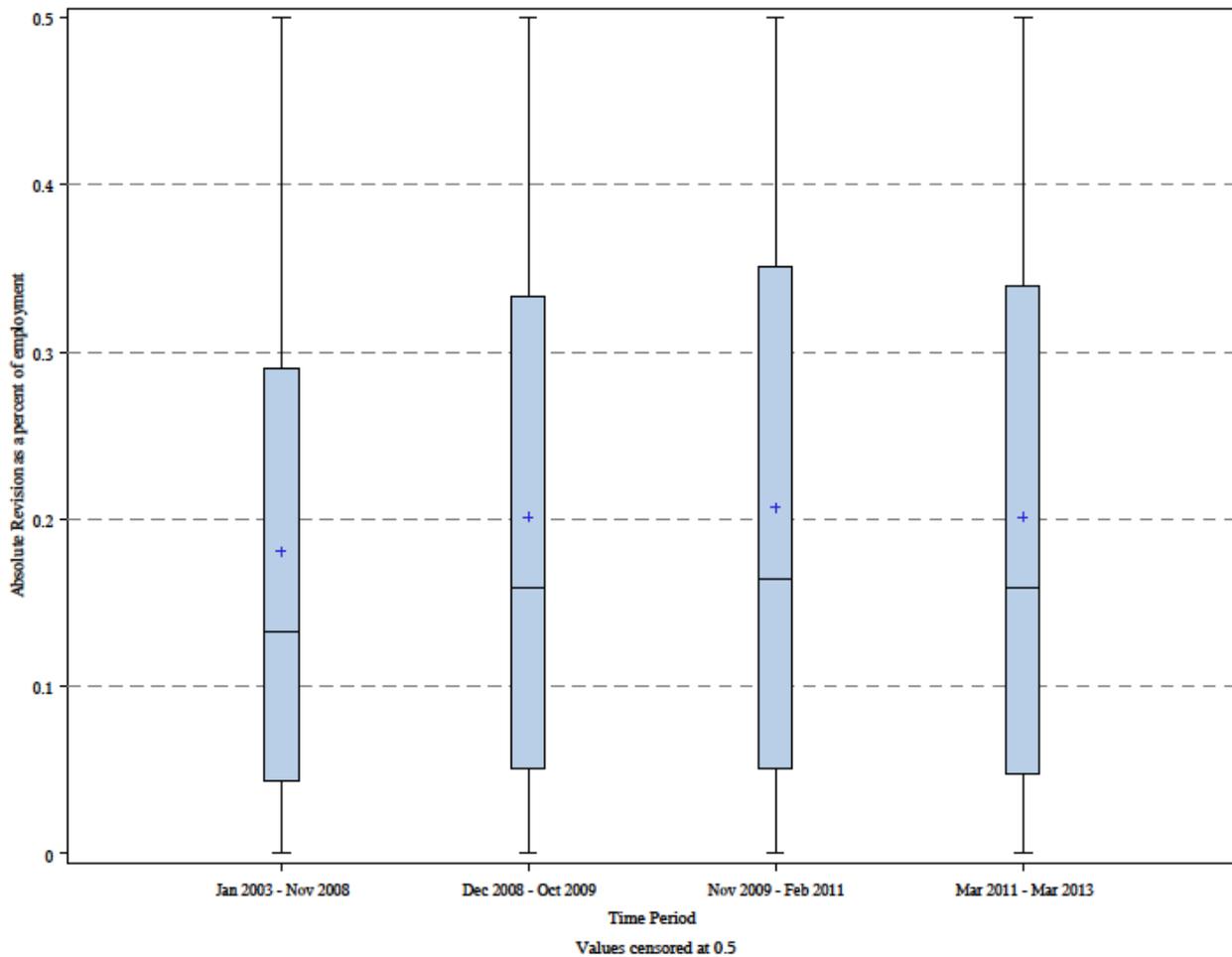
Table 11. Percentile distribution of absolute revisions from 1st to 2nd release, by industry, for initial and current time periods

Industry	Percentiles											
	Jan 2003 – Nov 2008						Mar 2011 – Mar 2013					
	P25	P50	P75	P90	P95	P99	P25	P50	P75	P90	P95	P99
Mining & Logging	0.0	0.0	0.9	2.9	5.0	5.0	0.0	0.0	1.4	5.0	5.0	5.0
Construction	0.1	0.2	0.6	1.4	2.6	5.0	0.1	0.3	0.7	1.3	2.7	5.0
Manufacturing	0.0	0.1	0.3	0.8	1.4	3.9	0.0	0.1	0.3	1.3	5.0	5.0
Trade, Transp. & Utils	0.2	0.5	1.2	2.5	4.3	5.0	0.2	0.6	1.1	2.5	4.7	5.0
Information	0.0	0.1	0.6	1.4	2.5	5.0	0.0	0.2	1.6	5.0	5.0	5.0
Finance	0.0	0.1	0.3	0.7	1.1	3.2	0.0	0.1	0.3	0.8	1.8	5.0
Prof. & Bus. Services	0.0	0.1	0.3	0.7	1.3	4.3	0.1	0.2	0.4	1.0	1.7	4.4
Education & Health	0.0	0.1	0.2	0.5	0.8	1.9	0.1	0.1	0.3	0.7	1.6	5.0
Leisure & Hospitality	0.0	0.1	0.3	0.7	1.2	3.1	0.1	0.2	0.4	0.9	1.8	4.7
Other Services	0.0	0.1	0.4	0.9	1.4	4.3	0.0	0.2	0.5	1.0	1.9	5.0
Government	0.0	0.1	0.3	0.6	1.0	2.2	0.0	0.1	0.3	0.8	1.5	3.0

In Table 11 we see minor differences in most industries between these two time periods; these minor differences tend to be small increases in the absolute size of revisions in the current time period. However, two industries appear to have a substantial increase in absolute revisions between the initial time period and the current time period: *Mining and Logging*, and *Information*. For these two industries the size of revision at the 75th and 90th percentiles are substantially larger in the current time period. *Manufacturing* has the upper end of the revisions distribution more skewed toward large revisions in the current timeframe than in the initial period; a 1.4 percent revision was found at the 95th percentile in the base period and a 1.3 percent revision was found at the 90th percentile in the current period.

Similar to the statewide data, an examination of the absolute value of revisions to Total Nonfarm employment between the 1st release and the 2nd release for Metropolitan Statistical Areas (MSAs) shows a modest increase in the size of revisions from the initial period to the current period.

Chart 5. Distribution of MSA absolute revisions as a percent of employment



With the production of March 2011 estimates in April 2011, BLS assumed responsibility for the production of state and MSA estimates, and in doing so completed the implementation of new estimation and review procedures. The new procedures include a methodology that automatically identifies and accounts for outliers based on statistical criteria, automated imputation procedures that account for key non-respondents⁷, and consistent and transparent procedures to account for other non-sample adjustments (e.g. to account for a strike in businesses not in the survey). Based on this analysis of revisions over time, we conclude that, on average, the newly implemented procedures result in published revisions that are somewhat larger on average than those published during the baseline period. It appears that state-produced estimates included ad-hoc adjustments – currently undefined – that resulted in somewhat smaller revisions to the over-the-month change. However, BLS is confident that the current procedures produce estimates (and revisions) that reflect the properties of the

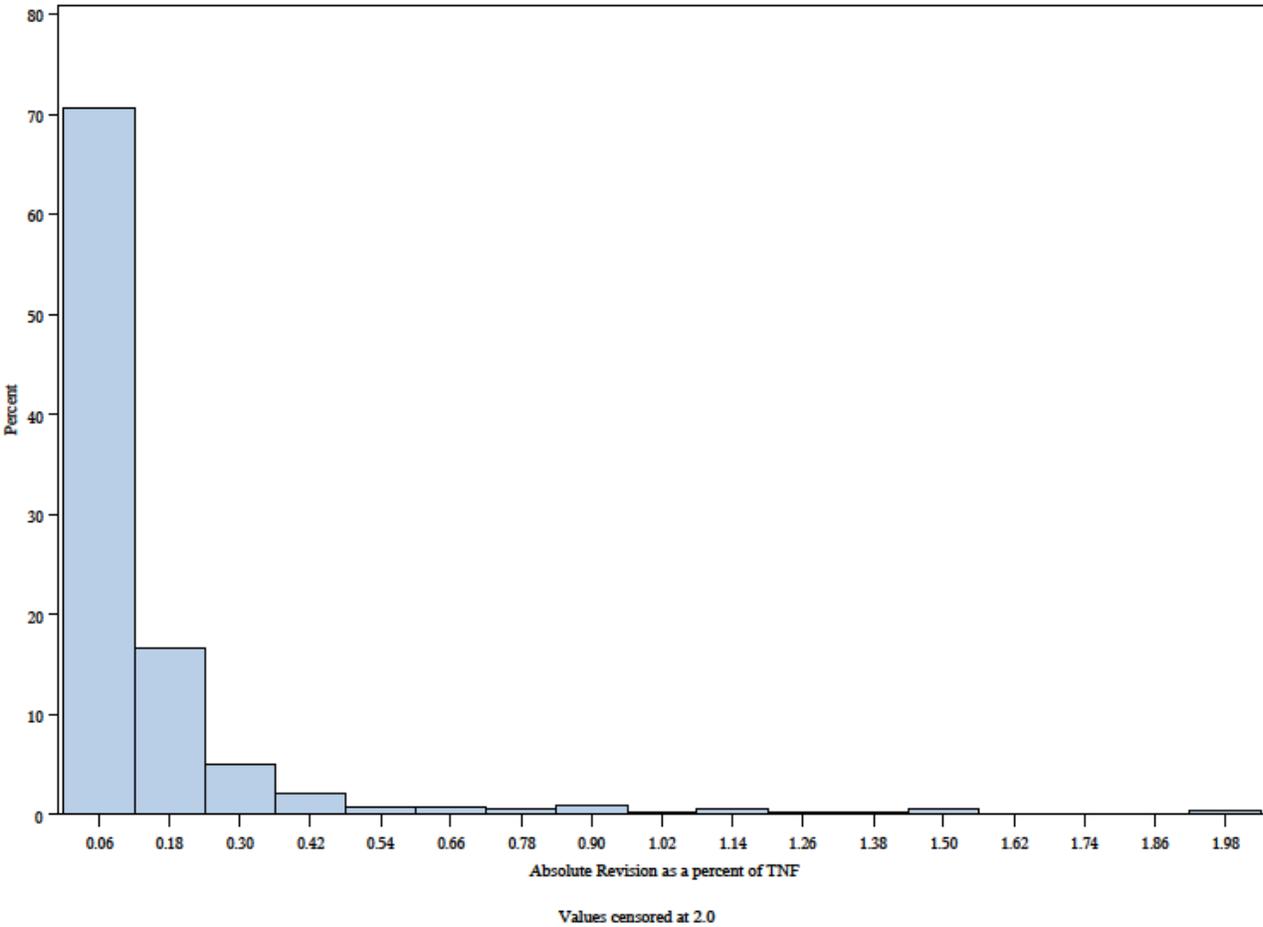
⁷ Kennon Copeland and Lan Pham’s research – *References* item [5] – laid the groundwork for the key non-respondent imputation procedure implemented by CES.

collected sample data, incorporating only well documented and transparent adjustments to account for non-sample factors. BLS continues to work with state staff, through the Workforce Information Council (WIC) and the CES Policy Council, to utilize their experience with these data to identify and prioritize research to improve the estimation and imputation procedures for the survey.

4.2 Profile of State Revisions to Total Nonfarm Employment

This section will provide a profile of state revisions, from the more recent period. First, we will take a look at revisions over this period as a percent of employment. The following chart includes estimates for statewide Total Nonfarm (TNF) employment.

Chart 6. Distribution of Statewide absolute revisions to Total Nonfarm as a percent of employment



The absolute percent revisions to statewide Total Nonfarm employment tend to be small, with the majority of revisions smaller than 0.1 percent of employment, and about 90 percent of the revisions less than 0.3 percent. Note, however, that there are a few revisions that are large, exceeding 2 percent of the associated employment level.

Table 12. Comparison of national and State distributions of absolute revisions, for total nonfarm (TNF) employment.

Percentile	National %TNF	State %TNF
25	0.01%	0.03%
50	0.03%	0.07%
75	0.05%	0.14%
90	0.09%	0.29%
95	0.10%	0.56%
99	0.13%	1.50%

In the table above we compare national and state absolute revisions to the total nonfarm estimate, as a percentage of total nonfarm employment. In this comparison state revisions tend to be larger than national revisions as a percentage of the associated employment. This is not unexpected. While the national and state estimates are independently derived at different points in time, one can still conceive of the national revision as approximating a sum of revisions to state data, with some of those revisions offsetting others. That is, some of the individual state revisions would be positive in a given month, and some would be negative, so the net revision would be smaller than the absolute sum of those revisions. Therefore, it is not surprising that national revisions tend to be smaller from this perspective than state revisions.

Another way to evaluate state revisions, as was done with the national revisions, is to see how they relate to the standard error of the change in employment. A revision of any size changes the level of significance of the OTM change; a larger revision has a correspondingly larger effect on the level of significance. If the revision to the state data is larger than a significant over-the-month change, then we might appropriately label the revision as ‘large’. As with national data, a large revision is one that alters the data user’s evaluation of the state of the economy, after taking into the account the level of reliability of the survey estimates.

Table 13. National and State absolute revisions for total nonfarm (TNF) employment – proportion of revisions compared to standard error of OTM change

National Standard Error	State Standard Error	Proportion of revisions ≤ this value
0.3	0.2	25%
0.7	0.3	50%
1.2	0.6	75%
2.1	1.3	90%
2.3	2.4	95%
3.0	5.0	99%

Table 13 presents information on how the revision between the 1st and 3rd release of national estimates compares to the revision between the 1st and 2nd release of state estimates of Total Nonfarm employment. The distributions are quite similar, with the exception that the most extreme values are larger for state revisions. Nearly 90% of the revisions for state estimates are less than the size of the standard error associated with the over-the-month change in employment. In general, we would not label these revisions as “large”. A small number of state estimates – about 5 percent –experienced revisions during this time period that would be labeled as large. Similarly, about 5 percent of national revisions would be labeled as large.

4.3 Profile of State Revisions to Industry Super-Sector Employment

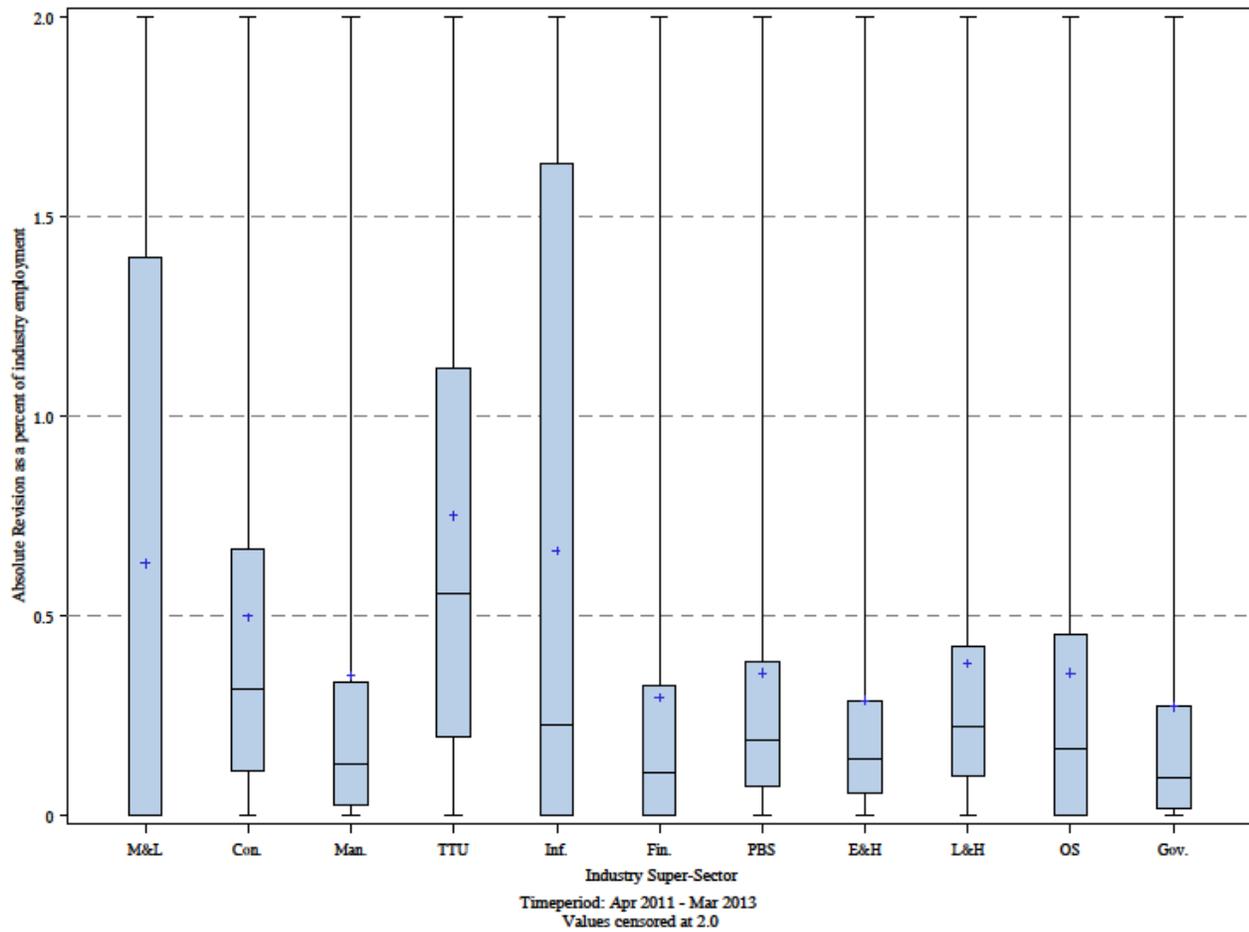
This section will provide a profile of revisions, from the most recent period, for statewide industry super-sectors.

Table 14. Percentile distribution of revisions from 1st to 2nd release as a percent of employment

Industry	Percentile				
	25	50	75	90	95
Mining and Logging	0.0	0.0	1.4	5.0	5.0
Construction	0.1	0.3	0.7	1.3	2.7
Manufacturing	0.0	0.1	0.3	1.3	5.0
Trade, Transp. & Utils	0.2	0.6	1.1	2.5	4.7
Information	0.0	0.2	1.6	5.0	5.0
Finance	0.0	0.1	0.3	0.8	1.8
Prof. and Business Services	0.1	0.2	0.4	1.0	1.7
Education and Health	0.1	0.1	0.3	0.7	1.6
Leisure and Hospitality	0.1	0.2	0.4	0.9	1.8
Other Services	0.0	0.2	0.5	1.0	1.9
Government	0.0	0.1	0.3	0.8	1.5

Table 14 shows that for most industries, revisions are small to moderate for about 90 to 95 percent of revisions. The main exceptions to this are *Mining and Logging* and *Information*, which have larger revisions for a much larger percentage of estimates. Note that these industries comprise 0.6 percent and 2.0 percent of national Total Nonfarm employment, respectively; they have small employment levels in most states. For *Mining and Logging*, the median 2012 statewide annual average is 9,900. A revision in the over-the-month change of 100 – the smallest possible change to a published value – is therefore greater than 1 percent for over half the states for this industry. The *Information* industry has somewhat larger employment; at the median state value, a revision of 300 results in a revision larger than 1 percent. *Trade, Transportation, and Utilities* also has a distribution of revisions larger than other industries. This industry super-sector comprises 19.1% of national Total Nonfarm employment (using 2012 annual averages).

Chart 7. Distribution of Statewide Super-Sector absolute revisions as a percent of employment



In the chart above, the following industry abbreviations are used.

Abbreviation	Industry Title	Abbreviation	Industry Title
M&L	Mining and Logging	PBS	Professional and Business Services
Con	Construction	E&H	Education and Health
Man	Manufacturing	L&H	Leisure and Hospitality
TTU	Trade, Transportation, and Utilities	OS	Other Services
Inf	Information	Gov	Government
Fin	Finance		

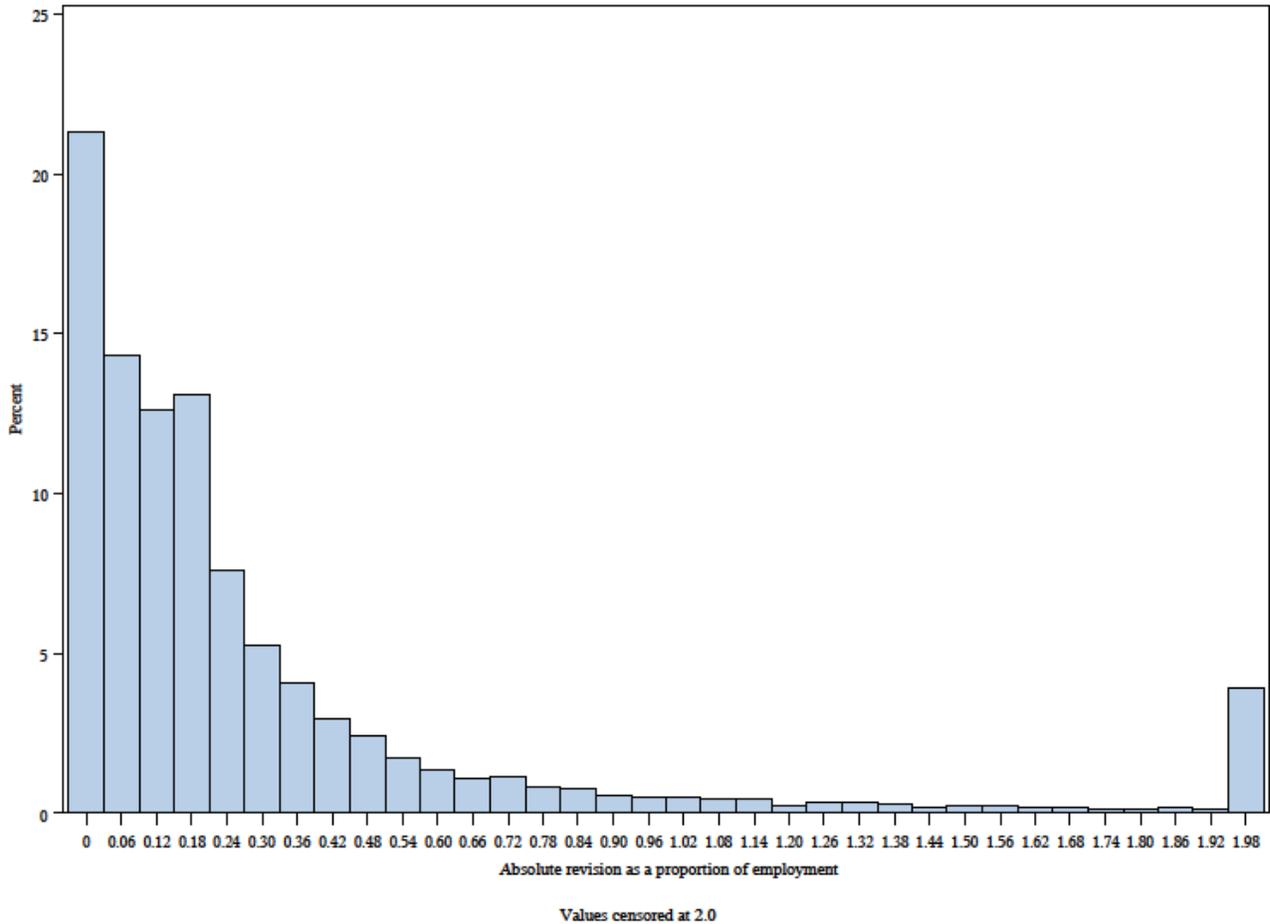
Chart 7 puts the distributions of these industry-based revisions in perspective. When examining the revisions in this manner it is easy to see that the industries discussed – *Mining and Logging*, *Information*, and *Trade, Transportation, and Utilities* – have distributions with larger inter-quartile ranges than other industries. While small revisions in states and industries with small employment will always result in larger percentage revisions, these industries may bear additional scrutiny in the future to see if there are other factors contributing to making these distributions larger than in other industries.

5. Profile of Metropolitan Area Revisions

This section of the paper provides a profile of revisions at the metropolitan area level.

First, we look at a histogram of MSA revisions to total nonfarm employment.

Chart 8. Distribution of MSA absolute revisions to Total Nonfarm as a proportion of employment



The percentile distribution presented in the chart above is also provided in Table 15 below.

Table 15. Percentile distribution of MSA absolute revisions to Total Nonfarm as a percent of employment, March 2011 – March 2013

Percentiles				
25 th	50 th	75 th	90 th	95 th
0.1	0.2	0.3	0.8	1.6

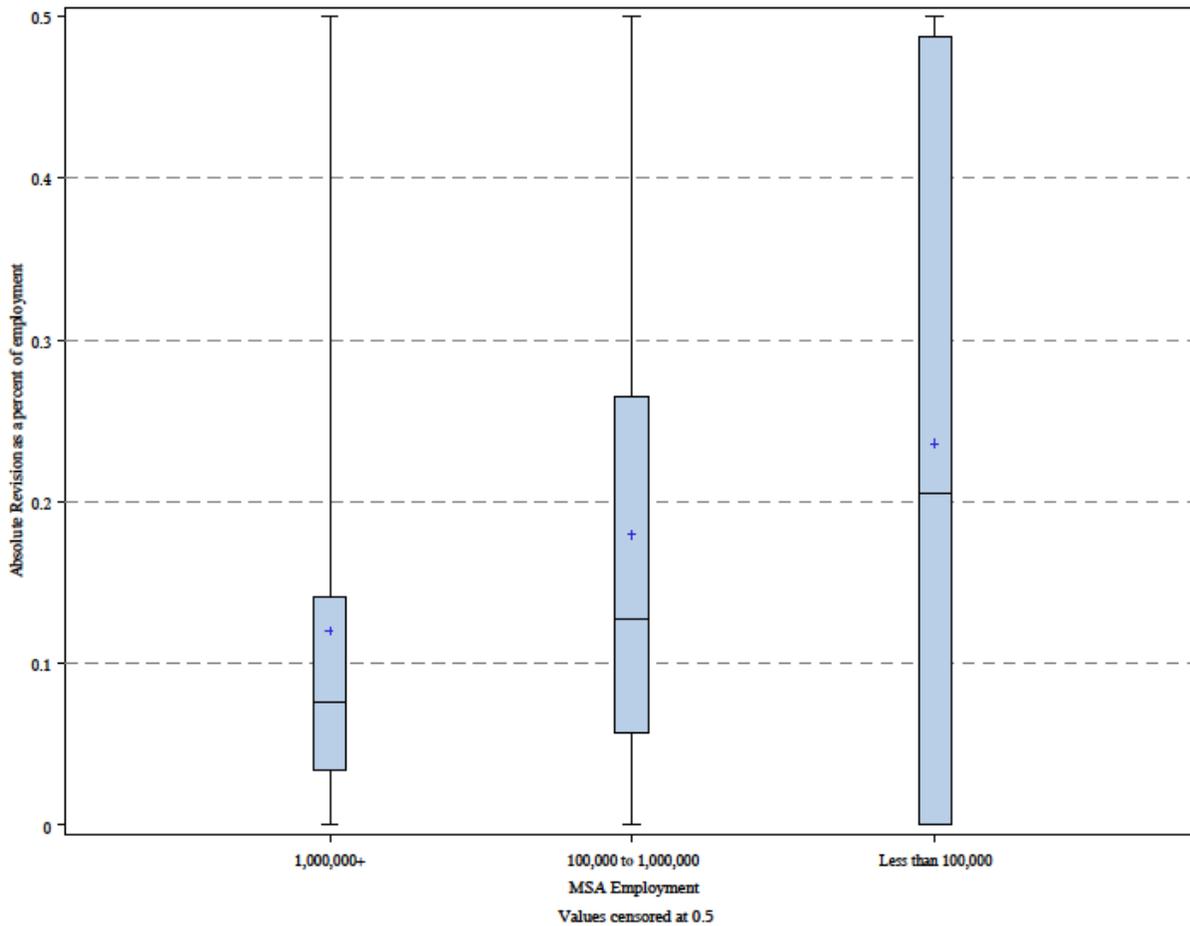
The chart and table above show that much of this distribution is comprised of moderate revisions. However, over 4 percent of the metropolitan area (MSA) revisions are greater than 2 percent of Total Nonfarm employment. This is a substantial number of large revisions at the Total Nonfarm level.

Table 16. Percentile distribution of MSA absolute revisions to Total Nonfarm as a percent of employment, by MSA employment size, April 2011 – March 2013

MSA Employment	Percentiles				
	25 th	50 th	75 th	90 th	95 th
1,000,000+	0.0	0.1	0.1	0.3	0.7
100,000 – 999,999	0.1	0.1	0.3	0.6	1.1
Less than 100,000	0.0	0.2	0.5	1.2	2.0

Table 16 above shows the distribution of MSA revisions by MSA employment size; and these data are presented below in the censored boxplot.

Chart 9. Distribution of MSA absolute revisions as a percent of employment



It is clear that estimates for metropolitan areas with larger employment levels tend to have smaller revisions as a percent of that employment level. Smaller domains, because of their smaller sample sizes, are likely to be more sensitive to a small number of late reports than a larger MSA would be.

6. Concluding Remarks

This analysis has examined response patterns by various characteristics and revisions to the over-the-month change for employment estimates from the Current Employment Statistics survey. For the most part, these revisions to the not-seasonally-adjusted data are caused by additional reports that are collected after the first release of the data. The survey is designed this way because a quick release of information is a highly important feature of these data, even though this means that the data will be revised. In general, revisions tend to be small, but there is a long tail to the distributions, with the occasional large outlier.

We found that revisions tend to be largest when large establishments, especially in government, reported late with unusual over-the-month changes. We noted that national absolute revisions tend to be similar in size for expansions and contractions. We saw that absolute revisions for state estimates are marginally larger now than they were in the base period (January 2003 to November 2008) we studied. We also saw that the primary industries with large state revisions were *Mining and Logging, Information*, and to a lesser extent *Trade, Transportation, and Utilities*. And we determined that metropolitan area revisions to Total Nonfarm employment tend to be substantially larger as a percent of employment for smaller metropolitan areas than they are for larger domains.

In conclusion, we note that the CES program, both at the national and state levels, maintains a very strong tradition of research to improve the program's estimation procedures. The CES program has also worked closely with state staff in the past to make improvements to the state estimates, and that collaboration will continue to benefit the program and its customers. The issues noted in this paper will be added to the programs research agenda to see if they point to additional improvements.

Any opinions expressed in this paper are those of the author and do not constitute policy of the Bureau of Labor Statistics.

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7. References

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[2] Current Employment Statistics (national) website, <http://www.bls.gov/ces/>

[3] Current Employment Statistics (state and area) website, <http://www.bls.gov/sae/>

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[5] Kennon Copeland and Lan Pham, proceedings of the Federal Committee on Statistical Methodology 2009, *Imputation Methods for the Current Employment Statistics Survey*

[6] Thomas Nardone, Kenneth Robertson, and Julie Hatch Maxfield, “Why are there revisions to the jobs numbers?”, *Beyond the Numbers: Employment and Unemployment*, vol. 2, no. 17 (U.S. Bureau of Labor Statistics, July 2013) <http://www.bls.gov/opub/btn/volume-2/revisions-to-jobs-numbers.htm>