cost and operational issues as well as respondent burden considerations. A final decision has not been made on whether CES will publish a total wages series.

Timetable for introduction

All-employee hours and earnings. BLS plans to transition from production/nonsupervisory worker hours and earnings to all-employee hours and earnings in two stages. This plan will provide a multiyear overlap between the two series.

Stage 1 –The new hours and earnings series added for all employees will be published beginning in early 2006. The current production and nonsupervisory worker series also will continue to be published. The retaining of current concepts should make the transition smoother for data users and for BLS, especially given that there will not be historical time series data available for the new all-employee-based hours and earnings series.

Stage 2–After the all-employee hours and earnings series become well established with users, and there is a sufficient history to permit seasonal adjustment, the production/nonsupervisory worker series will be discontinued. BLS tentatively plans to drop these series in 2009.

Elimination of women worker series. The women worker series will be discontinued after publication of the December 2004 estimates in early 2005. Respondents will be asked to begin reporting all-employee payroll and hours in early 2005 and to drop reporting of women workers.

Potential addition of a total wages series. BLS expects to decide by early 2004 whether to add this series to the CES program. If the decision is positive, the series will likely be added in early 2006, concurrent with the all-employee average weekly hours and average hourly earnings series.

Concurrent seasonal adjustment for national CES survey

Chris Manning

The Current Employment Statistics (CES) survey, conducted by the Bureau of Labor Statistics, is a monthly survey of more than 400,000 business establishments. The CES program obtains payroll employment, hours, and earnings information and produces industry-based estimates for the Nation, States, and major metropolitan areas. The national CES estimates of employment, hours, and earnings are some of the most timely and sensitive economic indicators published by the Federal Government. Widely viewed as a key measure of the health of the economy, the estimates are closely tracked by both public and private policymakers alike.

Most CES data users are interested in the seasonally adjusted over-the-month employment changes as a primary measure of overall national economic trends. Therefore, accurate seasonal adjustment is an important component in the usefulness of these monthly data. While seasonally adjusted series go through several monthly revisions and an annual benchmark revision before they are finalized, the first published estimates are the most widely anticipated and analyzed. Thus, it is important to use the most efficient and reliable methods for seasonal adjustment of current months' data.

In the past, the CES program employed seasonal adjustment methodology that applied forecasted seasonal factors to the employment estimate. Twice a year, seasonal factors were forecasted for 6 months into the future and applied to the nonseasonally-adjusted estimates during the next 6 months. However, simultaneously with the CES survey's conversion to the North American Industry Coding System (NAICS) with the publication of May 2003 first preliminary estimates, the survey converted to concurrent seasonal adjustment. Under this methodology, new seasonal factors are calculated each month, using all relevant data up to and including the current month. This article compares the two seasonal adjustment methodologies, examines results from recent research evaluating each of them, and discusses some implications of the CES conversion to concurrent seasonal adjustment.

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Background on CES estimates

One of the benefits of the CES program is the timeliness of its estimates. CES estimates are published each month after only 2½ weeks of data collection. The primary deadline for data receipts, referred to as "first closing," is the last Friday of the reference month, and preliminary estimates are generally published on the first Friday following the reference month. In order to incorporate additional sample responses received after the primary deadline, each estimate undergoes two monthly revisions before being finalized. The secondary cutoff, or "second closing," is usually 3 weeks after the primary deadline, and the third deadline, or "third closing," is 3 weeks after the second. Therefore, for any given reference month, second-closing estimates are published the following month, and third-closing estimates are published 2 months afterwards.

CES estimates also undergo annual revisions called *benchmarks*. Each year, the sample-based estimates for the previous year are adjusted to universe employment counts derived from State

unemployment insurance tax records. This adjustment constitutes the final estimate for all reference months in the benchmark period.

Customarily, the June CES publication incorporates annual benchmark revisions that include a recalculation of seasonally adjusted data for the most recent 5 years. After 5 years of seasonal adjustment revisions, figures are frozen. For example, the March 2002 benchmark revision, published in June 2003, provided revised seasonally adjusted data for 1998 through the first quarter of 2003. Beginning in 2004, the annual benchmark revision will be incorporated in February instead of June.

To seasonally adjust the estimates, the CES program uses X-12 ARIMA software developed by the U.S. Census Bureau. Under the old methodology, seasonal adjustment factors were recalculated semiannually, in April and November, and projected factors for the next 6 months were published in June and December of each year. Under the new methodology, seasonal factors are calculated each month, using all relevant data up to and including the current month. Projected seasonal factors are neither published nor used.

Research approach

During the last few years preceding the switch to concurrent seasonal adjustment, the Bureau of Labor Statistics researched the impact that a change in seasonal adjustment methodology would have both on the CES data and on data users. Each month, parallel to the monthly production of CES seasonally adjusted data with projected-factor methodology, the CES program would run concurrent seasonal adjustment for research purposes. The parallel tests were structured in such a way as to measure only the effect of incorporating additional months of data into the seasonal adjustment process. To do this, the Bureau kept as many variables as possible constant.

For example, standard CES practice requires that 10 years of historical data be used as input to the X-12 ARIMA model. The same historical input data set was used for both seasonal adjustment runs. Therefore, any prior adjustments originally made to the data during production, such as adjustments to account for strikes or for editing and screening, were included in the research simulations as well. The only difference in inputs between the two runs was that concurrent adjustment also incorporated up to 5 months of additional estimates in calculating the seasonal factors.

In the parallel series, the incorporation of revised seasonal factors was handled within the normal CES monthly revisions procedures. CES methodology dictates that, with the calculation of first-closing estimates for a current month, the second- and third-closing estimates for the previous 2 months be revised on an unadjusted basis to incorporate further sample receipts. In the parallel series, the concurrent seasonally adjusted data were recalculated by using revised second- and third-closing estimates, mirroring the production process under the projected-factor methodology. Finally, all published data types were seasonally adjusted under both methods; however, because the all-employee series is the most closely watched series published by the CES program, it is the focus of this report.

Results

In this section, the two methods are compared in terms of (1) the smoothness of the seasonally adjusted series, (2) mean absolute revisions to the over-the-month changes evident from the first preliminary estimate to the benchmarked series, and (3) the variation between monthly revisions. With regard to the smoothness of the series, chart 1 compares the third-closing over-the-month changes of the seasonally adjusted employment figures for total nonfarm employment from January 2001 to June 2002 for the two methodologies. The dashed line shows the third-closing over-the-month changes calculated under the projected-factor methodology (that is, what was published), while the solid line shows the same kind of changes for the concurrently adjusted series (that is, what the over-the-month changes would have been if the CES had been using concurrent seasonal adjustment at that time). As the graph illustrates, concurrent adjustment produces a slightly smoother seasonally adjusted series, with less variability in the over-the-month changes.

The following tabulation of the "smoothness ratio" for January 2001 through June 2002 underscores the smoothness of the concurrent seasonally adjusted employment series for total nonfarm plus all nine industry divisions, as defined and published under the 1987 Standard Industrial Classification (SIC) system:

SIC group	*Smoothness ratio*
Total nonfarm employment	0.67
Mining	.77
Construction	.47
Manufacturing	.87
Transportation and public utilities	78
Wholesale trade	.88
Retail trade	.56
Finance, insurance, and real estate	.68
Services	.58
Government	.67

The smoothness ratio is a measure of variability in the third-closing over-the-month change in the seasonally adjusted estimate. The calculation compares the sum of the squared over-the-month changes in the concurrent seasonally adjusted series with the sum of the squared over-the-month changes in the projected-factor seasonally adjusted series. A smoothness ratio below 1 indicates that concurrent seasonal

Chart 1. **Third-closing over-the-month change, total nonfarm employment, January 2001–June 2002**

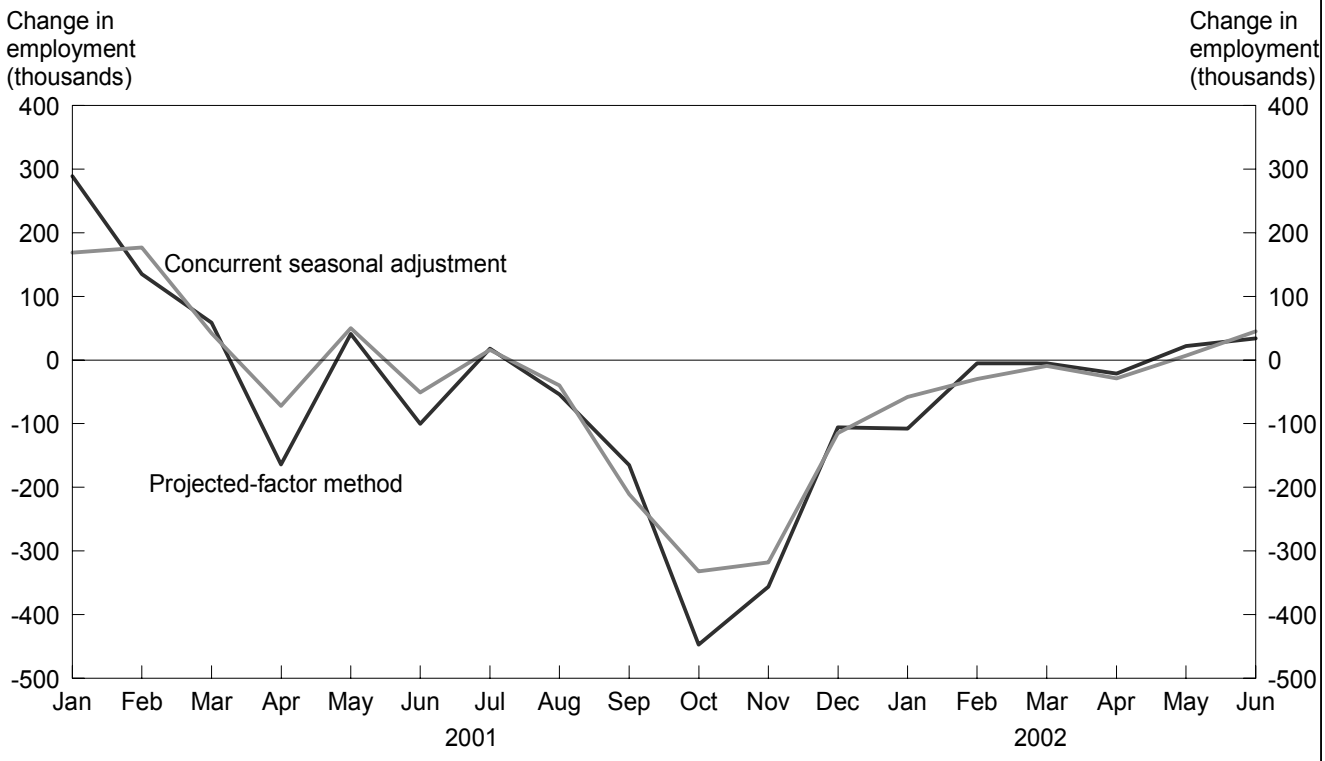
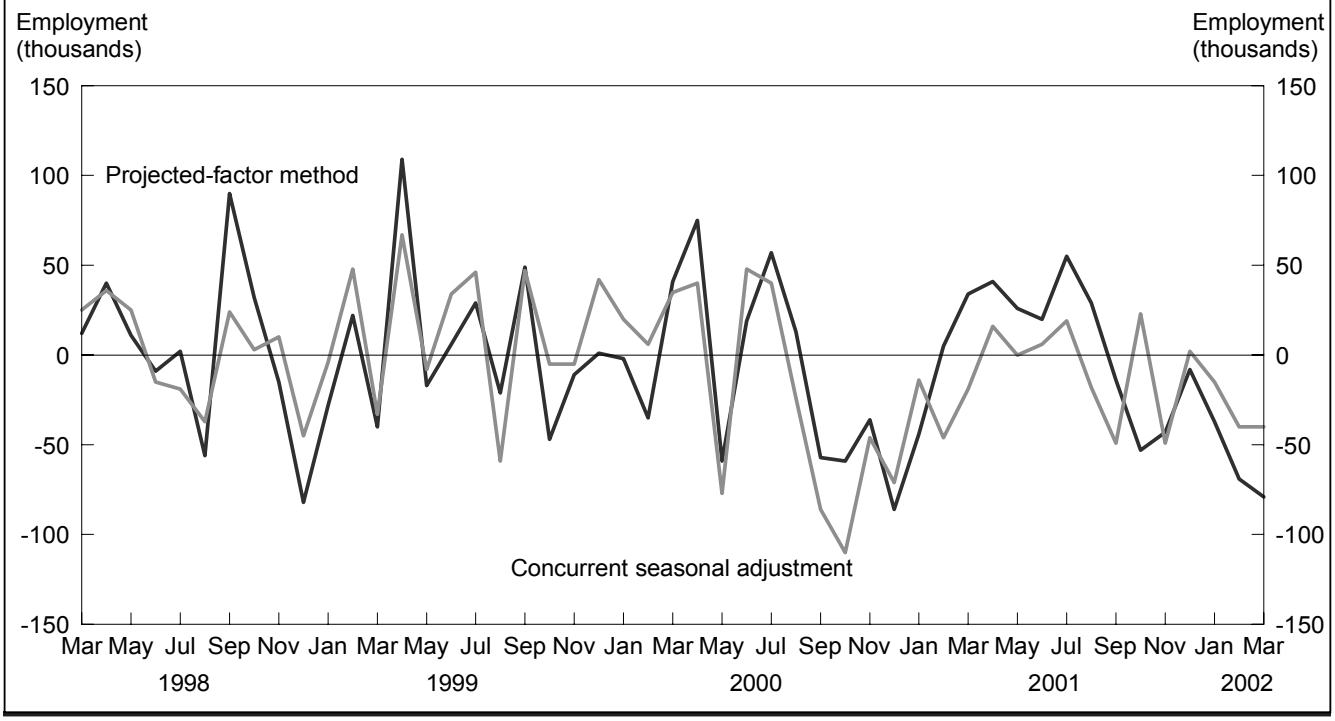


Chart 2. **Over-the-month changes between revisions, first closing to second closing, seasonally adjusted total nonfarm all-employees series, March 1998–March 2002**



adjustment has less variability in the over-the-month changes than does a series adjusted under projected-factor methodology. As the tabulation illustrates, concurrent adjustment produces a smoother seasonally adjusted employment series for total nonfarm plus all nine industry divisions. These results, combined with the results shown in chart 1, indicate that concurrent seasonal adjustment produces employment series with less variability in the over-the-month changes.

To this point, the results examined have focused solely on estimates of seasonally adjusted over-the-month changes in employment. Also of interest is the revision to the estimate of the seasonally adjusted over-the-month change, both from first closing to the final benchmarked series and between monthly closings. Table 1 illustrates the size of the mean absolute revision to the over-the-month change from the first preliminary to the final benchmarked employment series for all nine major industry divisions and their topside aggregate, total nonfarm. In the table, the second column shows the mean absolute revision in the over-the-month change calculated under the projected-factor methodology for March 1998 through March 2001, while the third column shows the same variable calculated under the concurrent-adjustment methodology. The fourth column shows the difference between the two methodologies (concurrent adjustment minus projected-factor adjustment). As the table indicates, CES employment estimates that are seasonally adjusted under the concurrent method have a smaller revision from first-closing estimates to final benchmarked series in eight of the nine industry divisions plus total nonfarm. Only in wholesale trade was the revision statistic larger for concurrent adjustment, and that by just 0.2 percent.

In addition to being concerned over a smaller revision between first closing and the final benchmarked series, economists and data users see revisions in the over-the-month changes between closings as potentially problematic. In particular, these monthly revisions between closings can increase under concurrent adjustment because the seasonal factors can change with each iteration of the monthly adjustment process. However, results indicate that, in addition to producing a smaller revision between first closing and the final benchmarked series, concurrent seasonal adjustment leads to equal or even less variability in the over-the-month changes between closings.

Chart 2 shows the revision to the over-the-month change between seasonally adjusted first-closing and second-closing total nonfarm employment estimates under both methods. The dashed line represents the revision to the over-the-month change between first and second closing published under the projected-factor methodology, while the solid line depicts the same revision for the concurrently adjusted series. The graph illustrates that, in general, the concurrent methodology leads to slightly less variability in the seasonally adjusted over-the-month changes between revisions. Results were similar for revisions between first and third closing.

The following tabulation presents a comparison of mean and mean absolute revisions in over-the-month-changes between closings from March 1998 through March 2002 for the CES series seasonally adjusted under the projected-factor methodology and for the same series adjusted concurrently:

Type of revision	*Projected-factor series*	*Concurrent series*	*Difference*
First closing to second closing:			
Mean revision	–4	–7	–3
Mean absolute revision	37	34	–3
First closing to third closing:			
Mean revision	19	4	–15
Mean absolute revision	48	36	–12

As the tabulation shows, the mean revision and the mean absolute revision in the over-the-month change do not differ between first closing and second closing across the two methods. However, from first closing to third closing, both the mean revision and the mean absolute revision are smaller in the concurrently adjusted series. Combined with the information illustrated in chart 2, these results suggest that concurrent seasonal adjustment does not increase the size of revisions between closings.

Table 1. Mean absolute revision in over-the-month changes in employment, March 1998–March 2001

SIC group	Projected-factor series	Concurrent series	Difference
Total nonfarm	77,973	64,973	–13,000
Mining	1,892	1,865	–27
Construction	22,892	17,838	–5,054
Manufacturing	13,757	12,487	–1,270
Transportation and public utilities	7,892	6,568	–1,324
Wholesale trade	11,135	11,162	27
Retail trade	32,162	21,946	–10,216
Finance, insurance, and real estate	6,919	5,703	–1,216
Services	38,784	29,703	–9,081
Government	23,135	17,432	–5,703

Evaluation of concurrent seasonal adjustment

Concurrent seasonal adjustment has a number of advantages and at least one potential disadvantage. Perhaps the greatest advantage of concurrent seasonal adjustment is that it affords more accurate seasonal factors. Concurrent

seasonal adjustment is technically superior to the projected-factor methodology because it takes into account the timeliest information available. Empirical results from the analysis set forth in this article illustrate the fact that seasonally adjusted CES data are closer to the final benchmarked series under concurrent adjustment than under the projected-factor methodology, leading to smaller revisions between first preliminary estimates and the final benchmark series. Furthermore, monthly revisions between first closing and third closing are slightly lower under concurrent adjustment.

Second, using concurrent seasonal adjustment will be especially advantageous during the first few years following the CES conversion to NAICS, because most of the NAICS historical data were reconstructed from the SIC-based sample. Only 2 years of NAICS history from a NAICS-based sample was available. Therefore, under the projected-factor method, in the first year of the NAICS conversion only two historical NAICS-based estimates per month would have been used to calculate projected seasonal factors. However, under the concurrent seasonal adjustment methodology, three actual NAICS-based estimates are used each month (the previous two years of NAICS-based estimates plus the current one). The additional observations are valuable because X-12 ARIMA weights the most recent years more heavily than the past in calculating seasonal factors.

Third, as mentioned earlier, the CES program traditionally revises two prior months of estimates with each current month's release. As part of the monthly production process under projected-factor methodology, non-seasonally-adjusted estimates were revised for the previous 2 months, and in the past, projected seasonal factors were applied to the revised estimates to calculate the new seasonally adjusted figures. Under concurrent seasonal adjustment, no additional revisions occur; non-seasonally-adjusted estimates for the previous 2 months are still revised as before, and the seasonally adjusted data for these months are based on these revisions.

Finally, one potential disadvantage of concurrent seasonal adjustment is that seasonal factors are not available ahead of time. As has been mentioned, the CES program traditionally calculated seasonal factors twice a year, and projected factors for the next 6 months were published in advance. Under concurrent seasonal adjustment, the program does *not* publish factors in advance, because the new seasonal factors are calculated each month. However, upon request, the Bureau does make available the specifications of the ARIMA model used by the CES program so that the seasonal adjustment run can be replicated if desired.

AFTER SEVERAL YEARS OF RESEARCH, the Current Employment Statistics program converted from projected-factor seasonal adjustment to concurrent seasonal adjustment with the publication of the May 2003 first preliminary estimates in June of that year. The research done with the national CES employment series indicates that the CES survey should benefit from the conversion to concurrent adjustment through smaller revisions to the over-the-month changes from the first closing estimates to the final benchmarked estimates. As the research indicated, concurrent adjustment did not increase the size of revisions between closings and actually reduced revisions from first closing to third closing, producing a smoother, more precise seasonally adjusted series. Expectations are that concurrent seasonal adjustment will continue to produce a smoother published series in the future. □