Noneconomic fluctuations in hours and earnings data

BLS hours and earnings series are subject to noneconomic calendar-related fluctuations caused by response error in semimonthly and monthly reports and the processing limitations of the payroll survey

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The Current Employment Statistics (CES) survey collects payroll information from a sample of about 390,000 business establishments across the Nation and provides monthly estimates of nonfarm wage and salary employment, average weekly hours, and average hourly earnings. The month-to-month movements in these series are closely watched by policymakers, forecasters, and other analysts as timely indicators of the overall strength and direction of the Nation's economy. In recent years, some CES data users have inquired about the possibility of noneconomic, calendar-related fluctuations in the hours and earnings series.

In 1997, researchers at the Bureau of Labor Statistics established a correlation between over-the-month changes in the hours and earnings series and the number of weekdays in a calendar month. An initial review of the hours and earnings series revealed that the fluctuations were concentrated in the service-producing industries—especially in finance, insurance and real estate—and that they could be traced to survey reporters with a high proportion of salaried employees and semimonthly or monthly payrolls. These findings led to an examination of how these reports are treated within the CES production system. The examination revealed that both response error and the "normalization" process used to convert reports with other-than-weekly pay periods to the weekly equivalent were contributing to the noneconomic fluctuations in the hours and earnings series.

This article describes the research methods used and the results obtained in this study. Several methods were used to identify and measure the noneconomic fluctuations. First, the microdata were tested for statistical differences between reported hours and earnings for months with different numbers of workdays. Second, reporters were contacted directly in order to clarify their reporting practices—specifically, their methods of calculating the hours and earnings data that they provided on the survey form. Third, the CES production process was simulated with certain modifications, including the elimination of problematic reports and the use of different correction factors to normalize the hours and earnings data. Finally, using the REGARIMA statistical technique, models were developed to measure and adjust for the effect of the length of pay period on the hours and earnings series.

To correct the noneconomic fluctuations in the hours and earnings series, the system should be modified to convert each report appropriately, depending on the reporting practice of the respondents. In addition, respondents should be educated on the proper method of reporting hours in unusual cases, such as when the length of pay period is 11 or 12 days. Also, ideally, hours and earnings data should be collected separately for workers paid by the hour versus those paid by salary. The implementation of these corrective measures would require considerable time and resources, however, and thus could only be accomplished as a long-term project. In the short run, the use of

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REGARIMA models continues to be the most feasible and effective method of correcting the fluctuations, although currently only the seasonally adjusted hours and earnings series are corrected.

The Current Employment Statistics survey

In the CES survey, average weekly hours and average hourly earnings data are not collected directly. Instead, respondents report their gross payrolls and the corresponding total hours paid for production workers, construction workers, and nonsupervisory workers. (Henceforth, these three types of workers will be referred to as production workers.) Data items refer to persons who worked during, or received pay for, any part of the pay period that includes the 12th of the month.

Average weekly hours are computed as

$$(1)\quad AWH = WH/PW,$$

where

WH = total worker hours,
PW = total production workers.

Average hourly earnings are given by

$$(2)\quad AHE = PR/WH,$$

where

PR = gross payroll (for production workers),
PW = total production workers.

Data are reported for the pay period that includes the 12th of the month, with respondents indicating the length of the pay period as follows:

Weekly	= 5-day pay period
Biweekly	= 10-day pay period
Semimonthly	= 10- to 11-day pay period
Monthly	= 20- to 23-day pay period.

When respondents report data for pay periods of more than 1 week in duration, the reports must be "normalized"—that is, the payroll and hours data must be converted to 1-week equivalents. For this purpose, conversion factors or length-of-pay-period (LP) codes are applied to the reported figures, using the modified formulas

$$AWH = (LP_D * WH_R) / PW,$$

and

$$AHE = (LP_D * PR) / WH_N,$$

where

LP_D =

1.0 when number of days (D) in pay period (PP) = 5,
.45 when D = 11 (semimonthly),
.50 when D = 10 (semimonthly or biweekly),
.45 when D = 11 (semimonthly),
.50 when D = 10 (semimonthly or biweekly),
.22 when D = 23 (monthly),
.23 when D = 22 (monthly),
.24 when D = 21 (monthly),
.25 when D = 20 (monthly),

WH_R = reported hours,
WH_N = normalized hours.

Test of microdata

The normalized microdata from the survey reports were analyzed in an attempt to identify problematic reports. The underlying assumption in the CES estimation process for average weekly hours and average hourly earnings is that respondents vary their reported payroll and hours data according to the number of days in their respective pay periods. This assumption is reasonable for respondents with predominantly hourly paid employees—these respondents are most likely to have accurate records on the number of hours for which their employees were paid.

But in cases in which the respondents have a high percentage of salaried employees who are paid a fixed amount for each pay period, the reported payroll figure does not vary by the number of days in a pay period, and a record of the actual number of hours paid may not be available. The reported number of total hours worked may reflect the fixed payroll and thus may not vary by the number of days worked either. As a result, when respondents with semimonthly or monthly pay periods report fixed work-hours and fixed payroll, the normalization procedure of the CES production system could introduce fluctuations for pay periods with varying numbers of workdays.

This hypothesis is translated into a test of the difference between two population means, namely

$$H_0:\ m_1 - m_2 = 0,$$

and

$$H_A:\ m_1 - m_2 < 0,$$

where

m_1 = population mean when D = 10, 20, and 21,
m_2 = population mean when D = 11, 22, and 23.

The test statistic is defined as

$$t = (y_1 - y_2) / s_p \sqrt{}(1/n_1 + 1/n_2),$$

where

y_1 = sample mean when D = 10, 20, and 21,
y_2 = sample mean when D = 11, 22, and 23,
n_1 = number of months in which D = 10, 20, and 21,
n_2 = number of months in which D = 11, 22, and 23,
s_p = estimated standard deviation s for m_1 and m_2,
$s_{1,2}$ = sample variances.

Note also that

$$s_p = \sqrt{}[(n_1-1)s_1^2 + (n_2-1)s_2^2]/(n_1+ n_2-2)$$

for the rejection region, α = .025, $df = n_1 + n_2 - 2$, and we reject H_0 if $t > t\alpha$.

The data tested were the calculated average weekly hours and average hourly earnings figures for each reporter, according to formulas (1) and (2) shown above. A reporter failing this means test (H_0 is rejected) is assumed to report fixed work-hours and payroll. By normalizing the reported data, the CES production system introduces the observed fluctuations into the data for these reporters.

Table 1 lists the distribution of reports by pay period and the percentage of reports failing the test for average weekly hours. The results of the means test indicate that nearly half of the semimonthly reports display significant differences in normalized work-hours between months with varying workdays per pay period. The table also shows that the majority of semimonthly (and hence, problematic) reporters are in the service-producing industries, with finance, insurance, and real estate having the largest share.

The results of the means test for hourly earnings are not as apparent as those for weekly hours. However, about 10 percent of semimonthly reports and 6 percent of the monthly reports display significant differences in normalized payrolls between months with varying numbers of workdays per pay period. The smaller number of reports testing significantly different for average hourly earnings can be best explained by recalling the procedure that the CES production system uses to calculate the hourly earnings figures:

$$\text{AHE} = (\text{LP}_{D,\,PP} * \text{PR}) / \text{WH}_N$$

The product $\text{LP}_{D,\,PP} * \text{PR}$ calculates the normalized payroll, which then is divided by the normalized work-hours. The same conversion factor (LP) is used to normalize both data elements. Therefore, for respondents who report fixed work-hours and fixed payroll, the division of the two data elements neutralizes the conversion factors and the resulting average hourly earnings series do not display the fluctuations introduced by the factors. Only the earnings series for those respondents who report fixed payroll figures but vary the number of reported work-hours according to the number of workdays per pay period display the fluctuations—in this case introduced by the conversion factor during the normalization of the payroll figures.

Respondents contact

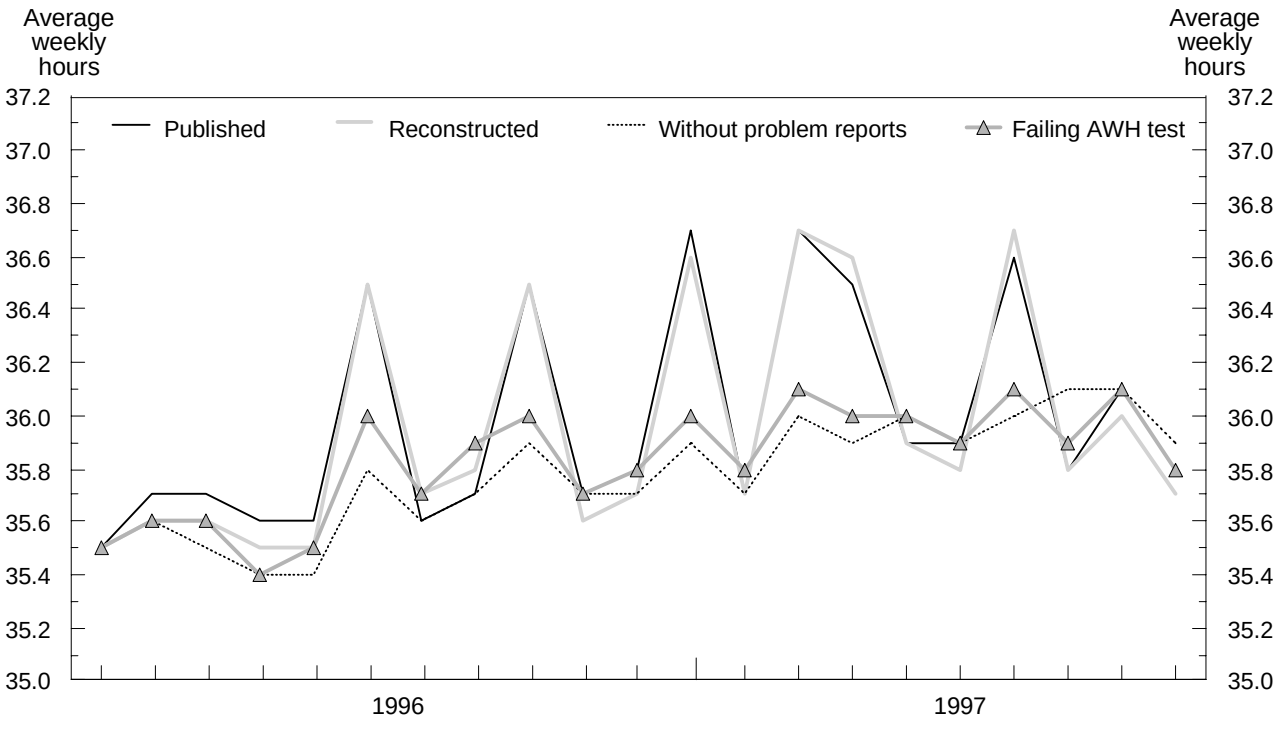
In an independent effort to confirm the results obtained from examining the microdata, a sample of 100 monthly and semimonthly respondents was selected and each was contacted by telephone to ask about how they report their hours and earnings data. Overall, there were 75 usable responses from the 100 sample cases. An important basic finding is that 53 of the 75—70 percent—had both salaried and hourly workers.

For their hourly paid workers, respondents stated that they used actual hours figures more than 90 percent of the time. For salaried workers, on the other hand, actual hours were available only 12 percent of the time. For the rest of the time,

Table 1. Distribution of reports failing means test for average weekly hours by pay period

Industry	All pay periods		Weekly pay periods		Biweekly pay periods		Semimonthly pay periods		Monthly pay periods	
	Total number of means test	Percent failing reports	Percent of total means test	Percent failing reports	Percent of total means test	Percent failing reports	Percent of total mean test	Percent failing reports	Percent of total reports	Percent failing means test
Total private	223,903	8.5	52.6	3.9	32.9	4.6	9.2	46.3	5.3	16.6
Mining	2,130	10.3	42.9	3.1	39.4	5.1	9.6	51.2	8.1	25.0
Construction	23,320	3.1	89.2	2.7	6.6	3.8	1.1	22.1	3.1	7.8
Manufacturing	48,763	5.6	74.2	4.5	20.2	4.9	3.0	32.2	2.6	12.1
Transportation and public utilities	11,660	8.7	36.2	3.2	44.1	3.2	11.9	42.1	7.7	14.1
Wholesale trade	17,939	10.4	47.6	3.5	35.1	4.6	10.4	52.4	6.9	24.7
Retail trade	49,231	6.5	53.3	3.0	36.6	4.7	6.3	41.1	3.8	15.2
Fire, insurance, and real estate	15,078	20.1	16.9	2.9	48.0	6.2	24.2	58.5	10.9	22.7
Service	55,782	11.6	32.8	3.3	44.3	4.4	15.7	45.3	7.2	15.1

Chart 1. Various average weekly hours series for finance, insurance, and real estate



the hours figures were estimated using some fixed formula or a constant value. Respondents said that they vary the number of hours that they report with the number of weekdays in a month for about 80 percent of their hourly paid workers and for only about 20 percent of their salaried workers. The results are similar for the payroll figures except that a higher percentage of respondents stated having actual payroll data for salaried workers—about 50 percent, compared with the 12 percent having actual hours data.

The overall conclusion from the data is that the CES conversion practices generally are appropriate for hourly paid workers, but not for salaried workers. Because most respondents have both types of workers, collecting separate reports for hourly and salaried workers would be better, but that would require far-reaching changes to CES production and data collection systems. From the point of view of the respondents, collecting separate reports may be quite feasible—77 percent of the respondents indicated that they could provide separate payroll figures for hourly and salaried workers.

The responses from telephone contacts were compared with the results from the means test and are shown in the following tabulation. In about 70 percent of the cases, the telephone survey answers supported the findings of the means tests for average weekly hours. For example, a report failed the average weekly hours means test and the respondent confirmed that they did in fact report a constant number of hours. For average hourly earnings, the comparison between the means test and the telephone survey answers yielded somewhat more disparate results—only 60 percent of the telephone respondents gave the expected answers.

Reporting practice	*Failed means test*	*Passed means test*
Fixed hours	43	9
Varying hours	9*	2**
Fixed payroll	30	4
Varying payroll	5*	5**

* False positive
** False negative

The lack of stronger correspondence between the means test results and the telephone respondent answers clouds the issue of whether the identification of the problematic reports could be a solution to the problem of noneconomic fluctuations in the CES hours and earnings series. Undoubtedly, at least part of the problem is due to the limitation imposed by collecting only one payroll and hours figure, making it difficult to separately review and test salaried and hourly worker data.

Simulation of estimates

In order to simulate the effects of three kinds of adjustments, the CES estimation process was recreated in this study. First, all reports with semimonthly or monthly pay periods were removed and the hours and earnings series were reestimated using only the remaining reports. Second, for average weekly hours, all reports failing the means test were removed, and for average hourly earnings, the reports passing the average weekly hours test but failing the earnings test were removed, and the series were reestimated using only the remaining reports. Third, the conversion factor to normalize the series was changed to reflect the fixed work-hours and payroll reports and the corrected factor was applied to the reports failing the means test. The factor was changed to a fixed value of .46 for semimonthly reports and .23 for monthly reports.

The average weekly hours series for finance, insurance, and real estate are shown in chart 1. All three treatments successfully reduce the magnitude of the fluctuations displayed by the published and reconstructed series during months with fewer workdays per pay period, although some evidence of the underlying spikes remains. The treatments for average hourly earnings produced a somewhat smoother series but because the fluctuations were not as pronounced as in the average weekly hours series, the interpretation is more ambiguous.

An important observation here is that some of the treatments lower the level of the series. A review of sample averages by length of pay period confirmed that semimonthly and monthly reports had higher paid workers as compared with weekly and biweekly reports. It is difficult to conclude that any of the simulated series are substantially improved over the published or reconstructed series. Moreover, because these series are not seasonally adjusted, the interpretation is particularly difficult, especially because the average hourly earnings series display strong seasonal movements in some months.

REGARIMA modeling and diagnostics

The Model. For seasonal adjustment, the CES program uses the X-12-ARIMA software developed by the Bureau of the Census. For most of the published seasonally adjusted series, a technique known as REGARIMA modeling is used to identify the estimated size and significance of calendar effects, adjusting for them accordingly. Examples include the adjustments for interval effect between survey weeks currently applied to the CES employment series and the adjustment for moving holidays in the hours series.

The REGARIMA models evaluate the variation in levels attributable to varying calendar effects in the same month of different years. The effects are examined by a joint chi-square test, which provides evidence of statistical significance across all model variables, and by *t*-tests on individual coefficients. Adjustment factors are calculated and applied to the original series in connection with the seasonal factors. Because calendar effects are known in advance, factors can be forecasted based on the observed effects in past months. The observed fluctuation in the hours and earnings series are also related to calendar effects, making the application of the REGARIMA modeling technique a possible alternative in the mitigation of the fluctuations.

The multiplicative decomposition of time series is described by the model

$$Y = T * S * I * P$$

where

T = trend component
S = seasonal component
I = irregular component
P = the prior adjustment factor with decomposition

$$P = P_T * P_L * P_I .$$

In this application, the length of the period is month-specific, and is estimated as the factor P_L. For seasonal adjustment, it is combined with the seasonal factor, and the seasonally adjusted values are derived from the formula

$$Y / (S * P_L) = T * I * P_T * P_I .$$

Table 2. ***t*-statistics for length-of pay-period variables for average weekly hours by selected industry divisions**

Length-of pay-period variable	Transportation and public utilities	Wholesale trade	Retail trade	Finance, insurance, and real estate	Services
January	3.87	5.15	5.79	12.29	9.20
February	2.19	6.30	5.06	14.28	7.53
March	.44	6.50	1.97	14.05	7.56
April	4.49	3.87	5.94	10.11	6.70
May	1.86	6.14	1.47	11.68	9.06
June	3.80	5.66	4.54	14.25	6.15
July	3.11	4.51	3.51	10.68	6.40
August	.52	4.48	2.49	12.68	6.93
September	2.54	3.25	1.81	11.63	4.91
October	3.26	5.78	4.02	12.10	8.23
November	4.16	4.65	.98	13.13	6.63
December	2.81	4.50	2.91	11.74	5.90

Table 3. Smoothness tests and sliding span evaluation of the length-of-pay-period adjustment

Data series and industry division	Smoothness Tests			Span I: 1988–95		Span II: 1989–96		Span III: 1990–97	
	Smoothness ratio	Percent change in root-mean-squared error		Number of months in which $t > 0$	Joint p-value	Number of months in which $t > 0$	Joint p-value	Number of months in which $t > 0$	Joint p-value
		Full series	Last 3 years						
Average hourly earnings:									
Wholesale trade	71.0	–40.1	–53.4	11	0.00	11	0.00	12	0.00
Finance, insurance, and real estate	66.0	–52.0	–47.4	12	0.00	12	0.00	12	0.00
Services	78.0	–27.5	–31.4	11	0.00	12	0.00	11	0.00
Average weekly hours:									
Transportation and public utilities	74.0	–35.8	–46.9	7	0.00	9	0.00	10	0.00
Wholesale trade	60.0	–66.6	–89.4	12	0.00	11	0.00	11	0.00
Retail trade	68.0	–48.0	–56.8	7	0.00	8	0.00	8	0.00
Finance, insurance, and real estate	47.0	–113.0	–210.0	12	0.00	12	0.00	12	0.00
Services	45.0	–123.0	–99.2	12	0.00	12	0.00	12	0.00

As with other interventions and calendar effects, extended ARIMA models are used to estimate the effect of the length of pay period on the estimates by means of the formula

$$\text{Log } y_t - \sum a_j M_{jt} - \sum b_j X_{jt} = \gamma(B, B^{12})\, a_t$$

where

y_t = the observed series;
M_{jt} = the month variables;
X_{jt} = the outliers or other interventions;
a_j = the noise term;
γ = the seasonal ARIMA model.

On the log scale, the effect of the length of the pay period of month j at time t is defined as

$$-a_j M_{jt},$$

where

M_{jt} =

1.0 when $t = j \pmod{12}$, 10-day pay period,
–0.4 when $t = j \pmod{12}$, 11-day pay period,
0, otherwise.

The adjustment for the length of pay period is sometimes positive and sometimes negative. Because there are more instances of 11-day pay periods, the factor -0.4 helps achieve balance in these effects. This is analogous to the property that the mean of the seasonally adjusted series should be close to the mean of the unadjusted series. Notice also that only two factors are used which test only the effects of semimonthly reports on the series. Tests showed that by including four additional factors to account for the effects of the differences in pay periods of monthly reporters, the model does not improve and the adjustment factors estimated by the model become weaker for some months.

Significance tests for the length-of-pay-period. Chi-square and *t*-statistics were observed for testing the significance of the joint contribution and coefficients for each of the 12 monthly length-of-pay-period variables. As shown in table 2, of the 29 published average weekly hours series fitted with models using the explanatory variables, all 5 service-producing divisions had *t*-statistics greater than 2 for at least 8 of the 12 monthly variables. Three industry divisions—wholesale trade; finance, insurance, and real estate; and services—had *t*-statistics for all 12 variables greater than 3. The finance, insurance, and real estate division had t-statistics greater than 10 for all 12 variables, indicating that the length of pay period has a dominating effect on the over-the-month changes of this series. In addition to these significant t-statistics, the variables for all 5 series were positive, resulting in regression factors greater than 1 for all months with 10-day pay periods, therefore adjusting the series in the correct direction and mitigating the fluctuations.

The mining and construction divisions and 22 two-digit industries in manufacturing displayed only a few significant *t*-statistics for the length-of-pay-period variables. Moreover, the signs

of the *t*-statistics were both positive and negative, therefore having coefficients, which in some months contribute to the spikes. Based on the *t*-statistics and the effect of the variables, it was concluded that the average weekly hours series for the goods-producing industries are not significantly affected by the length of pay period and do not require an adjustment for this effect.

Of the eight published average hourly earnings series fitted with models using the explanatory variables, three service-producing divisions had *t*-statistics greater than 2 for at least 11 of the 12 variables displaying the same sign. The other five divisions displayed only a few *t*-statistics greater than 2 and the signs of the *t*-statistics were not equal. Based on these results, only the average hourly earnings series for wholesale trade; finance, insurance, and real estate; and services are adjusted for the length-of-pay-period effect.

Smoothness tests, sliding spans, seasonal adjustment. For validation of the REGARMIA models, four tests were conducted, the results of which are shown in table 3. First, a smothness ratio was calculated for each treated series by dividing the square root of the sum of the squared first differences of the LP-adjusted series by those of the unadjusted series. A value of less than 100 indicates that the adjusted series is smoother. Second, the percent change in root-mean-squared error was calculated as the percent difference between the root-mean-squared errors of the unadjusted series and those of the LP-adjusted series. A negative percentage indicates that the LP-adjusted series is smoother. The percent change is calculated for the full series and for the last 3 years.

Third, a sliding span analysis was conducted, separately testing 3 different periods: 1988–95, 1989–96, and 1990–97. A *t*-statistic greater than 2.0 indicates the number of significant variables or months in the model (maximum = 12) for each span. The joint *p*-value of less than 0.10 indicates that the variables are jointly significant for each span.

Finally, the sliding span analysis also included tests of the seasonal factors, the final seasonally adjusted series, and the month-to-month changes in the seasonally adjusted series for stability over the 3 spans. Months were flagged as unstable if the difference of an analysis variable for the same month was greater than 3 percent from one span to the next. For these tests, no month was flagged as unstable.

The following tabulation shows statistics for finance, insurance, and real esate and for services before and after treatment.

	Finance, insurance, and real estate		*Services*	
Statistic	*Before*	*After*	*Before*	*After*
Stable F-Statistic	0.66	7.68	21.60	105.80
Moving F-Statistic	1.55	1.42	.61	0.30
M7-Statistic	2.83	.86	.47	.19
Q-Statistic	2.30	.83	1.27	.65

Table 4. Over-the-month changes in average weekly hours, with and without length-of-pay-period (LP) adjustment, and difference, 1993–98

Item	January	February	March	April	May	June	July	August	September	October	November	December
1993:												
LP-adjusted	.1	0	–.2	.2	0	–.1	.1	0	.1	0	0	0
Not LP-adjusted	.1	0	–2	.2	.2	–.2	.1	.1	–.1	0	0	0
Difference	0	0	0	0	–.2	.1	0	–.1	.2	0	0	0
1994:												
LP-adjusted	0	–.2	.3	–.1	.1	0	0	–.1	0	.1	–.1	.1
Not LP-adjusted	.3	–.5	.3	0	.1	–.1	0	–.1	.1	.2	–.2	0
Difference	–.3	.3	0	–.1	0	.1	0	0	–.1	–.1	.1	0.1
1995:												
LP-adjusted	0	–.2	0	0	–.2	.1	0	0	0	0	0	–.1
Not LP-adjusted	.3	–.4	0	.1	–.4	.2	.1	–.1	0	.1	–.1	–.1
Difference	–.3	.2	0	–.1	.2	–.1	–.1	.1	0	–.1	.1	0
1996:												
LP-adjusted	–.4	.6	–.1	–.1	.1	.2	–.2	.1	.1	–.1	0	.1
Not LP-adjusted	–.4	.5	0	–.1	0	.4	–.4	.2	.2	–.3	.1	.2
Difference	0	.1	–.1	0	.1	–.2	.2	–.1	–.1	.2	–.1	–.1
1997:												
LP-adjusted	–.1	.1	.1	–.1	.1	–.2	0	.2	–.1	0	.1	0
Not LP-adjusted	–.3	.4	0	–.3	0	.1	–.2	.2	–.1	0	.3	–.2
Difference	.2	–.3	.1	.2	.1	–.3	.2	0	0	0	–2	.2
1998:												
LP-adjusted	.1	–.1	–.1	–.1	–	–	–	–	–	–	–	–
Not LP-adjusted	.2	.1	–.2	–.3	–	–	–	–	–	–	–	–
Difference	–.1	–.2	.1	.2	–	–	–	–	–	–	–	–

– = Data unavailable at time of study.

Table 5. Over-the-month changes in average hourly earnings, with and without length-of-pay-period adjustment, and difference, 1993–98

Item	January	February	March	April	May	June	July	August	September	October	November	December
1993:												
LP-adjusted	0.03	0.01	0.05	0	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03
Not LP-adjusted	.04	.02	.03	.01	.04	–.01	.03	.03	.01	.02	.03	.03
Difference	–.01	–.01	.02	–.01	–.02	.03	–.01	–.01	.02	0	–.01	0
1994:												
LP-adjusted	.03	.03	.01	.02	.03	.02	.02	.02	.03	.04	.02	.03
Not LP-adjusted	.03	.04	0	.03	.03	.01	.02	.02	.03	.06	0	.03
Difference	0	–.01	.01	–.01	0	.01	0	0	0	–.02	.02	0
1995:												
LP-adjusted	.01	.04	.02	.02	.02	.04	.04	.03	.03	.03	.02	.03
Not LP-adjusted	.02	.04	.01	.04	0	.04	.06	0	.04	.05	.01	.02
Difference	–.01	0	.01	–.02	.02	0	–.02	.03	–.01	–.02	.01	.01
1996:												
LP-adjusted	.05	0	.03	.06	.02	.06	.03	.03	.04	.03	.05	.04
Not LP-adjusted	.04	.02	.02	.05	.03	.07	0	.05	.05	0	.07	.05
Difference	.01	–.02	.01	.01	–.01	–.01	.03	–.02	–.01	.03	–.02	–.01
1997:												
LP-adjusted	.04	.03	.04	.03	.04	.03	.03	.07	.03	.06	.04	.03
Not LP-adjusted	.02	.05	.04	0	.05	.04	.01	.07	.04	.05	.08	0
Difference	.02	–.02	0	.03	–.01	–.01	.02	0	–.01	.01	–.04	.03
1998:												
LP-adjusted	.04	.05	.04	.07	–	–	–	–	–	–	–	–
Not LP-adjusted	.04	.07	.04	.04	–	–	–	–	–	–	–	–
Difference	0	–.02	0	.03	–	–	–	–	–	–	–	–

– = Data unavailable at time of study.

As can be seen, the adjustment for the length of pay period resulted in additional improvements to the data. Before the LP-adjustment, the seasonally adjusted average weekly hours series for these two industry divisions were not available to the public because the data did not meet BLS publication standards. After the adjustment, both series met the publication standards.

Effects of the treatment

The implementation of the REGARIMA-based smoothing techniques eliminates a significant source of noneconomic volatility in the CES hours and earning series, thereby improving the month-to-month measurement of underlying economic trend. A recent example of this occurs for the months of November and December 1997. As shown in table 4, the over-the-month change for average weekly hours not adjusted for the length of pay period in November (a 10-day pay period) is 0.3 hour. This change is reversed in December (an 11-day pay period) with an over-the-month change of –0.2 hour.

When the series is adjusted for the length-of-pay period effect, it shows less volatility. The November over-the-month change is 0.1 hour, while the over-the-month change in December is zero, indicating there is little actual change in average weekly hours over those months. Similarly for average hourly earnings, as shown in table 5, the series not adjusted for the length of pay period increases in November by 8 cents and is flat for the December over-the-month change. The adjustment corrects the series to increase in November by 4 cents and by 3 cents in December, figures more reflective of the actual underlying earnings trend.

THE CES HOURS AND EARNINGS SERIES are subject to noneconomic, calendar-related fluctuations caused by response error in semimonthly and monthly reports and the processing limitations in the CES production systems. Modeling with the REGARIMA technique results in the successful treatment of these fluctuations and smooths the problematic series. The treatment succeeds both in correcting historical data and incorporating the treatment in forecasted seasonal factors. A drawback of the treatment process is that currently only the seasonally adjusted series are corrected. Correcting the unadjusted series would require a change in the CES data collection prodedures to solicit average weekly hours and average hourly earnings data separately for hourly and salaried employees. It also would require a change in the way in which hours and earnings data are handled in the CES data collection systems. BLS currently is evaluating both measures to determine the feasibility of further action. □