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Revisions in Household Survey Data Effective February 1996

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It is an annual end-of-year practice for BLS to compute and issue revised seasonally adjusted data for recent years and projected seasonal factors for the first half of the new year for the labor force time series derived from the household survey.[1] Revisions to the not seasonally adjusted data for those series are rare[2], but such revisions have been made this year to the data for 1990-93. This article discusses this year's revisions to the not seasonally adjusted and seasonally adjusted data and describes the current seasonal adjustment methodology.

Revision of Not Seasonally Adjusted Data

All of the household survey data released since 1994 reflect changes introduced effective with the data for January 1994.[3] For each series, the net effect of those changes reflects a combination of two underlying effects. One is a redesign effect resulting from the complete redesign of the survey questionnaire and of the technology and systems used to administer the questionnaire and process the data from it. The other is a population-control effect, resulting from the introduction of 1990 census-based population controls with adjustment for the estimated net census undercount.

Tables and databases that include data from before and after the 1994 changes contain notes or warnings that the data beginning in 1994 are not directly comparable with data for 1993 and earlier. Historical comparability is, however, a desirable characteristic for time series. Accordingly, BLS also has been concerned about trying to help users bridge the comparability break to the extent possible, by providing information about the redesign and population-control effects and by considering possible revisions to the historical series. The February 1994 article indicated the size of the population-control effects for various groups using 1993 annual data, and provided some estimates of the possible magnitude of the redesign effects. Subsequent research has provided some refined and alternative estimates of the redesign effects[4], but also has made it clear that there is enough uncertainty about the best way to measure the redesign effects to make it inappropriate for BLS to officially revise the historical series to adjust for them.

On the other hand, the magnitude of the population-control effects was already known for 1993 and could easily be computed by the Bureau of the Census back to 1990, the decennial census year. The main questions remaining about revision for these effects were: (1) Was 1990 the limit, or could defensible revisions be done further back in time; and (2) was there sufficient justification for, in effect, creating two breaks from one by separating the timing of the population-control and redesign effects. With respect to the first question, 1990 was determined to be the limit, principally because there is no adequate basis for computing estimates of undercount for any time prior to 1990 that would be comparable to those in the new population controls. No previous census had a Post Enumeration Survey (PES) comparable to the 1990 PES that provided the basis for the undercount estimates in the new controls. On the second question, the main consideration was that the redesign effects were probably small, and in some cases negligible, relative to the population-control effects, for many important labor force characteristics. The moving back in time of the population-control effects would therefore provide a longer current series of reasonably comparable data for those characteristics even though, technically, there might still be some effect of the redesign from January 1994 forward. Of course, for characteristics with significant definitional changes in 1994, such as part time for economic reasons, the redesign effects were not small relative to the population-control effects, and significant comparability breaks would still remain between 1993 and 1994 after population revisions.

The production of revised data for 1990-93 was based on revised monthly CPS sample weights for each of the 48 months, computed using population controls consistent with those used to weight the CPS samples during 1994. The derivation of population controls and their use in computing sample weights was described in some detail in the February 1994 article. Public use microdata files with the re-

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[1] Budget-related shutdowns and the weather-related closing of many Federal agencies, including BLS and the Bureau of the Census, delayed the timing of revisions this year.

[2] The last previous occurrence of such a revision was in early 1982. See "Revisions in the Current Population Survey Beginning in January 1982" in the February 1982 issue of this publication.

[3] See "Revisions in the Current Population Survey Effective January 1994" in the February 1994 issue of this publication.

[4] See Anne E. Polivka and Stephen M. Miller, "The CPS After the Redesign: Refocusing the Economic Lens," paper presented at NBER/CRIW Labor Statistics Measurement Issues Conference December 1994, BLS Working Paper 269, March 1995.

vised weights for 1990-93 are expected to be available later in 1996. The aggregate data for all of the months were retabulated using the revised sample weights, and recomposited. (See the Explanatory Notes for the household data at the back of this publication for information on compositing.)

Effect of new population controls

The effect of the new population controls on the national estimates for 1990-93 were very consistent with the effects described for 1993 in the February 1994 article cited previously. Table 1 displays the old and new data and the differences between them based on 1990 annual averages for several labor force status categories. Increases in levels were concentrated in younger age groups, races other than white or black, and persons of Hispanic origin. Data for older age groups generally decreased as a result of these revisions.

Over the 4 years subject to revision, the annual average estimates of the civilian noninstitutional population 16 years and over increased at a gradually increasing rate, beginning with an increase of about 1.1 million (0.6 percent) in 1990, and ending with an increase of about 1.3 million (0.7 percent) in 1993. Because of the demographic distribution of the population increase, particularly with respect to age, the estimated levels of civilian labor force went up by almost as much as the population, resulting in average increases of 0.1 in overall labor force participation rates and employment-population ratios. Within the civilian labor force, the new controls caused average increases of 0.1 in the overall unemployment rate because demographic groups with relatively high unemployment rates, such as youth and persons of Hispanic origin, had relatively large upward population adjustments.

As a result of the population-control effect having been moved from January 1994 to January 1990, the over-the-year changes in the annual average levels of the major labor force aggregates between 1993 and 1994 are now: An increase of 1.9 instead of 3.0 million for civilian labor force; an increase of 2.8 instead of 3.8 million for employment; and a decrease of 0.9 instead of 0.7 million in unemployment. Also, primarily because of the revisions to the not seasonally adjusted data, the month-to-month changes from December 1993 to January 1994 in the seasonally adjusted levels of the major labor force aggregates are now much closer to being within the bounds of what can be regarded as "normal" month-to-month change for these series: An increase of 0.7 instead of 1.8 million for civilian labor force; an increase of 0.5 instead of 1.3 million for employment; and an increase of 0.3 instead of 0.5 million for unemployment. The direction of these month-to-month changes are so consistent with our understanding of the redesign effects that it is virtually certain that the December 1993 to January 1994 month-to-month changes remaining after revision do reflect to some degree the effects of the redesign. On the other hand, the fact that changes such as these occur occasionally under normal conditions supports the idea that, for the major labor force series at least, the redesign effects are small and need not be a major concern when making longer term comparisons of data for these series across the 1993-94 period and back to 1990.

Revision of Seasonally Adjusted Data

Seasonal adjustment attempts to eliminate from economic time series the influence of weather, holidays, the opening and closing of schools, and other such seasonal events. Its purpose is to make it easier to observe and analyze the cyclical and other nonseasonal movements in the series. The seasonality which the adjustment process endeavors to eliminate is represented by seasonal factors. The seasonal factors used for current adjustment are estimates of how much the original unadjusted values can be expected to deviate from underlying trend-cycle levels due to annually recurring behavior as projected from average seasonal patterns in the recent past.

Even though seasonality involves regularly recurring patterns, it does tend to change over time, creating a need for periodic reestimation of factors and revision of recently adjusted estimates. By including more recent data in the estimation process, the revision process can provide better estimates of how much the original, unadjusted estimates actually deviated from underlying trend-cycle levels during the recent period, thereby improving the historical seasonally adjusted data for that period. In addition, the new information is incorporated to produce the new projected factors to be used for current seasonal adjustment.

Therefore, at the end of each calendar year, the Bureau of Labor Statistics reestimates the seasonality of the unemployment, employment, and other labor force series derived from the Current Population Survey (CPS) by including another full year of data in the estimation process. Based on this annual reestimation, BLS issues the projected factors for the first 6 months of the new year as well as revised estimates of historical seasonally adjusted data. Usually, the data for the last 5 years are revised. This time, because of the revision of the not seasonally adjusted data for 1990-93 discussed in the first part of this article, the revisions extend back 6 years, to January 1990. In addition, because of the processing delays caused by the recent shutdowns and the weather-related closing of many Federal agencies, the seasonally adjusted data for January 1996 also were subject to revision.

Table 2 contains the projected seasonal factors for the first 6 months of 1996 for the 12 component series used in the computation of the seasonally adjusted civilian labor force and unemployment rate. (See the section on aggregation procedures later in the article.) Projected factors for the last 6 months of 1996 will be published in the July issue of this publication.

Effect of revised seasonal factors

One of the criteria used to evaluate alternative methods of seasonal adjustment is how close initial estimates are to sub-

Table 1. Labor force status of the civilian noninstitutional population by sex, age, race, and Hispanic origin using 1980 and adjusted 1990 census population bases, 1990 annual averages

(Numbers in thousands)

Labor force status, age, race, and Hispanic origin	Both sexes			Men			Women		
	1980 base	Adjusted 1990 base	Net difference	1980 base	Adjusted 1990 base	Net difference	1980 base	Adjusted 1990 base	Net difference
TOTAL									
Civilian noninstitutional population	188,049	189,164	1,115	89,650	90,377	727	98,399	98,787	388
Civilian labor force	124,787	125,840	1,053	68,234	69,011	777	56,554	56,829	275
Participation rate	66.4	66.5	.1	76.1	76.4	.3	57.5	57.5	.0
Employed	117,914	118,793	879	64,435	65,104	669	53,479	53,689	210
Employment-population ratio	62.7	62.8	.1	71.9	72.0	.1	54.3	54.3	.0
Unemployed	6,874	7,047	173	3,799	3,906	107	3,075	3,140	65
Unemployment rate	5.5	5.6	.1	5.6	5.7	.1	5.4	5.5	.1
Not in labor force	63,262	63,324	62	21,417	21,367	-50	41,845	41,957	112
16 to 19 years									
Civilian noninstitutional population	13,794	14,520	726	6,947	7,347	400	6,847	7,173	326
Civilian labor force	7,410	7,792	382	3,866	4,094	228	3,544	3,698	154
Participation rate	53.7	53.7	.0	55.7	55.7	.0	51.8	51.6	-.2
Employed	6,261	6,581	320	3,237	3,427	190	3,024	3,154	130
Employment-population ratio	45.4	45.3	-.1	46.6	46.6	.0	44.2	44.0	-.2
Unemployed	1,149	1,212	63	629	667	38	519	544	25
Unemployment rate	15.5	15.5	.0	16.3	16.3	.0	14.7	14.7	.0
Not in labor force	6,385	6,727	342	3,081	3,253	172	3,304	3,474	170
20 to 24 years									
Civilian noninstitutional population	17,799	18,902	1,103	8,647	9,320	673	9,152	9,582	430
Civilian labor force	13,843	14,700	857	7,291	7,866	575	6,552	6,834	282
Participation rate	77.8	77.8	.0	84.3	84.4	.1	71.6	71.3	-.3
Employed	12,622	13,401	779	6,625	7,151	526	5,997	6,250	253
Employment-population ratio	70.9	70.9	.0	76.6	76.7	.1	65.5	65.2	-.3
Unemployed	1,221	1,299	78	666	715	49	555	584	29
Unemployment rate	8.8	8.8	.0	9.1	9.1	.0	8.5	8.5	.0
Not in labor force	3,956	4,202	246	1,356	1,454	98	2,600	2,748	148
25 to 54 years									
Civilian noninstitutional population	105,498	105,777	279	51,641	51,884	243	53,856	53,893	37
Civilian labor force	88,140	88,322	182	48,259	48,456	197	39,881	39,866	-15
Participation rate	83.5	83.5	.0	93.4	93.4	.0	74.1	74.0	-.1
Employed	84,139	84,277	138	46,071	46,240	169	38,068	38,037	-31
Employment-population ratio	79.8	79.7	-.1	89.2	89.1	-.1	70.7	70.6	-.1
Unemployed	4,001	4,045	44	2,188	2,216	28	1,813	1,829	16
Unemployment rate	4.5	4.6	.1	4.5	4.6	.1	4.5	4.6	.1
Not in labor force	17,358	17,455	97	3,383	3,428	45	13,975	14,027	52
55 years and over									
Civilian noninstitutional population	50,959	49,966	-993	22,415	21,826	-589	28,544	28,139	-405
Civilian labor force	15,395	15,026	-369	8,818	8,594	-224	6,577	6,431	-146
Participation rate	30.2	30.1	-.1	39.3	39.4	.1	23.0	22.9	-.1
Employed	14,892	14,535	-357	8,502	8,286	-216	6,390	6,248	-142
Employment-population ratio	29.2	29.1	-.1	37.9	38.0	.1	22.4	22.2	-.2
Unemployed	503	491	-12	316	308	-8	187	183	-4
Unemployment rate	3.3	3.3	.0	3.6	3.6	.0	2.8	2.9	.1
Not in labor force	35,563	34,940	-623	13,597	13,232	-365	21,966	21,708	-258
White									
Civilian noninstitutional population	160,415	160,625	210	77,082	77,369	287	83,332	83,256	-76
Civilian labor force	107,177	107,447	270	59,298	59,638	340	47,879	47,809	-70
Participation rate	66.8	66.9	.1	76.9	77.1	.2	57.5	57.4	-.1
Employed	102,087	102,261	174	56,432	56,703	271	45,654	45,558	-96
Employment-population ratio	63.6	63.7	.1	73.2	73.3	.1	54.8	54.7	-.1
Unemployed	5,091	5,186	95	2,866	2,935	69	2,225	2,251	26
Unemployment rate	4.7	4.8	.1	4.8	4.9	.1	4.6	4.7	.1
Not in labor force	53,237	53,178	-59	17,785	17,731	-54	35,453	35,447	-6
Black									
Civilian noninstitutional population	21,300	21,477	177	9,567	9,573	6	11,733	11,904	171
Civilian labor force	13,493	13,740	247	6,708	6,802	94	6,785	6,938	153
Participation rate	63.3	64.0	.7	70.1	71.0	.9	57.8	58.3	.5
Employed	11,966	12,175	209	5,915	5,995	80	6,051	6,180	129
Employment-population ratio	56.2	56.7	.5	61.8	62.6	.8	51.6	51.9	.3
Unemployed	1,527	1,565	38	793	806	13	734	758	24
Unemployment rate	11.3	11.4	.1	11.8	11.9	.1	10.8	10.9	.1
Not in labor force	7,808	7,737	-71	2,859	2,772	-87	4,948	4,965	17
Hispanic origin									
Civilian noninstitutional population	14,297	15,904	1,607	7,087	8,041	954	7,210	7,863	653
Civilian labor force	9,576	10,720	1,144	5,755	6,546	791	3,821	4,174	353
Participation rate	67.0	67.4	.4	81.2	81.4	.2	53.0	53.1	.1
Employed	8,808	9,845	1,037	5,304	6,021	717	3,504	3,823	319
Employment-population ratio	61.6	61.9	.3	74.8	74.9	.1	48.6	48.6	.0
Unemployed	769	876	107	451	524	73	317	351	34
Unemployment rate	8.0	8.2	.2	7.8	8.0	.2	8.3	8.4	.1
Not in labor force	4,721	5,184	463	1,332	1,495	163	3,389	3,689	300

Table 2. Pre-1994 adjustment and January–June 1996 seasonal adjustment factors for the 12 major civilian labor force components

Procedure and series	Prior adjustment factors	Seasonal adjustment factors					
		January	February	March	April	May	June
Multiplicative adjustment (Divide factor into original value)							
Agricultural employment:							
Men, 20 years and over	(1)	.895	.907	.936	.996	1.062	1.087
Women, 20 years and over	.776	.873	.891	.956	1.026	1.053	1.087
Men, 16 to 19 years	.860	.616	.645	.802	.862	1.081	1.563
Women, 16 to 19 years	.853	.708	.622	.699	.858	.956	1.537
Nonagricultural employment:							
Men, 20 years and over	(1)	.986	.989	.993	.996	1.000	1.005
Women, 20 years and over	(1)	.995	1.002	1.000	1.000	1.000	.993
Unemployment:							
Men, 20 years and over	.938	1.164	1.164	1.107	1.019	.965	.939
Women, 20 years and over	.976	1.047	.998	.980	.945	.923	1.022
Additive adjustment (Subtract factor from original value)							
Nonagricultural employment:							
Men, 16 to 19 years	-68	-292	-295	-269	-229	-186	382
Women, 16 to 19 years	-96	-213	-239	-210	-204	-92	370
Unemployment:							
Men, 16 to 19 years	-47	-31	10	-53	-28	17	223
Women, 16 to 19 years	(1)	-59	-42	-59	-27	38	228

[1] No prior adjustment was done.

sequent revisions. Policymakers and analysts must make determinations based on current information, and so it is important that the initial estimates of current factors for the seasonal adjustment of major economic series produce estimates of level and change that are as close as possible to the improved estimates that will be made after more data become available. Even though the current revisions of the seasonally adjusted data for January 1995 through January 1996 are not final, these are the first revisions for that period, and first revisions are usually more substantial than, and often indicate the direction of, any subsequent revisions. Therefore, it is appropriate to compare these first revisions with the initial estimates. Table 3 shows the civilian unemployment rate for January 1995 through January 1996 as first computed and as revised, as well as the changes due to revision. Rounded to one decimal place as published, the rate changes in only 2 of the 13 months, and only by 0.1 percentage point. Clearly, the trend observed in the initial estimates was sustained in the revisions.

Table 3. Seasonally adjusted unemployment rates and change due to revision, January 1995–January 1996

Month	As first computed	As revised	Change
1995			
January	5.7	5.7	.0
February	5.4	5.4	.0
March	5.5	5.5	.0
April	5.4	5.7	-0.1
May	5.7	5.6	-.1
June	5.6	5.6	.0
July	5.7	5.7	.0
August	5.6	5.6	.0
September	5.6	5.6	.0
October	5.5	5.5	.0
November	5.6	5.6	.0
December	5.6	5.6	.0
1996			
January	5.8	5.8	.0

Adjustment methods and procedures

The official seasonal adjustment procedure for the labor force series is the X-11 ARIMA program, which was developed at Statistics Canada during the 1970's as an extension of and improvement to the widely used X-11 method developed at the U.S. Bureau of the Census in the 1960's.[5] The X-11 ARIMA method improves current estimates for most series by allowing recent observations, especially those of the last 6 months, to weigh more heavily in the estimates of current and recent seasonal factors than did the X-11 alone.

[5] The primary documentation for the X-11 ARIMA procedure is *The X-11-ARIMA Seasonal Adjustment Method*, by Estela Bee Dagum (Statistics Canada Catalogue No. 12-564E, January 1983). (ARIMA is an acronym for AutoRegressive Integrated Moving Average.) The X-11 method was originally described in *The X-11 Variant of the Census Method II Seasonal Adjustment Program*, by Julius Shiskin, Alan Young, and John Musgrave (Technical Paper No. 15, Bureau of the Census, 1967).

Table 4. ARIMA models used in end-of-1995 seasonal adjustment for the 12 major civilian labor force components

Series	Model	Transformation
Agricultural employment:		
Men, 20 years and over	(1,0,0)(0,1,1)	LOG
Women, 20 years and over	(0,1,1)(0,1,1)	LOG
Men, 16 to 19 years	(0,1,2)(0,1,1)	NONE
Women, 16 to 19 years	(2,1,2)(0,1,1)	NONE
Nonagricultural employment:		
Men, 20 years and over	(0,1,1)(0,1,1)	LOG
Women, 20 years and over	(0,1,4)(0,1,1)	LOG
Men, 16 to 19 years	(2,1,0)(0,1,1)	NONE
Women, l6 to 19 years	(2,1,0)(0,1,1)	NONE
Unemployment:		
Men, 20 years and over	(0,1,3)(0,1,1)	LOG
Women, 20 years and over	(0,1,1)(0,1,1)	LOG
Men, 16 to 19 years	(0,1,1)(0,1,1)	NONE
Women, 16 to 19 years	(2,1,2)(0,1,1)	NONE

The method provides this improvement through the use of ARIMA models to extend the data series by 12 months. The X-11 algorithm for seasonal adjustment is then applied to the extended series.

ARIMA models. ARIMA projections are based only on the past experience observed in a series itself. ARIMA models have proved to have good properties for short-term projection or extrapolation of a large class of time series, especially in a seasonal adjustment context, since the extrapolations tend to track intra-year movements quite well. The ARIMA models in the X-11 ARIMA program used to seasonally adjust the labor force series are of the Box-Jenkins type.[6] They can generally be described with the notation:

(p,d,q)(P,D,Q) TRANSFORMATION,

Where:

(1) p is the number of regular (nonseasonal) autoregressive parameters
(2) d is the number of regular differences
(3) q is the number of regular moving average parameters
(4) P is the number of seasonal autoregressive parameters
(5) D is the number of seasonal differences
(6) Q is the number of seasonal moving average parameters
(7) TRANSFORMATION may be NONE, LOG, or POWER(n).

[6] For a more detailed discussion of ARIMA models, refer to previously cited Dagum (1983) and to G.E.P. Box and G.M. Jenkins, *Time Series Analysis, Forecasting, and Control* (San Francisco, Holden Day, 1970); and C.W.J. Granger and P. Newbold, *Forecasting Economic Time Series* (New York, Academic Press, 1977).

While the lettered elements within the parentheses of the model specifications can theoretically take on many values, in practice, only small values are useful.

For each labor force series which has been extended based on an ARIMA model, the model has been specifically chosen as well suited to the particular series, based on a set of established criteria. The criteria essentially require a model to: (1) Fit the series well, (2) have low average forecasting errors in the last 3 years prior to the projected year, and (3) produce residuals (the differences between the observed values and the values forecast by the model for the observed period) which follow a random pattern. Acceptable ARIMA models have been identified and were used for 167 of the 173 labor force series which were directly adjusted at the end of 1995, including all 12 major civilian labor force components, whose ARIMA models are shown in table 4. The models for two of those major components—unemployment for women 16-19 and women 20 years and over—are different from those used last year. The six remaining series (of the 173) for which acceptable models were not identified were simply run through the X-11 part of the program without any ARIMA extrapolations.

X-11 procedures. The procedures used for this year's adjustment of the labor force series within the X-11 part of the process were different from the standard procedures of most previous years in three respects. All three were intended to help the seasonal adjustment process deal more effectively or more easily with the effects discussed earlier—the population-control effects that now begin in January 1990, and the redesign effects that begin in January 1994.

First, like last year, prior adjustment factors were still used in the X-11 ARIMA runs for many of the series to link the pre-1994 data with the subsequent data for purposes of seasonal adjustment. Even after the revisions to the unadjusted data for 1990-93, there were still unusual changes in many of the series between December 1993 and January 1994 that could have caused distortion in the seasonal decomposition if no adjustment were done. The prior adjustment factors used a year ago[7] were recomputed to adjust for the effects of the revisions to the not seasonally adjusted data for 1990-93. Smaller prior adjustments resulted for many series, because the population-control effects were usually in the same direction as the redesign effects. For some series, including 4 of the 12 major components, prior adjustment was no longer necessary at all. However, for series such as part time for economic reasons and full-time employed, the population-control and redesign effects were in offsetting directions, and larger prior adjustments were needed. For each series still warranting prior adjustment, the factors were applied to all pre-1994 observations in X-11 ARIMA. The prior adjustment factors used for the 12 major components are shown in table 2 alongside the seasonal adjustment factors.

[7] For a discussion of the original derivation of those factors, see "Revision of Seasonally Adjusted Labor Force Series" in the January 1995 issue of this publication.

Second, also like last year, the shorter "3x3" seasonal factor moving averages were chosen in place of the normal "3x5" default ones for all series. This allowed the 1994 and 1995 data to contribute more weight (and the pre-1994 "old CPS" data less weight) to the revised seasonal factors for 1994 and 1995 and the projected seasonal factors for 1996 computed in these runs. The temporary use of the shorter seasonal factor moving averages in these early years of the redesigned CPS should enable the seasonal adjustment results to more quickly adapt to any changes in seasonal patterns that might have occurred in the labor force series due to the changes introduced at the beginning of 1994.

Third, a 6-year time span, including data from January 1990 through December 1995, was used for this year's adjustment of all the labor force series, instead of the usual 10-year span. This was done primarily for the sake of keeping the seasonal adjustment process no more complicated than it has to be to serve its principal objectives. Inclusion of pre-1990 data in these runs would have required the computation and use of additional prior adjustment factors for many series that would have had little or no effect on the seasonal adjustment of current data. To benefit the revisions of historical seasonally adjusted data back to 1990, the ARIMA option that computes a year of backcasted data in addition to the usual forecasted year was chosen for all of the directly adjusted series with identified ARIMA models.

The X-11 method of seasonal adjustment contained in the X-11 ARIMA procedure assumes that the original series, including the 12 extrapolated observations if an ARIMA model has been applied, is either the product or the sum of 3 components—trend-cycle, seasonal, and irregular. The method uses either a ratio-to- or difference-from-moving-average approach to estimate the components, depending on whether the multiplicative or additive model is used. The seasonally adjusted series values are computed by dividing each month's original value by the corresponding seasonal factor if the multiplicative model is used, or by subtracting the factor if the additive model is used. Of the 12 major civilian labor force components, the 4 teenage unemployment and nonagricultural employment series were adjusted using the additive model, and the other 8 series with the multiplicative model. Of all the 173 directly adjusted series, 48 were adjusted with the additive model, including most teenage employment and unemployment series, for which the seasonal components were found to be fairly independent of the trend-cycle.

Moving-holiday adjustment. Two of the series directly adjusted with multiplicative models were seasonally adjusted using the moving-holiday extension of X-11 ARIMA which was developed at BLS. Both holiday-adjusted series—at work on part-time schedules for noneconomic reasons, usually work part time, all industries and nonagricultural industries—had tested as having significant and well-defined effects in their April data related to the timing of Easter. A detailed discussion of the nature of the Easter effect in these series and of the procedure used to control for it as part of the seasonal adjustment process was included in the January 1990 version of this article.

Six-month updates. The current official practice for the seasonal adjustment of the labor force series involves the running of all directly adjusted series through X-11 ARIMA twice each year, usually after receipt of June and December data, with 6 months of projected factors drawn from each run and historical revisions drawn from the end-of-year run. This practice allows, among other things, the prior publication of seasonal factors, which historically has been regarded by BLS and other statistical agencies as an important way of ensuring the openness of their seasonal adjustment procedures, especially where very sensitive indicators such as the unemployment rate have been involved. A number of research studies, including a 1987 paper on the labor force series,[8] have indicated that the alternative practice of concurrent adjustment, where the seasonal adjustment procedure is run with all available data each month and factors cannot be published ahead of time, generally produces initial seasonally adjusted estimates requiring smaller revisions than those produced by adjustment using projected factors. BLS is continuing to compute and evaluate concurrent adjustment for the labor force series.

Aggregation procedures

BLS maintains and publishes several hundred seasonally adjusted labor force series in addition to the 173 directly adjusted series discussed above. These additional series are produced by arithmetically combining or aggregating the directly adjusted series with each other or, in some cases, with series on population which are not seasonally adjusted because they are not considered to have any significant seasonal variation. For example, the seasonally adjusted levels of total unemployment, civilian employment, and civilian labor force, and the seasonally adjusted unemployment rate for all civilian workers, are all produced by aggregation of some or all of the seasonally adjusted results for the 12 major civilian labor force components. The seasonally adjusted level of total unemployment is the sum of the seasonally adjusted levels of unemployment for the four age-sex groups—men and women 16 to 19, and men and women 20 years and over. Seasonally adjusted civilian employment is the sum of the seasonally adjusted levels of employment for the eight employment components—the same four age-sex groups as noted above employed in nonagricultural and agricultural industries. The seasonally adjusted civilian labor force is the sum of all 12 components. The seasonally adjusted civilian unemployment rate is calculated by taking the total seasonally adjusted unemployment level as a percent of the total seasonally adjusted civilian labor force.

[8] G.R. Methee and R.J. McIntire, "An Evaluation of Concurrent Seasonal Adjustment for the Major Labor Force Series," in the 1987 *Proceedings of the Business and Economic Statistics Section*, American Statistical Association.

The principal reason for producing many of the major seasonally adjusted estimates for the labor force by aggregation rather than by direct adjustment is that this approach ensures that the major seasonally adjusted totals will be arithmetically consistent with at least one major set of components. If the totals were directly adjusted along with the components, such consistency would not, in all likelihood, occur, since the X-11 is not a sum-preserving procedure; that is, the sum of the result for two or more directly adjusted series will not generally be the same as the result of directly adjusting the sum of the unadjusted versions of the same series. Another factor is that it would generally be inappropriate to apply seasonal factors computed for an aggregate series to the components of the aggregate. The various labor force components tend to have significantly different patterns of seasonal variation; for example, teenage unemployment tends to peak in June, while unemployment of adult men tends to peak in the winter months of January and February. In order to estimate properly these varying seasonal patterns, it is necessary to adjust the components directly. Of course, one of the implications of producing seasonally adjusted estimates for many major series by aggregation is that exact factors cannot be projected for those series. However, implicit seasonal adjustment factors can be calculated after the fact by taking the ratio of the unadjusted aggregate to the seasonally adjusted aggregate, or, for additive implicit factors, the difference between those two aggregates.

Availability of revised series

This issue of *Employment and Earnings* contains revised monthly data for 1990 through January 1996 for many seasonally adjusted labor force series. These revisions replace the seasonally adjusted estimates published previously for that period.

Additional data for any of the several hundred seasonally adjusted labor force series, as well as the January-June 1996 factors for any of the directly adjusted series beyond the 12 major components, can be obtained from BLS upon request. Requests for data or inquiries concerning seasonal adjustment methodology or the availability of machine-readable files of labor force data should be addressed to the Division of Data Development and Publications, Office of Employment and Unemployment Statistics, Bureau of Labor Statistics, Washington, DC 20212.