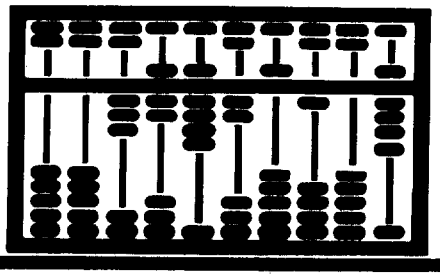
Technical notes



New benchmarks and SIC codes for Establishment Survey

Patricia M. Getz

With the release of data for August 1990, the Bureau of Labor Statistics introduced its annual revision of national estimates of employment, hours, and earnings from the monthly sample survey of nonfarm establishments. Each year, the sample estimates are adjusted to new benchmarks, which are comprehensive universe counts of employment based primarily on unemployment insurance reports filed by all employers with State employment security agencies.

Also effective with the August 1990 release, all industry series have been converted to 1987 Standard Industrial Classification (SIC) codes.[1] This new structure replaces the 1972 SIC coding structure previously in effect for the industry estimates.

All data from April 1988 forward have been revised to incorporate both the March 1989 benchmarks and the effects of the SIC revision. Historical (pre-1988) data for industry series affected by SIC redefinitions have been reconstructed where possible. Historical data for industry series unaffected by the SIC revision remain as previously published.

As is the usual practice with the introduction of new benchmarks, the Bureau has also revised all seasonally adjusted series for the previous 5-year period and has introduced new seasonal adjustment factors to be used to adjust data in the months ahead.

In addition, all published constant-dollar and indexed series have been recomputed on a 1982 base, replacing the previously published 1977-based data.

Conversion to 1987 SIC coding

The SIC coding system is periodically updated to reflect structural and technological changes in the economy. The 1987 SIC revision marks the first full SIC restructuring since 1972; minor updates were made to the SIC system in 1977.

There were almost no changes in scope at the major industry division levels, with only very minor shifts between wholesale and retail trade and between the finance, insurance, and real estate division and the services division. However, there were several significant redefinitions at the two-digit level. In manufacturing, a substantial realignment took place between electronic and other electrical equipment (SIC 36) and instruments and related products (SIC 38). In services, a new two-digit code (SIC 87) was established for "engineering and management services." Most of the activities under this new heading had previously been classified as business services (SIC 73) or miscellaneous services (SIC 89). At the three- and four-digit SIC levels, changes in scope were both more prevalent and more substantial.

All restructured industries were reestimated using the 1987 SIC-coded sample data from January 1988 forward. Some aggregate-level industries, without scope changes, have also been affected by the retabulations because they are formed from the summation of restratified, reestimated component industries.

For industries with relatively minor scope changes, historical data were reconstructed back to the inception of the series wherever possible. The reconstruction of historical series was done by adjusting the existing 1972-based employment series for the percentage of employment lost or the percentage of employment gained from other industries, using ratios derived from first-quarter 1988 universe employment data.[2] Hours and earnings data for restructured series were derived by computing a weighted average of the component series they were derived from. The weights are the percentages of employment each old series contributed to the new series.

Effect of revisions

The net impact of the SIC restructuring and the adjustment to March 1989 benchmark levels on total nonfarm employment was an upward revision of only 9,000 from the previously published level. Table 1 presents, for March 1989, previously published estimates based on the 1972 SIC codes, retabulated estimates based on the 1987 SIC codes, and the newly published benchmark levels. It displays separately the revision effects due to SIC restructuring and those due to benchmarking and shows the net effect, which is the sum of the two.

For total nonfarm employment, the SIC revision effect, due entirely to restratification and not to any scope change, was 56,000, or less than 0.05 percent. At the detailed industry level, the largest effects of the SIC revision were in business services, instruments and related products, and electronic and other electrical equipment.

The benchmark effect shown in the table represents a comparison of March 1989 estimates retabulated under the 1987 SIC structure with the March 1989 benchmark levels. For total nonfarm employment, the benchmark level stands at 107,026,000. This represents a benchmark adjustment of –47,000, or less than 0.05 percent. There were, however, larger but essentially offsetting errors between the goods-producing and service-producing sectors. Benchmark revisions totaling –286,000 were spread across all the major industry divisions in

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Table 1. **Differences between nonfarm employment benchmarks and estimates, by industry, March 1989**

[In thousands]

Industry	1972 SIC-based published estimate (1)	1987 SIC-based estimate (2)	Benchmark (3)	SIC revision effect (2 – 1) (4)	Benchmark effect (3 – 2) (5)	Difference between benchmark and estimate (3 – 1) (6)
Total	107,017	107,073	107,026	56	–47	9
Total private	89,052	89,108	89,015	56	–93	–37
Goods-producing	25,095	25,101	24,815	6	–286	–280
Mining[1]	702	703	678	1	–25	–24
Oil and gas extraction	391	391	374	0	–17	–17
Construction[1]	4,837	4,813	4,741	–24	–72	–96
General building contractors	1,287	1,287	1,239	0	–48	–48
Manufacturing	19,556	19,585	19,396	29	–189	–160
Durable goods[2]	11,550	11,538	11,448	–12	–90	–102
Lumber and wood products[2]	755	767	746	12	–21	–9
Furniture and fixtures	535	535	530	0	–5	–5
Stone, clay, and glass products[2]	592	560	559	–32	–1	–33
Primary metal industries	790	789	781	–1	–8	–9
Blast furnaces and basic steel products	276	276	281	0	5	5
Fabricated metal products[2]	1,451	1,454	1,454	3	0	3
Industrial machinery and equipment[2]	2,147	2,166	2,136	19	–30	–11
Electronic and other electrical equipment[2]	2,052	1,760	1,762	–292	2	–290
Transportation equipment[2]	2,067	2,045	2,071	–22	26	4
Motor vehicles and equipment	869	869	871	0	2	2
Instruments and related products[2]	774	1,075	1,027	301	–48	253
Miscellaneous manufacturing	388	389	383	1	–6	–5
Nondurable goods[2]	8,006	8,047	7,948	41	–99	–58
Food and kindred products	1,599	1,598	1,583	–1	15	–16
Tobacco products	55	55	51	0	–4	–4
Textile mill products	727	727	725	0	–2	–2
Apparel and other textile products	1,102	1,106	1,086	4	–20	–16
Paper and allied products[2]	693	689	693	–4	4	0
Printing and publishing	1,600	1,601	1,560	1	–41	–40
Chemicals and allied products	1,084	1,085	1,068	1	–17	–16
Petroleum and coal products	158	158	153	0	–5	–5
Rubber and miscellaneous plastics products[2]	846	886	893	40	7	47
Leather and leather products	142	142	138	0	–4	–4
Service-producing	81,922	81,972	82,211	50	239	289
Transportation and public utilities[2]	5,607	5,646	5,549	39	–97	–58
Transportation[2]	3,404	3,443	3,341	39	–102	–63
Communication and public utilities[2]	2,203	2,203	2,208	0	5	5
Wholesale trade[2]	6,154	6,145	6,195	–9	50	41
Durable goods[2]	3,658	3,654	3,676	–4	22	18
Nondurable goods	2,496	2,491	2,519	–5	28	23
Retail trade[1 2]	19,059	19,023	19,115	–36	92	56
General merchandise stores	2,398	2,386	2,452	–12	66	54
Food stores	3,184	3,184	3,121	0	–63	–63
Auto dealers and service stations	2,129	2,126	2,084	–3	–42	–45
Eating and drinking places	6,164	6,164	6,264	0	100	100
Finance, insurance, and real estate[2]	6,723	6,714	6,639	–9	–75	–84
Finance[2]	3,306	3,304	3,288	–2	–16	–18
Insurance[2]	2,115	2,115	2,089	0	–26	–26
Real estate[2]	1,302	1,295	1,262	–7	–33	–40
Services[1 2]	26,414	26,479	26,702	65	223	288
Business services[2]	5,678	4,750	4,828	–928	78	–850
Health services	7,480	7,476	7,401	–4	–75	–79
Government	17,965	17,965	18,011	0	46	46
Federal	2,976	2,976	2,976	0	0	0
State	4,213	4,213	4,257	0	44	44
Local	10,776	10,776	10,778	0	2	2

[1] Includes other industries not shown separately.

[2] Industry scope changed due to SIC revision. Other industries were not directly affected by the SIC revision, but some estimates changed as a result of restratification within the industry.

Table 2. **Differences in seasonally adjusted levels and over-the-month changes, total nonfarm employment, January 1989–May 1990**

[In thousands]

Month	Levels			Over-the-month changes		
	Previously published	Revised	Difference	Previously published	Revised	Difference
1989:						
January	107,442	107,430	–12	345	359	14
February	107,711	107,648	–63	269	218	–51
March	107,888	107,811	–77	177	163	–14
April	108,101	107,988	–113	213	177	–36
May	108,310	108,135	–175	209	147	–62
June	108,607	108,364	–243	297	229	–68
July	108,767	108,490	–277	160	126	–34
August	108,887	108,628	–259	120	138	18
September	109,096	108,868	–228	209	240	31
October	109,171	108,980	–191	75	112	37
November	109,452	109,245	–207	281	265	–16
December	109,570	109,383	–187	118	138	20
1990:						
January	109,931	109,654	–277	361	271	–90
February	110,304	109,958	–346	373	304	–69
March	110,427	110,122	–305	123	164	41
April	110,401	110,177	–224	–26	55	81
May	110,770	110,617	–153	369	440	71

the goods-producing sector, continuing the pattern of overestimation of these industries over the last several years. Offsets to this overestimation occurred in the service-producing industries, which were revised upward by a total of 239,000.

Revised estimates were computed each month from March 1989 forward (the postbenchmark period), based on the new benchmark levels. On a seasonally adjusted basis, the monthly revision increased from –77,000 in March 1989 to –153,000 by May 1990, with larger differences in some of the intervening months. These revisions reflect restratification effects from the SIC revision and a recomputation of both the bias adjustment and the seasonal adjustment factors. Table 2 shows the extent of the revisions for 1989 and 1990, in both level and change, through a comparison of seasonally adjusted monthly data as previously published and as revised.

Sources of differences

Differences between population benchmarks and sample-based estimates result from both sampling and nonsampling error. Sampling error occurs anytime a sample is used to make inferences about a population.

Both the benchmark levels and the sample-based estimates are subject to several sources of nonsampling error, chief among which are (1) the inability to measure employment in new firms from the time of their inception, due to the time lag between the creation of new firms and their inclusion in the sample; (2) the procedures for handling changes in industrial classification; (3) the quality of the various source data used to derive the benchmark; (4) the inability to cover completely all firms in the target population; and (5) other sources of errors in coverage, response, processing, and collection.

Effect of revisions on other series

As with the all-employee data, estimates were recomputed from sample data for women workers and production workers and for hours and earnings in industries affected by the SIC revision, from January 1988 forward. At the total private level, hours and earnings were unchanged, and there were only minor changes in major division-level data.

Benchmarks are not available for the series on women, production and nonsupervisory workers, hours, and earnings. Women and production worker series are revised by applying the sample-derived ratio to the revised employment estimate at the basic cell level. These revisions are then summarized and incorporated into the broader industry groupings. Production and nonsupervisory worker employment estimates are used as weights in the estimation of hours and earnings at aggregate industry levels. Benchmark revisions to employment may cause shifts in these weights, with a minor effect on summary-level estimates of hours and earnings.

Seasonal adjustment procedure

Each year, employment, hours, and earnings data from the new benchmark levels are incorporated into the calculation of new seasonal adjustment factors. The Bureau uses the X-11 ARIMA seasonal adjustment method, developed by Statistics Canada,[3] to seasonally adjust establishment-based employment, hours, and earnings data. The ARIMA option is used to project the unadjusted data forward for 1 year prior to seasonally adjusting the series. The use of ARIMA projections lessens the need for revisions of historical data in future seasonal adjustments.

All published seasonally adjusted series have been revised for the most recent 5 years (1985–90) for the incorporation of new seasonal factors, as usual. In addition, series affected by the SIC revision which were reconstructed for years prior to 1985 have again been seasonally adjusted, based on the 1987 SIC-based estimates.

Publication of revised data

Revised estimates for all series appear in the August 1990 issue of the Bureau's periodical, *Employment and Earnings*, along with a more complete explanation of benchmarking, SIC revision, bias factors, and the new seasonal adjustment factors.

Data for detailed industry categories of employment, hours, and earnings will be presented in the Bureau's historical bulletin, *Employment, Hours, and Earnings, United States, 1909–90*. This publication will contain all of the historical data that were revised as a result of the 1987 SIC revision, the March 1989 benchmarks, updated seasonal adjustment factors, and the rebasing of constant-dollar and indexed series, as well

as prior data unaffected by these revisions. Estimates reflecting the new benchmarks appear in the "Current Labor Statistics" section of the *Monthly Labor Review*, beginning with September data in the November issue. □

Footnotes

[1] As defined in the *1987 Standard Industrial Classification Manual*, issued by the Executive Office of the President, Office of Management and Budget.

[2] All ratios are based on first-quarter 1988 universe employment data. For additional information, see *Employment Data under the New Standard Industrial Classification, First Quarter 1988*, Report 772, October 1989.

[3] A detailed description of the procedure appears in *The X-11 ARIMA Seasonal Adjustment Method*, by Estella Bee Dagum, Statistics Canada Catalogue No. 12-564E, January 1983.

Quality adjustments for structural changes in the CPI housing sample

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The Consumer Price Index (CPI) estimates the average change in prices paid by the American public for a fixed set of consumer goods and services. When a characteristic of a good or service used in the index changes, the change may include a measurable difference in the quality of the item or service being priced from one time period to the next. If so, an adjustment reflecting this difference will be made.

Quality adjustments can be direct or implicit. If the value of the change in quality can be measured, the measured amount is removed from the observed price difference. If the value cannot be measured, an implicit adjustment is made for the item or service based on the change of all other items in the same estimating cell. As an example, for the Rent Index, when a price comparison is canceled because the dollar amount of the change in quality is not known, there is no direct imputed price used for the given housing unit. Instead, the proportional weight for the unit is spread out among the other housing units in the same cell—or groups of similar cells if the impact on one cell would be too large—in a process known as *noninterview adjustment*.

This noninterview technique of indirect quality adjustment performs well as long as the price movements for the items that change in quality are similar to the price movement of all other items in the cell. If they are different—for example, if the items that change in quality always are experiencing significant price changes while the rest of the sample is not—then we would be better off trying to estimate the value of the change in quality directly.

Prior to February 1989, the CPI used the noninterview indirect adjustment technique for observations in the rent sample that had a change in any of four structural characteristics: central air conditioning, the number of bedrooms, the number of bathrooms, and the number of other rooms.[2] The rent sample from the CPI housing survey is the source of information on price changes for the Residential Rent Index and the Owners' Equivalent Rent Index. Quite frequently, changes in rent accompany structural changes, and the indirect adjustment process underestimates the former, thus overestimating changes in quality. Accordingly, starting with the data used in the February 1989 indexes, the Bureau of Labor Statistics has made direct quality adjustments in the CPI for rental units with verified changes in structural quality.

This note describes the process of adjusting for quality changes in structural characteristics. CPI analysts now make direct dollar adjustments for changes in the four structural characteristics mentioned above, in addition to adjusting for changes in parking accommodations, amount of furniture, number and types of appliances, and utility billing, a practice that already existed in previous housing surveys.

Table 1. **1990 structural change factors, by census region**

[Percentage of rent]

Structural element	Northeast	North Central	South	West
Central air conditioning	6.29	8.56	18.00	5.86
Number of bedrooms	16.51	16.34	20.55	14.97
Number of bathrooms	15.55	9.54	9.25	8.52
Number of other rooms	8.69	1.90	2.05	3.05

Source of adjustments

The adjustment values for the changes in structural characteristics are based on hedonic regressions, which show the relationship between the logarithm of rent and various structural and locational variables that affect rent. These regressions provide a set of factors (regression coefficients) for the different housing characteristics. As a result of the semilogarithmic form of the regressions, the factors give estimates of the value of the structural characteristics that are percentages of the rent. The BLS housing team then estimates the dollar adjustment for each change by multiplying the appropriate factor by the rent. Table 1 shows the 1990 structural change factors, broken down by census region, for the four characteristics of central air conditioning, number of bedrooms, number of bathrooms, and number of other rooms mentioned above.

Hedonic regressions are run annually for the four U.S. census regions, shown in table 1. The primary purpose of the regressions is to estimate the effects of age bias on the housing indexes.[3] Using them for quality adjustments is a spinoff benefit.

Using the adjustments

Rental units in the CPI housing sample are contacted twice a year, at which times BLS agents obtain the rents for the current and previous month. The CPI estimates the average change in rent over a 1-month period and over a 6-month period. The movement of the CPI Rent Index is a composite of these two

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