

Technical Note

This technical note describes the method of collection, concepts, scope, and estimating methods used in the preparation of the employment, hours, and earnings series shown in this bulletin.

COLLECTION

Payroll reports provide current information on wage and salary employment, hours, and earnings in nonagricultural establishments, by industry and geographic location.

Federal-State cooperation

Under cooperative arrangements between the States and the Bureau of Labor Statistics, responding establishments report employment, hours, and earnings data to State agencies. The State agencies mail payroll report forms to the establishments and examine the returns for consistency, accuracy, and completeness. The States use the reported data to prepare State and area statistics and also send the reported data to BLS for use in preparing the national series. This avoids a duplicate reporting burden on establishments, and together with the use of similar estimating techniques at the national and State levels, promotes increased comparability between estimates.

Shuttle schedules

Data are collected on Form BLS 790—Report on Employment, Payroll, and Hours. The collecting agency returns the schedule to the respondent each month so that the next month's data can be entered on the space allotted for that month. This "shuttle" procedure assures maximum comparability and accuracy of reporting, since the respondent can see the figures that have been reported for previous months.

Form BLS 790 provides for entry of data on the total number of workers on the payrolls of nonagricultural establishments and, for

most industries, payroll and hours of production and related workers or nonsupervisory workers for the pay period which includes the 12th of the month.

CONCEPTS

Industrial classification

Establishments reporting on Form BLS 790 are classified into industries on the basis of their principal product or activity, determined from information on annual sales volume. This information is collected on a supplement to the quarterly unemployment insurance tax reports filed by employers. For an establishment making more than one product or engaging in more than one activity, the entire employment of the establishment is included in the industry of the principal product or activity.

All national, State, and area employment, hours, and earnings series are classified according to the 1972 *Standard Industrial Classification Manual*, published by the Office of Management and Budget.

Industry employment

Employment data, except those for employees of the Federal Government, refer to persons on establishment payrolls who received pay for any part of the pay period which includes the 12th of the month. For Federal Government establishments, employment figures represent the number of persons who occupied positions on the last day of the calendar month. Intermittent workers are counted if they performed any service during the month.

The data exclude proprietors, the self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency and the National Security Agency are also excluded.

Persons on establishment payrolls who are on paid sick leave (when pay is received directly from the firm), on paid holiday or paid vacation, or who work during a part of the pay period even though they are unemployed or on strike during the rest of the period, are counted as employed. Not counted as employed are persons who are laid off, on leave without pay, or on strike for the entire period, or who are hired but have not been paid during the period.

Industry hours and earnings

Hours and earnings data are derived from reports of payrolls and hours for production and related workers in manufacturing and mining, construction workers in construction, and nonsupervisory employees in the remaining private nonagricultural components. These terms are defined below. When the pay period reported is longer than 1 week, the figures are converted to a weekly basis.

Production and related workers include working supervisors and all nonsupervisory workers (including group leaders and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, packing, warehousing, shipping, maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (e.g., power plant), and recordkeeping and other services closely associated with the above production operations.

Construction workers include the following employees in the construction division: Working supervisors, qualified craft workers, mechanics, apprentices, laborers, etc., whether working at the site of construction or in shops or yards, at jobs ordinarily performed by members of the construction trades (such as precutting and preassembling).

Nonsupervisory employees include employees (not above the working supervisory level) such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, social workers, teachers, research aides, drafters, photographers, beauticians, musicians, restaurant workers, custodial workers, attendants, line installers, laborers, janitors, guards, and other employees at similar occupational levels, whose services are closely associated with those of the employees listed.

Payroll covers the payroll for full- and part-time production, con-

struction, or nonsupervisory workers who received pay for any part of the pay period which includes the 12th of the month. The payroll is reported before deductions of any kind, e.g., for old-age and unemployment insurance, group insurance, withholding taxes, bonds, or union dues; also included is pay for overtime, holidays, vacations, and sick leave paid directly by the firm. Bonuses (unless earned and paid regularly each pay period), other pay not earned in the pay period reported (e.g., retroactive pay), tips, and the value of free rent, fuel, meals, or other payment in kind are excluded. Moreover, "fringe benefits" (such as health and other types of insurance, contributions to retirement, etc., paid by the employer) are also excluded.

Hours cover hours paid for, during the pay period which includes the 12th of the month, for production, construction, or nonsupervisory workers. The hours data include hours paid for holidays and vacations, and for sick leave when pay is received directly from the firm.

Overtime hours cover hours worked by production or related workers for which overtime premiums were paid because the hours exceeded the number of hours of either the straight-time workday or the workweek during the pay period which includes the 12th of the month. Weekend and holiday hours are included only if overtime premiums were paid. Hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid are excluded.

Average hourly earnings are on a "gross" basis. They reflect not only changes in basic hourly and incentive wage rates but also such variable factors as premium pay for overtime and late-shift work and changes in output of workers paid on an incentive plan. They also reflect shifts in the number of employees between relatively high-paid and low-paid work and changes in workers' earnings in individual establishments. Averages for groups and divisions further reflect changes in average hourly earnings for individual industries.

Averages of hourly earnings differ from wage rates. Earnings are the actual return to the worker for a stated period of time; rates are the amounts stipulated for a given unit of work or time. The earnings series do not measure the level of total labor costs on the part of the employer since the following are excluded: Irregular bonuses, retroactive items, payments of various welfare benefits, payroll taxes paid by employers, and earnings for those

employees not covered under the production worker, construction worker, or nonsupervisory employee definitions.

Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings. Therefore, weekly earnings are affected not only by changes in average hourly earnings but also by changes in the length of the workweek. In addition, monthly variations in such factors as proportion of part-time workers, stoppages for varying reasons, labor turnover during the survey period, and absenteeism for which employees are not paid may cause the average workweek to fluctuate.

Long-term trends of average weekly earnings can be affected by structural changes in the makeup of the work force. For example, persistent long-term increases in the proportion of part-time workers in retail trade and many of the service industries have reduced average workweeks in these industries and have affected the average weekly earnings series.

Average weekly hours relate to the average hours for which pay was received and are different from standard or scheduled hours. Such factors as absenteeism, labor turnover, part-time work, and stoppages cause average weekly hours to be lower than scheduled hours of work for an establishment. Group averages further reflect changes in the workweek of component industries.

Average overtime hours represent that portion of average weekly hours which exceeds regular hours and for which overtime premiums are paid. If an employee were to work on a paid holiday at regular rates, receiving as total compensation holiday pay plus straight-time pay for hours worked that day, no overtime hours would be reported.

Since overtime hours are premium hours by definition, average weekly hours and overtime hours do not necessarily move in the same direction from month to month; for example, overtime premiums may be paid for hours exceeding the straight-time workday although less than a full week is worked. Diverse trends at the industry-group level also may be caused by a marked change in average hours for a component industry where little or no overtime was worked in both the previous and current months. In addition, such factors as stoppages, absenteeism, and labor turnover may not have the same influence on overtime as on average hours.

Railroad hours and earnings figures relate to Class 1 railroads (excluding switching and terminal companies) and are derived from monthly data summarized in the M-300 report of the In-

terstate Commerce Commission. Data refer to all employees, except executives, officials, and staff assistants (ICC Group 1), who received pay during the month. Average hourly earnings are computed by dividing total compensation by total hours paid for. Average weekly hours are obtained by dividing the total number of hours paid for, converted to a weekly basis, by the number of employees, as defined above. Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings.

Real earnings, or earnings in constant dollars, are calculated from the earnings averages for the current month by using a deflator derived from the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Average hourly earnings excluding overtime are computed by dividing the total production worker payroll for the industry group by the sum of the total production worker hours and one-half of total overtime hours. Only earnings due to overtime paid for at 1-1/2 times the straight-time rates are eliminated. No adjustment is made for other premium payment provisions, such as holiday work, late-shift work, and overtime rates other than time and one-half.

The indexes of aggregate weekly hours and payrolls are prepared by dividing the current month's aggregate by the monthly average for 1977. The hours aggregates are the product of average weekly hours and production worker employment, and the payroll aggregates are the product of the hours aggregates and average hourly earnings. At all the higher levels of aggregation, hours and payroll aggregates are the sum of the component aggregates.

ESTIMATING METHODS

The principal features of the procedure used to estimate employment for the industry statistics are (1) the use of the "link relative" technique, which is a form of ratio estimation, (2) the use of size and regional stratification, and (3) periodic adjustment of employment levels to new benchmarks. Other features of the procedures are summarized later in table A. Further details are given in the *BLS Handbook of Methods*, Bulletin 2134-1 (1982), chapter 2. Reprints are available upon request.

Table A. Summary of methods for computing industry statistics on employment, hours, and earnings

Employment, hours, and earnings	Basic estimating cell (industry, region, size, or region/size cell)	Aggregate industry level (division and where stratified industry)
Monthly data		
All employees	All-employee estimate for previous month multiplied by ratio of all employees in current month to all employees in previous month, for sample establishments which reported for both months ¹	Sum of all-employee estimates for component cells
Production or nonsupervisory workers, women employees	All-employees estimate for current month multiplied by (1) ratio of production or nonsupervisory workers to all employees in sample establishments for current month, (2) estimated ratio of women to all employees. ²	Sum of production or nonsupervisory worker estimates, or estimates of women employees, for component cells
Average weekly hours	Production or nonsupervisory worker hours divided by number of production or nonsupervisory workers. ²	Average, weighted by production or nonsupervisory worker employment, of the average weekly hours for component cells.
Average weekly overtime hours	Production worker overtime hours divided by number of production workers. ²	Average, weighted by production worker employment, of the average weekly overtime hours for component cells
Average hourly earnings	Total production or nonsupervisory worker payroll divided by total production or nonsupervisory worker hours. ²	Average, weighted by aggregate hours, of the average hourly earnings for component cells
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings
Annual average data		
All employees, women employees, and production or nonsupervisory workers	Sum of monthly estimates divided by 12	Sum of monthly estimates divided by 12
Average weekly hours	Annual total of aggregate hours (production or nonsupervisory worker employment multiplied by average weekly hours) divided by annual sum of employment.	Annual total of aggregate hours for production or nonsupervisory workers divided by annual sum of employment for these workers
Average weekly overtime hours	Annual total of aggregate overtime hours (production worker employment multiplied by average weekly overtime hours) divided by annual sum of employment.	Annual total of aggregate overtime hours for production workers divided by annual sum of employment for these workers
Average hourly earnings	Annual total of aggregate payrolls (product of production or nonsupervisory worker employment by weekly hours and hourly earnings) divided by annual aggregate hours.	Annual total of aggregate payrolls divided by annual aggregate hours
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.

¹ The estimates are computed by multiplying the above product by bias adjustment factors, which compensate for the underrepresentation of newly formed enterprises and other sources of bias in the sample.

² The sample production-worker ratio, women-worker ratio, average weekly hours, average overtime hours, and average hourly earnings are modified by

a wedging technique designed to compensate for changes in the sample arising mainly from the voluntary character of the reporting. The wedging procedure accepts the advantage of continuity from the use of the matched sample and, at the same time, tapers or wedges the estimate toward the level of the latest sample average.

The "link relative" technique

From a sample composed of establishments reporting for both the previous and current months, the ratio of current-month employment to that of the previous month is computed. This is called a "link relative". The estimates of employment (all employees including production and nonproduction workers together) for the current month are obtained by multiplying the estimates for the previous month by these "link relatives". In addition, bias correction factors are applied to selected employment estimates each month. The size of the bias correction factors is determined from past benchmark comparisons. Beginning with data for April 1983, these factors are modified by changes in the sample link relatives for the most recent quarter.

Size and regional stratification

A number of industries are stratified by size of establishments and/or by region, and the stratified production or nonsupervisory worker data are used to weight the hours and earnings estimates into broader industry groupings. Accordingly, the basic estimating cell for an employment, hours, or earnings series may be a whole industry or a size stratum, a region stratum, or a size stratum of a region within an industry. This stratified estimating procedure offsets the tendency of the sample to produce biased estimates for certain industries.

Benchmark adjustments

Employment estimates are compared periodically with benchmarks (comprehensive counts of employment) for the various nonagricultural industries, and appropriate adjustments are made as indicated. The industry estimates in this publication are projected from March 1984 benchmark levels. Unadjusted data from April 1984 forward and seasonally adjusted data from January 1981 forward are subject to adjustment to future benchmarks. Normally, benchmark adjustments are made annually.

The primary sources of benchmark information are the employment data by industry, compiled quarterly by State agencies from reports of establishments covered under State unemployment insurance laws. These tabulations cover about 98 percent of employees on nonagricultural payrolls in the United States. Benchmark data for the residual are obtained from the records of the Social Security Administration, the Interstate Commerce Com-

Table B. Comparison of nonagricultural employment benchmarks and estimates for March 1984

Industry	Benchmark	Estimate	Percent difference
Total	92,587,000	92,234,000	0.4
Mining	952,000	967,000	-1.6
Construction	3,914,000	3,794,000	3.1
Manufacturing	19,151,000	19,323,000	-.9
Transportation and public utilities	5,063,000	5,055,000	.2
Wholesale trade	5,447,000	5,421,000	.5
Retail trade	15,891,000	15,629,000	1.6
Finance, insurance, and real estate	5,588,000	5,565,000	.4
Services	20,365,000	20,276,000	.4
Government	16,216,000	16,204,000	.1

mission, and a number of other agencies in private industry or government.

The estimates for the benchmark month are compared with new benchmark levels for each estimating cell. If revisions are necessary, the monthly series of estimates between benchmark periods are adjusted by correcting the differences between the new benchmark and the preceding one. The new benchmark for each industry then is carried forward progressively to the current month by use of the sample trends. Thus, the benchmark is used to establish the level of employment; the sample is used to measure the month-to-month changes in the level. A comparison of nonagricultural employment benchmarks and estimates for March 1984 is shown in table B.

THE SAMPLE

Design

The sampling plan used in the Current Employment Statistics program is an optimum allocation design known as "sampling proportionate to average size of establishment." Under this type of design, large establishments fall into the sample with certainty. The size of the samples for the various industries is determined on the basis of experience and cost considerations. In a manufacturing industry in which a large proportion of total employment is concentrated in relatively few establishments, a large percentage of total employment is included in the sample. Consequent-

ly, the sample design for such industries provides for a complete census of the larger establishments with only a few chosen from among the smaller establishments, or none at all if the concentration of employment is great enough. On the other hand, in an industry in which a large proportion of total employment is in small establishments, the sample design calls for inclusion of all large establishments and also for a substantial number of smaller ones. Many industries in the trade and services divisions fall into this category. To keep the sample to a size which can be handled by available resources, it is necessary to design samples for these industries with a smaller proportion of universe employment than is the case for most manufacturing industries. Since individual establishments in the nonmanufacturing divisions generally show less fluctuation from regular cyclical or seasonal patterns than do establishments in manufacturing industries, these smaller samples (in terms of employment) generally produce reliable estimates.

In the context of the BLS Current Employment Statistics program, with its emphasis on producing timely data at minimum cost, a sample must be obtained which will provide coverage of a sufficiently large segment of the universe to provide reasonably reliable estimates that can be published promptly and regularly. The present sample meets these specifications for most industries. This sample design allows BLS to produce preliminary estimates each month for many industries and for many geographic levels within a few weeks after reports are mailed by respondents. At a somewhat later date, estimates in considerably greater industrial detail are also made available.

Coverage

The BLS sample of establishment employment and payrolls is the largest monthly sampling operation in the field of social statistics. Table C shows the approximate proportion of total employment in each industry division covered by the group of establishments furnishing monthly employment data. The coverage for individual industries within the division may vary from the proportions shown.

Reliability of the employment estimates

The estimates derived from the establishment survey may differ from the figures that would have been obtained if it were possible

Table C. Approximate size and coverage of BLS employment and payrolls sample, March 1984¹

Industry	Number of establishments in sample	Employees	
		Number reported	Percent of total
Total.....	221,700	36,946,000	40
Mining	3,400	376,000	39
Construction	21,500	827,000	21
Manufacturing	50,600	10,571,000	55
Transportation and public utilities	10,500	2,377,000	47
Wholesale trade	19,200	909,000	17
Retail trade	35,900	2,875,000	18
Finance, insurance, and real estate	15,900	2,101,000	38
Services	41,900	4,838,000	24
Government:			
Federal ²	5,100	2,779,000	100
State	4,000	3,121,000	82
Local	13,700	6,172,000	64

¹ Since a few establishments do not report payroll and hours information, hours and earnings estimates may be based on a slightly smaller sample than employment estimates.

² National estimates of Federal employment by agency are provided to BLS by the Office of Personnel Management. Detailed industry estimates for the Executive Branch, as well as State and area estimates of Federal employment, are based on a sample of 5,100 reports covering about 64 percent of employment in Federal establishments.

to take a complete census using the same schedules and procedures. The relatively large size of the BLS establishment sample assures a high degree of accuracy. However, since the link relative technique requires the use of the previous month's estimate as the base in computing the current month's estimate, small sampling and response errors may accumulate over several months. To remove this accumulated error, the estimates are usually adjusted annually to new benchmarks. In addition to correcting sampling and response errors, the benchmark revision adjusts the estimates for changes in the industrial classification of individual establishments resulting from changes in their product. In fact, at the more detailed industry levels, particularly within manufacturing, changes in classification are the major cause of benchmark adjustments. Another cause of differences results from improvements in the quality of the benchmark data. Table D presents the average percent revisions of employment estimates for the five most recent benchmarks, for major industry divisions. Detail-

Table D. Average benchmark revision in employment estimates and relative errors for average weekly hours and average hourly earnings by industry

(Percent)

Industry	Average benchmark revision in estimates of employment ¹	Relative error ²	
		Average weekly hours	Average hourly earnings
Total	0.2	-	-
Total private .....	.3	0.1	0.2
Mining	2.4	1.0	1.3
Construction	1.6	.2	.5
Manufacturing .....	.6	.1	.2
Durable goods .....	.6	.1	.3
Nondurable goods .....	.5	.1	.2
Transportation and public utilities .....	.2	.7	.6
Wholesale trade .....	.2	.2	.4
Retail trade	1.4	.2	.4
Finance, insurance, and real estate .....	.2	.2	.4
Services .....	.4	.4	.6
Government ³ .....	.3	-	-

¹ The average percent revision in employment for the 1980-84 benchmarks.² Relative errors relate to 1982 data.³ Estimates for government are based on a total count for Federal Government provided by the Office of Personnel Management and a sample of State and local government reports.

ed descriptions of individual benchmark revisions are available from the Bureau upon request.

Hours and earnings estimates for cells are computed directly from reported figures and are not subject to benchmark revisions, although the broader groupings may be affected slightly by changes in employment weights. The hours and earnings estimates, however, are subject to sampling errors which may be expressed as relative errors of the estimates. (A relative error is a standard error expressed as a percent of the estimate.) Relative errors for major industries are presented in table D and for individual industries with the specified number of employees in table E. The chances are about 2 out of 3 that the hours and earnings estimates from the sample would differ by a smaller percentage than the relative error from the averages that would have been obtained from a complete census.

One measure of the reliability of ratio estimates is the root-mean-square error (RMSE). This measure is the standard deviation adjusted for the bias in estimates:

$$RMSE = \sqrt{(\text{Standard Deviation})^2 + (\text{Bias})^2}$$

If the bias is small, the chances are about 2 out of 3 that an estimate from the sample would differ from its benchmark by less than the root-mean-square error. The chances are about 19 out of 20 that the difference would be less than twice the root-mean-square error.

Approximations of the root-mean-square errors of differences between final estimates and benchmarks are presented in table E. Since the differences are those that have accumulated at the end of 12 monthly estimates, the amount of difference that accumulates in 1 month is much smaller, or approximately 1/12 of the amount indicated.

Table E. Root-mean-square errors of differences between benchmarks and estimates of employment and average relative errors for average weekly hours and average hourly earnings

Size of employment estimate	Root-mean-square error of employment estimates ¹	Relative error ² (in percent)	
		Average weekly hours	Average hourly earnings
50,000	2,100	2.2	4.0
100,000	3,900	1.3	2.3
200,000	5,600	1.1	2.0
500,000	14,000	.9	1.6
1,000,000	15,000	.8	1.2
2,000,000	26,000	.5	.9

¹ Assuming 12-month intervals between benchmark revisions.² Relative errors relate to 1982 data.

SEASONAL ADJUSTMENT

Many economic statistics reflect a regular recurring seasonal movement which can be estimated on the basis of past experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in the series. However, in evaluating deviations from the seasonal pattern—that is, changes in a seasonally adjusted series—it is important to note that seasonal adjustment is merely an approximation based

on past experience. Seasonally adjusted estimates have a broader margin of possible error than the original data on which they are based, since they are subject not only to sampling and other errors but, in addition, are affected by the uncertainties of the seasonal adjustment process itself. The seasonally adjusted establishment-based series shown in this supplement reflect the experience through March 1985. Current seasonally adjusted data are published regularly in *Employment and Earnings*.

The seasonal adjustment methodology used for these series is an adaptation of the standard ratio-to-moving-average method. It provides for "moving" adjustment factors to take account of changing seasonal patterns. Since July 1980, the specific procedure used to seasonally adjust the BLS employment, hours, and earnings series is the X-11 ARIMA method, developed by Statistics Canada. A detailed description of this procedure appears in *The X-11 ARIMA Seasonal Adjustment Method*, by Estela Bee Dagum, Statistics Canada Catalogue No. 12-564E, February 1980.

All series are seasonally adjusted using the multiplicative models under X-11 ARIMA. Seasonal adjustment factors used in calculating the current year's estimates are based on actual data through March of 1985 and projected data through March of 1986. These factors appear in the June 1985 issue of *Employment and Earnings*. Seasonal adjustment factors are applied directly to the component series. Seasonally adjusted totals for most of these series are then obtained by taking a weighted average of the seasonally adjusted data for the component series.

Seasonally adjusted average weekly earnings are the product of seasonally adjusted average hourly earnings and seasonally adjusted average weekly hours. Average hourly and weekly earnings in constant dollars, seasonally adjusted, are obtained by dividing average earnings, seasonally adjusted, by the seasonally adjusted Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), and multiplying by 100. Indexes of aggregate weekly hours, seasonally adjusted, are obtained by multiplying average weekly hours, seasonally adjusted, by production or non-supervisory workers, seasonally adjusted, and dividing by the 1977 base. For total private, total goods-producing, total private service-producing, trade, manufacturing, and durable and non-durable goods industries, the indexes of aggregate weekly hours, seasonally adjusted, are obtained by summing the aggregate weekly hours, seasonally adjusted, for the appropriate component industries and dividing by the 1977 base.

Seasonally adjusted data are not published for a number of series characterized by small seasonal components relative to their trend-cycle and/or irregular components. However, these "failed" or unsatisfactory seasonally adjusted series are used in the aggregation to higher level seasonally adjusted series.

Prior to June 1983, seasonal adjustment factors for Federal Government employment were derived from unadjusted data which excluded Christmas temporary workers employed by the Postal Service. In earlier years, the number of these workers was substantial, and at times varied greatly from year to year, based on administrative decisions of the Postal Service. Hence, it was considered desirable to exclude this group from the unadjusted data upon which the seasonal adjustment factors were based. In the past several years, the number of these workers has decreased to the point where their presence has no impact on seasonal adjustment. Temporary census takers for the 1980 decennial census will continue to be removed prior to the calculation of seasonal factors for Federal Government employment.

COMPARABILITY OF DATA WITH OTHER SERIES

Current Population Survey

Data based on household interviews are obtained from a sample survey of the population. The survey is conducted each month by the Bureau of the Census for the Bureau of Labor Statistics and provides a comprehensive measure of the labor force, i.e., the total number of civilians 16 years of age and over who are employed or unemployed. It also provides data on their personal and economic characteristics such as age, sex, race, marital status, occupation, industry, hours of work, and duration of unemployment. The information is collected by trained interviewers from a sample of about 59,500 households throughout the country and is based on the activity or status reported for the calendar week including the 12th of the month. These data are published monthly in *Employment and Earnings*.

Data from payroll reports and household interviews differ from each other because of differences in definition and coverage, sources of information, methods of collection, and estimating procedures. Sampling variability and response errors are additional reasons for discrepancies.

Some specific factors which have a differential effect on levels and trends of the two series are described as follows:

Coverage. The household survey definition of employment comprises wage and salary workers (including domestics and other private household workers), self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises. Civilian employment in both agricultural and nonagricultural industries is included. The payroll survey covers only wage and salary employees on the payrolls of nonagricultural establishments.

Multiple jobholding. The household survey provides information on the work status of the population without duplication, since each person is classified as employed, unemployed, or not in the labor force. Employed persons holding more than one job are counted only once, and are classified according to the job at which they worked the greatest number of hours during the survey week. In the figures based on establishment records, persons who worked in more than one establishment during the reporting period are counted each time their name appears on payrolls.

Unpaid absences from jobs. The household survey includes among the employed all persons who had jobs but were not at work during the survey week—that is, were not working but had jobs from which they were temporarily absent because of illness, bad weather, vacation, labor management dispute, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off. Payroll reports include persons on leave which is paid for by the company and exclude those on leave without pay for the entire payroll period.

Hours of work. The household survey measures hours actually worked, whereas the payroll survey measures hours paid for by employers. In the household survey all persons with a job but not at work are excluded from the hours distributions and the computations of average hours. In the payroll survey, employees on paid vacation, paid holiday, or paid sick leave are included and assigned the number of hours for which they were paid during the reporting period.

Earnings. The household survey measures median earnings of wage and salary workers in all occupations and industries in both

the private and public sectors. Data refer to the usual earnings received from the worker's sole or primary job. Data from the establishment survey generally refer to average earnings of production and related workers in mining and manufacturing, construction workers in construction, and nonsupervisory employees in private service-producing industries.

County Business Patterns

Data in *County Business Patterns*, published by the Bureau of the Census, differ from BLS establishment statistics in the treatment of central administrative offices and auxiliary units. Differences also may arise because of industrial classification and reporting practices. In addition, CBP excludes interstate railroads and government, and coverage is incomplete for some of the non-profit activities.

Employment covered by State unemployment insurance programs

Most nonagricultural wage and salary workers are covered by unemployment insurance programs. However, certain employees, such as those working for interstate railroads or members of religious orders working in parochial schools and churches, are not covered. They are included, however, in BLS establishment statistics. Data for railroads are obtained from the Interstate Commerce Commission; data for parochial schools and churches are obtained from the U.S. Office of Education, the National Catholic Welfare Conference, the National Council of Churches, and surveys of churches conducted by several State agencies.

Statistics on manufactures and business, Bureau of the Census

BLS establishment statistics on employment differ from employment counts derived by the Bureau of the Census from its censuses or sample surveys of manufacturing and business establishments. The major reasons for noncomparability are different treatment of business units considered parts of an establishment, such as central administrative offices and auxiliary units, the industrial classification of establishments, and different reporting patterns by multiunit companies. There are also differences in the scope of the industries covered, e.g., the Census of Business excludes professional services, public utilities, and financial establishments, whereas these are included in the BLS statistics.

Employee Benefits in Medium and Large Firms, 1984

U.S. Department of Labor
Bureau of Labor Statistics
Bulletin 2237

The Bureau of Labor Statistics issues its 1984 bulletin on employee benefits in medium and large firms. This survey is the sixth in an annual series.

Data available

- Incidence and detailed characteristics of 11 private sector employee benefits paid for at least in part by the employer: Lunch and rest periods, holidays, vacations, and personal and sick leave; sickness and accident, long-term disability, health, and life insurance; and private retirement pension plans.
- Incidence data on 18 other employee benefits, including stock, savings and thrift, and profit sharing plans; employee discounts; and educational assistance.
- Data presented separately for three occupational groups--professional-administrative, technical-clerical, and production workers.

Coverage

- Major benefits in medium and large firms, nationwide.
- Minimum employment in establishments covered is generally 100 or 250 employees, depending on the industry.

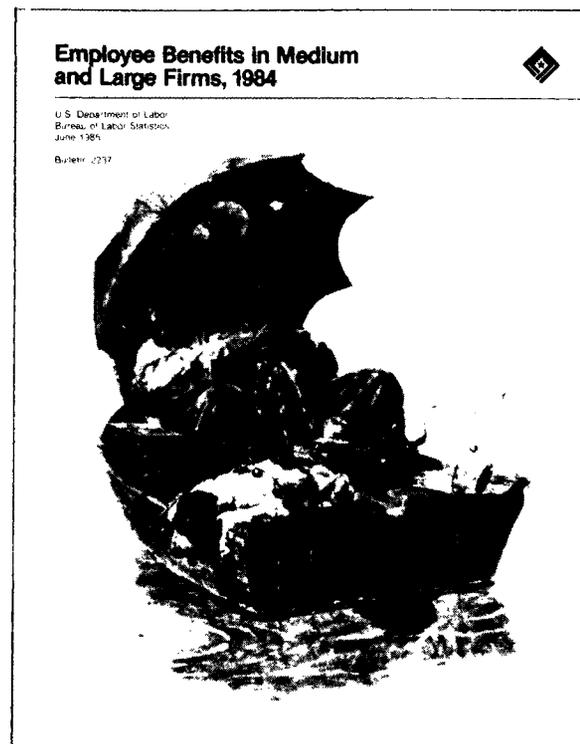
Source of data

- Sample of about 1,500 establishments in a cross-section of the Nation's private

industries; primarily by personal interview.

Uses

- Benefit administration in public and private employment.
- Union contract negotiations.
- Conciliation and arbitration in public and private sectors.
- Development of legislation affecting the welfare of workers.



Order Form

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Technical Note

This technical note describes the method of collection, concepts, scope, and estimating methods used in the preparation of the employment, hours, and earnings series shown in this bulletin.

COLLECTION

Payroll reports provide current information on wage and salary employment, hours, and earnings in nonagricultural establishments, by industry and geographic location.

Federal-State cooperation

Under cooperative arrangements between the States and the Bureau of Labor Statistics, responding establishments report employment, hours, and earnings data to State agencies. The State agencies mail payroll report forms to the establishments and examine the returns for consistency, accuracy, and completeness. The States use the reported data to prepare State and area statistics and also send the reported data to BLS for use in preparing the national series. This avoids a duplicate reporting burden on establishments and, together with the use of similar estimating techniques at the national and State levels, promotes increased comparability between estimates.

Shuttle schedules

Data are collected on Form BLS 790—Report on Employment, Payroll, and Hours. The collecting agency returns the schedule to the respondent each month so that the next month's data can be entered on the space allotted for that month. This "shuttle" procedure assures maximum comparability and accuracy of reporting, since the respondent can see the figures that have been reported for previous months.

Form BLS 790 provides for entry of data on the total number of workers on the payrolls of nonagricultural establishments and, for

most industries, payroll and hours of production and related workers or nonsupervisory workers for the pay period which includes the 12th of the month.

CONCEPTS

Industrial classification

Establishments reporting on Form BLS 790 are classified into industries on the basis of their principal product or activity, determined from information on annual sales volume. This information is collected on a supplement to the quarterly unemployment insurance tax reports filed by employers. For an establishment making more than one product or engaging in more than one activity, the entire employment of the establishment is included in the industry of the principal product or activity.

All national, State, and area employment, hours, and earnings series are classified according to the 1972 *Standard Industrial Classification Manual*, published by the Office of Management and Budget.

Industry employment

Employment data, except those for employees of the Federal Government, refer to persons on establishment payrolls who received pay for any part of the pay period which includes the 12th of the month. For Federal Government establishments, employment figures represent the number of persons who occupied positions on the last day of the calendar month. Intermittent workers are counted if they performed any service during the month.

The data exclude proprietors, the self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency and the National Security Agency are also excluded.

Persons on establishment payrolls who are on paid sick leave (when pay is received directly from the firm), on paid holiday or paid vacation, or who work during a part of the pay period even though they are unemployed or on strike during the rest of the period, are counted as employed. Not counted as employed are persons who are laid off, on leave without pay, or on strike for the entire period, or who are hired but have not been paid during the period.

Industry hours and earnings

Hours and earnings data are derived from reports of payrolls and hours for production and related workers in manufacturing and mining, construction workers in construction, and nonsupervisory employees in the remaining private nonagricultural components. These terms are defined below. When the pay period reported is longer than 1 week, the figures are converted to a weekly basis.

Production and related workers include working supervisors and all nonsupervisory workers (including group leaders and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, packing, warehousing, shipping, maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (e.g., power plant), and recordkeeping and other services closely associated with the above production operations.

Construction workers include the following employees in the construction division: Working supervisors, qualified craft workers, mechanics, apprentices, laborers, etc., whether working at the site of construction or in shops or yards, at jobs ordinarily performed by members of the construction trades (such as precutting and preassembling).

Nonsupervisory employees include employees (not above the working supervisory level) such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, social workers, teachers, research aides, drafters, photographers, beauticians, musicians, restaurant workers, custodial workers, attendants, line installers, laborers, janitors, guards, and other employees at similar occupational levels, whose services are closely associated with those of the employees listed.

Payroll covers the payroll for full- and part-time production, con-

struction, or nonsupervisory workers who received pay for any part of the pay period which includes the 12th of the month. The payroll is reported before deductions of any kind, e.g., for old-age and unemployment insurance, group insurance, withholding taxes, bonds, or union dues; also included is pay for overtime, holidays, vacations, and sick leave paid directly by the firm. Bonuses (unless earned and paid regularly each pay period), other pay not earned in the pay period reported (e.g., retroactive pay), tips, and the value of free rent, fuel, meals, or other payment in kind are excluded. Moreover, "fringe benefits" (such as health and other types of insurance, contributions to retirement, etc., paid by the employer) are also excluded.

Hours cover hours paid for, during the pay period which includes the 12th of the month, for production, construction, or nonsupervisory workers. The hours data include hours paid for holidays and vacations, and for sick leave when pay is received directly from the firm.

Overtime hours cover hours worked by production or related workers for which overtime premiums were paid because the hours exceeded the number of hours of either the straight-time workday or the workweek during the pay period which includes the 12th of the month. Weekend and holiday hours are included only if overtime premiums were paid. Hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid are excluded.

Average weekly hours relate to the average hours for which pay was received and are different from standard or scheduled hours. Such factors as absenteeism, labor turnover, part-time work, and stoppages cause average weekly hours to be lower than scheduled hours of work for an establishment. Group averages further reflect changes in the workweek of component industries.

Average overtime hours represent that portion of average weekly hours which exceeds regular hours and for which overtime premiums are paid. If an employee were to work on a paid holiday at regular rates, receiving as total compensation holiday pay plus straight-time pay for hours worked that day, no overtime hours would be reported.

Since overtime hours are premium hours by definition, average weekly hours and overtime hours do not necessarily move in the same direction from month to month; for example, overtime premiums may be paid for hours exceeding the straight-time work-

day although less than a full week is worked. Diverse trends at the industry-group level also may be caused by a marked change in average hours for a component industry where little or no overtime was worked in both the previous and current months. In addition, such factors as stoppages, absenteeism, and labor turnover may not have the same influence on overtime as on average hours.

Average hourly earnings are on a "gross" basis. They reflect not only changes in basic hourly and incentive wage rates but also such variable factors as premium pay for overtime and late-shift work and changes in output of workers paid on an incentive plan. They also reflect shifts in the number of employees between relatively high-paid and low-paid work and changes in workers' earnings in individual establishments. Averages for groups and divisions further reflect changes in average hourly earnings for individual industries.

Averages of hourly earnings differ from wage rates. Earnings are the actual return to the worker for a stated period of time; rates are the amounts stipulated for a given unit of work or time. The earnings series do not measure the level of total labor costs on the part of the employer since the following are excluded: Irregular bonuses, retroactive items, payments of various welfare benefits, payroll taxes paid by employers, and earnings for those employees not covered under the production worker, construction worker, or nonsupervisory employee definitions.

Average hourly earnings excluding overtime are computed by dividing the total production worker payroll for the industry group by the sum of the total production worker hours and one-half of total overtime hours. Only earnings due to overtime paid for at 1-1/2 times the straight-time rates are eliminated. No adjustment is made for other premium payment provisions, such as holiday work, late-shift work, and overtime rates other than time and one-half.

Railroad hours and earnings figures relate to Class 1 railroads (excluding switching and terminal companies) and are derived from monthly data summarized in the M-300 report of the Interstate Commerce Commission. Data refer to all employees, except executives, officials, and staff assistants (ICC Group 1), who received pay during the month. Average hourly earnings are computed by dividing total compensation by total hours paid for. Average weekly hours are obtained by dividing the total number of

hours paid for, converted to a weekly basis, by the number of employees, as defined above.

Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings. Therefore, weekly earnings are affected not only by changes in average hourly earnings but also by changes in the length of the workweek. In addition, monthly variations in such factors as proportion of part-time workers, stoppages for varying reasons, labor turnover during the survey period, and absenteeism for which employees are not paid may cause the average workweek to fluctuate.

Long-term trends of average weekly earnings can be affected by structural changes in the makeup of the work force. For example, persistent long-term increases in the proportion of part-time workers in retail trade and many of the service industries have reduced average workweeks in these industries and have affected the average weekly earnings series.

Real earnings, or earnings in constant dollars, are calculated from the earnings averages for the current month by using a deflator derived from the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

The indexes of aggregate weekly hours and payrolls are prepared by dividing the current month's aggregate by the monthly average for 1977. The hours aggregates are the product of average weekly hours and production worker employment, and the payroll aggregates are the product of the hours aggregates and average hourly earnings. At all the higher levels of aggregation, hours and payroll aggregates are the sum of the component aggregates.

ESTIMATING METHODS

The principal features of the procedure used to estimate employment for the industry statistics are (1) the use of the "link relative" technique, which is a form of ratio estimation, (2) the use of size and regional stratification, and (3) periodic adjustment of employment levels to new benchmarks. Other features of the procedures are summarized later in table A. Further details are given in the *BLS Handbook of Methods*, Bulletin 2134-1 (1982), chapter 2. Reprints are available upon request.

Table A. Summary of methods for computing industry statistics on employment, hours, and earnings

Employment, hours, and earnings	Basic estimating cell (industry, region, size, or region/size cell)	Aggregate industry level (division and where stratified, industry)
Monthly data		
All employees	All-employee estimate for previous month multiplied by ratio of all employees in current month to all employees in previous month, for sample establishments which reported for both months. ¹	Sum of all-employee estimates for component cells.
Production or nonsupervisory workers, women employees	All-employee estimate for current month multiplied by (1) ratio of production or nonsupervisory workers to all employees in sample establishments for current month, (2) estimated ratio of women to all employees. ²	Sum of production or nonsupervisory worker estimates, or estimates of women employees, for component cells.
Average weekly hours	Production or nonsupervisory worker hours divided by number of production or nonsupervisory workers. ²	Average, weighted by production or nonsupervisory worker employment, of the average weekly hours for component cells.
Average weekly overtime hours	Production worker overtime hours divided by number of production workers. ²	Average, weighted by production worker employment, of the average weekly overtime hours for component cells.
Average hourly earnings	Total production or nonsupervisory worker payroll divided by total production or nonsupervisory worker hours. ²	Average, weighted by aggregate hours, of the average hourly earnings for component cells.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.
Annual average data		
All employees, women employees, and production or nonsupervisory workers	Sum of monthly estimates divided by 12.	Sum of monthly estimates divided by 12.
Average weekly hours	Annual total of aggregate hours (production or nonsupervisory worker employment multiplied by average weekly hours) divided by annual sum of employment.	Annual total of aggregate hours for production or nonsupervisory workers divided by annual sum of employment for these workers.
Average weekly overtime hours	Annual total of aggregate overtime hours (production worker employment multiplied by average weekly overtime hours) divided by annual sum of employment.	Annual total of aggregate overtime hours for production workers divided by annual sum of employment for these workers.
Average hourly earnings	Annual total of aggregate payrolls (product of production or nonsupervisory worker employment by weekly hours and hourly earnings) divided by annual aggregate hours.	Annual total of aggregate payrolls divided by annual aggregate hours.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.

¹ The estimates are computed by multiplying the above product by bias adjustment factors, which compensate for the underrepresentation of newly formed enterprises and other sources of bias in the sample.

² The sample production-worker ratio, women-worker ratio, average weekly hours, average overtime hours, and average hourly earnings are modified by

a wedging technique designed to compensate for changes in the sample arising mainly from the voluntary character of the reporting. The wedging procedure accepts the advantage of continuity from the use of the matched sample and, at the same time, tapers or wedges the estimate toward the level of the latest sample average.

The "link relative" technique

From a sample composed of establishments reporting for both the previous and current months, the ratio of current-month employment to that of the previous month is computed. This is called a "link relative". The estimates of employment (all employees including production and nonproduction workers together) for the current month are obtained by multiplying the estimates for the previous month by these "link relatives". In addition, bias correction factors are applied to selected employment estimates each month. The size of the bias correction factors is determined from past benchmark comparisons. Beginning with data for April 1983, these factors are modified by changes in the sample link relatives for the most recent quarter.

Size and regional stratification

A number of industries are stratified by size of establishment and/or by region, and the stratified production or nonsupervisory worker data are used to weight the hours and earnings estimates into broader industry groupings. Accordingly, the basic estimating cell for an employment, hours, or earnings series may be a whole industry or a size stratum, a region stratum, or a size stratum of a region within an industry. This stratified estimating procedure offsets the tendency of the sample to produce biased estimates for certain industries.

Benchmark adjustments

Employment estimates are compared periodically with benchmarks (comprehensive counts of employment) for the various nonagricultural industries, and appropriate adjustments are made as indicated. The industry estimates in this publication are projected from March 1985 benchmark levels. Unadjusted data from April 1985 forward and seasonally adjusted data from January 1982 forward are subject to adjustment to future benchmarks. Normally, benchmark adjustments are made annually.

The primary sources of benchmark information are the employment data by industry, compiled quarterly by State agencies from reports of establishments covered under State unemployment insurance laws. These tabulations cover about 98 percent of employees on nonagricultural payrolls in the United States. Benchmark data for the residual are obtained from the records of the Social Security Administration, the Interstate Commerce Com-

Table B. Comparison of nonagricultural employment benchmarks and estimates for March 1985

Industry	Benchmark	Estimate	Percent difference
Total	96,042,000	96,045,000	(1)
Mining	933,000	962,000	-3.1
Construction	4,241,000	4,180,000	1.4
Manufacturing	19,295,000	19,399,000	- .5
Transportation and public utilities	5,155,000	5,205,000	-1.0
Wholesale trade	5,654,000	5,681,000	- .5
Retail trade	16,782,000	16,818,000	- .2
Finance, insurance, and real estate	5,825,000	5,796,000	.5
Services	21,561,000	21,536,000	.1
Government	16,596,000	16,468,000	.8

¹ Less than 0.05 percent.

mission, and a number of other agencies in private industry or government.

The estimates for the benchmark month are compared with new benchmark levels for each estimating cell. If revisions are necessary, the monthly series of estimates between benchmark periods are adjusted by correcting the differences between the new benchmark and the preceding one. The new benchmark for each industry then is carried forward progressively to the current month by use of the sample trends. Thus, the benchmark is used to establish the level of employment; the sample is used to measure the month-to-month changes in the level. A comparison of nonagricultural employment benchmarks and estimates for March 1985 is shown in table B.

THE SAMPLE

Design

The sampling plan used in the Current Employment Statistics program is an optimum allocation design known as "sampling proportionate to average size of establishment." Under this type of design, large establishments fall into the sample with certainty. The size of the samples for the various industries is determined on the basis of experience and cost considerations. In a manufacturing industry in which a large proportion of total employment is concentrated in relatively few establishments, a large percentage of total employment is included in the sample. Consequent-

ly, the sample design for such industries provides for a complete census of the larger establishments with only a few chosen from among the smaller establishments, or none at all if the concentration of employment is great enough. On the other hand, in an industry in which a large proportion of total employment is in small establishments, the sample design calls for inclusion of all large establishments and also for a substantial number of smaller ones. Many industries in the trade and services divisions fall into this category. To keep the sample to a size which can be handled by available resources, it is necessary to design samples for these industries with a smaller proportion of universe employment than is the case for most manufacturing industries. Since individual establishments in the nonmanufacturing divisions generally show less fluctuation from regular cyclical or seasonal patterns than do establishments in manufacturing industries, these smaller samples (in terms of employment) generally produce reliable estimates.

In the context of the BLS Current Employment Statistics program, with its emphasis on producing timely data at minimum cost, a sample must be obtained which will provide coverage of a sufficiently large segment of the universe to provide reasonably reliable estimates that can be published promptly and regularly. The present sample meets these specifications for most industries. This sample design allows BLS to produce preliminary estimates each month for many industries and for many geographic levels within a few weeks after reports are mailed by respondents. At a somewhat later date, estimates in considerably greater industrial detail are also made available.

Coverage

The BLS sample of establishment employment and payrolls is the largest monthly sampling operation in the field of social statistics. Table C shows the approximate proportion of total employment in each industry division covered by the group of establishments furnishing monthly employment data. The coverage for individual industries within the division may vary from the proportions shown.

Reliability of the employment estimates

The estimates derived from the establishment survey may differ from the figures that would have been obtained if it were possible

Table C. Approximate size and coverage of BLS employment and payrolls sample, March 1985¹

Industry	Number of establishments in sample	Employees	
		Number reported	Percent of total
Total	243,000	38,173,000	40
Mining	3,600	374,000	40
Construction	22,500	858,000	20
Manufacturing	52,000	10,654,000	55
Transportation and public utilities	11,500	2,409,000	47
Wholesale trade	22,300	1,042,000	18
Retail trade	42,400	3,319,000	20
Finance, insurance, and real estate	17,100	2,091,000	36
Services	48,500	5,267,000	24
Government:			
Federal ²	5,100	2,839,000	100
State	3,800	3,087,000	79
Local	14,200	6,233,000	63

¹ Since a few establishments do not report payroll and hours information, hours and earnings estimates may be based on a slightly smaller sample than employment estimates.

² National estimates of Federal employment by agency are provided to BLS by the Office of Personnel Management. Detailed industry estimates for the Executive Branch, as well as State and area estimates of Federal employment, are based on a sample of 5,100 reports covering about 64 percent of employment in Federal establishments.

to take a complete census using the same schedules and procedures. The relatively large size of the BLS establishment sample assures a high degree of accuracy. However, since the link relative technique requires the use of the previous month's estimate as the base in computing the current month's estimate, small sampling and response errors may accumulate over several months. To remove this accumulated error, the estimates are usually adjusted annually to new benchmarks. In addition to correcting sampling and response errors, the benchmark revision adjusts the estimates for changes in the industrial classification of individual establishments resulting from changes in their product. In fact, at the more detailed industry levels, particularly within manufacturing, changes in classification are the major cause of benchmark adjustments. Another cause of differences results from improvements in the quality of the benchmark data. Table D presents the average percent revisions of employment estimates for the five most recent benchmarks, for major industry divisions. Detail-

Table D. Average benchmark revision in employment estimates and relative errors for average weekly hours and average hourly earnings by industry

(Percent)

Industry	Average benchmark revision in estimates of employment ¹	Relative error ²	
		Average weekly hours	Average hourly earnings
Total	0.2	-	-
Total private .....	.3	0.1	0.2
Mining	2.9	1.0	1.3
Construction	1.6	.2	.5
Manufacturing .....	.6	.1	.2
Durable goods .....	.7	.1	.3
Nondurable goods .....	.6	.1	.2
Transportation and public utilities .....	.4	.7	.6
Wholesale trade .....	.3	.2	.4
Retail trade	1.2	.2	.4
Finance, insurance, and real estate .....	.3	.2	.4
Services .....	.2	.4	.6
Government ³ .....	.4	-	-

¹ The average percent revision in employment for the 1981-85 benchmarks.² Relative errors relate to 1982 data.³ Estimates for government are based on a total count for Federal Government provided by the Office of Personnel Management and a sample of State and local government reports.

ed descriptions of individual benchmark revisions are available from the Bureau upon request.

Hours and earnings estimates for cells are computed directly from reported figures and are not subject to benchmark revisions, although the broader groupings may be affected slightly by changes in employment weights. The hours and earnings estimates, however, are subject to sampling errors which may be expressed as relative errors of the estimates. (A relative error is a standard error expressed as a percent of the estimate.) Relative errors for major industries are presented in table D and for individual industries with the specified number of employees in table E. The chances are about 2 out of 3 that the hours and earnings estimates from the sample would differ by a smaller percentage than the relative error from the averages that would have been obtained from a complete census.

One measure of the reliability of ratio estimates is the root-mean-square error (RMSE). This measure is the standard deviation adjusted for the bias in estimates:

$$RMSE = \sqrt{(\text{Standard Deviation})^2 + (\text{Bias})^2}$$

If the bias is small, the chances are about 2 out of 3 that an estimate from the sample would differ from its benchmark by less than the root-mean-square error. The chances are about 19 out of 20 that the difference would be less than twice the root-mean-square error.

Approximations of the root-mean-square errors of differences between final estimates and benchmarks are presented in table E. Since the differences are those that have accumulated at the end of 12 monthly estimates, the amount of difference that accumulates in 1 month is much smaller, or approximately 1/12 of the amount indicated.

Table E. Root-mean-square errors of differences between benchmarks and estimates of employment and average relative errors for average weekly hours and average hourly earnings

Size of employment estimate	Root-mean-square error of employment estimates ¹	Relative error ² (in percent)	
		Average weekly hours	Average hourly earnings
50,000	2,100	2.2	4.0
100,000	3,900	1.3	2.3
200,000	5,600	1.1	2.0
500,000	14,000	.9	1.6
1,000,000	15,000	.8	1.2
2,000,000	26,000	.5	.9

¹ Assuming 12-month intervals between benchmark revisions.² Relative errors relate to 1982 data.

SEASONAL ADJUSTMENT

Many economic statistics reflect a regular recurring seasonal movement which can be estimated on the basis of past experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in the series. However, in evaluating deviations from the seasonal pattern—that is, changes in a seasonally adjusted series—it is important to note that seasonal adjustment is merely an approximation based

on past experience. Seasonally adjusted estimates have a broader margin of possible error than the original data on which they are based, since they are subject not only to sampling and other errors but, in addition, are affected by the uncertainties of the seasonal adjustment process itself. The seasonally adjusted establishment-based series shown in this supplement reflect the experience through March 1986. Current seasonally adjusted data are published regularly in *Employment and Earnings*.

The seasonal adjustment methodology used for these series is an adaptation of the standard ratio-to-moving-average method. It provides for "moving" adjustment factors to take account of changing seasonal patterns. Since July 1980, the specific procedure used to seasonally adjust the BLS employment, hours, and earnings series is the X-11 ARIMA method, developed by Statistics Canada. A detailed description of this procedure appears in *The X-11 ARIMA Seasonal Adjustment Method*, by Estela Bee Dagum, Statistics Canada Catalogue No. 12-564E, February 1980.

All series are seasonally adjusted using the multiplicative models under X-11 ARIMA. Seasonal adjustment factors used in calculating the current year's estimates are based on actual data through March of 1986 and projected data through March of 1987. These factors appear in the June 1986 issue of *Employment and Earnings*. Seasonal adjustment factors are applied directly to the component series. Seasonally adjusted totals for most of these series are then obtained by taking a weighted average of the seasonally adjusted data for the component series.

Seasonally adjusted average weekly earnings are the product of seasonally adjusted average hourly earnings and seasonally adjusted average weekly hours. Average hourly and weekly earnings in constant dollars, seasonally adjusted, are obtained by dividing average earnings, seasonally adjusted, by the seasonally adjusted Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), and multiplying by 100. Indexes of aggregate weekly hours, seasonally adjusted, are obtained by multiplying average weekly hours, seasonally adjusted, by production or non-supervisory workers, seasonally adjusted, and dividing by the 1977 base. For total private, total goods-producing, total private service-producing, trade, manufacturing, and durable and non-durable goods industries, the indexes of aggregate weekly hours, seasonally adjusted, are obtained by summing the aggregate weekly hours, seasonally adjusted, for the appropriate component industries and dividing by the 1977 base.

Seasonally adjusted data are not published for a number of series characterized by small seasonal components relative to their trend-cycle and/or irregular components. However, these "failed" or unsatisfactory seasonally adjusted series are used in the aggregation to higher level seasonally adjusted series.

Prior to June 1983, seasonal adjustment factors for Federal Government employment were derived from unadjusted data which excluded Christmas temporary workers employed by the Postal Service. In earlier years, the number of these workers was substantial, and at times varied greatly from year to year, based on administrative decisions of the Postal Service. Hence, it was considered desirable to exclude this group from the unadjusted data upon which the seasonal adjustment factors were based. In the past several years, the number of these workers has decreased to the point where their presence has no impact on seasonal adjustment. Temporary census takers for the 1980 decennial census will continue to be removed prior to the calculation of seasonal factors for Federal Government employment.

COMPARABILITY OF DATA WITH OTHER SERIES

Current Population Survey

Data based on household interviews are obtained from a sample survey of the population. The survey is conducted each month by the Bureau of the Census for the Bureau of Labor Statistics and provides a comprehensive measure of the labor force, i.e., the total number of civilians 16 years of age and over who are employed or unemployed. It also provides data on their personal and economic characteristics such as age, sex, race, marital status, occupation, industry, hours of work, and duration of unemployment. The information is collected by trained interviewers from a sample of about 59,500 households throughout the country and is based on the activity or status reported for the calendar week including the 12th of the month. These data are published monthly in *Employment and Earnings*.

Data from payroll reports and household interviews differ from each other because of differences in definition and coverage, sources of information, methods of collection, and estimating procedures. Sampling variability and response errors are additional reasons for discrepancies.

Some specific factors which have a differential effect on levels and trends of the two series are described as follows:

Coverage. The household survey definition of employment comprises wage and salary workers (including domestics and other private household workers), self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises. Civilian employment in both agricultural and nonagricultural industries is included. The payroll survey covers only wage and salary employees on the payrolls of nonagricultural establishments.

Multiple jobholding. The household survey provides information on the work status of the population without duplication, since each person is classified as employed, unemployed, or not in the labor force. Employed persons holding more than one job are counted only once, and are classified according to the job at which they worked the greatest number of hours during the survey week. In the figures based on establishment records, persons who worked in more than one establishment during the reporting period are counted each time their name appears on payrolls.

Unpaid absences from jobs. The household survey includes among the employed all persons who had jobs but were not at work during the survey week—that is, were not working but had jobs from which they were temporarily absent because of illness, bad weather, vacation, labor management dispute, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off. Payroll reports include persons on leave which is paid for by the company and exclude those on leave without pay for the entire payroll period.

Hours of work. The household survey measures hours actually worked, whereas the payroll survey measures hours paid for by employers. In the household survey all persons with a job but not at work are excluded from the hours distributions and the computations of average hours. In the payroll survey, employees on paid vacation, paid holiday, or paid sick leave are included and assigned the number of hours for which they were paid during the reporting period.

Earnings. The household survey measures median earnings of wage and salary workers in all occupations and industries in both

the private and public sectors. Data refer to the usual earnings received from the worker's sole or primary job. Data from the establishment survey generally refer to average earnings of production and related workers in mining and manufacturing, construction workers in construction, and nonsupervisory employees in private service-producing industries.

County Business Patterns

Data in *County Business Patterns*, published by the Bureau of the Census, differ from BLS establishment statistics in the treatment of central administrative offices and auxiliary units. Differences also may arise because of industrial classification and reporting practices. In addition, CBP excludes interstate railroads and government, and coverage is incomplete for some of the non-profit activities.

Employment covered by State unemployment insurance programs

Most nonagricultural wage and salary workers are covered by unemployment insurance programs. However, certain employees, such as those working for interstate railroads or members of religious orders working in parochial schools and churches, are not covered. They are included, however, in BLS establishment statistics. Data for railroads are obtained from the Interstate Commerce Commission; data for parochial schools and churches are obtained from the U.S. Office of Education, the National Catholic Welfare Conference, the National Council of Churches, and surveys of churches conducted by several State agencies.

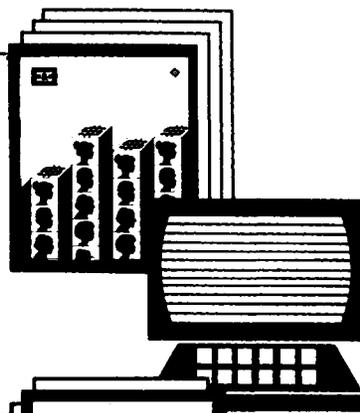
Statistics on manufactures and business, Bureau of the Census

BLS establishment statistics on employment differ from employment counts derived by the Bureau of the Census from its censuses or sample surveys of manufacturing and business establishments. The major reasons for noncomparability are different treatment of business units considered parts of an establishment, such as central administrative offices and auxiliary units, the industrial classification of establishments, and different reporting patterns by multiunit companies. There are also differences in the scope of the industries covered, e.g., the Census of Business excludes professional services, public utilities, and financial establishments, whereas these are included in the BLS statistics.

Where to Find Information on Employment and Unemployment

Employment and Earnings:

Monthly periodical containing labor force and establishment data. National, State, and area figures on employment, unemployment, hours, and earnings. Order *Employment and Earnings* from Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402. Includes text, statistical tables, and technical notes.



Electronic News Release:

Quickest. Accessible electronically immediately at release time through BLS news release service. Write the Office of Publications, Bureau of Labor Statistics, Washington, DC. 20212, or call (202) 523-1913.

Employment Situation News Release:

Statistical summaries of this national monthly release reach the public about a week after the release date. Write: Inquiries and Correspondence, Bureau of Labor Statistics, Washington, DC. 20212.



Telephone:

Quick summary on 24-hour recorded message. Key numbers, plus other BLS indicators and upcoming release dates. Call (202) 523-9658.

Machine-Readable Form:

Labor force data from the household survey and employment, hours, and earnings data from the establishment survey are available on both computer tape and diskette. For information, write the Office of Publications, Bureau of Labor Statistics, Washington, DC. 20212 or call (202) 523-1090.



Monthly Labor Review:

Employment and unemployment statistics included in monthly 48-page summary of BLS data and in analytical articles. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402.

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Technical Note

This technical note describes the method of collection, concepts, scope, and estimating methods used in the preparation of the employment, hours, and earnings series shown in this bulletin.

COLLECTION

Payroll reports provide current information on wage and salary employment, hours, and earnings in nonagricultural establishments, by industry and geographic location.

Federal-State cooperation

Under cooperative arrangements between the States and the Bureau of Labor Statistics, responding establishments report employment, hours, and earnings data to State agencies. The State agencies mail payroll report forms to the establishments and examine the returns for consistency, accuracy, and completeness. The States use the reported data to prepare State and area statistics and also send the reported data to BLS for use in preparing the national series. This avoids a duplicate reporting burden on establishments and, together with the use of similar estimating techniques at the national and State levels, promotes increased comparability between estimates.

Shuttle schedules

Data are collected on Form BLS 790—Report on Employment, Payroll, and Hours. The collecting agency returns the schedule to the respondent each month so that the next month's data can be entered on the space allotted for that month. This "shuttle" procedure assures maximum comparability and accuracy of reporting, since the respondent can see the figures that have been reported for previous months.

Form BLS 790 provides for entry of data on the total number of workers on the payrolls of nonagricultural establishments and, for

most industries, payroll and hours of production and related workers or nonsupervisory workers for the pay period which includes the 12th of the month.

CONCEPTS

Industrial classification

Establishments reporting on Form BLS 790 are classified into industries on the basis of their principal product or activity, determined from information on annual sales volume. This information is collected on a supplement to the quarterly unemployment insurance tax reports filed by employers. For an establishment making more than one product or engaging in more than one activity, the entire employment of the establishment is included in the industry of the principal product or activity.

All national, State, and area employment, hours, and earnings series are classified according to the 1972 *Standard Industrial Classification Manual*, published by the Office of Management and Budget.

Industry employment

Employment data, except those for employees of the Federal Government, refer to persons on establishment payrolls who received pay for any part of the pay period which includes the 12th of the month. For Federal Government establishments, employment figures represent the number of persons who occupied positions on the last day of the calendar month. Intermittent workers are counted if they performed any service during the month.

The data exclude proprietors, the self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency and the National Security Agency are also excluded.

Persons on establishment payrolls who are on paid sick leave (when pay is received directly from the firm), on paid holiday or paid vacation, or who work during a part of the pay period even though they are unemployed or on strike during the rest of the period, are counted as employed. Not counted as employed are persons who are laid off, on leave without pay, or on strike for the entire period, or who are hired but have not been paid during the period.

Industry hours and earnings

Hours and earnings data are derived from reports of payrolls and hours for production and related workers in manufacturing and mining, construction workers in construction, and nonsupervisory employees in the remaining private nonagricultural components. These terms are defined below. When the pay period reported is longer than 1 week, the figures are converted to a weekly basis.

Production and related workers include working supervisors and all nonsupervisory workers (including group leaders and trainees) engaged in fabricating, processing, assembling, inspection, receiving, storage, handling, packing, warehousing, shipping, maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (e.g., power plant), and recordkeeping and other services closely associated with the above production operations.

Construction workers include the following employees in the construction division: Working supervisors, qualified craft workers, mechanics, apprentices, laborers, etc., whether working at the site of construction or in shops or yards, at jobs ordinarily performed by members of the construction trades (such as precutting and preassembling).

Nonsupervisory employees include employees (not above the working supervisory level) such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, social workers, teachers, research aides, drafters, photographers, beauticians, musicians, restaurant workers, custodial workers, attendants, line installers, laborers, janitors, guards, and other employees at similar occupational levels, whose services are closely associated with those of the employees listed.

Payroll covers the payroll for full- and part-time production, con-

struction, or nonsupervisory workers who received pay for any part of the pay period which includes the 12th of the month. The payroll is reported before deductions of any kind, e.g., for old-age and unemployment insurance, group insurance, withholding taxes, bonds, or union dues; also included is pay for overtime, holidays, vacations, and sick leave paid directly by the firm. Bonuses (unless earned and paid regularly each pay period), other pay not earned in the pay period reported (e.g., retroactive pay), tips, and the value of free rent, fuel, meals, or other payment in kind are excluded. Moreover, "fringe benefits" (such as health and other types of insurance, contributions to retirement, etc., paid by the employer) are also excluded.

Hours cover hours paid for, during the pay period which includes the 12th of the month, for production, construction, or nonsupervisory workers. The hours data include hours paid for holidays and vacations, and for sick leave when pay is received directly from the firm.

Overtime hours cover hours worked by production or related workers for which overtime premiums were paid because the hours exceeded the number of hours of either the straight-time workday or the workweek during the pay period which includes the 12th of the month. Weekend and holiday hours are included only if overtime premiums were paid. Hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid are excluded.

Average weekly hours relate to the average hours for which pay was received and are different from standard or scheduled hours. Such factors as absenteeism, labor turnover, part-time work, and stoppages cause average weekly hours to be lower than scheduled hours of work for an establishment. Group averages further reflect changes in the workweek of component industries.

Average overtime hours represent that portion of average weekly hours which exceeds regular hours and for which overtime premiums are paid. If an employee were to work on a paid holiday at regular rates, receiving as total compensation holiday pay plus straight-time pay for hours worked that day, no overtime hours would be reported.

Since overtime hours are premium hours by definition, average weekly hours and overtime hours do not necessarily move in the same direction from month to month; for example, overtime premiums may be paid for hours exceeding the straight-time work-

day although less than a full week is worked. Diverse trends at the industry-group level also may be caused by a marked change in average hours for a component industry where little or no overtime was worked in both the previous and current months. In addition, such factors as stoppages, absenteeism, and labor turnover may not have the same influence on overtime as on average hours.

Average hourly earnings are on a "gross" basis. They reflect not only changes in basic hourly and incentive wage rates but also such variable factors as premium pay for overtime and late-shift work and changes in output of workers paid on an incentive plan. They also reflect shifts in the number of employees between relatively high-paid and low-paid work and changes in workers' earnings in individual establishments. Averages for groups and divisions further reflect changes in average hourly earnings for individual industries.

Averages of hourly earnings differ from wage rates. Earnings are the actual return to the worker for a stated period of time; rates are the amounts stipulated for a given unit of work or time. The earnings series do not measure the level of total labor costs on the part of the employer since the following are excluded: Irregular bonuses, retroactive items, payments of various welfare benefits payroll taxes paid by employers, and earnings for those employees not covered under the production worker, construction worker, or nonsupervisory employee definitions.

Average hourly earnings excluding overtime are computed by dividing the total production worker payroll for the industry group by the sum of the total production worker hours and one-half of total overtime hours. Only earnings due to overtime paid for at 1-1/2 times the straight-time rates are eliminated. No adjustment is made for other premium payment provisions, such as holiday work, late-shift work, and overtime rates other than time and one-half.

Railroad hours and earnings figures relate to Class 1 railroads (excluding switching and terminal companies) and are derived from monthly data summarized in the M-300 report of the Interstate Commerce Commission. Data refer to all employees, except executives, officials, and staff assistants (ICC Group 1), who received pay during the month. Average hourly earnings are computed by dividing total compensation by total hours paid for. Average weekly hours are obtained by dividing the total number of

hours paid for, converted to a weekly basis, by the number of employees, as defined above.

Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings. Therefore, weekly earnings are affected not only by changes in average hourly earnings but also by changes in the length of the workweek. In addition, monthly variations in such factors as proportion of part-time workers, stoppages for varying reasons, labor turnover during the survey period, and absenteeism for which employees are not paid may cause the average workweek to fluctuate.

Long-term trends of average weekly earnings can be affected by structural changes in the makeup of the work force. For example, persistent long-term increases in the proportion of part-time workers in retail trade and many of the service industries have reduced average workweeks in these industries and have affected the average weekly earnings series.

Real earnings, or earnings in constant dollars, are calculated from the earnings averages for the current month by using a deflator derived from the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Indexes of aggregate weekly hours and payrolls are prepared by dividing the current month's aggregate by the monthly average for 1977. The hours aggregates are the product of average weekly hours and production worker employment, and the payroll aggregates are the product of the hours aggregates and average hourly earnings. At all the higher levels of aggregation, hours and payroll aggregates are the sum of the component aggregates.

ESTIMATING METHODS

The principal features of the procedure used to estimate employment for the industry statistics are (1) the use of the "link relative" technique, which is a form of ratio estimation, (2) the use of size and regional stratification, and (3) periodic adjustment of employment levels to new benchmarks. Other features of the procedures are summarized in table A. Further details are given in the *BLS Handbook of Methods*, Bulletin 2134-1 (1982), chapter 2. Reprints are available upon request.

Table A. Summary of methods for computing industry statistics on employment, hours, and earnings

Employment, hours, and earnings	Basic estimating cell (industry, region, size, or region/size cell)	Aggregate industry level (division and, where stratified, industry)
Monthly data		
All employees	All-employee estimate for previous month multiplied by ratio of all employees in current month to all employees in previous month for sample establishments which reported for both months.	Sum of all-employee estimates for component cells.
Production or nonsupervisory workers, women employees	All-employee estimate for current month multiplied by (1) ratio of production or nonsupervisory workers to all employees in sample establishments for current month, (2) estimated ratio of women to all employees. ²	Sum of production or nonsupervisory worker estimates, or estimates of women employees, for component cells.
Average weekly hours	Production or nonsupervisory worker hours divided by number of production or nonsupervisory workers. ²	Average, weighted by production or nonsupervisory worker employment, of the average weekly hours for component cells.
Average weekly overtime hours	Production worker overtime hours divided by number of production workers. ²	Average, weighted by production worker employment, of the average weekly overtime hours for component cells.
Average hourly earnings	Total production or nonsupervisory worker payroll divided by total production or nonsupervisory worker hours. ²	Average, weighted by aggregate hours, of the average hourly earnings for component cells.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.
Annual average data		
All employees, women employees, and production or nonsupervisory workers	Sum of monthly estimates divided by 12.	Sum of monthly estimates divided by 12.
Average weekly hours	Annual total of aggregate hours (production or nonsupervisory worker employment multiplied by average weekly hours) divided by annual sum of employment.	Annual total of aggregate hours for production or nonsupervisory workers divided by annual sum of employment for these workers.
Average weekly overtime hours	Annual total of aggregate overtime hours (production worker employment multiplied by average weekly overtime hours) divided by annual sum of employment.	Annual total of aggregate overtime hours for production workers divided by annual sum of employment for these workers.
Average hourly earnings	Annual total of aggregate payrolls (product of production or nonsupervisory worker employment by weekly hours and hourly earnings) divided by annual aggregate hours.	Annual total of aggregate payrolls divided by annual aggregate hours.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.

¹ The estimates are computed by multiplying the above product by bias adjustment factors, which compensate for the underrepresentation of newly formed enterprises and other sources of bias in the sample.

² The sample production-worker ratio, women-worker ratio, average weekly hours, average overtime hours, and average hourly earnings are modified by

a wedging technique designed to compensate for changes in the sample arising mainly from the voluntary character of the reporting. The wedging procedure accepts the advantage of continuity from the use of the matched sample and, at the same time, tapers or wedges the estimate toward the level of the latest sample average.

The "link relative" technique

From a sample composed of establishments reporting for both the previous and current months, the ratio of current-month employment to that of the previous month is computed. This is called a "link relative". The estimates of employment (all employees including production and nonproduction workers together) for the current month are obtained by multiplying the estimates for the previous month by these "link relatives". In addition, bias correction factors are applied to selected employment estimates each month. The size of the bias correction factors is determined from past benchmark comparisons. Beginning with data for April 1983, these factors are modified by changes in the sample link relatives for the most recent quarter.

Size and regional stratification

A number of industries are stratified by size of establishment and/or by region, and the stratified production or nonsupervisory worker data are used to weight the hours and earnings estimates into broader industry groupings. Accordingly, the basic estimating cell for an employment, hours, or earnings series may be a whole industry or a size stratum, a region stratum, or a size stratum of a region within an industry. This stratified estimating procedure offsets the tendency of the sample to produce biased estimates for certain industries.

Benchmark adjustments

Employment estimates are compared periodically with benchmarks (comprehensive counts of employment) for the various nonagricultural industries, and appropriate adjustments are made as indicated. The industry estimates in this publication are projected from March 1986 benchmark levels. Unadjusted data from April 1986 forward and seasonally adjusted data from January 1983 forward are subject to adjustment to future benchmarks. Normally, benchmark adjustments are made annually.

The primary sources of benchmark information are the employment data by industry, compiled quarterly by State agencies from reports of establishments covered under State unemployment insurance laws. These tabulations cover about 98 percent of employees on nonagricultural payrolls in the United States. Benchmark data for the residual are obtained from the records of the Social Security Administration, the Interstate Commerce Com-

Table B. Comparison of nonagricultural employment benchmarks and estimates for March 1986

Industry	Benchmark	Estimate	Percent difference
Total	98,150,000	98,617,000	- 0.5
Mining	832,000	842,000	- 1.2
Construction	4,415,000	4,441,000	- .6
Manufacturing	18,945,000	19,148,000	-1.1
Transportation and public utilities	5,200,000	5,215,000	- .3
Wholesale trade	5,695,000	5,803,000	- 1.9
Retail trade	17,327,000	17,418,000	- .5
Finance, insurance, and real estate	6,140,000	6,144,000	- .1
Services	22,650,000	22,593,000	.3
Government	16,946,000	17,013,000	- .4

¹ Less than 0.05 percent.

mission, and a number of other agencies in private industry or government.

The estimates for the benchmark month are compared with new benchmark levels for each estimating cell. If revisions are necessary, the monthly series of estimates between benchmark periods are adjusted by correcting the differences between the new benchmark and the preceding one. The new benchmark for each industry then is carried forward progressively to the current month by use of the sample trends. Thus, the benchmark is used to establish the level of employment; the sample is used to measure the month-to-month changes in the level. A comparison of nonagricultural employment benchmarks and estimates for March 1986 is shown in table B.

THE SAMPLE

Design

The sampling plan used in the Current Employment Statistics program is an optimum allocation design known as "sampling proportionate to average size of establishment." Under this type of design, large establishments fall into the sample with certainty. The size of the samples for the various industries is determined on the basis of experience and cost considerations. In a manufacturing industry in which a large proportion of total employment is concentrated in relatively few establishments, a large percentage of total employment is included in the sample. Consequent-

ly, the sample design for such industries provides for a complete census of the larger establishments with only a few chosen from among the smaller establishments, or none at all if the concentration of employment is great enough. On the other hand, in an industry in which a large proportion of total employment is in small establishments, the sample design calls for inclusion of all large establishments and also for a substantial number of smaller ones. Many industries in the trade and services divisions fall into this category. To keep the sample to a size which can be handled by available resources, it is necessary to design samples for these industries with a smaller proportion of universe employment than is the case for most manufacturing industries. Since individual establishments in the nonmanufacturing divisions generally show less fluctuation from regular cyclical or seasonal patterns than do establishments in manufacturing industries, these smaller samples (in terms of employment) generally produce reliable estimates.

In the context of the BLS Current Employment Statistics program, with its emphasis on producing timely data at minimum cost, a sample must be obtained which will provide coverage of a sufficiently large segment of the universe to provide reasonably reliable estimates that can be published promptly and regularly. The present sample meets these specifications for most industries. This sample design allows BLS to produce preliminary estimates each month for many industries and for many geographic levels within a few weeks after reports are mailed by respondents. At a somewhat later date, estimates in considerably greater industrial detail are also made available.

Coverage

The BLS sample of establishment employment and payrolls is the largest monthly sampling operation in the field of social statistics. Table C shows the approximate proportion of total employment in each industry division covered by the group of establishments furnishing monthly employment data. The coverage for individual industries within the division may vary from the proportions shown.

Reliability of the employment estimates

The estimates derived from the establishment survey may differ from the figures that would have been obtained if it were possible

Table C. Approximate size and coverage of BLS employment and payrolls sample, March 1986¹

Industry	Number of establishments in sample	Employees	
		Number reported	Percent of total
Total.....	249,800	37,762,000	38
Mining.....	3,700	319,000	38
Construction.....	23,100	840,000	19
Manufacturing.....	51,100	10,018,000	53
Transportation and public utilities.....	11,600	2,380,000	46
Wholesale trade.....	21,900	978,000	17
Retail trade.....	42,900	3,352,000	19
Finance, insurance, and real estate.....	17,700	2,135,000	35
Services.....	53,300	5,362,000	24
Government:			
Federal ²	5,000	2,908,000	100
State.....	4,800	3,194,000	80
Local.....	14,700	6,276,000	62

¹ Since a few establishments do not report payroll and hours information, hours and earnings estimates may be based on a slightly smaller sample than employment estimates.

² National estimates of Federal employment by agency are provided to BLS by the Office of Personnel Management. Detailed industry estimates for the Executive Branch, as well as State and area estimates of Federal employment, are based on a sample of 5,000 reports covering about 62 percent of employment in Federal establishments.

to take a complete census using the same schedules and procedures. The relatively large size of the BLS establishment sample assures a high degree of accuracy. However, since the link relative technique requires the use of the previous month's estimate as the base in computing the current month's estimate, small sampling and response errors may accumulate over several months. To remove this accumulated error, the estimates are usually adjusted annually to new benchmarks. In addition to correcting sampling and response errors, the benchmark revision adjusts the estimates for changes in the industrial classification of individual establishments resulting from changes in their product. In fact, at the more detailed industry levels, particularly within manufacturing, changes in classification are the major cause of benchmark adjustments. Differences also result from improvements in the quality of the benchmark data. Table D presents the average percent revisions of employment estimates for the five most recent benchmarks, for major industry divisions. Detailed descriptions of individual benchmark revi-

Table D. Average benchmark revision in employment estimates and relative errors for average weekly hours and average hourly earnings by industry

(Percent)

Industry	Average benchmark revision in estimates of employment ¹	Relative error ²	
		Average weekly hours	Average hourly earnings
Total	0.2	—	—
Total private .....	.3	0.1	0.2
Mining	2.7	1.0	1.3
Construction	1.2	.2	.5
Manufacturing .....	.7	.1	.2
Durable goods .....	.8	.1	.3
Nondurable goods .....	.7	.1	.2
Transportation and public utilities .....	.4	.7	.6
Wholesale trade .....	.7	.2	.4
Retail trade	1.0	.2	.4
Finance, insurance, and real estate .....	.2	.2	.4
Services .....	.2	.4	.6
Government ³ .....	.4	—	—

¹ The average percent revision in employment for the 1982-86 benchmarks.

² Relative errors relate to 1982 data.

³ Estimates for government are based on a total count for Federal Government provided by the Office of Personnel Management and a sample of State and local government reports.

sions are available from the Bureau upon request.

Hours and earnings estimates for cells are computed directly from reported figures and are not subject to benchmark revisions, although the broader groupings may be affected slightly by changes in employment weights. The hours and earnings estimates, however, are subject to sampling errors, which may be expressed as relative errors of the estimates. (A relative error is a standard error expressed as a percent of the estimate.) Relative errors for major industries are presented in table D and for individual industries with the specified number of employees in table E. The chances are about 2 out of 3 that the hours and earnings estimates from the sample would differ by a smaller percentage than the relative error from the averages that would have been obtained from a complete census.

One measure of the reliability of ratio estimates is the root-mean-square error (RMSE). This measure is the standard deviation adjusted for the bias in estimates:

$$RMSE = \sqrt{(\text{standard deviation})^2 + (\text{bias}^2)}$$

If the bias is small, the chances are about 2 out of 3 that an estimate from the sample would differ from its benchmark by less than the root-mean-square error. The chances are about 19 out of 20 that the difference would be less than twice the root-mean-square error.

Approximations of the root-mean-square errors of differences between final estimates and benchmarks are presented in table E. Since the differences are those that have accumulated at the end of 12 monthly estimates, the amount of difference that accumulates in 1 month is much smaller, or approximately 1/12 of the amount indicated.

Table E. Root-mean-square errors of differences between benchmarks and estimates of employment and average relative errors for average weekly hours and average hourly earnings

Size of employment estimate	Root-mean-square error of employment estimates ¹	Relative error ² (in percent)	
		Average weekly hours	Average hourly earnings
50,000	2,100	2.2	4.0
100,000	3,900	1.3	2.3
200,000	5,600	1.1	2.0
500,000	14,000	.9	1.6
1,000,000	15,000	.8	1.2
2,000,000	26,000	.5	.9

¹ Assuming 12-month intervals between benchmark revisions.

² Relative errors relate to 1982 data.

SEASONAL ADJUSTMENT

Many economic statistics reflect a regularly recurring seasonal movement which can be estimated on the basis of past experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in the series. However, in evaluating deviations from the seasonal pattern—that is, changes in a seasonally adjusted series—it is important to note that seasonal adjustment is merely an approximation based

on past experience. Seasonally adjusted estimates have a broader margin of possible error than the original data on which they are based, since they are subject not only to sampling and other errors but, in addition, are affected by the uncertainties of the seasonal adjustment process itself. The seasonally adjusted establishment-based series shown in this supplement reflect the experience through March 1987. Current seasonally adjusted data are published regularly in *Employment and Earnings*.

The seasonal adjustment methodology used for these series is an adaptation of the standard ratio-to-moving-average method. It provides for "moving" adjustment factors to take account of changing seasonal patterns. Since July 1980, the specific procedure used to seasonally adjust the BLS employment, hours, and earnings series is the X-11 ARIMA method, developed by Statistics Canada. A detailed description of this procedure appears in *The X-11 ARIMA Seasonal Adjustment Method*, by Estela Bee Dagum, Statistics Canada Catalogue No. 12-564E, January 1983.

All series are seasonally adjusted using the multiplicative models under X-11 ARIMA. Seasonal adjustment factors used in calculating the current year's estimates are based on actual data through March of 1987 and projected data through March of 1988. These factors appear in the June 1987 issue of *Employment and Earnings*. Seasonal adjustment factors are applied directly to the component series. Seasonally adjusted totals for most of these series are then obtained by taking a weighted average of the seasonally adjusted data for the component series.

Seasonally adjusted average weekly earnings are the product of seasonally adjusted average hourly earnings and seasonally adjusted average weekly hours. Average hourly and weekly earnings in constant dollars, seasonally adjusted, are obtained by dividing average earnings, seasonally adjusted, by the seasonally adjusted Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), and multiplying by 100. Indexes of aggregate weekly hours, seasonally adjusted, are obtained by multiplying average weekly hours, seasonally adjusted, by production or non-supervisory workers, seasonally adjusted, and dividing by the 1977 base. For total private, total goods-producing, total private service-producing, trade, manufacturing, and durable and non-durable goods industries, the indexes of aggregate weekly hours, seasonally adjusted, are obtained by summing the aggregate weekly hours, seasonally adjusted, for the appropriate component industries and dividing by the 1977 base.

Seasonally adjusted data are not published for a number of series characterized by small seasonal components relative to their trend-cycle and/or irregular components. However, these "failed" or unsatisfactory seasonally adjusted series are used in the aggregation to higher level seasonally adjusted series.

Prior to June 1983, seasonal adjustment factors for Federal Government employment were derived from unadjusted data which excluded Christmas temporary workers employed by the Postal Service. In earlier years, the number of these workers was substantial, and at times varied greatly from year to year, based on administrative decisions of the Postal Service. Hence, it was considered desirable to exclude this group from the unadjusted data upon which the seasonal adjustment factors were based. In the past several years, the number of these workers has decreased to the point where their presence has no impact on seasonal adjustment. Temporary census takers for the 1980 decennial census will continue to be removed prior to the calculation of seasonal factors for Federal Government employment.

COMPARABILITY OF DATA WITH OTHER SERIES

Current Population Survey

Data based on household interviews are obtained from a sample survey of the population. The survey is conducted each month by the Bureau of the Census for the Bureau of Labor Statistics and provides a comprehensive measure of the labor force, i.e., the total number of civilians 16 years of age and over who are employed or unemployed. It also provides data on their personal and economic characteristics such as age, sex, race, marital status, occupation, industry, hours of work, and duration of unemployment. The information is collected by trained interviewers from a sample of about 59,500 households throughout the country and is based on the activity or status reported for the calendar week including the 12th of the month. These data are published monthly in *Employment and Earnings*.

Data from payroll reports and household interviews differ from each other because of differences in definition and coverage, sources of information, methods of collection, and estimating procedures. Sampling variability and response errors are additional reasons for discrepancies.

Some specific factors which have a differential effect on levels and trends of the two series are described as follows:

Coverage. The household survey definition of employment comprises wage and salary workers (including domestics and other private household workers), self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises. Civilian employment in both agricultural and nonagricultural industries is included. The payroll survey covers only wage and salary employees on the payrolls of nonagricultural establishments.

Multiple jobholding. The household survey provides information on the work status of the population without duplication, since each person is classified as employed, unemployed, or not in the labor force. Employed persons holding more than one job are counted only once, and are classified according to the job at which they worked the greatest number of hours during the survey week. In the figures based on establishment records, persons who worked in more than one establishment during the reporting period are counted each time their name appears on payrolls.

Unpaid absences from jobs. The household survey includes among the employed all persons who had jobs but were not at work during the survey week—that is, were not working but had jobs from which they were temporarily absent because of illness, bad weather, vacation, labor management dispute, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off. Payroll reports include persons on leave which is paid for by the company and exclude those on leave without pay for the entire payroll period.

Hours of work. The household survey measures hours actually worked, whereas the payroll survey measures hours paid for by employers. In the household survey, all persons with a job but not at work are excluded from the hours distributions and the computations of average hours. In the payroll survey, employees on paid vacation, paid holiday, or paid sick leave are included and assigned the number of hours for which they were paid during the reporting period.

Earnings. The household survey measures median earnings of wage and salary workers in all occupations and industries in both

the private and public sectors. Data refer to the usual earnings received from the worker's sole or primary job. Data from the establishment survey generally refer to average earnings of production and related workers in mining and manufacturing, construction workers in construction, and nonsupervisory employees in private service-producing industries.

County Business Patterns

Data in *County Business Patterns*, published by the Bureau of the Census, differ from BLS establishment statistics in the treatment of central administrative offices and auxiliary units. Differences also may arise because of industrial classification and reporting practices. In addition, CBP excludes interstate railroads and government, and coverage is incomplete for some of the non-profit activities.

Employment covered by State unemployment insurance programs

Most nonagricultural wage and salary workers are covered by unemployment insurance programs. However, certain employees, such as those working for interstate railroads or members of religious orders working in parochial schools and churches, are not covered. They are included, however, in BLS establishment statistics. Data for railroads are obtained from the Interstate Commerce Commission; data for parochial schools and churches are obtained from the U.S. Office of Education, the National Catholic Welfare Conference, the National Council of Churches, and surveys of churches conducted by several State agencies.

Statistics on manufactures and business, Bureau of the Census

BLS establishment statistics on employment differ from employment counts derived by the Bureau of the Census from its censuses or sample surveys of manufacturing and business establishments. The major reasons for noncomparability are different treatment of business units considered parts of an establishment, such as central administrative offices and auxiliary units, the industrial classification of establishments, and different reporting patterns by multiunit companies. There are also differences in the scope of the industries covered, e.g., the Census of Business excludes professional services, public utilities, and financial establishments, whereas these are included in the BLS statistics.

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Bureau of Labor Statistics**

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Technical Note

This technical note describes the method of collection, concepts, scope, and estimating methods used in the preparation of the employment, hours, and earnings series shown in this bulletin.

COLLECTION

Payroll reports provide current information on wage and salary employment, hours, and earnings in nonagricultural establishments, by industry and geographic location.

Federal-State cooperation

Under cooperative arrangements between the States and the Bureau of Labor Statistics, responding establishments report employment, hours, and earnings data to State agencies. The State agencies mail payroll report forms to the establishments and examine the returns for consistency, accuracy, and completeness. The States use the reported data to prepare State and area statistics and also send the reported data to BLS for use in preparing the national series. This avoids a duplicate reporting burden on establishments and, together with the use of similar estimating techniques at the national and State levels, promotes increased comparability between estimates.

Shuttle schedules

Data are collected on Form BLS 790—Report on Employment, Payroll, and Hours. The collecting agency returns the schedule to the respondent each month so that the next month's data can be entered on the space allotted for that month. This "shuttle" procedure assures maximum comparability and accuracy of reporting, since the respondent can see the figures that have been reported for previous months.

Form BLS 790 provides for entry of data on the total number of workers on the payrolls of nonagricultural establishments and, for most industries,

payroll and hours of production and related workers or nonsupervisory workers for the pay period which includes the 12th of the month.

CONCEPTS

Industrial classification

Establishments reporting on Form BLS 790 are classified into industries on the basis of their principal product or activity, determined from information on annual sales volume. This information is collected on a supplement to the quarterly unemployment insurance tax reports filed by employers. For an establishment making more than one product or engaging in more than one activity, the entire employment of the establishment is included in the industry of the principal product or activity.

All national, State, and area employment, hours, and earnings series are classified according to the 1972 *Standard Industrial Classification Manual*, published by the Office of Management and Budget.

Industry employment

Employment data, except those for employees of the Federal Government, refer to persons on establishment payrolls who received pay for any part of the pay period which includes the 12th of the month. For Federal Government establishments, employment figures represent the number of persons who occupied positions on the last day of the calendar month. Intermittent workers are counted if they performed any service during the month.

The data exclude proprietors, the self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency and the National Security Agency are also excluded.

Persons on establishment payrolls who are on paid sick leave (when pay is received directly from the firm), on paid holiday or paid vacation, or who

work during a part of the pay period even though they are unemployed or on strike during the rest of the period, are counted as employed. Not counted as employed are persons who are laid off, on leave without pay, or on strike for the entire period, or who are hired but have not been paid during the period.

Industry hours and earnings

Hours and earnings data are derived from reports of payrolls and hours for production and related workers in manufacturing and mining, construction workers in construction, and nonsupervisory employees in the remaining private nonagricultural components. These terms are defined below. When the pay period reported is longer than 1 week, the figures are converted to a weekly basis.

Production and related workers include working supervisors and all nonsupervisory workers (including group leaders and trainees) engaged in fabricating, processing, assembling, inspecting, receiving, storage, handling, packing, warehousing, shipping, maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (e.g., power plant), and recordkeeping and other services closely associated with the above production operations.

Construction workers include the following employees in the construction division: Working supervisors, qualified craft workers, mechanics, apprentices, laborers, etc., whether working at the site of construction or in shops or yards, at jobs ordinarily performed by members of the construction trades (such as precutting and preassembling).

Nonsupervisory employees include employees (not above the working supervisory level) such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, social workers, teachers, research aides, drafters, photographers, beauticians, musicians, restaurant workers, custodial workers, attendants, line installers, laborers, janitors, guards, and other employees at similar occupational levels, whose services are closely associated with those of the employees listed.

Payroll covers the payroll for full- and part-time production, construction, or nonsupervisory workers who received pay for any part of the pay period which includes the 12th of the month. The payroll is reported before deductions of any kind, e.g., for old-age and unemployment insurance, group insurance, withholding taxes, bonds, or union dues; also included is pay for overtime, holidays, vacations, and sick leave paid directly by the firm. Bonuses (unless earned and paid regularly each pay period), other pay not earned in the pay period reported (e.g., retroactive pay), tips, and the value of free rent, fuel, meals, or other payment in kind are excluded. Moreover,

“fringe benefits” (such as health and other types of insurance, contributions to retirement, etc., paid by the employers) are also excluded.

Hours cover hours paid for, during the pay period which includes the 12th of the month, for production, construction, or nonsupervisory workers. The hours data include hours paid for holidays and vacations, and for sick leave when pay is received directly from the firm.

Overtime hours cover hours worked by production or related workers for which overtime premiums were paid because the hours exceeded the number of hours of either the straight-time workday or the workweek during the pay period which includes the 12th of the month. Weekend and holiday hours are included only if overtime premiums were paid. Hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid are excluded.

Average weekly hours relate to the average hours for which pay was received and are different from standard or scheduled hours. Such factors as absenteeism, labor turnover, part-time work, and stoppages cause average weekly hours to be lower than scheduled hours of work for an establishment. Group averages further reflect changes in the workweek of component industries.

Average overtime hours represent that portion of average weekly hours which exceeds regular hours and for which overtime premiums are paid. If an employee were to work on a paid holiday at regular rates, receiving as total compensation holiday pay plus straight-time pay for hours worked that day, no overtime hours would be reported.

Since overtime hours are premium hours by definition, average weekly hours and overtime hours do not necessarily move in the same direction from month to month; for example, overtime premiums may be paid for hours exceeding the straight-time workday although less than a full week is worked. Diverse trends at the industry-group level also may be caused by a marked change in average hours for a component industry where little or no overtime was worked in both the previous and current months. In addition, such factors as stoppages, absenteeism, and labor turnover may not have the same influence on overtime as on average hours.

Average hourly earnings are on a “gross” basis. They reflect not only changes in basic hourly and incentive wage rates but also such variable factors as premium pay for overtime and late-shift work and changes in output of workers paid on an incentive plan. They also reflect shifts in the number of employees between relatively high-paid and low-paid work and changes in workers' earnings in individual establishments. Averages for groups and divisions further reflect changes in average hourly earnings for individual industries.

Averages of hourly earnings differ from wage rates. Earnings are the actual

return to the worker for a stated period of time; rates are the amounts stipulated for a given unit of work or time. The earnings series do not measure the level of total labor costs on the part of the employer since the following are excluded: Irregular bonuses, retroactive items, payments of various welfare benefits, payroll taxes paid by employers, and earnings for those employees not covered under the production worker, construction worker, or nonsupervisory employee definitions.

Average hourly earnings excluding overtime are computed by dividing the total production worker payroll for the industry group by the sum of the total production worker hours and one-half of total overtime hours. Only earnings due to overtime paid for at 1-1/2 times the straight-time rates are eliminated. No adjustment is made for other premium payment provisions, such as holiday work, late-shift work, and overtime rates other than time and one-half.

Railroad hours and earnings figures relate to Class 1 railroads (excluding switching and terminal companies) and are derived from monthly data summarized in the M-300 report of the Interstate Commerce Commission. Data refer to all employees, except executives, officials, and staff assistants (ICC group 1), who received pay during the month. Average hourly earnings are computed by dividing total compensation by total hours paid for. Average weekly hours are obtained by dividing the total number of hours paid for, converted to a weekly basis, by the number of employees, as defined above.

Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings. Therefore, weekly earnings are affected not only by changes in average hourly earnings but also by changes in the length of the workweek. In addition, monthly variations in such factors as proportion of part-time workers, stoppages for varying reasons, labor turnover during the survey period, and absenteeism for which employees are not paid may cause the average workweek to fluctuate.

Long-term trends of average weekly earnings can be affected by structural changes in the makeup of the work force. For example, persistent long-term increases in the proportion of part-time workers in retail trade and many of the service industries have reduced average workweeks in these industries and have affected the average weekly earnings series.

Real earnings, or earnings in constant dollars, are calculated from the earnings averages for the current month by using a deflator derived from the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Indexes of aggregate weekly hours and payrolls are derived by dividing the current month's aggregate by the monthly average for 1977. The hours aggregates are the product of average weekly hours and production worker employment; the payroll aggregates are the product of the hours aggregates and average hourly earnings. At all the higher levels of aggregation, hours

and payroll aggregates are the sum of the component aggregates.

ESTIMATING METHODS

The principal features of the procedure used to estimate employment for the industry statistics are (1) the use of the "link relative" technique, which is a form of ratio estimation, (2) the use of size and regional stratification, and (3) periodic adjustment of employment levels to new benchmarks. Other features of the procedures are summarized in table A. Further details are given in the *BLS Handbook of Methods*, Bulletin 2285 (1988), chapter 2. Reprints are available upon request.

The "link relative" technique

From a sample composed of establishments reporting for both the previous and current months, the ratio of current-month employment to that of the previous month is computed. This is called a "link relative." The estimates of employment (all employees including production and nonproduction workers) for the current month are obtained by multiplying the estimates for the previous month by these "link relatives." In addition, bias correction factors are applied to selected employment estimates each month. The size of the bias correction factors is determined from past benchmark comparisons. Beginning with data for April 1983, these factors are modified by changes in the sample link relatives for the most recent quarter.

Size and regional stratification

A number of industries are stratified by size of establishment and/or by region, and the stratified production or nonsupervisory worker data are used to weight the hours and earnings estimates into broader industry groupings. Accordingly, the basic estimating cell for an employment, hours, or earnings series may be a whole industry or a size stratum, a region stratum, or a size stratum of a region within an industry. This stratified estimating procedure offsets the tendency of the sample to produce biased estimates for certain industries.

Benchmark adjustments

Employment estimates are compared periodically with benchmarks (comprehensive counts of employment) for various nonagricultural industries, and appropriate adjustments are made as indicated. The industry estimates in this publication are projected from March 1987 benchmark levels.

Table A. Summary of methods for computing industry statistics on employment, hours, and earnings

Employment, hours, and earnings	Basic estimating cell (industry, region, size, or region/size cell)	Aggregate industry level (division and, where stratified, industry)
Monthly data		
All employees	All-employee estimate for previous month multiplied by ratio of all employees in current month to all employees in previous month, for sample establishments which reported for both months. ¹	Sum of all-employee estimates for component cells.
Production or nonsupervisory workers, women employees	All-employee estimate for current month multiplied by (1) ratio of production or nonsupervisory workers to all employees in sample establishments for current month, (2) estimated ratio of women to all employees. ²	Sum of production or nonsupervisory workers estimates, or estimates of women employees, for component cells.
Average weekly hours	Production or nonsupervisory worker hours divided by number of production or nonsupervisory workers. ²	Average, weighted by production or nonsupervisory worker employment, of the average weekly hours for component cells.
Average weekly overtime hours	Production worker overtime hours divided by number of production workers. ²	Average, weighted by production worker employment, of the average weekly overtime hours for component cells.
Average hourly earnings	Total production or nonsupervisory worker payroll divided by total production or nonsupervisory worker hours. ²	Average, weighted by aggregate hours, of the average hourly earnings for component cells.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.
Annual average data		
All employees, women employees, and production or nonsupervisory workers	Sum of monthly estimates divided by 12.	Sum of monthly estimates divided by 12.
Average weekly hours	Annual total of aggregate hours (production or nonsupervisory worker employment multiplied by average weekly hours) divided by annual sum of employment.	Annual total of aggregate hours for production or nonsupervisory workers divided by annual sum of employment for these workers.
Average weekly overtime hours	Annual total of aggregate overtime hours (production worker employment multiplied by average weekly overtime hours) divided by annual sum of employment.	Annual total of aggregate overtime hours for production workers divided by annual sum of employment for these workers.
Average hourly earnings	Annual total of aggregate payrolls (product of production or nonsupervisory worker employment by weekly hours and hourly earnings) divided by annual aggregate hours.	Annual total of aggregate payrolls divided by annual aggregate hours.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.

¹ The estimates are computed by multiplying the above product by bias adjustment factors, which compensate for the underrepresentation of newly formed enterprises and other sources of bias in the sample.

² The sample production-worker ratio, women-worker ratio, average weekly hours, average overtime hours, and average hourly earnings are

modified by a wedging technique designed to compensate for changes in the sample arising mainly from the voluntary character of the reporting. The wedging procedure accepts the advantage of continuity from the use of the matched sample and, at the same time, tapers or wedges the estimate toward the level of the latest sample average.

Unadjusted data from April 1987 forward and seasonally adjusted data from January 1984 forward are subject to adjustment to future benchmarks. Normally, benchmark adjustments are made annually.

The primary sources of benchmark information are the employment data by industry, compiled quarterly by State agencies from reports of establishments covered under State unemployment insurance laws. These tabulations cover about 98 percent of employees on nonagricultural payrolls in the United States. Benchmark data for the residual are obtained from the records of the Social Security Administration, the Interstate Commerce Commission, and a number of other agencies in private industry or government.

The estimates for the benchmark month are compared with new benchmark levels for each estimating cell. If revisions are necessary, the monthly series of estimates between benchmark periods are adjusted by correcting the differences between the new benchmark and the preceding one. The new benchmark for each industry then is carried forward progressively to the current month by use of the sample trends. Thus, the benchmark is used to establish the level of employment; the sample is used to measure the month-to-month changes in the level. A comparison of nonagricultural employment benchmarks and estimates for March 1987 is shown in table B.

THE SAMPLE

Design

The sampling plan used in the Current Employment Statistics program is an optimum allocation design known as "sampling proportionate to average size of establishment." Under this type of design, large establishments fall into the sample with certainty. The size of the samples for the various industries is determined on the basis of experience and cost considerations. In a manufacturing industry in which a large proportion of total employment is concentrated in relatively few establishments, a large percentage of total employment is included in the sample. Consequently, the sample design for such industries provides for a complete census of the larger establishments with only a few chosen from among the smaller establishments, or none at all if the concentration of employment is great enough. On the other hand, in an industry in which a large proportion of total employment is in small establishments, the sample design calls for inclusion of all large establishments and also for a substantial number of smaller ones. Many industries in the trade and services divisions fall into this category. To keep the sample to a size which can be handled by available resources, it is

Table B. Differences between nonagricultural employment benchmarks and estimates, March 1987

Industry	Benchmark	Estimate	Percent difference
Total	100,427,000	100,462,000	(1)
Mining	696,000	718,000	-3.2
Construction	4,531,000	4,599,000	-1.5
Manufacturing	18,810,000	18,897,000	- .5
Transportation and public utilities	5,274,000	5,275,000	(1)
Wholesale trade	5,763,000	5,725,000	7
Retail trade	17,902,000	17,737,000	9
Finance, insurance, and real estate	6,443,000	6,478,000	- .5
Services	23,754,000	23,723,000	1
Government	17,254,000	17,310,000	- .3

¹ Less than 0.05 percent.

necessary to design samples for these industries with a smaller proportion of universe employment than is the case for most manufacturing industries. Since individual establishments in the nonmanufacturing division generally show less fluctuation from regular cyclical or seasonal patterns than do establishments in manufacturing industries, these smaller samples (in terms of employment) generally produce reliable estimates.

In the context of the BLS Current Employment Statistics program, with its emphasis on producing timely data at minimum cost, a sample must be obtained which will provide coverage of a sufficiently large segment of the universe to provide reasonably reliable estimates that can be published promptly and regularly. The present sample meets these specifications for most industries. The sample design allows BLS to produce preliminary estimates each month for many industries and for many geographic levels within a few weeks after reports are mailed by respondents. At a somewhat later date, estimates in considerably greater industrial detail are also made available.

Coverage

The BLS sample of establishment employment and payrolls is the largest monthly sampling operation in the field of social statistics. Table C shows the approximate proportion of total employment in each industry division covered by the group of establishments furnishing monthly employment data. The coverage for individual industries within the division may vary from the proportions shown.

Table C. Approximate size and coverage of BLS employment and payrolls sample, March 1987¹

Industry	Number of establishments in sample	Employees in sample	
		Number	Percent of total employment
Total	246,256	37,530,000	37
Mining	3,434	265,000	38
Construction	22,567	808,000	18
Manufacturing	49,214	9,522,000	51
Transportation and public utilities	11,820	2,377,000	45
Wholesale trade	21,802	956,000	17
Retail trade	44,982	3,509,000	20
Finance, insurance, and real estate	17,699	2,140,000	33
Services	54,782	5,495,000	23
Government:			
Federal ²	(²)	2,916,000	100
State	4,795	3,298,000	81
Local	15,161	6,244,000	61

¹ Counts reflect reports used in final estimates. Since not all establishments report payroll and hours information, hours and earnings estimates are based on a smaller sample than employment estimates.

² Total Federal employment counts for use in national estimates are provided to BLS by the Office of Personnel Management. Detailed industry estimates for the Executive Branch, as well as State and area estimates of Federal employment, are based on a sample of 4,600 reports covering about 55 percent of employment in Federal establishments.

Reliability of the employment estimates

The estimates derived from the establishment survey may differ from the figures that would have been obtained if it were possible to take a complete census using the same schedules and procedures. The relatively large size of the BLS establishment sample assures a high degree of accuracy. However, since the link relative technique requires the use of the previous month's estimate as the base in computing the current month's estimate, small sampling and response errors may accumulate over several months. To remove this accumulated error, the estimates are usually adjusted annually to new benchmarks. In addition to correcting sampling and response errors, the benchmark revision adjusts the estimates for changes in the industrial classification of individual establishments resulting from changes in their product. In fact, at the more detailed industry levels, particularly within manufacturing, changes in classification are the major cause of benchmark adjustments. Differences also result from improvement in the quality of the benchmark data. Table D presents the average percent revisions of employment estimates for the five most recent benchmarks, for major industry divisions. Detailed descriptions of individual benchmark revisions are available from the Bureau upon request.

Hours and earnings estimates for cells are computed directly from reported figures and are not subject to benchmark revisions, although the broader grouping may be affected slightly by changes in employment weights. The hours and earnings estimates, however, are subject to sampling errors, which may be expressed as relative errors of the estimates. (A relative error is a standard error expressed as a percent of the estimate.) Relative errors for major industries are presented in table D and for individual industries with the specified number of employees in table E. The chances are about 2 out of 3 that the hours and earnings estimates from the sample would differ by a smaller percentage than the relative error from the averages that would have been obtained from a complete census.

One measure of the reliability of ratio estimates is the root-mean-square error (RMSE). This measure is the standard deviation adjusted for the bias in estimates:

$$RMSE = \sqrt{(\text{standard deviation})^2 + (\text{bias})^2}$$

If the bias is small, the chances are about 2 out of 3 that an estimate from

Table D. Average benchmark revision in employment estimates and relative errors for average weekly hours and average hourly earnings by industry

(Percent)

Industry	Average benchmark revision in estimates of employment ¹	Relative error ²	
		Average weekly hours	Average hourly earnings
Total	0.2	-	-
Total private .....	.2	0.1	0.2
Mining	2.9	1.0	1.3
Construction	1.4	.2	.5
Manufacturing .....	.8	.1	.2
Durable goods .....	.9	.1	.3
Nondurable goods .....	.8	.1	.2
Transportation and public utilities .....	.3	.7	.6
Wholesale trade .....	.8	.2	.4
Retail trade .....	.9	.2	.4
Finance, insurance, and real estate .....	.3	.2	.4
Services .....	.2	.4	.6
Government ³ .....	.5	-	-

¹ The average percent revision in employment for the 1983-87 benchmarks.

² Relative errors relate to 1982 data.

³ Estimates for government are based on a total count for Federal Government provided by the Office of Personnel Management and a sample of State and local government reports.

the sample would differ from its benchmark by less than the root-mean-square error. The chances are about 19 out of 20 that the difference would be less than twice the root-mean-square error.

Approximations of the root-mean-square errors of differences between final estimates and benchmarks are presented in table E. Since the differences are those that have accumulated at the end of 12 monthly estimates, the amount of difference that accumulates in 1 month is much smaller, or approximately 1/12 of the amount indicated.

SEASONAL ADJUSTMENT

Many economic statistics reflect a regularly recurring seasonal movement which can be estimated on the basis of past experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in the series. However, in evaluating deviations from the seasonal pattern—that is, changes in a seasonally adjusted series—it is important to note that seasonal adjustment is merely an approximation based on past experience. Seasonally adjusted estimates have a broader margin of possible error than the original data on which they are based, since they are subject not only to sampling and other errors but, in addition, are affected by the uncertainties of the seasonal adjustment process itself. The seasonally adjusted establishment-based series shown in this supplement reflect the experience through March 1988. Current seasonally adjusted data are published regularly in *Employment and Earnings*.

The seasonal adjustment methodology used for these series is an adaptation of the standard ratio-to-moving average method. It provides for “moving” adjustment factors to take account of changing seasonal patterns. Since July 1980, the specific procedure used to seasonally adjust the BLS employment, hours, and earnings series is the X-11 ARIMA method, developed by Statistics Canada. A detailed description of this procedure appears in *The X-11 ARIMA Seasonal Adjustment Method*, by Estela Bee Dagum, Statistics Canada Catalogue No. 12-564E, January 1983.

All series are seasonally adjusted using the multiplicative models under X-11 ARIMA. Seasonal adjustment factors used in calculating the current year’s estimates are based on actual data through March 1988 and projected data through March of 1989. These factors appear in the June 1988 issue of *Employment and Earnings*. Seasonal adjustment factors are applied directly to the component series. Seasonally adjusted totals for most of these series are then obtained by taking a weighted average of the seasonally adjusted data for the component series.

Seasonally adjusted average weekly earnings are the product of seasonally adjusted average hourly earnings and seasonally adjusted average weekly hours. Average hourly and weekly earnings in constant dollars, seasonally adjusted, are obtained by dividing average earnings, seasonally adjusted, by the seasonally adjusted Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) and multiplying by 100. Indexes of aggregate weekly hours, seasonally adjusted, are obtained by multiplying average weekly hours, seasonally adjusted, by production or nonsupervisory workers, seasonally adjusted, and dividing by the 1977 base. For total private, total goods-producing, total private service-producing, trade, manufacturing, and durable and nondurable goods industries, the indexes of aggregate weekly hours, seasonally adjusted, are obtained by summing the aggregate weekly hours, seasonally adjusted, for the appropriate component industries and dividing by the 1977 base.

Seasonally adjusted data are not published for a number of series characterized by small seasonal components relative to their trend-cycle and/or irregular components. However, these “failed” or unsatisfactory seasonally adjusted series are used in the aggregation to higher level seasonally adjusted series.

Prior to June 1983, seasonal adjustment factors for Federal Government employment were derived from unadjusted data which excluded Christmas temporary workers employed by the Postal Service. In earlier years, the number of these workers was substantial, and at times varied greatly from year to year, based on administrative decisions of the Postal Service. Hence, it was considered desirable to exclude this group from the unadjusted data upon which the seasonal adjustment factors were based. In the past several

Table E. Root-mean-square errors of differences between benchmarks and estimates of employment and average relative errors for average weekly hours and average hourly earnings

Size of employment estimates	Root-mean-square error of employment estimates ¹	Relative error ² (in percent)	
		Average weekly hours	Average hourly earnings
50,000	2,100	2.2	4.0
100,000	3,900	1.3	2.3
200,000	5,600	1.1	2.0
500,000	14,000	.9	1.6
1,000,000	15,000	.8	1.2
2,000,000	26,000	.5	.9

¹ Assuming 12-month intervals between benchmark revisions.

² Relative errors relate to 1982 data.

years, the number of these workers has decreased to the point where their presence has no impact on seasonal adjustment. Temporary census takers for the 1980 decennial census will continue to be removed prior to the calculation of seasonal factors for Federal employment.

COMPARABILITY OF DATA WITH OTHER SERIES

Current Population Survey

Data based on household interviews are obtained from a sample survey of the population. The survey is conducted each month by the Bureau of the Census for the Bureau of Labor Statistics and provides a comprehensive measure of the labor force, i.e., the total number of civilians 16 years of age and over who are employed or unemployed. It also provides data on their personal and economic characteristics such as age, sex, race, marital status, occupation, industry, hours of work, and duration of unemployment. This information is collected by trained interviewers from a sample of about 55,800 households throughout the country and is based on the activity or status reported for the calendar week including the 12th of the month. These data are published monthly in *Employment and Earnings*.

Data from payroll reports and household interviews differ from each other because of differences in definition and coverage, sources of information, methods of collection, and estimating procedures. Sampling variability and response errors are additional reasons for discrepancies. Some specific factors which have a differential effect on levels and trends of the two series are described as follows:

Coverage. The household survey definition of employment comprises wage and salary workers (including domestics and other private household workers), self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises. Civilian employment in both agricultural and nonagricultural industries is included. The payroll survey covers only wage and salary employees on the payrolls of nonagricultural establishments.

Multiple jobholding. The household survey provides information on the work status of the population without duplication, since each person is classified as employed, unemployed, or not in the labor force. Employed persons holding more than one job are counted only once, and are classified according to the job at which they worked the greatest number of hours during the survey week. In the figures based on establishment records, persons who worked

in more than one establishment during the reporting period are counted each time their name appears on payrolls.

Unpaid absences from jobs. The household survey includes among the employed all persons who had jobs but were not at work during the survey week—that is, were not working but had jobs from which they were temporarily absent because of illness, bad weather, vacation, labor-management dispute, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off. Payroll reports include persons on leave which is paid for by the company and exclude those on leave without pay for the entire payroll period.

Hours of work. The household survey measures hours actually worked, whereas the payroll survey measures hours paid for by employers. In the household survey, all persons with a job but not at work are excluded from the hours distributions and the computations of average hours. In the payroll survey, employees on paid vacation, paid holiday, or paid sick leave are included and assigned the number of hours for which they were paid during the reporting period.

Earnings. The household survey measures median earnings of wage and salary workers in all occupations and industries in both the private and public sectors. Data refer to the usual earnings received from the worker's sole or primary job. Data from the establishment survey generally refer to average earnings of production and related workers in mining and manufacturing, construction workers in construction, and nonsupervisory employees in private service-producing industries.

County Business Patterns

Data in *County Business Patterns* (CPB), published by the Bureau of the Census, differ from BLS establishment statistics in the treatment of central administrative offices and auxiliary units. Differences also may arise because of industrial classification and reporting practices. In addition, CBP excludes interstate railroads and government, and coverage is incomplete for some of the nonprofit activities.

Employment covered by State unemployment insurance programs

Most nonagricultural wage and salary workers are covered by unemployment insurance programs. However, certain employees, such as those working for interstate railroads or members of religious orders working

in parochial schools and churches, are not covered. They are included, however, in BLS establishment statistics. Data for railroads are obtained from the Interstate Commerce Commission; data for parochial schools and churches are obtained from the U.S. Office of Education, the National Catholic Welfare Conference, the National Council of Churches, and surveys of churches conducted by several State agencies.

Statistics on manufactures and business, Bureau of the Census

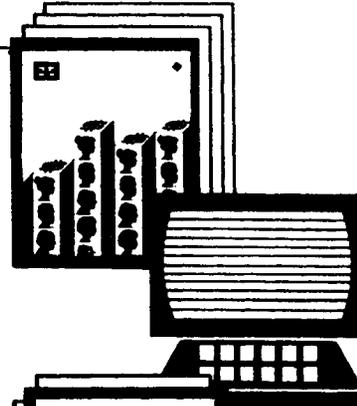
BLS establishment statistics on employment differ from employment counts

derived by the Bureau of the Census from its censuses or sample surveys of manufacturing and business establishments. The major reasons for noncomparability are different treatment of business units considered parts of an establishment, such as central administrative offices and auxiliary units, the industrial classification of establishments, and different reporting patterns by multiunit companies. There are also differences in the scope of the industries covered, e.g., the Census of Business excludes professional services, public utilities, and financial establishments, whereas these are included in the BLS statistics.

Where to Find Information on Employment and Unemployment

Employment and Earnings:

Monthly periodical containing labor force and establishment data. National, State, and area figures on employment, unemployment, hours, and earnings. Order *Employment and Earnings* from Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402. Includes text, statistical tables, and technical notes.



Electronic News Release:

Quickest. Accessible electronically immediately at release time through BLS news release service. Write the Office of Publications, Bureau of Labor Statistics, Washington, DC. 20212, or call (202) 523-1913.

Employment Situation News Release:

Copies of this national monthly release reach the public about a week after the release date. Write: Inquiries and Correspondence, Bureau of Labor Statistics, Washington, DC 20212.



Telephone:

Quick summary on 24-hour recorded message. Key numbers, plus other BLS indicators and upcoming release dates. Call (202) 523-9658.

Machine-Readable Form:

Labor force data from the household survey and employment, hours, and earnings data from the establishment survey are available on both computer tape and diskette. For information, write the Office of Publications, Bureau of Labor Statistics, Washington, DC. 20212 or call (202) 523-1090.



Monthly Labor Review:

Employment and unemployment statistics included in monthly 47-page summary of BLS data and in analytical articles. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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Technical Note

This technical note describes the method of collection, concepts, scope, and estimating methods used in the preparation of the employment, hours, and earnings series derived from the Current Employment Statistics (CES) program.

COLLECTION

Payroll reports provide current information on wage and salary employment, hours, and earnings in nonagricultural establishments, by industry and geographic location.

Federal-State cooperation

Under cooperative arrangements between the States and the Bureau of Labor Statistics, responding establishments report employment, hours, and earnings data to State agencies. The State agencies mail payroll report forms to the establishments and examine the returns for consistency, accuracy, and completeness. The States use the reported data to prepare State and area statistics and also send the reported data to BLS for use in preparing the national series. This avoids a duplicate reporting burden on establishments and, together with the use of similar estimating techniques at the national and State levels, promotes increased comparability between estimates.

Shuttle schedules

Data are collected on Form BLS 790—Report on Employment, Payroll, and Hours. The collecting agency returns the schedule to the respondent each month so that the next month's data can be entered on the space allotted for that month. This "shuttle" procedure assures maximum comparability and accuracy of reporting, since the respondent can see the figures that have been reported for previous months.

Form BLS 790 provides for entry of data on the total number of workers on the payrolls of nonagricultural establishments and, for most industries, payroll and hours of production or nonsupervisory workers for the pay period which includes the 12th of the month.

CONCEPTS

Industrial classification

Establishments reporting on Form BLS 790 are classified into industries on the basis of their principal product or activity, determined from information on annual sales volume. This information is collected on a supplement to the quarterly unemployment insurance tax reports filed by employers. For an establishment making more than one product or engaging in more than one activity, the entire employment of the establishment is included in the industry of the principal product or activity.

All national, State, and area employment, hours, and earnings series are classified according to the 1972 *Standard Industrial Classification Manual*, published by the Office of Management and Budget. Beginning in 1990, data will be reclassified in accordance with the 1987 SIC Manual.

Industry employment

Employment data, except those for employees of the Federal Government, refer to persons on establishment payrolls who received pay for any part of the pay period which includes the 12th of the month. For Federal Government establishments, employment figures represent the number of persons who occupied positions on the last day of the calendar month. Intermittent workers are counted if they performed any service during the month.

The data exclude proprietors, the self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency and the National Security Agency are also excluded.

Persons on establishment payrolls who are on paid sick leave (when pay is received directly from the firm), on paid holiday or paid vacation, or who work during a part of the pay period even though they are unemployed or on strike during the rest of the period, are counted as employed. Not counted as employed are persons who are laid off, on leave without pay, or on strike for the entire period, or who are hired but have not been paid during the period.

Industry hours and earnings

Hours and earnings data are derived from reports of payrolls and hours for production and related workers in manufacturing and mining, construction workers in construction, and nonsupervisory employees in the remaining private non-agricultural components. These terms are defined below. When the pay period reported is longer than 1 week, the figures are converted to a weekly basis.

Production and related workers include working supervisors and all non-supervisory workers (including group leaders and trainees) engaged in fabricating, processing, assembling, inspecting, receiving, storage, handling, packing, warehousing, shipping, maintenance, repair, janitorial and guard services, product development, auxiliary production for a plant's own use (e.g., power plant), and recordkeeping and other services closely associated with the above production operations.

Construction workers include the following employees in the construction division: Working supervisors, qualified craft workers, mechanics, apprentices, laborers, etc., whether working at the site of construction or in shops or yards, at jobs ordinarily performed by members of the construction trades (such as precutting and preassembling).

Nonsupervisory employees include employees (not above the working supervisory level) such as office and clerical workers, repairers, salespersons, operators, drivers, physicians, lawyers, accountants, nurses, social workers, teachers, research aides, drafters, photographers, beauticians, musicians, restaurant workers, custodial workers, attendants, line installers, laborers, janitors, guards, and other employees at similar occupational levels, whose services are closely associated with those of the employees listed.

Payroll covers the payroll for full- and part-time production, construction, or nonsupervisory workers who received pay for any part of the pay period which includes the 12th of the month. The payroll is reported before deductions of any kind, e.g., for old-age and unemployment insurance, group insurance, withholding taxes, bonds, or union dues; also included is pay for overtime, holidays, vacations, and sick leave paid directly by the firm. Bonuses (unless earned and paid regularly each pay period), other pay not earned in the pay period reported (e.g., retroactive pay), tips, and the value of free rent, fuel, meals, or other payment in kind are excluded. Moreover, "fringe benefits" (such as health and other types of insurance, contributions to retirement, etc., paid by the employers) are also excluded.

Hours cover hours paid for, during the pay period which includes the 12th of the month, for production, construction, or nonsupervisory workers. The hours data include hours paid for holidays and vacations, and for sick leave when pay is received directly from the firm.

Overtime hours cover hours worked by production or related workers for

which overtime premiums were paid because the hours exceeded the number of hours of either the straight-time workday or the workweek during the pay period which includes the 12th of the month. Weekend and holiday hours are included only if overtime premiums were paid. Hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid are excluded.

Average weekly hours relate to the average hours for which pay was received and are different from standard or scheduled hours. Such factors as absenteeism, labor turnover, part-time work, and stoppages cause average weekly hours to be lower than scheduled hours of work for an establishment. Group averages further reflect changes in the workweek of component industries.

Average overtime hours represent that portion of average weekly hours which exceeds regular hours and for which overtime premiums are paid. If an employee were to work on a paid holiday at regular rates, receiving as total compensation holiday pay plus straight-time pay for hours worked that day, no overtime hours would be reported.

Since overtime hours are premium hours by definition, average weekly hours and overtime hours do not necessarily move in the same direction from month to month; for example, overtime premiums may be paid for hours exceeding the straight-time workday although less than a full week is worked. Diverse trends at the industry-group level also may be caused by a marked change in average hours for a component industry where little or no overtime was worked in both the previous and current months. In addition, such factors as stoppages, absenteeism, and labor turnover may not have the same influence on overtime as on average hours.

Average hourly earnings are on a "gross" basis. They reflect not only changes in basic hourly and incentive wage rates but also such variable factors as premium pay for overtime and late-shift work and changes in output of workers paid on an incentive plan. They also reflect shifts in the number of employees between relatively high-paid and low-paid work and changes in workers' earnings in individual establishments. Averages for groups and divisions further reflect changes in average hourly earnings for individual industries.

Averages of hourly earnings differ from wage rates. Earnings are the actual return to the worker for a stated period of time; rates are the amounts stipulated for a given unit of work or time. The earnings series do not measure the level of total labor costs on the part of the employer since the following are excluded: Irregular bonuses, retroactive items, payments of various welfare benefits, payroll taxes paid by employers, and earnings for those employees not covered under the production worker, construction worker, or nonsupervisory employee definitions.

Average hourly earnings, including lump-sum wage payments are compiled

only for aircraft (SIC 3721) and guided missiles and space vehicles (SIC 3761) manufacturing. The same concepts and estimation methods apply to these series as apply to the average hourly earnings series described above; the one difference between the series is definitional. The payroll data used to calculate these series include lump-sum payments made to production workers in lieu of general wage rate increases; such payments are excluded from the definition of gross payrolls used to calculate the other average hourly earnings series.

For each sample establishment in SIC 3721 and SIC 3761 covered by a lump-sum agreement, the reported payroll data are adjusted to include a prorated portion of the lump-sum payment. Such payments are generally made once a year and cover the following 12-month period. In order to spread the payment across this time period, a prorated portion of the payment is added to the payroll each month. This prorated portion is adjusted by an exit rate to reduce the lump-sum amount to account for persons who receive the payment but left before the payment allocation period expired.

Average hourly earnings, excluding overtime are computed by dividing the total production worker payroll for the industry group by the sum of the total production worker hours and one-half of total overtime hours. Only earnings due to overtime paid for at 1-1/2 times the straight-time rates are eliminated. No adjustment is made for other premium payment provisions, such as holiday work, late-shift work, and overtime rates other than time and one-half.

Railroad hours and earnings figures relate to Class 1 railroads (excluding switching and terminal companies) and are derived from monthly data summarized in the M-300 report of the Interstate Commerce Commission. Data refer to all employees, except executives, officials, and staff assistants (ICC group 1), who received pay during the month. Average hourly earnings are computed by dividing total compensation by total hours paid for. Average weekly hours are obtained by dividing the total number of hours paid for, converted to a weekly basis, by the number of employees, as defined above.

Average weekly earnings are derived by multiplying average weekly hours by average hourly earnings. Therefore, weekly earnings are affected not only by changes in average hourly earnings but also by changes in the length of the workweek. In addition, monthly variations in such factors as the proportion of part-time workers, stoppages for varying reasons, labor turnover during the survey period, and absenteeism for which employees are not paid may cause the average workweek to fluctuate.

Long-term trends of average weekly earnings can be affected by structural changes in the makeup of the work force. For example, persistent long-term increases in the proportion of part-time workers in retail trade and many of the services industries have reduced average workweeks in these industries and have affected the average weekly earnings series.

Real earnings, or earnings in constant dollars, are calculated from the earn-

ings averages for the current month by using a deflator derived from the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W).

Indexes

Indexes of aggregate weekly hours and payrolls are derived by dividing the current month's aggregate by the monthly average for 1977. The hours aggregates are the product of average weekly hours and production worker employment; the payroll aggregates are the product of the hours aggregates and average hourly earnings. At all the higher levels of aggregation, hours and payroll aggregates are the sum of the component aggregates.

Diffusion indexes of employment change measure the dispersion among industries of the change in employment over the specified time span. The overall indexes are calculated from 349 seasonally adjusted employment series (3-digit industries) covering all nonagricultural payroll employment in the private sector. The manufacturing diffusion indexes are based on 141 3-digit industries.

To derive the indexes, each component industry is assigned a value of 0, 50, or 100 percent, depending on whether its employment showed a decrease, no change, or an increase, respectively, over the time span. The average value (mean) is then calculated, and this percent is the diffusion index number.

The reference point for diffusion analysis is 50 percent, the value which indicates that the same number of component industries had increased as had decreased. Index numbers above 50 show that more industries had increasing employment, and values below 50 indicate that more had decreasing employment. The margin between the percent that increased and the percent that decreased is equal to the difference between the index and its complement, i.e., 100 minus the index. For example, an index of 65 percent means that 30 percent more industries had increasing employment than had decreasing employment ($65 - (100 - 65) = 30$). However, for dispersion analysis, the distance of the index number from the 50-percent reference point is the most significant observation.

Although diffusion indexes are commonly interpreted as showing the percent of components that increased over the time span, it should be remembered that the index reflects half of the unchanged components as well. (This is the effect of assigning a value of 50 percent to the unchanged components when computing the index.)

ESTIMATING METHODS

The principal features of the procedure used to estimate employment for the industry statistics are (1) the use of the "link relative" technique, which

is a form of ratio estimation, (2) the use of size and regional stratification, and (3) periodic adjustment of employment levels to new benchmarks. Other features of the procedures are summarized in table A. Further details are given in the *BLS Handbook of Methods*, Bulletin 2285 (1988), chapter 2.

The "link relative" technique

From a sample composed of establishments reporting for both the previous and current months, the ratio of current-month employment to that of the previous month is computed. This is called a "link relative." The estimates of employment (all employees including production and nonproduction workers) for the current month are obtained by multiplying the estimates for the previous month by these "link relatives." In addition, bias correction factors are applied to selected employment estimates each month. The size of the bias correction factors is determined from past benchmark comparisons. Beginning with data for April 1983, these factors are modified by changes in the sample link relatives for the most recent quarter.

Size and regional stratification

A number of industries are stratified by size of establishment and/or by region, and the stratified production or nonsupervisory worker data are used to weight the hours and earnings estimates into broader industry groupings. Accordingly, the basic estimating cell for an employment, hours, or earnings series may be a whole industry or a size stratum, a region stratum, or a size stratum of a region within an industry. This stratified estimating procedure offsets the tendency of the sample to produce biased estimates for certain industries.

Benchmark adjustments

Employment estimates are compared periodically with benchmarks (comprehensive counts of employment) for various nonagricultural industries, and appropriate adjustments are made as indicated. The industry estimates in this publication are projected from March 1988 benchmark levels. Unadjusted data from April 1988 forward and seasonally adjusted data from January 1985 forward are subject to adjustment to future benchmarks. Normally, benchmark adjustments are made annually.

The primary sources of benchmark information are the employment data by industry, compiled quarterly by State agencies from reports of establishments covered under State unemployment insurance laws. These tabulations cover about 98 percent of employees on nonagricultural payrolls in the United States. Benchmark data for the residual are obtained from the records of the Social

Security Administration, the Interstate Commerce Commission, and a number of other agencies in private industry or government.

The estimates for the benchmark month are compared with new benchmark levels for each estimating cell. If revisions are necessary, the monthly series of estimates between benchmark periods are adjusted by correcting the differences between the new benchmark and the preceding one. The new benchmark for each industry then is carried forward progressively to the current month by use of the sample trends. Thus, the benchmark is used to establish the level of employment; the sample is used to measure the month-to-month changes in the level. A comparison of nonagricultural employment benchmarks and estimates for March 1988 is shown in table B.

THE SAMPLE

Design

The sampling plan used in the CES program is an optimum allocation design known as "sampling proportionate to average size of establishment." Under this type of design, large establishments fall into the sample with certainty. The size of the samples for the various industries is determined on the basis of experience and cost considerations. In a manufacturing industry in which a large proportion of total employment is concentrated in relatively few establishments, a large percentage of total employment is included in the sample. Consequently, the sample design for such industries provides for a complete census of the larger establishments with only

Table B. Differences between nonagricultural employment benchmarks and estimates, March 1988

Industry	Benchmark	Estimate	Percent difference
Total	103,835,000	104,161,000	-0.3
Mining	711,000	723,000	-1.7
Construction	4,686,000	4,787,000	-2.2
Manufacturing	19,171,000	19,302,000	-.7
Transportation and public utilities	5,437,000	5,473,000	-.7
Wholesale trade	5,926,000	6,016,000	-1.5
Retail trade	18,551,000	18,612,000	-.3
Finance, insurance, and real estate	6,594,000	6,599,000	-.1
Services	25,103,000	24,978,000	.5
Government	17,656,000	17,671,000	-.1

Table A. Summary of methods for computing industry statistics on employment, hours, and earnings

Employment, hours, and earnings	Basic estimating cell (industry, region, size, or region/size cell)	Aggregate industry level (division and, where stratified, industry)
Monthly data		
All employees	All-employee estimate for previous month multiplied by ratio of all employees in current month to all employees in previous month, for sample establishments which reported for both months. ¹	Sum of all-employee estimates for component cells.
Production or nonsupervisory workers, women employees	All-employee estimate for current month multiplied by (1) ratio of production or nonsupervisory workers to all employees in sample establishments for current month, (2) estimated ratio of women to all employees. ²	Sum of production or nonsupervisory workers estimates, or estimates of women employees, for component cells.
Average weekly hours	Production or nonsupervisory worker hours divided by number of production or nonsupervisory workers. ²	Average, weighted by production or nonsupervisory worker employment, of the average weekly hours for component cells.
Average weekly overtime hours	Production worker overtime hours divided by number of production workers. ²	Average, weighted by production worker employment, of the average weekly overtime hours for component cells.
Average hourly earnings	Total production or nonsupervisory worker payroll divided by total production or nonsupervisory worker hours. ²	Average, weighted by aggregate hours, of the average hourly earnings for component cells.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.
Annual average data		
All employees, women employees, and production or nonsupervisory workers	Sum of monthly estimates divided by 12.	Sum of monthly estimates divided by 12.
Average weekly hours	Annual total of aggregate hours (production or nonsupervisory worker employment multiplied by average weekly hours) divided by annual sum of employment.	Annual total of aggregate hours for production or nonsupervisory workers divided by annual sum of employment for these workers.
Average weekly overtime hours	Annual total of aggregate overtime hours (production worker employment multiplied by average weekly overtime hours) divided by annual sum of employment.	Annual total of aggregate overtime hours for production workers divided by annual sum of employment for these workers.
Average hourly earnings	Annual total of aggregate payrolls (product of production or nonsupervisory worker employment by weekly hours and hourly earnings) divided by annual aggregate hours.	Annual total of aggregate payrolls divided by annual aggregate hours.
Average weekly earnings	Product of average weekly hours and average hourly earnings.	Product of average weekly hours and average hourly earnings.

¹ The estimates are computed by multiplying the above product by bias adjustment factors, which compensate for the underrepresentation of newly formed enterprises and other sources of bias in the sample.

² The sample production-worker ratio, women-worker ratio, average weekly hours, average overtime hours, and average hourly earnings are

modified by a wedging technique designed to compensate for changes in the sample arising mainly from the voluntary character of the reporting. The wedging procedure accepts the advantage of continuity from the use of the matched sample and, at the same time, tapers or wedges the estimate toward the level of the latest sample average.

a few chosen from among the smaller establishments, or none at all if the concentration of employment is great enough. On the other hand, in an industry in which a large proportion of total employment is in small establishments, the sample design calls for inclusion of all large establishments and also for a substantial number of smaller ones. Many industries in the trade and services divisions fall into this category. To keep the sample to a size which can be handled by available resources, it is necessary to design samples for these industries with a smaller proportion of universe employment than is the case for most manufacturing industries. Since individual establishments in the nonmanufacturing division generally show less fluctuation from regular cyclical or seasonal patterns than do establishments in manufacturing industries, these smaller samples (in terms of employment) generally produce reliable estimates.

In the context of the CES program, with its emphasis on producing timely data at minimum cost, a sample must be obtained which will provide coverage of a sufficiently large segment of the universe to provide reasonably reliable estimates that can be published promptly and regularly. The present sample meets these specifications for most industries. The sample design allows BLS to produce preliminary estimates each month for many industries and for many geographic levels within a few weeks after reports are mailed by respondents. At a somewhat later date, estimates in considerably greater industrial detail are also made available.

Coverage

The BLS sample of establishment employment and payrolls is the largest monthly sampling operation in the field of social statistics. Table C shows the latest benchmarks and the approximate proportion of total employment in each industry division covered by the sample of establishments furnishing monthly employment data. The coverage for individual industries within the division may vary from the proportions shown.

Reliability of the employment estimates

The estimates derived from the establishment survey may differ from the figures that would have been obtained if it were possible to take a complete census using the same schedules and procedures. The relatively large size of the BLS establishment sample assures a high degree of accuracy. However, since the link relative technique requires the use of the previous month's estimate as the base in computing the current month's estimate, small sampling and response errors may accumulate over several months. To remove this accumulated error, the estimates are usually adjusted annually to new benchmarks. In addition to correcting sampling and response errors, the bench-

Table C. Employment benchmarks and approximate coverage of BLS employment and payrolls sample, March 1988

Industry	Benchmarks (thousands)	Sample coverage ¹		
		Number of establishments	Employees	
			Number (thousands)	Percent of benchmarks
Total	103,835	262,856	38,922	37
Mining	711	3,361	276	39
Construction	4,686	24,924	917	20
Manufacturing	19,171	49,889	9,483	49
Transportation and public utilities	5,437	214,091	22,482	46
Wholesale trade	5,926	22,810	1,062	18
Retail trade	18,551	49,015	3,704	20
Finance, insurance, and real estate	6,594	19,711	2,126	32
Services	25,103	58,713	5,795	23
Government:				
Federal	2,964	(³)	2,964	100
State	4,151	4,883	3,406	82
Local	10,541	15,459	6,707	64

¹ Counts reflect reports used in final estimates. Since not all establishments report payroll and hours information, hours and earnings estimates are based on a smaller sample than employment estimates.

² The Interstate Commerce Commission provides a complete count of employment for Class I railroads.

³ Total Federal employment counts for use in national estimates are provided to BLS by the Office of Personnel Management. Detailed industry estimates for the Executive Branch, as well as State and area estimates of Federal employment, are based on a sample of 5,000 reports covering about 56 percent of employment in Federal establishments.

mark revision adjusts the estimates for changes in the industrial classification of individual establishments resulting from changes in their product. In fact, at the more detailed industry levels, particularly within manufacturing, changes in classification are the major cause of benchmark adjustments. Differences also result from improvement in the quality of the benchmark data. Table D presents the average percent revisions of employment estimates for the five most recent benchmarks, for major industry divisions. Detailed descriptions of individual benchmark revisions are available from the Bureau upon request.

Hours and earnings estimates for cells are computed directly from reported figures and are not subject to benchmark revisions, although the broader grouping may be affected slightly by changes in employment weights. The hours and earnings estimates, however, are subject to sampling errors, which may be expressed as relative errors of the estimates. (A relative error is a standard error expressed as a percent of the estimate.) Relative errors for major industries are presented in table D and for individual industries with the specified number of employees in table E. The chances are about 2 out

Table D. Average benchmark revision in employment estimates and relative errors for average weekly hours and average hourly earnings by industry

(Percent)

Industry	Average benchmark revision in estimates of employment ¹	Relative error ²	
		Average weekly hours	Average hourly earnings
Total	0.2	—	—
Total private .....	.3	0.1	0.2
Mining	2.2	1.0	1.3
Construction	1.8	.2	.5
Manufacturing .....	.7	.1	.2
Durable goods .....	.7	.1	.3
Nondurable goods .....	.9	.1	.2
Transportation and public utilities .....	.4	.7	.6
Wholesale trade	1.0	.2	.4
Retail trade .....	.7	.2	.4
Finance, insurance, and real estate .....	.3	.2	.4
Services .....	.3	.4	.6
Government ³ .....	.3	—	—

¹ The average percent revision in employment for the 1984-88 benchmarks.

² Relative errors relate to 1982 data.

³ Estimates for government are based on a total count for Federal Government provided by the Office of Personnel Management and a sample of State and local government reports.

of 3 that the hours and earnings estimates from the sample would differ by a smaller percentage than the relative error from the averages that would have been obtained from a complete census.

One measure of the reliability of ratio estimates is the root-mean-square error (RMSE). This measure is the standard deviation adjusted for the bias in estimates:

$$RMSE = \sqrt{(\text{standard deviation})^2 + (\text{bias}^2)}$$

If the bias is small, the chances are about 2 out of 3 that an estimate from the sample would differ from its benchmark by less than the root-mean-square error. The chances are about 19 out of 20 that the difference would be less than twice the root-mean-square error.

Approximations of the root-mean-square errors of differences between final estimates and benchmarks are presented in table E. Since the differences are those that have accumulated at the end of 12 monthly estimates, the amount of difference that accumulates in 1 month is much smaller, or approximately 1/12 of the amount indicated.

SEASONAL ADJUSTMENT

Many economic statistics reflect a regularly recurring seasonal movement which can be estimated on the basis of past experience. By eliminating that part of the change which can be ascribed to usual seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in the series. However, in evaluating deviations from the seasonal pattern—that is, changes in a seasonally adjusted series—it is important to note that seasonal adjustment is merely an approximation based on past experience. Seasonally adjusted estimates have a broader margin of possible error than the original data on which they are based, since they are subject not only to sampling and other errors but, in addition, are affected by the uncertainties of the seasonal adjustment process itself. Seasonally adjusted establishment-based series from January 1984 forward reflect the experience through March 1989. Current seasonally adjusted data are published monthly in *Employment and Earnings* and the *Monthly Labor Review*.

Since the early 1980's, the BLS has used the X-11 ARIMA (Auto-Regressive Integrated Moving Average) seasonal adjustment procedure to seasonally adjust establishment-based employment, hours, and earnings data. The X-11 ARIMA program has been run once each year after benchmarking and seasonal adjustment factors have been projected and published for 12 months ahead (April-March). Beginning in June 1989, with the introduction of the March 1988 benchmarks, the Bureau introduced a modification to this procedure to parallel that used in seasonally adjusting the household survey

Table E. Root-mean-square errors of differences between benchmarks and estimates of employment and average relative errors for average weekly hours and average hourly earnings

Size of employment estimates	Root-mean-square error of employment estimates ¹	Relative error ² (in percent)	
		Average weekly hours	Average hourly earnings
50,000	2,100	2.2	4.0
100,000	3,900	1.3	2.3
200,000	5,600	1.1	2.0
500,000	14,000	.9	1.6
1,000,000	15,000	.8	1.2
2,000,000	26,000	.5	.9

¹ Assuming 12-month intervals between benchmark revisions.

² Relative errors relate to 1982 data.

data. Projected seasonal adjustment factors are now calculated only for the first 6 months after benchmarking. A second set of projected seasonal adjustment factors, for use during the subsequent period, will be computed based upon data through September and introduced with the publication of data for October. Revisions of historical data for the most recent 5 years will continue to be made once a year, coincident with the benchmark revisions.

The BLS is also working on an extension to X-11 ARIMA to allow it to more adequately adjust for the effects of the presence or absence of religious holidays in the April survey reference period (as well as for the occasional effects of Labor Day in the September survey reference period). If this research proves successful, this extension will be introduced for the computation of the seasonal adjustment factors to be published in November 1989.

All series are seasonally adjusted using the multiplicative models under X-11 ARIMA. Seasonal adjustment factors are applied directly to the component series. Seasonally adjusted totals for most of these series are then obtained by taking a weighted average of the seasonally adjusted data for the component series.

Seasonally adjusted average weekly earnings are the product of seasonally adjusted average hourly earnings and seasonally adjusted average weekly hours. Average hourly and weekly earnings in constant dollars, seasonally adjusted, are obtained by dividing average earnings, seasonally adjusted by the seasonally adjusted Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), and multiplying by 100. Indexes of aggregate weekly hours, seasonally adjusted, are obtained by multiplying average weekly hours, seasonally adjusted, by production or nonsupervisory workers, seasonally adjusted, and dividing by the 1977 base. For total private, total goods-producing, total private service-producing, and major industry divisions, the indexes of aggregate weekly hours, seasonally adjusted, are obtained by summing the aggregate weekly hours, seasonally adjusted, for the appropriate component industries and dividing by the 1977 base.

Seasonally adjusted data are not published for a number of series characterized by small seasonal components relative to their trend-cycle and/or irregular components. These "failed" or unsatisfactory seasonally adjusted series, however, are used in the aggregation to higher level seasonally adjusted series.

Seasonal adjustment factors for Federal Government employment are derived from unadjusted data which include Christmas temporary workers employed by the Postal Service. The number of temporary census takers for the 1980 decennial census are removed, however, prior to the calculation of seasonal adjustment factors.

COMPARABILITY OF DATA WITH OTHER SERIES

Current Population Survey

Data based on household interviews are obtained from a sample survey of the population. The survey is conducted each month by the Bureau of the Census for the Bureau of Labor Statistics and provides a comprehensive measure of the labor force, i.e., the total number of civilians 16 years of age and over who are employed or unemployed. It also provides data on their personal and economic characteristics such as age, sex, race, marital status, occupation, industry, hours of work, and duration of unemployment. This information is collected by trained interviewers from a sample of about 55,800 households throughout the country and is based on the activity or status reported for the calendar week including the 12th of the month. These data are published monthly in *Employment and Earnings*. Historical national data appear in *Labor Force Statistics Derived from the Current Population Survey, 1948-87*, BLS Bulletin 2307.

Data from payroll reports and household interviews differ from each other because of differences in definition and coverage, sources of information, methods of collection, and estimating procedures. Sampling variability and response errors are additional reasons for discrepancies. Some specific factors which have a differential effect on levels and trends of the two series are described as follows:

Coverage. The household survey definition of employment comprises wage and salary workers (including domestics and other private household workers), self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises. Civilian employment in both agricultural and nonagricultural industries is included. The payroll survey covers only wage and salary employees on the payrolls of nonagricultural establishments.

Multiple jobholding. The household survey provides information on the work status of the population without duplication, since each person is classified as employed, unemployed, or not in the labor force. Employed persons holding more than one job are counted only once, and are classified according to the job at which they worked the greatest number of hours during the survey week. In the figures based on establishment records, persons who worked in more than one establishment during the reporting period are counted each time their name appears on payrolls.

Unpaid absences from jobs. The household survey includes among the employed all persons who had jobs but were not at work during the survey week—that is, were not working but had jobs from which they were

temporarily absent because of illness, bad weather, vacation, labor-management dispute, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off. Payroll reports include persons on leave which is paid for by the company and exclude those on leave without pay for the entire payroll period.

Hours of work. The household survey measures hours actually worked, whereas the payroll survey measures hours paid for by employers. In the household survey, all persons with a job but not at work are excluded from the hours distributions and the computations of average hours. In the payroll survey, employees on paid vacation, paid holiday, or paid sick leave are included and assigned the number of hours for which they were paid during the reporting period.

Earnings. The household survey measures median earnings of wage and salary workers in all occupations and industries in both the private and public sectors. Data refer to the usual earnings received from the worker's sole or primary job. Data from the establishment survey generally refer to average earnings of production and related workers in mining and manufacturing, construction workers in construction, and nonsupervisory employees in private service-producing industries.

County Business Patterns

Data in *County Business Patterns* (CBP), published by the Bureau of the Census, differ from BLS establishment statistics in the treatment of central administrative offices and auxiliary units. Differences also may arise because of industrial classification and reporting practices. In addition, CBP excludes

interstate railroads and government, and coverage is incomplete for some of the nonprofit activities.

Employment covered by State unemployment insurance programs

Most nonagricultural wage and salary workers are covered by unemployment insurance programs. However, certain employees, such as those working for interstate railroads or members of religious orders working in parochial schools and churches, are not covered. They are included, however, in BLS establishment statistics. Data for railroads are obtained from the Interstate Commerce Commission; data for parochial schools and churches are obtained from the U.S. Office of Education, the National Catholic Welfare Conference, the National Council of Churches, and surveys of churches conducted by several State agencies.

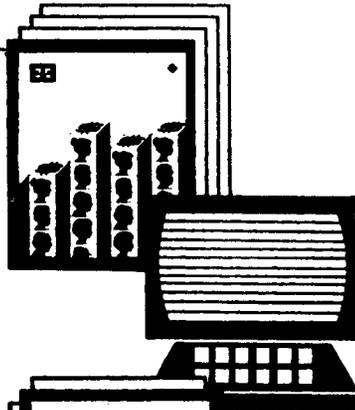
Statistics on manufactures and business, Bureau of the Census

BLS establishment statistics on employment differ from employment counts derived by the Bureau of the Census from its censuses or sample surveys of manufacturing and business establishments. The major reasons for non-comparability are different treatment of business units considered parts of an establishment, such as central administrative offices and auxiliary units, the industrial classification of establishments, and different reporting patterns by multiunit companies. There are also differences in the scope of the industries covered, e.g., the Census of Business excludes professional services, public utilities, and financial establishments, whereas these are included in the BLS statistics.

Where to Find Information on Employment and Unemployment

Employment and Earnings:

Monthly periodical containing labor force and establishment data. National, State, and area figures on employment, unemployment, hours, and earnings. Order *Employment and Earnings* from Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402. Includes text, statistical tables, and technical notes.

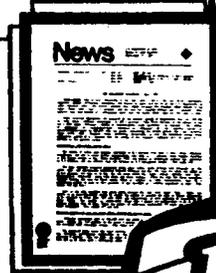


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Machine-Readable Form:

Labor force data from the household survey and employment, hours, and earnings data from the establishment survey are available on both computer tape and diskette. For information, write the Office of Publications, Bureau of Labor Statistics, Washington, DC. 20212 or call (202) 523-1090.



Monthly Labor Review:

Employment and unemployment statistics included in monthly 47-page summary of BLS data and in analytical articles. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.



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