BLS Handbook of Methods

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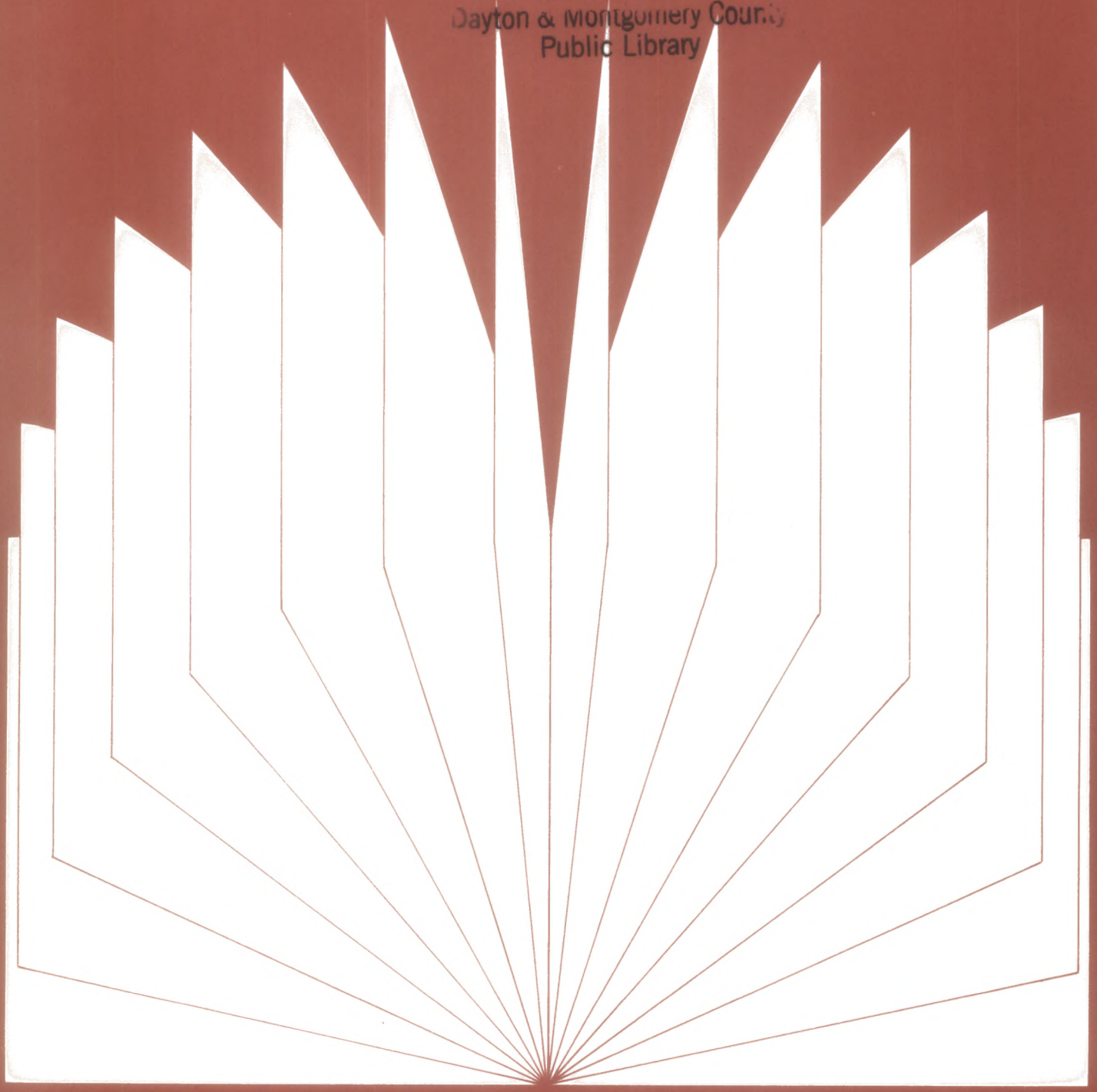

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U.S. Department of Labor
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Preface

The *BLS Handbook of Methods* presents detailed explanations of how the Bureau of Labor Statistics obtains and prepares the economic data it publishes. BLS statistics are used for many purposes, and sometimes data well suited to one purpose may have limitations for another. This edition of the *Handbook*, like its predecessors, aims to provide users of BLS data with the information necessary to evaluate the suitability of the statistics for their needs.

Chapters for each major Bureau program give a brief account of the program's origin and development and then follow with comprehensive information on concepts and definitions, sources of data and methods of collection, statistical procedures, where the data are published, and their uses and limitations. Sources of additional technical information are given at the end of most chapters.

The *Handbook* was written by members of the staffs of the various BLS program offices. It was prepared for publication by Rosalind Springsteen and Rosalie Epstein in the Division of Special Publications, Office of Publications.

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Introduction

When U.S. Commissioner of Labor Carroll Wright issued his first annual report in March 1886, he established the policy of explaining his statistical methods to his readers and of seeking to avoid misinterpretation of the figures presented. During the more than 100 years which have followed that initial report, the definitions, methods, and limitations of the data published by the Bureau of Labor and its successor, the Bureau of Labor Statistics, have been explained again and again. The reason for this is not merely to make the readers aware of the known limitations of the statistics, but also to guide them in the appropriate use of the information and to assure them that proper standards have been observed.

This volume continues that tradition by providing detailed descriptions of the Bureau's statistical series. The Bureau's role, organization, and staff, and its approach to its data collection activities also are discussed briefly.

BLS role

Among Federal agencies collecting and issuing statistics, the Bureau of Labor Statistics has been termed a general-purpose statistical collection agency. The Bureau's figures are prepared to serve the needs of business, labor, Congress, the general public, and the administrative and executive agencies for information on economic and social trends. BLS statistics are often quite specialized, yet they meet general economic and social data requirements. As the needs of users are likely to differ, no statistic is ideal for all. This makes it important that the characteristics of the measures and their limitations be well understood.

Organization

The statistical programs of the Bureau were developed, for the most part, independently of each other, taking on characteristics suited to the requirements of the subject under observation. As a result, the Bureau was organized according to subject matter areas, an arrangement which has proved efficient and has been continued over the years. Expertise in techniques, economic analysis, and other staff activities across subject-matter lines was added to provide better use of the Bureau's resources.

As the Bureau's collection activities increased, regional offices were established to administer the field programs, to disseminate data to local users, and to furnish technical advice and assistance to State agencies and other cooperating organizations. An important aspect of the work of the regional staffs has been explaining the concepts and techniques which the Bureau uses in compiling the statistics.

Staff

The Bureau's work extends beyond the initial collection and processing of data. Its findings frequently influence, and sometimes are crucial to, the determining and shaping of public policy. Over the years, it has developed a staff of professionals—economists, statisticians, mathematical statisticians, computer analysts, and administrative specialists, among others—each playing a significant role to ensure that the information issued by the Bureau is of the highest quality.

An atmosphere of professional growth is fostered at the Bureau. Education is a continual process reached through technical and on-the-job training, attendance at seminars and conferences, and university classes. The end result is a highly skilled staff whose competence is well regarded throughout the community of users of BLS data.

Consultation and advice

A statistical program too much detached from the users of its data may fail in its principal mission. To avoid sterility, the Bureau continuously invites advice and ideas from users and experts in business, labor, professional, and academic organizations and from members of the public. Over the years, several commissions and committees have been appointed to review specific Bureau programs and have made valuable suggestions. Of course, the Commissioner of Labor Statistics always retains final responsibility for all decisions on statistical policy.

The Commissioner established two standing research advisory committees in 1947. These groups, now called the Business Research Advisory Council and the Labor Research Advisory Council, advise on technical problems and provide perspectives on Bureau programs in relation to needs of their members. The councils accomplish their work in general sessions and also through committees on specialized subject-matter fields. Committees are augmented by persons in industry or labor who, although not council members, have special expertise. The councils may take formal action through resolutions or

recommendations on appropriate matters, but such resolutions are merely advisory. Members of the councils and the subcommittees serve in their individual capacities, not as representatives of their organizations.

The members of the Business Research Advisory Council are designated by the Commissioner under authorization of the Secretary of Labor, after nomination by the National Association of Manufacturers, the U.S. Chamber of Commerce, the Business Round Table, and the National Federation of Independent Business. The members of the Labor Research Advisory Council are designated by the Commissioner under authorization of the Secretary of Labor, from nominations by the Director of Research, AFL-CIO. All research directors of international unions represented in the AFL-CIO are invited to attend the general meetings of the council.

Voluntary reporting and confidentiality

Voluntary reporting and the preserving of the confidential nature of reported data are important characteristics of BLS programs. For more than a century, the Bureau has asked hundreds of thousands of firms and individuals to provide information closely related to their daily affairs and their personal lives. To some who have supplied the desired information, the Bureau has gone back often for later information on the same subject or for new types of information. The Bureau's respondents have been remarkable in their generosity. In no small measure, their cooperation has been due to the great care taken to avoid identifying the firm or the person supplying the information. Bureau employees pledge themselves to protect these data and understand the adverse long-run consequences of even a single lapse. The only inducement is to tell respondents that their contributions are important to the success of the survey and that they may find the survey results useful in their own pursuits.

The policy of not identifying respondents is implemented by combining the data reported by the different sources and issuing the findings in summary form. Thus, respondents are assured that their reports will be used for statistical purposes only. All efforts to obtain legal access to individual respondents' reports have been successfully resisted.[1]

Bureau Commissioners and their staffs have been convinced over the years that these policies contribute to the reliability of BLS statistics.

[1] For example, see Hustead v. Norwood, 529 F. SUPP. 323 (S.D. Fla. 1981).

Chapter 1. Labor Force, Employment, and Unemployment from the Current Population Survey

Each month, the Bureau analyzes and publishes statistics on the labor force, employment, unemployment, and persons not in the labor force, classified by a variety of demographic, social, and economic characteristics. These statistics are derived from the Current Population Survey (CPS), which is conducted by the Bureau of the Census for the BLS. This monthly survey of the population is conducted using a scientifically selected sample of households, representative of the civilian noninstitutional population of the United States.

Background

Specific concepts of the labor force, employment, and unemployment were introduced in the later stages of the depression of the 1930's. Before the 1930's, aside from attempts in some of the decennial censuses, no direct measurements were made of the number of jobless persons. Mass unemployment in the early 1930's increased the need for statistics, and widely conflicting estimates based on a variety of indirect techniques began to appear. Dissatisfied with these methods, many research groups, as well as State and municipal governments, began experimenting with direct surveys of the population or samples of the population. In these surveys, an attempt was made to classify the population as employed, unemployed, or out of the labor force by means of a series of questions addressed to each individual. In most of the surveys, the unemployed were defined as those who were not working but were "willing and able to work." This concept, however, did not meet the standards of objectivity that many technicians felt were necessary to measure either the level of unemployment at a point in time or changes over periods of time. The criterion "willing and able to work," when applied in specific situations, appeared to be too intangible and too dependent upon the interpretation and attitude of the persons being interviewed.

A set of precise concepts was developed in the late 1930's to meet these various criticisms. The classification of an individual depended principally upon his or her actual activity within a designated time period; i.e., was he or she working, looking for work, or engaged in other activities? These concepts were adopted for the national sample survey of households, called the Monthly Report of Unemployment, initiated by the Works Progress Administration in 1940.

The household survey was transferred to the Bureau of the Census in late 1942, and its name was changed to the Monthly Report on the Labor Force. The survey title was changed once more in 1948 to the present Current Population Survey in order to reflect its expanding role as a source for a wide variety of demographic, social, and economic characteristics of the population. In 1959, responsibility for analyzing and publishing the CPS labor force data was transferred to BLS, although the Bureau of the Census continues to collect and tabulate the statistics.

Description of Survey

The CPS provides statistics on the civilian noninstitutional population 16 years of age and over. Figures on the resident Armed Forces (obtained monthly from the Department of Defense) are added to the CPS estimates to derive estimates of the "total employed," "labor force," and the "noninstitutional population." Persons under 16 years of age are excluded from the official definition of the labor force because child labor laws, compulsory school attendance, and general social custom prevent most of these children in the United States from working. The institutional population, which is also excluded from coverage, consists of inmates of penal and mental institutions, sanitariums, and homes for the aged, infirm, and needy.

The CPS is collected each month from a probability sample of approximately 59,500 occupied households. Respondents are assured that all information obtained is completely confidential and is used only for the purpose of statistical analysis. Although the survey is conducted on a strictly voluntary basis, refusals to cooperate have averaged about 2½ percent or less since its inception.

The time period covered in the monthly survey is a calendar week. A calendar week was selected as the survey reference period because the period used must be short enough so that the data obtained are "current" but not

so short that the occurrence of holidays or other accidental events might cause erratic fluctuations in the information obtained. A calendar week fulfills these conditions as well as being a convenient and easily defined period of time. Since July 1955, the calendar week, Sunday through Saturday, which includes the 12th day of the month has been defined as the reference week. The actual survey is conducted during the following week, which is the week containing the 19th day of the month.

Concepts

The criteria used in classifying persons on the basis of their labor force activity are as follows:

Employment. Employed persons comprise (1) all those who, during the survey week, did any work at all as paid employees, or in their own business, profession, or on their own farm, or who worked 15 hours or more as unpaid workers in a family-operated enterprise; and (2) all those who did not work but had jobs or businesses from which they were temporarily absent due to illness, bad weather, vacation, labor-management dispute, or various personal reasons—whether or not they were paid by their employers for the time off and whether or not they were seeking other jobs. Members of the Armed Forces stationed in the United States are also included in the employed total. Each employed person is counted only once. Those who held more than one job are counted in the job at which they worked the greatest number of hours during the survey week. Included in the total are employed citizens of foreign countries, temporarily in the United States, who are not living on the premises of an embassy. Excluded are persons whose only activity consisted of work around their own home (such as housework, painting, repairing, etc.) or volunteer work for religious, charitable, and similar organizations.

Unemployment. Unemployed persons include those who did not work at all during the survey week, were looking for work, and were available for work during the reference period (except for temporary illness). Those who had made specific efforts to find work within the preceding 4-week period—such as by registering at a public or private employment agency, writing letters of application, canvassing for work, etc.—are considered to be looking for work. Persons who were waiting to be recalled to a job from which they had been laid off or were waiting to report to a new job within 30 days need not be looking for work to be classified as unemployed.

Duration of unemployment represents the length of time (through the current survey week) during which persons classified as unemployed had been continuously looking for work and thus is a measure of an in-progress spell of joblessness. For persons on layoff, duration of unemployment represents the number of full weeks since the termination of their most recent employment. A period of 2 weeks or more during which a person was employed or ceased looking for work is considered to break the continuity of the present period of seeking work. Two useful measures of the duration of unemployment are the mean and the median. Mean duration is the arithmetic average computed from single weeks of unemployment. Median duration is the midpoint of a distribution of weeks of unemployment.

The reasons for unemployment are divided into four major groups. (1) Job losers are persons whose employment ended involuntarily and who immediately began looking for work, including those on layoff. (2) Job leavers are persons who quit or otherwise terminated their employment voluntarily and immediately began looking for work. (3) Reentrants are persons who previously worked at a full-time job lasting 2 weeks or longer but who were out of the labor force prior to beginning to look for work. (4) New entrants are persons who never worked at a full-time job lasting 2 weeks or longer.

Labor force. The civilian labor force comprises the total of all civilians classified as employed and unemployed. The labor force, in addition, includes members of the Armed Forces stationed in the United States.

Unemployment rate. The overall unemployment rate represents the number of unemployed as a percent of the labor force including members of the Armed Forces stationed in the United States. The unemployment rate for all civilian workers represents the number of unemployed as a percent of the civilian labor force. This measure is also computed for various groups within the labor force classified by sex, age, race, Hispanic ethnicity, industry, occupation, etc., or for combinations of these characteristics. Because there is no comparable labor force, the job-loser, job-leaver, reentrant, and new entrant rates are each calculated as a percent of the total civilian labor force; the sum of the rates for the four groups thus equals the unemployment rate for all civilian workers.

Not in labor force. All civilians 16 years of age and over who are not classified as employed or unemployed are defined as "not in the labor force." These persons are further classified as "engaged in own housework," "in school," "unable to work" because of long-term physical or mental illness, "retired," and "other." The "other" group includes the voluntarily idle, seasonal workers for whom the survey week fell in an "off" season and who were not reported as looking for work, and persons who did not look for work because they believed that no jobs were available because of personal factors—age, lack of education or training, etc.—or because of the prevailing job market situation.

In addition to students with no current interest in labor force activity, the category "not in labor force—in

school" includes persons attending school during the survey week who had new jobs to which they were scheduled to report within 30 days. It also includes students looking for jobs for some period in the future, such as the summer months. All persons—whether or not attending school—who had new jobs not scheduled to begin until after 30 days (and who were not working or looking for work) are also classified as not in the labor force.

For persons not in the labor force, detailed questions are asked about previous work experience, intentions to seek work, desire for a job at the time of interview, and reasons for not looking for work. These questions are asked only in those households that are in the fourth and eighth months of the sample; i.e., the "outgoing" rotation groups, those which had been in the sample for 3 previous months and would not be in for the subsequent month. Prior to 1970, the detailed not-in-labor force questions were asked of persons in the first and fifth months in the sample; i.e., the "incoming" groups. (See Sampling.)

Sampling

The CPS sample is located in 729 areas comprising over 1,000 counties and independent cities with coverage in every State and the District of Columbia. In all, about 71,000 housing units and other living quarters are designated for the sample each month, of which about 59,500 are occupied and thus eligible for interview. The remainder are units found to be vacant, converted to nonresidential use, containing persons who reside elsewhere, or ineligible for other reasons. Of the occupied units eligible for enumeration, about 4 to 5 percent are not interviewed in a given month because the residents are not found at home after repeated calls, are temporarily absent, refuse to cooperate, or are unavailable for other reasons. Information is obtained each month for approximately 113,000 individuals 16 years and over.

The CPS sample was redesigned in April 1984–July 1985 to incorporate data from the 1980 census into the sampling frame, as is done after every decennial census. At the same time, the structure of the sample design was changed. Previously, the CPS had been designed as a national sample with the goal of providing the best estimates of employment and unemployment for the United States as a whole. During the 1970's, however, growing demands were placed on the CPS for the development of State and local labor force estimates used in the allocation of Federal revenues to States and areas and for other purposes. The CPS sample was selectively expanded on several occasions to improve the ability to provide State and local area labor force estimates. Even with these efforts, it was still difficult to obtain very reliable subnational data from the CPS except in large States and metropolitan areas. Therefore, to provide more accurate and reliable subnational estimates, the survey was redesigned as 51 separate samples, one for each of the States and the District of Columbia. At the same time, the redesign maintained the statistical reliability of the national estimates.[1]

Selection of sample areas. The entire area of the United States, consisting of 3,137 counties and independent cities, is divided into 1,973 primary sampling units (PSU's). With some minor exceptions, a PSU consists of a county or a number of contiguous counties.

Metropolitan areas within a State are used as a basis for forming PSU's. Outside of metropolitan areas, counties normally are combined, except where the geographic area of the sample county is very large. Combining counties to form PSU's provides greater heterogeneity; a typical PSU includes urban and rural residents of both high and low economic levels and encompasses, to the extent feasible, diverse occupations and industries. Another important consideration is to have the PSU sufficiently compact so that, with a small sample spread throughout, it can be efficiently canvassed without undue travel cost.

In the sample, the 1,973 PSU's are grouped into strata within each State. Then one PSU is selected from each stratum with the probability of selection proportionate to the population size of the PSU. PSU's in strata by themselves are self-representing, and generally are the most populated PSU's in each State. Other strata are formed by combining PSU's that are similar in such characteristics as population growth; proportions of blacks and of Hispanics; and population distribution by occupation, industry, age, and sex. PSU's selected from these strata are non-self-representing, since each one chosen represents the entire stratum.

Selection of sample households. Since the sample design is essentially State based, the sampling ratio differs by State and depends on the reliability requirements for estimates for each State. The State sampling ratios range roughly from 1 in every 200 households to 1 in every 2,500 households in each stratum of the State. The sampling ratio occasionally is modified slightly to hold the size of the sample relatively constant given the overall growth of the population. The sampling ratio used within a sample PSU depends on the probability of selection of the PSU and the sampling ratio for the State. In a sample PSU with a probability of selection of 1 in 10 in a State with a sampling ratio of 1 in 2,500, the within-PSU sampling ratio that results is 1 in 250, thereby achieving the desired ratio of 1 in 2,500 for the stratum.

Within each designated PSU, several steps are involved in selecting the housing units to be enumerated. First, the 1980 census enumeration districts (ED's), which are

[1] For a complete description of the CPS redesign, see "Redesign of the Sample for the Current Population Survey," *Employment and Earnings,* May 1984, pp. 7–10.

administrative units and contain on the average about 300 housing units, are ordered so that the sample would reflect the demographic and residential characteristics of the PSU. Within each ED, the housing units are sorted geographically and are grouped into clusters of approximately four housing units. Then a systematic sample of these clusters of housing units is selected.

The identification of the sample housing units within an ED is made wherever possible from the list of ED addresses compiled during the 1980 census or, if the addresses are incomplete or inadequate, by area sampling methods. The address lists are used in about two-thirds of the cases, primarily in urban areas, and area sampling is applied in the remainder. In using the census lists, an effort is made to have all small multiunit addresses (2–4 units) included within the same segment. This improves the ability of the interviewer to cover all units designated for the sample. Subject to this restriction, clusters consist of geographically contiguous addresses to the extent possible.

This address list sample is supplemented by a selection of the appropriate proportion of units newly constructed in the PSU since the census date. The addresses of these units are obtained mainly from records of building permits in that area.

In those enumeration districts where area sampling methods are used, mainly rural areas, the ED's are subdivided into segments; that is, small land areas having well-defined boundaries and, in general, an expected "size" of about 8 to 12 housing units or other living quarters. For each subdivided ED, one segment is designated for the sample. When a selected segment contains about four households, for example, all units are included in the sample. When the size of the segment is several times four units, an interviewer does not conduct interviews at all housing units in the segment but uses a systematic sampling pattern to achieve the equivalent of a four-household cluster which is canvassed completely. The remaining housing units in the segment are then available for further samples.[2]

Rotation of sample. Part of the sample is changed each month. For each sample, eight systematic subsamples (rotation groups) or segments are identified. A given rotation group is interviewed for a total of 8 months, divided into two equal periods. It is in the sample for 4 consecutive months 1 year, leaves the sample during the following 8 months, and then returns for the same 4 calendar months of the next year. In any 1 month, one-eighth of the sample segments are in their first month of enumeration, another eighth are in their second month, and so on; the last eighth are in for the eighth time, the fourth month of the second period of enumeration. Under this system, 75 percent of the sample segments are common from month to month and 50 percent from year to year. This procedure provides a substantial amount of month-to-month and year-to-year overlap in the panel, thus reducing discontinuities in the series of data without burdening any specific group of households with an unduly long period of inquiry.

[2] For more detail on the selection of sample households, see "The Current Population Survey: Design and Methodology," *Technical Paper No. 40* (U.S. Department of Commerce, Bureau of the Census, 1978).

Collection Methods

Each month, during the calendar week containing the 19th day, interviewers contact some responsible person in each of the sample households in the CPS. At the time of the first enumeration of a household, the interviewer visits the household and prepares a roster of the household members, including their personal characteristics (date of birth, sex, race, ethnic origin, marital status, educational attainment, veteran status, etc.) and their relationship to the person maintaining the family. This roster is brought up to date at each subsequent interview to take account of new or departed residents, changes in marital status, and similar items. The information on personal characteristics is thus available each month for identification purposes and for cross-classification with economic characteristics of the sample population.

Personal visits are required in the first, second, and fifth month that the household is in the sample. In other months, the interview may be conducted by telephone if the respondent agrees to this procedure. Also, if no one is at home when the interviewer visits, the respondent may be contacted by telephone after the first month. Approximately 67 percent of the households in any given month are interviewed by telephone.

At each monthly visit, a questionnaire is completed for each household member 16 years of age and over. The interviewer asks a series of standard questions on economic activity during the preceding week. The primary purpose of these questions is to classify the sample population into the three basic economic groups—the employed, the unemployed, and those not in the labor force. (See facsimile of the CPS standard questionnaire at the end of this chapter.)

Additional questions are asked each month to help clarify the information on labor force status. For the employed, information is obtained on hours worked during the survey week, together with a description of the current job. For those temporarily away from their jobs, the enumerator records their reason for not working during the survey week, whether or not they were paid for their time off, and whether they usually work full or part time. For the unemployed, information is obtained on (1) method(s) used to find work during the 4 weeks prior to the interview, (2) the reasons the unemployed persons

had started to look for work, (3) the length of time they had been looking for work, (4) whether they were seeking full- or part-time work, and (5) a description of their last full-time civilian job. For those outside the labor force, their principal activity during the survey week—keeping house, going to school, etc.—is recorded. In addition, all households in the outgoing rotation groups are asked questions on the work history, reasons for nonparticipation, and jobseeking intentions of individuals not in the labor force. In 1979, questions were added to collect data on hourly and weekly earnings from a quarter of the sample households—those in the two outgoing rotation groups.

The information obtained for each person in the sample is subjected to an edit by the regional offices of the Bureau of the Census. The field edit serves to catch omissions, inconsistencies, illegible entries, and errors at the point where correction is possible.

After the field edit, the questionnaires are forwarded to the Jeffersonville, Indiana, office of the Bureau of the Census by the end of the week after enumeration. The raw data are transferred to computer tape and transmitted to the computers in the Bureau of the Census' Washington office where they are checked for completeness and consistency.

Although the CPS interviewers are chiefly part-time workers, most have had several years of experience on the survey. They are given intensive training when first recruited and further training each month before the survey. Through editing of their completed questionnaires, repeated observation during enumeration, and a systematic reinterview of part of their assignments by the field supervisory staff, the work of the interviewers is monitored and errors or deficiencies are brought directly to their attention.

Estimating Methods

Under the estimating methods used in the CPS, all of the results for a given month become available simultaneously and are based on returns from the entire panel of respondents. The estimation procedure involves weighting the data from each sample person by the inverse of the probability of the person being in the sample. This gives a rough measure of the number of persons the sample person represents. Beginning in 1985, almost all sample persons within the same State will have the same probability of selection. These estimates are then adjusted for noninterviews, and the ratio estimation procedure is applied.

1. *Noninterview adjustment.* The weights for all interviewed households are adjusted to the extent needed to account for occupied sample households for which no information was obtained because of absence, impassable roads, refusals, or unavailability of the respondents for other reasons. This noninterview adjustment is made separately for combinations of similar sample areas that are not necessarily contained within a State. Similarity of sample areas is based on Metropolitan Statistical Area (MSA) status and size. Within each combination of sample areas, there is a further breakdown by residence. MSA sample areas are categorized by "central city" and "balance of the MSA." Residence categories of non-MSA areas are "urban" and "rural." The proportion of sample households not interviewed varies from 4 to 5 percent depending on weather, vacations, etc.

2. *Ratio estimates.* The distribution of the population selected for the sample may differ somewhat, by chance, from that of the population as a whole, in such characteristics as age, race, sex, and residence. Since these characteristics are closely correlated with labor force participation and other principal measurements made from the sample, the survey estimates can be substantially improved when weighted appropriately by the known distribution of these population characteristics. This is accomplished through two stages of ratio estimates as follows:

a. *First-stage ratio estimate.* In the CPS, a portion of the 729 sample areas is chosen to represent other areas not in the sample; the remainder of the sample areas represent only themselves. The first-stage ratio estimation procedure was designed to reduce the portion of the variance resulting from requiring sample areas to represent nonsample areas. Therefore, this procedure is not applied to sample areas which represent only themselves. The adjustment is made at the State level for each of the 43 States that contain nonsample areas by race cells of black and nonblack. The procedure corrects for the differences that existed in each cell at the time of the 1980 census between the race distribution of the population in sample areas and the known race distribution of the State.

b. *Second-stage ratio estimate.* In this stage, the sample proportions of persons in specific categories are adjusted to the distribution of independent current estimates of the civilian noninstitutional population in the same categories. The second-stage ratio adjustment, which is performed to further reduce variability of the estimates and to correct to some extent for CPS undercoverage relative to the decennial census, is carried out in three steps.

In the first step, the sample estimates are adjusted within each State and the District of Columbia to an independent control for the population 16 years and over.

The second step involves an adjustment by Hispanic origin to a national estimate for eight age-sex categories by Hispanic and non-Hispanic. This step was initiated in January 1985. The adjustment is prepared by carrying

forward the 1980 census count for Hispanics by adding estimated Hispanic births and immigrants and subtracting estimated Hispanic deaths and emigrants to yield an estimate of the Hispanic population by age and sex.

In the third step, a national adjustment is made by the race categories of white, black, and other races to independent estimates by age and sex. The white and black categories contain 32 age-sex groups each while the other races category has 6 age-sex cells. The entire second-stage adjustment procedure is iterated six times, each time beginning at the weights developed the previous time. This ensures that the sample estimates of the population for both State and national age-sex-race-origin categories will be virtually equal to the independent population control totals. This second-stage adjustment procedure incorporates changes instituted in January 1985. The nature and effect of these changes are discussed in detail in "Changes in Estimation Procedure in the Current Population Survey Beginning in January 1985" in the February 1985 issue of *Employment and Earnings*.

The controls by State for the civilian noninstitutional population 16 years and over are an arithmetic extrapolation of the trend in the growth of this segment of the population from the April 1, 1980, census through the latest available July 1 estimate, adjusted as a last step to a current estimate of the U.S. population of this group.

The "inflation-deflation" method is used in the preparation of the independent national controls used for the age-sex-race groups in the third step of the second-stage ratio estimation procedure. With the "inflation-deflation" method, the independent controls are prepared by inflating the 1980 census counts to include estimated undercounts by age, sex, and race, aging this population forward to each subsequent month and later age by adding births and net migration and subtracting deaths. These postcensal population estimates are then deflated to census level to reflect the pattern of net undercount in the most recent census by age, sex, and race. Because an estimate of undercount is first added and then subtracted, the size of each race-sex group is unaffected by the "inflation-deflation" method. Similarly, the final estimate is affected only by the age structure of the undercount, but not the level. This feature of the method is important since the exact amount of undercount in the 1980 census remains unknown.

Data on births and deaths between April 1, 1980, and the estimate date are based on tabulations of vital statistics for the resident population made by the National Center for Health Statistics and data on deaths of military personnel overseas from the Department of Defense. Estimates of net civilian immigration are based on data provided by the Immigration and Naturalization Service, the Department of Defense, the Office of Personnel Management, and the Puerto Rico Planning Board. The civilian noninstitutional population is derived by subtracting the Armed Forces and the institutional population for the estimate date from the total including Armed Forces overseas. The institutional population is computed by applying institutional proportions derived from the 1980 census to the total population, including Armed Forces overseas, for the estimate date. All computations described above are performed in cells defined by single year of age, race, and sex. The independent national control totals are then obtained by collapsing these cells into broader age groups for the population 16 years and older.

Beginning in January 1986, two changes were introduced into the estimation of the independent population controls. For the first time, an explicit allowance for net undocumented immigration since April 1, 1980 (the census date), was added to the estimated level of legal immigration. In addition, an increase in the estimate of emigration of legal foreign-born residents has been incorporated into the postcensal population estimates since 1980. The nature and effect of these changes are discussed in detail in "Changes in the Estimation Procedure in the Current Population Survey Beginning in January 1986" in the February 1986 issue of *Employment and Earnings*.

Composite estimate. The last step in the preparation of estimates makes use of a composite estimating procedure. The composite estimate for the CPS is a weighted average of the noncomposited estimate for the current month and of the composite estimate for the previous month, adjusted for the net month-to-month change (based on the continuing 75 percent of the households in the sample from the previous month). Also included is an additional term which is an estimate of the net difference between incoming and continuing parts of the current month's sample.

The composite estimate results in a reduction in the sampling error beyond that which is achieved after the two stages of ratio estimates described; for some items, the reduction is substantial. The resultant gains in reliability are greatest in estimates of month-to-month change, although gains are also usually obtained for estimates of level in a given month, change from year to year, and change over other intervals of time.

Presentation and Uses

The CPS provides a large amount of detail on the economic and social characteristics of the population. It is the source of monthly estimates of total employment, both farm and nonfarm; of nonfarm self-employed persons, domestics, and unpaid helpers in nonfarm family enterprises, as well as wage and salaried employees; and of total unemployment, whether or not covered by unemployment insurance. It is a comprehensive source of information on the personal characteristics such as age, sex, race, Hispanic origin, educational attainment, and the marital and family status of the total civilian population

(not in institutions) 16 years of age and over and of the employed, the unemployed, and those not in the labor force.

The survey provides distributions of workers by the number of hours worked, as distinguished from aggregate or average hours for an industry, permitting separate analyses of part-time workers, workers on overtime, etc. It is a comprehensive current source of information on the occupation of workers, whether teachers, stenographers, engineers, laborers, etc.; and the industries in which they work. It also provides data on the usual weekly earnings of wage and salary workers, which are published on a quarterly basis because the monthly detail is collected from only a quarter of the sample (the two "outgoing" rotation groups).

Information is available from the survey not only for persons currently in the labor force but also for those who are outside of the labor force, some of whom may be considered to be a "labor reserve." The characteristics of such persons—whether married women with or without young children, disabled persons, students, retired workers, etc.—can be determined. Also, through special inquiries, it is possible to obtain information on their skills and past work experience.

Each month, the employment and unemployment data are published initially in The *Employment Situation* news release 2 weeks after they are collected. The release includes a narrative summary and analysis of the major employment and unemployment developments together with tables containing statistics for the principal data series. Subsequently, more detailed statistics are published in *Employment and Earnings.* Labor force data are available in machine-readable form and on BLS data diskettes. The detailed tables in this periodical provide information on the labor force, employment, and unemployment by a number of characteristics, such as age, sex, race, marital status, industry, and occupation. Estimates of the labor force status of selected population groups not published on a monthly basis, such as poverty and nonpoverty residents of the Nation's metropolitan and nonmetropolitan areas, special data for Vietnam-era veterans, etc., are published every quarter. Additionally, data are published quarterly on employment and unemployment by family relationship and on median weekly earnings classified by a variety of characteristics. Approximately 250 of the most important estimates from the CPS are presented each month on a seasonally adjusted basis.[3] Over 20,000 of the most important monthly labor force data series plus quarterly and annual averages are maintained on a one-reel tape. In many cases, these data are available from the inception of the series through the current month.

[3] Since 1980, the X–11 ARIMA seasonal adjustment method has been used to seasonally adjust labor force data. For a detailed description of the X–11 ARIMA method, see Estela Bee Dagum, *The X–11 ARIMA Seasonal Adjustment Method,* Statistics Canada Catalogue No. 12–564E, January 1983.

The CPS is used also for a program of special inquiries to obtain detailed information from particular segments, or for particular characteristics of the population and labor force. About four such special surveys are made each year. The inquiries are repeated annually in the same month for some topics, including the earnings and total incomes of individuals and families (published by the Bureau of the Census); the extent of work experience of the population during the calendar year; the marital and family characteristics of workers; the employment of school age youth, high school graduates and dropouts, and recent college graduates; and the educational attainment of workers. Surveys have been made periodically on subjects such as job mobility, job tenure, job-search activities of the unemployed, displaced workers, and work schedules.

Generally, the persons who provide information for the monthly CPS questions also answer the supplemental questions. Occasionally, the kind of information sought in the special survey requires the respondent to be the person about whom the questions are asked.

Information obtained through the supplemental questions is combined with data in the regular questionnaire to provide tabulations of all the desired personal and economic characteristics of the persons in the special survey. Reports on these special surveys are first published as news releases and subsequently in the *Monthly Labor Review.*[4]

In addition to the regularly tabulated statistics described above, special data can be generated through the use of the CPS individual record (micro) tapes. These tape files contain records of the responses to the survey questionnaire for all individuals in the survey. While the tapes can be used simply to create additional cross-sectional detail, an important feature of their use is the ability to match the records of specific individuals at different points in time during their participation in the survey. By matching these records, data files can be created which lend themselves to some limited longitudinal analysis and the investigation of short-run labor market dynamics. While a number of technical difficulties lie in the path of more complete utilization of these data files for the purposes of longitudinal analysis, this area is continually being investigated and holds considerable promise.

Limitations

Geographic. Although the present CPS sample is a State-based design, the CPS continues to produce reliable national monthly estimates. The sample does not permit

[4] Historical data through 1981 for many of the CPS regular monthly data series as well as those derived from the supplemental questions were published in *Labor Force Statistics Derived From the Current Population Survey: A Databook,* Volumes I and II, Bulletin 2096 (U.S. Department of Labor, Bureau of Labor Statistics, 1982).

the production of reliable monthly estimates for all States. Subnational data from the CPS are published monthly for 11 large States and annually for all States, 30 large metropolitan areas, and selected central cities. The production of subnational labor force and unemployment estimates is discussed in more detail in chapter 4 of this bulletin.

Sources of errors in the survey estimates. The estimates from the survey are subject to sampling errors, that is, errors arising from the fact that the estimates each month are based on information from a sample rather than the whole population. In addition, as in any survey, the results are subject to errors made in the field and in the process of compilation.

Classification errors in labor force surveys may be particularly large in the case of persons with marginal attachments to the labor force. These errors may be caused by interviewers, respondents, or both, or may arise from faulty questionnaire design. In spite of a continuous quality control program, interviewers may not always ask the questions in the prescribed fashion. To the extent that varying the wording of the question causes differences in response, errors or lack of uniformity in the statistics may result. Similarly, the data are limited by the adequacy of the information possessed by the respondent and the willingness to report accurately.

The estimates from the survey also are subject to various other types of errors. Some of these are:

Nonresponse—about 4 to 5 percent of occupied units are not interviewed in a typical month because of temporary absence of the occupants, refusals to cooperate, or other reasons. Although an adjustment is made in weights for interviewed households to account for noninterviews, they still represent a possible source of bias. Similarly, for a relatively few households, some of the information is omitted because of lack of knowledge on the part of the respondent or because of interviewer error. In processing the completed questionnaires, entries usually are supplied for omitted items on the basis of the distributions of these items for persons of similar characteristics.

Independent population estimates—the independent population estimates used in the estimation procedure may be a source of error although, on balance, their use substantially improves the statistical reliability of many of the figures. (See Ratio estimates.) Errors may arise in the independent population estimates because of underenumeration of certain population groups or errors in age reporting in the last census (which serves as the base for the estimates) or similar problems in the components of population change (mortality, immigration, etc.) since that date.

Processing errors—although there is a quality control program on coding and a close control on all other phases of processing and tabulation of the returns, some processing errors are almost inevitable in a large statistical operation of this type. However, the net error arising from processing is probably fairly negligible.

Measuring the accuracy of results. Modern sampling theory provides methods for estimating the range of errors due to sampling where, as in the CPS sample, the probability of selection of each member of the population is known. Methods are also available for determining the effect of response variability in the CPS. A measure of sampling variability indicates the range of differences that may be expected because only a sample of the population is surveyed. A measure of response variability indicates the range of difference that may be expected as a result of compensating types of errors arising from practices of different interviewers and the replies of respondents; these would tend to cancel out in an enumeration of a large enough population. In practice, these two sources of error—sampling and response variability—are estimated jointly from the results of the survey. The computations, however, do not incorporate the effect of response bias, that is, any systematic errors of response. Response biases occur in the same way in a complete census as in a sample, and, in fact, may be smaller in a well-conducted sample survey where it may be feasible to collect the information more skillfully.

Estimates of sampling and response variability combined are provided in *Employment and Earnings* and in other reports based on CPS data, thus permitting the user to take this factor into account in interpreting the data. In general, the smaller figures and small differences between figures are subject to relatively large variation and should be interpreted with caution.

Estimation of response bias is one of the most difficult aspects of survey and census work. In many instances, available techniques are not sufficiently precise to provide satisfactory estimates. Continuing experimentation is carried out with the aim of developing more precise measurements and improving the overall accuracy of the series.

Technical References

National Commission on Employment and Unemployment Statistics. *Counting the Labor Force,* 1979.

A comprehensive review of the entire labor market data system; includes an appraisal of current concepts and methodology and recommendations for further research and improvements.

President's Committee to Appraise Employment and Unemployment Statistics. *Measuring Employment and Unemployment,* 1962.

A review of all Federal statistical series on employment and unemployment and a comparison of the sources and uses of each series; includes a brief history of the development of labor force statistics, an evaluation of concepts and techniques, and recommendations for further research and improvements.

U.S. Department of Commerce, Bureau of the Census. "The Current Population Survey: Design and Methodology," *Technical Paper No. 40,* 1978.

A comprehensive description of the CPS, based on the design following the 1970 census.

U.S. Department of Commerce, Office of Federal Statistical Policy and Standards. "An Error Profile: Employment as Measured by the Current Population Survey," *Statistical Policy Working Paper 3,* 1978.

A description of the potential sources of error in the CPS as they affect the national employment statistics.

Bureau of Labor Statistics. *Employment and Earnings,* Explanatory Notes, monthly.

An up-to-date, concise description of the concepts and methods used in the labor force data from the Current Population Survey. Provides tables which present the sampling errors for labor force series.

Bureau of Labor Statistics. *A Guide to Seasonal Adjustment of Labor Force Data,* Bulletin 2114, 1982.

A description of the concepts and techniques used in seasonally adjusting labor force statistics from the Current Population Survey.

Bureau of Labor Statistics. *Labor Force Statistics Derived From the Current Population Survey: A Databook,* Volumes I and II, Bulletin 2096, 1982.

A compilation of historical data through 1981 for many of the data series obtained from the Current Population Survey.

Bureau of Labor Statistics. *How the Government Measures Unemployment*, Report 742, 1987.

A short, nontechnical discussion of the concepts and methods used in obtaining labor force statistics from the Current Population Survey.

Bureau of Labor Statistics. "Redesign of the Sample for the Current Population Survey," *Employment and Earnings,* May 1984, pp. 7–10.

A description of the CPS redesign following the 1980 census and the change in the structure of the CPS sample from a national sample to a State-based design.

Bureau of Labor Statistics. *Technical Description of the Quarterly Data on Weekly Earnings from the Current Population Survey,* Bulletin 2113, 1982.

A description of the collection, processing, and reliability of the weekly and hourly earnings data obtained from the CPS.

18. LINE NUMBER

19. What was . . . doing most of LAST WEEK — Working / Keeping house / Going to school / or something else?

Working *(Skip to 20A)* . . . . WK ○
With a job but not at work . . J ○
Looking for work. . . . . LK ○
Keeping house. . . . . H ○
Going to school . . . . . S ○
Unable to work *(Skip to 24)* . . U ○
Retired. . . . . R ○
Other *(Specify)*. . . . . OT ○

20. Did . . . do any work at all LAST WEEK, not counting work around the house? *(Note: If farm or business operator in hh., ask about unpaid work.)*

Yes ○ No ○ *(Go to 21)*

20A. How many hours did . . . work LAST WEEK at all jobs? ∅∅ / 1 1 / 2 2 / 3 3 / 4 4

20B. INTERVIEWER CHECK ITEM

49+ ○ *(Skip to item 23)*
1–34 ○ *(Go to 20C)*
35–48 ○ *(Go to 20D)*

20C. Does . . . USUALLY work 35 hours or more a week at this job?

Yes ○ What is the reason . . . worked less than 35 hours LAST WEEK?

No ○ What is the reason . . . USUALLY works less than 35 hours a week?

(Mark the appropriate reason)

Slack work . . . . . ○
Material shortage. . . . . ○
Plant or machine repair. . . . . ○
New job started during week . . ○
Job terminated during week. . . ○
Could find only part-time work ○
Holiday *(Legal or religious)* . . . . ○
Labor dispute . . . . . ○
Bad weather. . . . . ○
Own illness . . . . . ○
On vacation. . . . . ○
Too busy with housework, school, personal bus., etc. . . ○
Did not want full-time work. . . ○
Full-time work week under 35 hours . . . . . ○
Other reason *(Specify)*. . . . . ○

(Skip to 23 and enter job worked at last week)

20D. Did . . . lose any time or take any time off LAST WEEK for any reason such as illness, holiday or slack work?

Yes ○ How many hours did . . . take off?

(Correct 20A if lost time not already deducted; if 20A reduced below 35, correct 20B and fill 20C)

No ○

20E. Did . . . work any overtime or at more than one job LAST WEEK?

Yes ○ How many extra hours did . . . work?

(Correct 20A and 20B as necessary if extra hours not already included and skip to 23.)

No ○ *(Skip to 23)*

21. *(If J in 19, skip to 21A.)* Did . . . have a job or business from which he/she was temporarily absent or on layoff LAST WEEK?

Yes ○ No ○ *(Go to 22)*

21A. Why was . . . absent from work LAST WEEK?

Own illness. . . . . ○
On vacation. . . . . ○
Bad weather . . . . . ○
Labor dispute. . . . ○
New job to begin within 30 days ○ *(Skip to 22B and 22C2)*
Temporary layoff *(Under 30 days)* ○
Indefinite layoff *(30 days or more or no def. recall date)* . . . . . ○ *(Skip to 22C3)*
Other *(Specify)* . . ○

21B. Is . . . receiving wages or salary from his/her employer for any of the time off LAST WEEK?

Yes ○
No ○

21C. Does . . . usually work 35 hours or more a week at this job?

Yes ○
No ○

(Skip to 23 and enter job held last week)

OFFICE USE ONLY

INDUSTRY ∅∅∅ / 1 1 1 / 2 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9
Ref. ○ Unc. ○

OCCUPATION ∅∅ / 1 1 / 2 2 / 3 3 3 / 4 4 4 / 5 5 5 / 6 6 6 / 7 7 7 / 8 8 8 / 9 9 9
Ref. ○ Unc. ○

22. *(If LK in 19, Skip to 22A.)* Has . . . been looking for work during the past 4 weeks?

Yes ○ No ○ *(Go to 24)*

22A. What has . . . been doing in the last 4 weeks to find work? *(Mark all methods used; do not read list.)*

Checked with— pub. employ. agency ○ / pvt. employ. agency ○ / employer directly . . . ○ / friends or relatives . . ○
Placed or answered ads. . . . . ○
Nothing *(Skip to 24)* . . . . . ○
Other *(Specify in notes, e.g., JTPA, union or prof. register, etc.)*. . . . . ○

22B. At the time . . . started looking for work, was it because he/she lost or quit a job or was there some other reason?

- Lost job . . . . . ○
- Quit job . . . . . ○
- Left school. . . . . ○
- Wanted temporary work. . ○
- Change in home or family responsibilities ○
- Left military service . . . . . ○
- Other *(Specify in notes)*. . . . ○

22C. 1) How many weeks has . . . been looking for work? ∅∅ / 1 1 / 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9

2) How many weeks ago did . . . start looking for work?

3) How many weeks ago was . . . laid off?

22D. Has . . . been looking for full-time or part-time work?

Full ○ Part ○

22E. Could . . . have taken a job LAST WEEK if one had been offered?

Yes ○ No ○ Why not?

Already has a job. . . . ○
Temporary illness . . . . ○
Going to school. . . . . ○
Other *(Specify in notes)* ○

22F. When did . . . last work at a full-time job or business lasting 2 consecutive weeks or more?

Within last 12 months *(Specify)* . . ○
(Month) _____
One to five years ago . . . . . ○
More than 5 years ago . . . . . ○
Never worked full-time 2 wks. or more. . . . . ○
Never worked at all . . . . . ○

(SKIP to 23. If layoff entered in 21A, enter job, either full or part time, from which laid off. Else enter last full time job lasting 2 weeks or more, or "never worked.")

24. INTERVIEWER CHECK ITEM

(Rotation number)
First digit of SEGMENT number is:

○ 2, 3, 4, 6, 7, 8 *(Skip to 26)*
○ 1 or 5 *(Go to 24A)*

24A. When did . . . last work for pay at a regular job or business, either full- or part-time?

Within past 12 months ○
1 up to 2 years ago . . . ○
2 up to 3 years ago . . . ○
3 up to 4 years ago . . . ○
4 up to 5 years ago. . . ○
5 or more years ago. . . ○ *(Go to 24B)*
Never worked. . . . . ○ *(Skip to 24C)*

24B. Why did . . . leave that job?

Personal, family *(Incl. pregnancy)* or school. . . . ○
Health. . . . . ○
Retirement or old age . . . . . ○
Seasonal job completed. . . . . ○
Slack work or business conditions ○
Temporary nonseasonal job completed. . . ○
Unsatisfactory work arrangements *(Hours, pay, etc.)* ○
Other. . . . . ○

24C. Does . . . want a regular job now, either full- or part-time?

Yes. . . . . ○
Maybe — it depends *(Specify in notes)* ○ *(Go to 24D)*
No . . . . . ○
Don't know . . . . ○ *(Skip to 24E)*

24D. What are the reasons . . . is not looking for work? *(Mark each reason mentioned)*

- Believes no work available in line of work or area ○
- Couldn't find any work. . . . . ○
- Lacks nec. schooling, training, skills or experience . . . ○
- Employers think too young or too old. . . . . ○
- Other pers. handicap in finding job ○
- Can't arrange child care. . . . . ○
- Family responsibilities. . . . . ○
- In school or other training. . . . . ○
- Ill health, physical disability. . . . . ○
- Other *(Specify in notes)* . . . . . ○
- Don't know . . . . . ○

24E. Does . . . intend to look for work of any kind in the next 12 months?

Yes . . . . . ○
It depends *(Specify in notes)* ○
No. . . . . ○
Don't know. . . . . ○

(If entry in 24B, describe job in 23, otherwise, skip to 26)

25. INTERVIEWER CHECK ITEM

(Rotation number)
First digit of SEGMENT number is:

○ 2, 3, 4, 6, 7, 8 *(Skip to 26)*
○ 1 or 5 *(Go to 25A)*

25A. How many hours per week does . . . USUALLY work at this job? ∅∅ / 1 1 / 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9

25B. Is . . . paid by the hour on this job?

Yes ○ *(Go to 25C)*
No ○ *(Skip to 25D)*

25C. How much does . . . earn per hour? Dollars $ ____ Cents ¢ ∅∅ / 1 1 / 2 2 / 3 3 / 4 4 / 5 5 / 6 6 / 7 7 / 8 8 / 9 9

(Ask 25D) REF ○

25D. How much does . . . USUALLY earn per week at this job BEFORE deductions? Include any overtime pay, commissions, or tips usually received. $ ____ ∅∅∅ / 1 1 1 / 2 2 2 / 3 3 3 / 4 4 4 / 5 5 5 / 6 6 6 / 7 7 7 / 8 8 8 / 9 9 9

REF ○

25E. On this job, is . . . a member of a labor union or of an employee association similar to a union?

Yes ○ *(Skip to 26)*
No ○ *(Ask 25F)*

25F. On this job, is . . . covered by a union or employee association contract?

Yes ○
No ○ *(Go to 26)*

23. DESCRIPTION OF JOB OR BUSINESS

23A. For whom did . . . work? *(Name of company, business, organization or other employer.)*

23B. What kind of business or industry is this? *(For example: TV and radio mfg., retail shoe store, State Labor Dept., farm.)*

23C. What kind of work was . . . doing? *(For example: electrical engineer, stock clerk, typist, farmer.)*

23D. What were . . .'s most important activities or duties at this job? *(For example: types, keeps account books, files, sells cars, operates printing press, finishes concrete.)*

23E. Was this person

An employee of a PRIVATE Co, bus., or individual for wages, salary or comm. . . P ○
A FEDERAL government employee. . . . . F ○
A STATE government employee. . . . . S ○
A LOCAL government employee. . . . . L ○ *(Go to 23F)*

Self-empl. in OWN bus., prof. practice, or farm
Is the business incorporated? Yes . . . . . I ○ / No . . . . . SE ○
Working WITHOUT PAY in fam. bus. or farm. . . . WP ○
NEVER WORKED. . . . . NEV ○ *(Skip to 26)*

23F. INTERVIEWER CHECK ITEM

Entry (or NA) in item 20A ○
Entry (or NA) in item 21B ○ *(Go to 25 at top of page)*

All other cases ○ *(Skip to 26)*

Chapter 2. Employment, Hours, and Earnings from the Establishment Survey

BLS cooperates with State employment security agencies in a survey collecting data each month on employment, hours, and earnings from a sample of nonagricultural establishments (including government). In 1987, this sample included approximately 290,000 reporting units. From these data, a large number of employment, hours, and earnings series in considerable industry and geographic detail are prepared and published each month. The employment data include series on all employees, women workers, and production or nonsupervisory workers; hours and earnings data include average weekly hours, average weekly overtime hours, and average hourly and weekly earnings. For many series, seasonally adjusted data are also published.

Background

The first monthly studies of employment and payrolls by BLS began in 1915 and covered four manufacturing industries. Before 1915, the principal sources of employment data in the United States were the census surveys—the decennial Census of Population and the quinquennial Census of Manufactures. No regular employment data were compiled between the Census dates.

In 1916, the survey was expanded to cover employment and payrolls in 13 manufacturing industries; by 1923, the number had increased to 52, and by 1932, 91 manufacturing and 15 nonmanufacturing industries were covered by a monthly employment survey.

With the deepening economic crisis in 1930, President Hoover appointed an Advisory Committee on Employment Statistics which recommended extension of the Bureau's program to include the development of hours and earnings series. In 1932, Congress granted an increase in the BLS appropriation for the survey. In 1933, average hourly earnings and average weekly hours were published for the first time for total manufacturing, for 90 manufacturing industries, and for 14 nonmanufacturing categories.

During the Great Depression, there was controversy concerning the actual number of unemployed people; no reliable measures of employment or unemployment existed. This confusion stimulated efforts to develop comprehensive estimates of total wage-and-salary employment in nonagricultural industries, and, in 1936, BLS survey data produced such a figure for the first time.

Interest in employment statistics for States and areas also grew. Even before BLS entered the field in 1915, Massachusetts, New York, and New Jersey were preparing employment statistics. In 1915, New York and Wisconsin entered into cooperative agreements with BLS, whereby sample data collected from employers by a State agency would be used jointly with BLS to prepare State and national series. By 1928, five other States had entered into such compacts, and another five were added by 1936. By 1940, estimates of total nonagricultural employment for all 48 States and the District of Columbia were available.

Since 1949, the Current Employment Statistics (CES) program has been a fully integrated Federal-State project which provides employment, hours, and earnings information by industry on a national, State, and area basis. BLS has begun a long-range project to improve the Current Employment Statistics program. The CES revision will assess all aspects of the program at the national, State, and area levels, from collection and processing of data through estimation and publication. In 1987, cooperative arrangements were in effect with all 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands.

Concepts

Establishment

An establishment is defined as an economic unit which produces goods or services, such as a factory, mine, or store. It is generally at a single location and engaged predominantly in one type of economic activity. Where a single location encompasses two or more distinct activities, these are treated as separate establishments, provided that separate payroll records are available and certain other criteria are met.

Employment

Employment represents the total number of persons employed full or part time in nonagricultural establishments during a specified payroll period. Temporary employees are included. In general, data refer to persons who worked during, or received pay for, any part of the pay period that includes the 12th of the month, which is standard for all Federal agencies collecting employment data from business establishments. However, national employment figures for Federal Government establishments 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.

Workers on an establishment payroll who are on paid sick leave (when pay is received directly from the employer), on paid holiday, or paid vacation, or who work during only a part of the specified pay period are counted as employed. Persons on the payroll of more than one establishment during the pay period are counted in each establishment which reports them, whether the duplication is due to turnover or dual jobholding. Persons are considered employed if they receive pay for any part of the specified pay period, but are not considered employed if they receive no pay at all for the pay period. Since proprietors, the self-employed, and unpaid family workers do not have the status of paid employees, they are not included. Domestic workers in households are excluded from the data for nonagricultural establishments. The employment statistics for government refer to civilian employees only.

All persons who meet these specifications are included in the designation "all employees." Major categories of employees are differentiated primarily to ensure the expeditious collection of current statistics on hours and earnings; these groups of employees are designated production workers, construction workers, or nonsupervisory workers, depending upon the industry.

In manufacturing industries, data are collected for *production workers.* This group, in general, covers employees, up through the level of working supervisors, who are engaged directly in the manufacture of the product of the establishment. Among those excluded from this category are persons in executive and managerial positions and persons engaged in activities such as accounting, sales, advertising, routine office work, professional and technical functions, and force account construction. (Force-account construction is construction work performed by an establishment, primarily engaged in some business other than construction, for its own account and use by its own employees.) Production workers in mining are defined in a similar manner. A more detailed description of the classes of employees included in the production and nonproduction worker categories in manufacturing is shown on the facsimile of the BLS 790 C schedule at the end of this chapter.

In construction, the term *construction workers* covers workers, up through the level of working supervisors, who are engaged directly on the construction project either at the site or in shops or yards at jobs ordinarily performed by members of construction trades. Excluded from this category are executive and managerial personnel, professional and technical employees, and workers in routine office jobs.

In the remaining industries (transportation, communication, and public utilities; retail and wholesale trade; finance, insurance, and real estate; and services), data are collected for *nonsupervisory workers.* Nonsupervisory workers include most employees except those in top executive and managerial positions. (See facsimile of BLS 790 E, the reporting form for wholesale and retail trade.)

An *employment benchmark* is defined as a reasonably complete count of employment used to adjust estimates derived from a sample. Adjustment is usually done annually. The basic source of benchmark data for the Current Employment Statistics program is data collected from employers by State employment security agencies as a byproduct of the unemployment insurance (UI) system. About 98 percent of all employees on nonagricultural payrolls are covered by the UI system. The compilation and use of benchmark data are explained in detail in later sections of this chapter.

Hours and earnings

The hours and earnings series are based on reports of gross payrolls and the corresponding paid hours for production workers, construction workers, or nonsupervisory workers. (See facsimile of BLS 790 C.) (In government and private educational institutions, payroll data are for "all employees.")

Aggregate payrolls include pay before deductions for Social Security, unemployment insurance, group insurance, withholding tax, salary reduction plans, bonds, and union dues. The payroll figures also include pay for overtime, shift premiums, holidays, vacations, and sick leave paid directly by the employer to employees for the pay period reported. They exclude bonuses (unless earned and paid regularly each pay period) or other pay not earned in the pay period concerned (e.g., retroactive pay). Tips and the value of free rent, fuel, meals, or other payment in kind are not included.

Total hours during the pay period include the hours worked, overtime hours, hours paid for standby or reporting time, and equivalent hours for which employees received pay directly from the employer for sick leave, holidays, vacations, and other leave. Overtime or other premium pay hours are not converted to straight-time equivalent hours. Total hours differ from scheduled

hours or hours worked. The average weekly hours derived from the total hours reflect the effects of such factors as absenteeism, labor turnover, part-time work, and strikes.

Overtime hours are hours worked for which premiums were paid because they were in excess of the number of hours of either the straight-time workday or workweek. Saturday and Sunday hours (or 6th and 7th day hours) are included as overtime only if overtime premiums were paid. Holiday hours worked as overtime are not included unless they are paid for at more than the straight-time rate. Hours for which only shift differential, hazard, incentive, or similar types of premiums were paid are excluded from overtime hours. Overtime hours data are collected only from establishments in manufacturing industries.

Average hourly earnings series, derived by dividing gross payrolls by total hours, reflect the actual earnings of workers, including premium pay. They differ from wage rates, which are the amounts stipulated for a given unit of work or time. Average hourly earnings do not represent total labor costs per hour for the employer, because they exclude retroactive payments and irregular bonuses, various fringe benefits, and the employer's share of payroll taxes. Earnings for those employees not covered under the production worker and nonsupervisory categories are, of course, not reflected in the estimates.

Real earnings data (those expressed in 1977 dollars), resulting from the adjustment of average weekly earnings by means of the Bureau's Consumer Price Index, indicate the changes in the purchasing power of money earnings as a result of changes in prices for consumer goods and services. These data cannot be used to measure changes in living standards as a whole, which are affected by other factors such as total family income, the extension and incidence of various social services and benefits, and the duration and extent of employment and unemployment. The long-term trends of these earnings data are also affected by changing mixes of full-time/part-time workers, high-paid/low-paid workers, etc.

Straight-time average hourly earnings are approximated by adjusting average hourly earnings by eliminating only premium pay for overtime at a rate of time and one-half. Thus, no adjustment is made for other premium payment provisions such as holiday work, late-shift work, and premium overtime rates other than at time and one-half.

Industrial classification

Industrial classification refers to the grouping of reporting establishments into industries on the basis of their major product or activity as determined by the establishments' percent of total sales or receipts for the previous calendar year. This information is collected as an administrative byproduct of the UI reporting system. All data for an establishment making more than one product or engaging in more than one activity are classified under the industry of the most important product or activity, based on the percentages reported.

Data are currently classified in accordance with the *Standard Industrial Classification Manual,* Office of Management and Budget, 1972, as modified by the 1977 *Supplement.* (See appendix B of this bulletin for a description of this system.) Beginning in 1989, data will be reclassified in accordance with the 1987 SIC manual.

Data Sources and Collection Methods

Sample data

Each month, the State agencies cooperating with BLS in the survey collect data by mail on employment, payrolls, and hours paid for, from a sample of establishments. The respondents extract these data from their payroll records, which must be maintained for a variety of tax and accounting purposes. Despite the voluntary nature of the survey, numerous large establishments have reported regularly for many years.

A "shuttle" schedule is used (BLS form 790 series), that is, one which is submitted each month by the respondent, edited by the State agency, and returned to the respondent for use again the following month. The shuttle schedule has been used since 1930, but there have been substantial changes in its design and in the data collected. A major redesign was completed in 1986 and introduced with 1987 data collection.

All aspects of the schedule—its format, the wording of the requested items and definitions, and the concepts embodied therein—are subjected to a continuing review, not only by BLS and the State agencies, but also by other government agencies, private business, and labor organizations. The report forms are basically alike for each industry, but there are several variants tailored to the characteristics of different industries.

The technical characteristics of the shuttle schedule are particularly important in maintaining continuity and consistency in reporting from month to month. The shuttle design automatically exhibits the trends of the reported data during the year covered by the schedule, and therefore, the relationship of the current data to the data for the previous months. The schedule also has operational advantages; for example, accuracy and economy are obtained by entering the identification codes and the address of the reporter only once a year.

All schedules are edited by the State agencies each month to make sure that the data are correctly reported and that they are consistent with the data reported by the establishment in earlier months and with the data reported by other establishments in their industry. This editing

process is carried out in accordance with detailed instructions from BLS. The State agencies use the information provided on the forms to develop State and area estimates of employment, hours, and earnings, and then forward the data, either on the schedules themselves or in machine-readable form, to BLS–Washington. At BLS, they are edited again by computer to detect processing and reporting errors which may have been missed in the initial State editing. Questionable reports discovered at any stage of the editing process are returned, if necessary, to the respondent for review and correction. When all questions have been resolved, the data are used to prepare national estimates.

Benchmark data

Since about 1940, the basic source of benchmark information for "all employees" has been the periodic tabulations compiled by State employment security agencies from reports of establishments covered under State UI laws.

The State employment security agencies receive quarterly reports from each employer subject to the UI laws showing total employment in each month of the quarter, and the total quarterly wages for all employees. The State agencies submit tabulations of these reports to BLS–Washington each quarter. (See chapter 4.)

For the few industries exempt from mandatory UI coverage, other sources are used for benchmark information. For example, data on employees covered under Social Security laws, published by the Bureau of the Census in *County Business Patterns,* are used to augment the UI data for nonoffice insurance sales workers. Data for interstate railroads are obtained from the Interstate Commerce Commission. Employment figures for religious organizations are obtained from data provided by the National Council of Churches, the Bureau of the Census, and special surveys conducted by the State agencies.

In benchmarking the Federal Government sector, BLS uses monthly employment data compiled by the Office of Personnel Management. The UI data for State and local government employment are supplemented as necessary with Bureau of the Census data derived from the Census of Governments for local elected officials and certain other groups.[1]

Sample Design

Sampling is used by BLS in the Current Employment Statistics survey to collect data in most industries, since full coverage would be prohibitively costly and time consuming. The sampling plan for the program must: (a) provide for the preparation of reliable monthly estimates of employment, hours of work, and weekly and hourly earnings, which can be published promptly and regularly; (b) through a single, general system, yield considerable industry detail for metropolitan areas, States, and the Nation; (c) be appropriate for the existing framework of operating procedures, administrative practices, resource availability, and other institutional characteristics of the program; and (d) be efficient, that is, provide maximum accuracy at minimum cost.

The primary sampling design is "optimum allocation," which produces an efficient and equitable sample distribution by stratifying the universe of establishments into homogeneous groups. The strata are arranged according to industry and size characteristics. Under optimum allocation, a larger sample is usually required for a size stratum if the stratum has a greater number of units in the universe or if it has a high degree of variability. The optimum number of establishments to be included in each size stratum of the national CES sample is determined by the number of establishments in a stratum's universe and the standard deviation of the establishments in that universe.

A specific form of optimum allocation, called allocation proportional to employment, is used in the CES survey. This requires that the universe of establishments for each industry be stratified into employment-size classes. Then a total sample size sufficient to produce satisfactory employment estimates is determined and distributed among the size classes in each industry on the basis of the average employment per establishment and the relative importance of each size class to its industry. In practice, this amounts to distributing the total number of establishments needed in the sample among the cells on the basis of the ratio of the employment in each cell to the total employment in the industry.

The likelihood that a certain establishment will be selected depends upon its employment level. Large establishments are certain of selection; smaller ones have less chance. Within each cell, sample members are selected at random. Sampling ratios are determined in order to aid this selection process. In nearly all industries, establishments with 250 or more employees are included in the sample with certainty; in many industries, the cutoff is lower. In a manufacturing industry in which a high proportion of total employment is concentrated in a relatively few large establishments, a high percentage of total employment is included in the sample. Consequently, the sample design for such industries provides for a complete census of the large establishments with only a few chosen from among the smaller establishments. On the other hand, in an industry where a large proportion of total employment is in small establishments, the sample design calls for the inclusion of all large establishments, and also for a substantial number of the

[1] For a more detailed description of the benchmarks, see Fred R. Cronkhite, "BLS Establishment Estimates Revised to March 1986 Benchmarks," *Employment and Earnings,* June 1987, pp. 6–23.

smaller establishments. Many industries in the trade and services divisions fall into this category.

This sample design, although aimed primarily at meeting the needs of the national program, provides a technical framework within which State and area needs can be met. It incorporates the trends in all size classes, reduces geographic bias, and reduces large-firm bias by giving smaller firms proper representation in the sample. Since the estimates for States and areas generally are not prepared at the same degree of industry detail as the national estimates, it may be necessary to modify the national sampling ratios in order to obtain a sufficient sample. The additional reports needed for State and area samples are added to the sample required by the national design.

Estimating Procedures

Employment

Employment estimates are made at what is termed the basic estimating cell level and aggregated upward to broader levels of industry detail by simple addition. Basic cells are defined by industry (usually at the 3- or 4-digit SIC level) and in some cases are stratified within industry by geographic region and/or size class. Within the wholesale trade, retail trade, and services divisions, most industries are stratified into five size classes (beginning in 1984) because research demonstrated that estimates produced under this scheme require less benchmark revision. (See earlier section on benchmarks.) For other divisions, size and region strata are used when they improve the hours and earnings estimates.

To obtain "all employee" estimates for a basic estimating cell, the following three steps are necessary:

1. A total employment figure (benchmark) for the basic estimating cell as of a specified month (usually March) is obtained.
2. For each cell, the ratio of all employees in 1 month to all employees in the preceding month (i.e., the link relative) is computed for sample establishments which reported for both months.
3. Beginning with the benchmark month, the all-employee estimate for each month is obtained by multiplying the all-employee estimate for the previous month by the link relative for the current month.

Application of the estimating procedure in preparing a series is illustrated by the following example. Assume that the estimate of all employees for a given cell was 50,000 in July. The reporting sample, composed of 60 establishments, had 25,000 employees in July and 26,000 in August, a 4-percent increase. To derive the August estimate, the change for identical establishments reported in the July–August sample is applied to the July estimate:

$$50{,}000 \times \frac{26{,}000}{25{,}000} \text{ (or } 1.04) = 52{,}000$$

This procedure, known as the link relative technique, is efficient in that it takes advantage of a reliable, complete count of employment and of the high correlation between levels of employment in successive months in identical establishments.

Most employment estimates are multiplied by bias adjustment factors to produce the monthly published estimates. Bias adjustment factors are used to compensate for the inability to capture the entry of new firms on a timely basis, and other biases of the survey method. The bias factors are derived based on a 3-year average of differences between benchmarks and sample estimates, and the rate of employment change in the most recent quarter.

To obtain estimates of production, construction, or nonsupervisory worker employment, the sample ratio of production workers to all employees for the current month is used. For example, the 60 sample firms which had 26,000 employees in August reported an August production-worker figure of 19,500, resulting in a ratio of 19,500/26,000 or 0.750. Using this ratio, the number of production workers in August is estimated to be 39,000 (52,000 multiplied by 0.750 = 39,000). A similar ratio method is used to estimate the number of women workers.

If permanent changes in the composition of the sample occur, the "production worker to all employee" ratios and the "women worker to all employee" ratios calculated from the sample data are modified using the wedging technique described in the hours and earnings section.

The estimates for each type of series (all employees, production workers, and women workers) for individual basic estimating cells are summed to obtain the corresponding totals for broader industry groupings and divisions.

All estimates back to the previous benchmark month are subject to revision each year when new benchmarks become available. Because of the complexity of developing benchmarks, they are not available until at least 15 months after the benchmark month (usually March). For example, the revised estimates based on the March 1986 benchmarks were released in June 1987. The revision period extended from April 1985 through February 1986.

To determine the appropriate revisions, the new benchmarks for March are compared to the estimates for that month based on the previous benchmarks. The differences represent estimating errors that accumulated since the previous benchmark revision. These differences are assumed to have accumulated at a regular rate. The all-employee estimates are wedged, or tapered, in order to smooth out the differences between the new and old benchmarks. Estimates subsequent to the benchmark month are revised by applying the sample link relative

to the new benchmark level. Estimates for women workers and production workers are recomputed using the revised all-employee estimates.

Although most national all-employee series are adjusted by this wedging technique, in some cases the CES estimates are replaced by the benchmark source figures if this results in more accurate levels and trends. (In many States, the replacement technique predominates.)

A comparison of the national revisions made in recent years is presented in table 1.

Table 1. Percent differences between nonagricultural employment estimates and benchmarks by industry, March 1984–86

Industry	1984	1985	1986
Total	0.4	(1)	-0.5
Mining	-1.6	-3.1	-1.2
Construction	3.1	1.4	-.6
Manufacturing	-.9	-.5	-1.1
Transportation and public utilities	.2	-1.0	-.3
Wholesale trade	.5	-.5	-1.9
Retail trade	1.6	-.2	-.5
Finance, insurance, and real estate	.4	.5	-.1
Services	.4	.1	.2
Government	.1	.8	-.4

[1] Less than 0.05 percent.

Hours and earnings

Independent benchmarks are not available for the hours and earnings series. Consequently, the levels are derived directly from the CES sample averages.

Since 1959, when all-employee benchmark data stratified by employment size became available, estimates have been prepared using a cell structure which makes use of size and, in some cases, regional stratification.

In preparing the estimates, the nine standard size classes are usually combined into no more than three size classes when stratification by size is needed.

Size classes are combined because the preliminary estimates are based on only partially reported samples. Experience indicates that estimates of hours and earnings prepared from the CES sample using a maximum of three size strata generally do not differ significantly from those computed with four or more size strata.

At the same time that the national benchmark revisions for employment are made, national estimates of average weekly hours and average hourly earnings are prepared using eight size strata and four regional strata (Northeast, Midwest, South, and West). These estimates are used as a standard against which the published averages are compared. If this comparison indicates that modification of the stratification pattern is needed, a change is introduced into the estimating cell structure at the time of the next benchmark revision.

In the wholesale trade, retail trade, and services divisions, size stratification based on employment estimation requirements takes precedence over stratification for hours and earnings purposes; hence, the procedures described above are not used for these divisions. The cell stratification developed for employment estimates is also used for hours and earnings estimates.

Average weekly hours and average hourly earnings. To obtain average weekly hours for a basic estimating cell, the sum of the worker hours reported by the establishments classified in the cell is divided by the total number of production workers reported for the same establishments. In computing average hourly earnings, the reported payroll is divided by the reported worker hours.

The first estimates, which equal the unmodified sample averages, of average hourly earnings and average weekly hours are modified at the basic estimating cell level by a wedging technique designed to compensate for changes from month to month in the sample of reporting establishments.

For example, a first estimate of average hourly earnings for the current month, $\bar{x}_c$, is obtained from aggregates from a matched sample of establishments reporting for both the current month and the previous month. Similarly, a first estimate of average hourly earnings for the previous month, $\bar{x}_p$, is calculated from the same matched sample. $\bar{x}_c - \bar{x}_p$ is a measure of the change between the 2 months.

Note is then taken of the final estimate of average hourly earnings for the previous month, $\overline{X}_p$. Because the panel of establishments reporting in the sample is not fixed from month to month, there may be differences between $\overline{X}_p$ and $\bar{x}_p$. A final estimate for the current month, $\overline{X}_c$, is obtained by making use of both pieces of information:

$$\overline{X}_c = (0.9\ \overline{X}_p + 0.1\bar{x}_p) + (\bar{x}_c - \bar{x}_p)$$

The procedure reflected in this formula has the following advantages: (1) it uses matched sample data; (2) it tapers the estimate for the previous month ($\overline{X}_p$) towards the sample average for the previous month of the current matched sample ($\bar{x}_p$); and (3) it promotes continuity by heavily favoring the estimate for the previous month ($\overline{X}_p$) when applying the numerical factors.

The results of the formula may be modified if the difference between $\overline{X}_p$ and $\bar{x}_p$ is too great. This is done by changing the numerical factors from 0.9 and 0.1 to 0.8 and 0.2, or 0.7 and 0.3, etc., or by using a special wedging procedure when the difference exceeds 3 percent in the same direction for 3 consecutive months.

Average weekly hours and average hourly earnings for industries and groups above the basic estimating cell level are weighted averages of the figures for component cells. The average weekly hours for each basic estimating cell are multiplied by the corresponding estimate of the number of production workers to derive aggregate worker hours. Payroll aggregates are the product of the aggregate

worker hours and average hourly earnings. The payroll and worker hour aggregates for industry groups and divisions represent the sum of the aggregates for the component industries.

Average weekly hours for industry groups are obtained by dividing the worker hour aggregates by the corresponding production worker estimates. Average hourly earnings for industry groups are computed by dividing the payroll aggregates by the worker hour aggregates. This method is equivalent to weighting average weekly hours by the estimated number of production workers in the universe and weighting average hourly earnings by the estimated worker hours for the universe.

For all levels, from basic estimating cells to major industry divisions, average weekly earnings are computed by multiplying average hourly earnings by average weekly hours.

Overtime hours. Average weekly overtime hours are estimated in basically the same way as average weekly hours. Overtime worker hour sample averages are used in the computations rather than the sample averages for total worker hours. The sample totals for production workers used in the computations are those for the reports containing overtime worker hours as well as production workers, total payroll, and total worker hours. The wedging technique and the summary level estimating technique are also comparable to those used to estimate average weekly hours.

Average weekly earnings in 1977 dollars. Average weekly earnings are computed and published in terms of 1977 dollars to give an approximate measure of changes in "real" average weekly earnings (earnings in constant dollars). These series are computed by dividing the average weekly earnings (in current dollars) by the BLS Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) for the same months.

Average hourly earnings, excluding overtime, for manufacturing industries. These are computed by dividing the total production worker payroll for an industry group by the sum of the total production worker hours and one-half of the total overtime worker hours, which is equivalent to the payroll divided by straight-time hours. This method excludes overtime earnings at an assumed rate of $1\frac{1}{2}$ times the straight-time rates; no further adjustment is made for other premium payment provisions.

Hourly earnings indexes. These indexes reflect the average change of the component industries' average hourly earnings since the base period (1977). The method used to derive these indexes adjusts for the effects of fluctuations and varying trends in employment activity (aggregate worker hours) in higher wage versus lower wage industries. This is done by assigning a fixed weight to each of the component industries. The weights are derived from the industries' base period estimates of aggregate worker hours. The hourly earnings indexes utilize a further adjustment to the component industries in the manufacturing sector (the only sector for which overtime data are available) to adjust for the varying impact that changes in overtime hours have on the estimates of average hourly earnings. No attempt is made to adjust the hourly earnings indexes for the impact of the fluctuations and varying trends in occupational employment within industries and other factors which also influence the trends in average hourly earnings. Hourly earnings indexes are published for "total private" and the major industry divisions except government.

Indexes of aggregate weekly worker hours and payrolls. These indexes are prepared by dividing the current month's aggregates by the average of the monthly aggregates for 1977.

Indexes of diffusion of changes in the number of employees on nonagricultural payrolls. These indexes measure the percentage of industries which posted increases in employment over the specified time span. The indexes are calculated from 185 seasonally adjusted employment series (2-digit nonmanufacturing industries and 3-digit manufacturing industries) covering all nonagricultural payroll employment in the private sector.

Seasonally adjusted series

Many economic statistics reflect a regularly recurring seasonal movement which can be measured on the basis of past experience. By eliminating that part of the change which can be ascribed to the normal seasonal variation, it is possible to observe the cyclical and other nonseasonal movements in these series. Seasonally adjusted series are published regularly for selected employment, hours, and earnings series.[2]

The seasonally adjusted series are computed by multiplying the corresponding unadjusted series by the appropriate seasonal adjustment factors. Seasonally adjusted series for broader industry groups are obtained by summing the seasonally adjusted data for the component industries. Seasonally adjusted hours and earnings averages for broader level industry groups are weighted averages of the component series.

Presentation

The CES program has continued to improve and expand since its inception; it currently uses payroll reports

[2] See appendix A of this bulletin for a description of the seasonal adjustment methodology.

from over 290,000 establishments to provide monthly estimates of employment, hours, and earnings in considerable industry detail. Estimates are prepared at the 4-digit SIC level for manufacturing industries and the 3-digit SIC level for most nonmanufacturing industries. However, as a result of an expansion in the SIC coding structure, BLS began publication of 82 additional industries in the service-producing sector, including 58 at the 4-digit SIC level, in June 1984, coincident with the introduction of the March 1983 benchmarks.[3]

At the national level, the CES program currently produces more than 3,500 separately published series each month. Tables 2, 3, and 4 provide a summary of the published national detail by major industry division. Table 2 describes the primary series produced by the program, that is, those computed directly from the sample and benchmark data. Table 3 indicates the special series which are obtained from the primary series by the application of special adjustments, while table 4 lists the seasonally adjusted series.

In addition to the series published on a current monthly basis, employment in March of each year (based on benchmark data) is published in the June issue of *Employment and Earnings* for a number of industries for which monthly estimates do not meet established publication standards. In June 1987, following revisions of the establishment-based data to March 1986 benchmarks, data for nearly 330 such industries were published.

In addition to the national estimates, BLS publishes employment estimates for all 50 States, the District of Columbia, Puerto Rico, the Virgin Islands, and 278 areas.[4] Approximately 12,000 employment series and about 10,000 hours and earnings series (for 184 areas) are published for these States and areas. (These estimates were adjusted to March 1986 benchmarks with the publication of January 1987 data.) The employment series usually cover total nonagricultural employment, major industry divisions (e.g., mining, construction, manufacturing), and major industry groups (e.g., textile mill products, transportation equipment, retail trade) for each State and area. Additional industry detail is frequently provided for the larger States and areas, particularly for industries which are locally important in the various jurisdictions.

The series on employment, hours, and earnings appear in several BLS publications. The summary data are first published each month in The *Employment Situation* news release which contains preliminary national estimates of nonagricultural employment, average weekly hours, and average weekly and hourly earnings in the preceding month, for major industries. The release also includes seasonally adjusted data on employment, average weekly hours, and average weekly overtime hours. The preliminary estimates are based on tabulations of data for less than the full sample to permit early release of these widely used economic indicators. This release is normally issued 3 weeks after the week of reference for the data. The news release also includes a brief analysis of current trends in employment, hours, and earnings, highlighting current trends as compared with the data for the previous month and for the same month in the prior year.

Most of the national estimates in the detail described in tables 2, 3, and 4 are published monthly in the periodical *Employment and Earnings,* issued about 5 weeks after the week of reference. Employment data for total nonagricultural employment and for the major industry divisions, as well as hours and earnings for total manufacturing, are published for the States and areas in *Employment and Earnings* 1 month later than employment data for the Nation. Special articles describe technical developments in the program. Many of the national series are also published in the *Monthly Labor Review.*

Historical national statistics (monthly data and annual averages) derived from the CES program are published in *Employment, Hours, and Earnings, United States, 1909–84* (Bulletin 1312–12). Following each benchmark revision, a supplement has been published which contains all revised data. The latest supplement, issued in July 1987, reflects all revisions resulting from the introduction of the March 1986 benchmarks. A companion volume, *Employment, Hours, and Earnings, States and Areas, 1939–82* (Bulletin 1370–17) and its most recent supplement, Bulletin 1370–19, provide annual averages on all employees and on production-worker hours and earnings. Plans are underway to publish a new edition of the historical bulletin incorporating monthly and annual data for States and areas through 1987. Detailed industry data are available each month in releases published by the cooperating State agencies.

Employment, hours, and earnings (national) data are available in machine-readable form and on data diskettes. The data are also disseminated in the publications of other Federal agencies; e.g., the Department of Commerce, the Board of Governors of the Federal Reserve System, and the Council of Economic Advisers. They are also regularly republished in summary form or for specific industries in many trade association journals, the labor press, and in general reference works.

Comparison with the Current Population Survey

Total employment in nonagricultural establishments from the CES or payroll survey is not directly comparable with the Bureau's estimates of the number of persons employed in nonagricultural industries obtained from the monthly household survey. (See chapter 1 for a description

[3] See John T. Tucker, "Publication of Employment Data for Additional Service-Producing Industries," *Employment and Earnings*, June 1984, pp. 24–27.

[4] Data for Puerto Rico and the Virgin Islands are not used in compiling national estimates.

Table 2. Number of "primary" national series on employment, hours, and earnings published from the Current Employment Statistics program by industry, June 1987

Industry	All employees	Production workers[1]	Women workers	Average weekly hours	Average weekly overtime hours	Average hourly earnings	Average weekly earnings
Total	597	452	522	451	323	451	451
Total nonagricultural	1	—	1	—	—	—	—
Total private	1	1	1	1	—	1	1
Goods-producing	1	1	1	—	—	—	—
Mining	13	11	9	11	—	11	11
Construction	15	15	15	15	—	15	15
Manufacturing	324	323	269	323	323	323	323
Service-producing	1	—	1	—	—	—	—
Private service-producing	1	1	1	—	—	—	—
Transportation and public utilities	32	16	27	17	—	17	17
Wholesale trade	46	20	46	20	—	20	20
Retail trade	45	31	45	31	—	31	31
Finance, insurance, and real estate	30	10	30	10	—	10	10
Services	65	23	64	23	—	23	23
Government	22	—	12	—	—	—	—

[1] Production workers in manufacturing and mining; construction workers in construction; and nonsupervisory workers in all other industries.

Table 3. Number of "special" national series on employment, hours, and earnings published from the Current Employment Statistics program by industry, June 1987

Industry	Indexes of aggregate weekly hours	Indexes of aggregate weekly payrolls	The Hourly Earnings Index	Average hourly earnings, excluding overtime	Average hourly earnings (1977 = 100)	Average weekly earnings (1977 = 100)
Total private	1	1	1	—	1	1
Goods-producing	1	1	—	—	—	—
Mining	1	1	1	—	1	1
Construction	1	1	1	—	1	1
Manufacturing	25	25	1	23	1	1
Service-producing	1	1	—	—	—	—
Transportation and public utilities	1	1	1	—	1	1
Wholesale trade	1	1	1	—	1	1
Retail trade	1	1	1	—	1	1
Finance, insurance, and real estate	1	1	1	—	1	1
Services	1	1	1	—	1	1

Table 4. Number of "seasonally adjusted" national series on employment, hours, and earnings published from the Current Employment Statistics program by industry, June 1987

Industry	All employees	Production workers[1]	Women workers	Average weekly hours	Indexes of aggregate weekly hours	Average overtime hours	Average hourly earnings		Average weekly earnings	
							Current dollars	1977 dollars	Current dollars	1977 dollars
Total nonagricultural	1	—	1	—	—	—	—	—	—	—
Total private	1	1	1	1	1	—	1	1	1	1
Goods-producing	1	1	1	—	1	—	—	—	—	—
Mining	2	1	1	—	1	—	—	—	—	—
Construction	2	1	1	—	1	—	1	—	—	—
Manufacturing	25	25	23	21	25	3	1	—	—	—
Service-producing	2	1	2	—	1	—	—	—	—	—
Transportation and public utilities	3	1	1	1	1	—	1	—	—	—
Wholesale trade	3	1	1	1	1	—	1	—	—	—
Retail trade	5	1	1	1	1	—	1	—	—	—
Finance, insurance, and real estate	4	1	1	—	1	—	1	—	—	—
Services	3	1	1	1	1	—	1	—	—	—
Government	4	—	4	—	—	—	—	—	—	—

[1] Production workers in manufacturing and mining; construction workers in construction; and nonsupervisory workers in all other industries.

of the Current Population Survey, or household survey.) The two surveys have differences in concept and scope and employ different collection and estimating techniques.

The payroll survey excludes unpaid family workers, domestic workers in private homes, proprietors, and other self-employed persons, all of whom are covered by the household survey. Moreover, the payroll survey counts a person who is employed by two or more establishments at each place of employment, while the household survey counts a person only once, and classifies him or her according to the major activity. Certain persons on unpaid leave are counted as employed under the household survey, but are not included in the employment count derived from the payroll survey. However, over time, they show similar trends in employment.

The household survey places its primary emphasis on the employment status of individuals and also provides a great deal of information on the demographic characteristics (sex, age, race) of the labor force. The survey is not well suited to providing detailed information on the industrial and the geographic distribution of employment. The establishment survey, while providing limited information on personal characteristics of workers, is an excellent vehicle for obtaining these detailed industrial and geographic data; in addition, it provides hours and earnings information which is directly related to the employment figures. The payroll and household surveys, therefore, should be regarded as complementary.

Uses

The series are used by business firms, labor unions, universities, trade associations, private research organizations, and many government agencies to study economic conditions and to develop plans for the future. Business firms, for example, use the employment, hours, and earnings data for guidance in plant location, sales, and purchases. Also, firms negotiating long-term supply or construction contracts often use escalation clauses based on the average hourly earnings series as an aid in reaching equitable agreements; escalation clauses permit an adjustment of wages depending on the movement of average hourly earnings in a selected industry.

Researchers use the trends reflected in these statistics as economic indicators. The average weekly hours series, for example, is a leading indicator of swings in the business cycle.

Employment trends indicate changes in the structure and growth of individual industries and, in conjunction with trends in hours and other economic data, yield measures of productivity.

Wide need has been demonstrated by both labor and business for industry series on hourly earnings and weekly hours, to provide a basis for labor-management negotiations. They not only furnish current and historical information on a given industry but provide comparative data on related industries.

Reliability of Estimates

Although the relatively large size of the CES sample assures a high degree of accuracy, the estimates derived from it may differ from the figures that would be obtained if it were possible to take a complete census using the same schedules and procedures. While the estimates are adjusted annually to new benchmarks, changes between benchmark months are not reflected in the data—new establishments, for example, or changes in the industrial classification of establishments resulting from changes in their product or activity. In addition, small sampling and response errors may accumulate over several months as a result of the link relative technique of estimation between benchmarks.

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

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

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

Hours and earnings estimates are not subject to benchmark revisions although the broader industry groupings may be affected slightly by changes in the production-worker 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.) Measures of root-mean-square errors for employment estimates and relative errors for hours and earnings estimates are provided in the Explanatory Notes in *Employment and Earnings.*

Technical References

Bureau of Labor Statistics

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Bureau of Labor Statistics Report on
Employment, Payroll, and Hours—Manufacturing

U.S. Department of Labor

This report is authorized by law 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely. The information collected on this form by the Bureau of Labor Statistics and the States cooperating in its statistical programs will be held in confidence and will be used for statistical purposes only.

Form Approved
O.M.B. No. 1220-0011

State	Report Number	Industry

Return promptly each month in the enclosed envelope which requires no postage. Change name and mailing address if incorrect—Include Zip code.

Return to:

SAMPLE COPY

A. Please provide the following information in case questions arise concerning this report.
Your Name **Title** **Phone Number** ( )

B. Please provide the location of establishments covered by this report.
Number of establishments **City** **County** **State**

C. Please check one: Production workers are paid ☐ **each week** ☐ **every 2 weeks** ☐ **twice a month** ☐ **once a month** ☐ **other, specify:**

D. Please complete columns 1-6 for the pay period checked above which includes the 12th of the month. Detailed explanations are on the reverse side.

Reference Period Please report data **only** for the pay period which includes the 12th of the month	**(1) All Employees:** Report the number of paid employees who worked during or received pay for any part of the pay period which includes the 12th of the month	**(2) Women Employees:** Report the number of employees from column 1 that are women	**(3) Production Workers:** Report the number of employees from column 1 that are production workers	**(4) Production Worker Payroll:** Report the total production worker payroll, including overtime, for the pay period which includes the 12th of the month (omit cents)	**(5) Production Worker Hours:** Report the total production worker hours, including overtime, for the pay period which includes the 12th of the month (omit fractions)	**(6) Production Worker Overtime Hours:** Report the total production worker overtime hours included in column 5 (omit fractions)	**OFFICE USE ONLY** Expl code	L/P code
DEC 1986				$				
JAN 1987								
FEB								
MAR								
APR								
MAY								
JUN								
JUL								
AUG								
SEP								
OCT								
NOV								
DEC								

E. Please report comments on significant changes in your employment, payroll, or hours on the reverse.

BLS-790 C Rev Dec 86

Explanations for Entering Data on Reverse Side

For what time period should I complete this form?

Complete this form only for the single pay period checked in Part C (weekly, monthly, etc.) that includes the 12th day of the month. Payroll and hours (Part D, columns 4-6) should be reported for the entire pay period checked in Part C, regardless of its length.

If your pay period is Monday through Friday, and the 12th falls on a Saturday, please report for the week of the 6th through the 12th. When the 12th falls on a Sunday, report for the week of the 12th through the 18th.

Column 1 All Employees:
Enter the total number of persons who worked full- or part-time or received pay for any part of the pay period including the 12th of the month.

"All Employees" includes:

salaried officials of corporations
executives and their staff
persons on paid vacation
persons on paid sick leave
persons on other paid leave
part-time employees
trainees

"All Employees" excludes:

proprietors
pensioners
unpaid family workers
partners of unincorporated firms
persons on strike the entire pay period
persons on leave without pay the entire pay period
armed forces personnel on active duty the entire pay period

Column 2 Women Employees:
Enter the number of employees from column 1 that are women.

Column 3 Production Workers:
Enter the number of employees from column 1 that are production workers. "Production workers" includes all nonsupervisory workers engaged in such occupations as:

fabricating	shipping	processing
storage	trucking	assembling
receiving	packing	janitorial
warehousing	handling	repair

maintenance
product development
recordkeeping (clerical) related to production

"Production workers" also includes working supervisors and group leaders who may be "in charge" of a group of employees, but whose supervisory functions are only incidental to their regular work.

"Production workers" excludes:

executives	personnel	cafeterias
finance	medical	accounting
technical	professional	legal
advertising	credit	sales
collection	sales-delivery	purchasing

recordkeeping (clerical) not related to production
force account construction
installation of products
servicing of products

Column 4 Production Worker Payroll:
Enter the total amount of pay earned during the entire pay period checked in Part C (weekly, etc.) for all production workers in column 3.

Report pay ***before*** employee deductions for:

FICA (social security)
unemployment insurance
health insurance
pensions
pay deferral plans (401K plans)
Federal, State, and local income taxes
bonds
union dues

Include pay for:	***Exclude:***
overtime	bonuses, unless paid regularly
holidays	lump sum payments
vacations	retroactive pay
sick leave	pay advances
other paid leave	payments-in-kind

Column 5 Production Worker Hours:
Enter the total number of hours paid for during the entire pay period checked in Part C (weekly, etc.) for all production workers in column 3. Do not convert overtime or other premium hours to straight-time equivalent hours. "Hours paid for" is the sum of:

1. Hours worked, including overtime hours.
2. Hours paid for stand-by or reporting time.
3. Hours not worked, but for which pay was received directly from the firm. Included are holidays, vacations, sick leave, or other paid leave.

Column 6 Production Worker Overtime Hours:
Enter the total number of hours from column 5 for which overtime premiums were paid because the hours were in excess of the regularly scheduled hours. Include Saturday, Sunday, 6th day, 7th day, and holiday hours only if overtime premiums were paid. Exclude hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid.

If there were no overtime hours, enter "O" in column 6.

E. Comments. Check the box which best indicates the reason for significant changes in employment (Emp), payroll (PR), or hours (Hrs). Circle the item(s) (Emp, PR, or Hrs) to which the comment applies.

				seasonal increase	seasonal decrease	more business (new orders)	less business (lack of orders)	majority on paid vacation	majority on unpaid vacation	more overtime	less overtime	longer scheduled workweek	shorter scheduled workweek	higher earnings for piece work or incentive pay	lower earnings for piece work or incentive pay	general wage change—COLA	temporary or permanent shutdown	If none of the checkboxes apply, write your own comments here.
JAN	Emp	PR	Hrs															
FEB	Emp	PR	Hrs															
MAR	Emp	PR	Hrs															
APR	Emp	PR	Hrs															
MAY	Emp	PR	Hrs															
JUN	Emp	PR	Hrs															
JUL	Emp	PR	Hrs															
AUG	Emp	PR	Hrs															
SEP	Emp	PR	Hrs															
OCT	Emp	PR	Hrs															
NOV	Emp	PR	Hrs															
DEC	Emp	PR	Hrs															

BLS-790 C Rev Dec 86

Bureau of Labor Statistics Report on
Employment, Payroll, and Hours—Trade

U.S. Department of Labor

This report is authorized by law 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely. The information collected on this form by the Bureau of Labor Statistics and the States cooperating in its statistical programs will be held in confidence and will be used for statistical purposes only.

Form Approved
O.M.B. No. 1220-0011

State	Report Number	Industry

Return promptly each month in the enclosed envelope which requires no postage. Change name and mailing address if incorrect—Include Zip code.

Return to:

SAMPLE COPY

A. Please provide the following information in case questions arise concerning this report.
Your Name Title Phone Number ( )

B. Please provide the location of establishments covered by this report.
Number of establishments City County State

C. Please check one.
Nonsupervisory employees are paid: ☐ each week ☐ every 2 weeks ☐ twice a month ☐ once a month ☐ other, specify:

D. Please check one.
Nonsupervisory employees are paid commissions: ☐ each week ☐ every 2 weeks ☐ twice a month ☐ once a month ☐ no commissions are paid ☐ other, specify:

E. Please complete columns 1-4 and 6 for the pay period checked in C above which includes the 12th of the month. Complete column 5 for the commission period checked in D above which includes the 12th of the month. Detailed explanations are on the reverse side.

Reference Period Please report data only for the pay period which includes the 12th of the month	(1) All Employees: Report the number of paid employees who worked during or received pay for any part of the pay period which includes the 12th of the month	(2) Women Employees: Report the number of employees from column 1 that are women	(3) Nonsupervisory Employees: Report the number of employees from column 1 that are nonsupervisory employees	(4) Nonsupervisory Employee Payroll: Report the total nonsupervisory employee payroll, excluding commissions, for the pay period including the 12th of the month (omit cents)	(5) Commissions of Nonsupervisory Employees: Report the total commissions paid for the period including the 12th of the month (omit cents)	DO NOT USE OFFICE USE ONLY PR	(6) Nonsupervisory Employee Hours: Report the total nonsupervisory employee hours, including overtime, for the pay period including the 12th of the month (omit fractions)	DO NOT USE OFFICE USE ONLY Expl code	L/P code
DEC 1986				$	$				
JAN 1987									
FEB									
MAR									
APR									
MAY									
JUN									
JUL									
AUG									
SEP									
OCT									
NOV									
DEC									

F. Please report comments on significant changes in your employment, payroll, hours, or commissions on the reverse.

BLS-790 E Rev Dec 86

Explanations for Entering Data on Reverse Side

For what time period should I complete this form?

Complete Part E, columns 1-4 and 6, only for the single pay period checked in Part C (weekly, monthly, etc.) that includes the 12th day of the month. Payroll and hours (Part E, columns 4 and 6) should be reported for the entire pay period checked in Part C, regardless of its length.

Commissions (Part E, column 5) should be reported for the entire commission period checked in Part D, regardless of its length. If your commission period ends more than 2 weeks after the end of the pay period checked in Part C, do not delay this report. Instead, report commissions on a one month lag, the next time you receive this form.

If your pay period checked in Part C is Monday through Friday, and the 12th falls on a Saturday, please report for the week of the 6th through the 12th. When the 12th falls on a Sunday, report for the week of the 12th through the 18th.

Column 1 All Employees:
Enter the total number of persons who worked full- or part-time or received pay for any part of the pay period including the 12th of the month.

"All Employees" includes:

salaried officials of corporations
executives and their staff
persons on paid vacation
persons on paid sick leave
persons on other paid leave
part-time employees
trainees

"All Employees" excludes:

proprietors
pensioners
unpaid family workers
partners of unincorporated firms
persons on strike the entire pay period
persons on leave without pay the entire pay period
armed forces personnel on active duty the entire pay period

Column 2 Women Employees:
Enter the number of employees from column 1 that are women.

Column 3 Nonsupervisory Employees:
Enter the number of employees from column 1 that are nonsupervisory employees. Nonsupervisory employees are all employees in column 1 who are NOT:

officers of corporations
executives
department heads
managers

"Nonsupervisory employees" includes working supervisors and group leaders who may be "in charge" of a group of employees, but whose supervisory functions are only incidental to their regular work.

In other words, "nonsupervisory employees" includes every employee except those whose major responsibility is to supervise, plan, or direct the work of others.

Column 4 Nonsupervisory Employee Payroll:
Enter the total amount of pay earned during the entire pay period checked in Part C (weekly, etc.) for all nonsupervisory employees in column 3. Do not include commissions. Commissions are reported in column 5.

Report pay ***before*** employee deductions for:

FICA (social security)
unemployment insurance
health insurance
pensions
pay deferral plans (401K plans)
Federal, State, and local income taxes
bonds
union dues

Include pay for:	***Exclude:***
overtime	tips
holidays	commissions
vacations	lump sum payments
sick leave	retroactive pay
other paid leave	pay advances
	payments-in-kind (meals, etc.)
	bonuses, unless paid regularly
	travel expenses

Column 5 Commissions of Nonsupervisory Employees:
Enter commissions (not base pay, drawing accounts, or basic guarantees) paid to all nonsupervisory employees in column 3 during the entire commission period checked in Part D (weekly, etc.). If no commissions are paid, check the appropriate box in Part D and leave column 5 blank.

Column 6 Nonsupervisory Employee Hours:
Enter the total number of hours paid for during the entire pay period checked in Part C (weekly, etc.) for all nonsupervisory employees in column 3. Do not convert overtime or other premium hours to straight-time equivalent hours. "Hours paid for" is the sum of:

1. Hours worked, including overtime hours.
2. Hours paid for stand-by or reporting time.
3. Hours not worked, but for which pay was received directly from the firm. Included are holidays, vacations, sick leave, or other paid leave.

F. Comments. Check the box which best indicates the reason for significant changes in employment (Emp), payroll (PR), or hours (Hrs). Circle the item(s) (Emp, PR, or Hrs) to which the comment applies.

				seasonal increase	seasonal decrease	more business (not seasonal)	less business (not seasonal)	more overtime	less overtime	longer scheduled workweek	shorter scheduled workweek	more commissions earned	less commissions earned	general wage change—COLA	temporary or permanent shutdown	If none of the checkboxes apply, write your own comments here.
JAN	Emp	PR	Hrs													
FEB	Emp	PR	Hrs													
MAR	Emp	PR	Hrs													
APR	Emp	PR	Hrs													
MAY	Emp	PR	Hrs													
JUN	Emp	PR	Hrs													
JUL	Emp	PR	Hrs													
AUG	Emp	PR	Hrs													
SEP	Emp	PR	Hrs													
OCT	Emp	PR	Hrs													
NOV	Emp	PR	Hrs													
DEC	Emp	PR	Hrs													

BLS-790 E Rev Dec 86

Chapter 3. Occupational Employment Statistics

The Occupational Employment Statistics (OES) survey is a periodic mail survey conducted by State employment security agencies of a sample of nonfarm establishments to obtain wage and salary employment by occupation. These data are used to estimate total employment by occupation for the Nation, each State, and selected areas within States.

Background

In 1971, questionnaires were sent to 50,000 manufacturing establishments throughout the United States, marking the beginning of the OES survey. This survey was conducted in cooperation with the Employment and Training Administration and 10 State employment security agencies. It was designed to obtain occupational estimates for the Nation and for the cooperating States. Similar surveys were inaugurated for nonmanufacturing industries with the participation of additional cooperating State agencies. State and local governments were surveyed as well.

OES surveys follow a 3-year cycle. Between 1971 and 1987, three surveys, on average, were conducted alternately for manufacturing; nonmanufacturing; and trade, transportation, communications, public utilities, and government services industries. Surveys of hospitals were added to the cycle in 1980 and educational services in 1985. Currently, the 50 States, the District of Columbia, Puerto Rico, Guam, and American Samoa are cooperating in this effort.

Concepts

An *establishment* is an economic unit which processes goods or provides services, such as a factory, mine, or store. It is generally at a single physical location and is engaged predominantly in one type of economic activity. Where a single physical location encompasses two or more distinct activities, these are treated as separate establishments, provided that separate payroll records are available and certain other criteria are met.

Unit total employment includes full- or part-time workers; workers on paid vacations or other types of leave; workers on unpaid, short-term absences (i.e., illness, bad weather, temporary layoff, jury duty); salaried officers, executives, and staffs of incorporated firms; employees temporarily assigned to other units; and employees for whom this unit is their permanent (home) duty station, regardless of whether this unit prepares their paycheck. Unit total employment excludes proprietors (owners and partners) of unincorporated firms; unpaid family workers; workers on extended leave (i.e., pensioners and members of the Armed Forces); and workers on long-term layoff.

Employees are reported in the occupation in which they are working, not in an occupation for which they may have been trained, if that is different. For example, an employee trained as an engineer but working as a drafter is reported as a drafter.

Working supervisors (those spending 20 percent or more of their time at work similar to that performed by workers under their supervision) are reported in the occupations which are most closely related to their work.

Part-time workers, learners, and apprentices are reported in the occupation in which they ordinarily work.

Industrial classification

The classification system currently used for compiling and publishing data is that described in the 1972 *Standard Industrial Classification* (SIC) *Manual* as revised in 1977. (See appendix B for a detailed description of this system.) Beginning with the 1988 OES survey, data will be collected in accordance with the 1987 SIC manual.

Reporting establishments are classified on the basis of major product or activity for the previous calendar year.

Occupational classification

The OES classification system introduced in 1983 is based primarily on the *Dictionary of Occupational Titles,* (DOT) and is compatible with the 1980 Standard Occupational Classification (SOC) system. The titles and descriptions of occupations are principally derived from the DOT. The classification of occupations, with some exceptions, follows the SOC principles which group occupations by function, industry, and skill.

The revision of the OES classification system achieved four objectives: (1) it addressed general and specific user needs for data, (2) it achieved compatibility with the 1980 SOC at the lowest level of detail, (3) it maintained

historical compatibility with the previous OES system, and (4) it simplified the classification structure.

Information compiled from industry officials and other sources was incorporated and contributed to the classification system. This system continues to allow for the constant state of change that occupational terminology and classification undergo. This flexibility permits integration of the insights gained from each successive round of OES surveys.

A "crosswalk" which relates OES occupations to the SOC, the 1980 Census of Population classification system, and the DOT, has been developed so that users can integrate OES data with these other sources, using the DOT as a common denominator.

Data Sources and Collection Methods

Sources of occupational data reported by respondents are personnel records and, especially for the small reporting units, personal knowledge of persons completing the reports.

Employment benchmarks for this survey are derived from employment data tabulated from the reports of the unemployment insurance program. In some nonmanufacturing industries, supplemental sources are used to obtain lists of establishments that are not covered by unemployment insurance laws.

Employment information is currently being collected for more than 700 occupations. A list of occupations has been designed for each industry or for each group of industries having a similar occupational structure.

Two types of survey questionnaires—one long and one short—are used. The short form was developed to reduce the reporting burden in smaller establishments. Both forms include specific occupational titles and definitions, establishment identification information, and several questions concerning the nature of the business. In addition, the questionnaire provides descriptions of 3-digit SIC industries to reduce industry misclassifications.

The long form specifies an extensive list of occupations selected for each industry grouped under broad headings such as Clerical Occupations, Professional and Technical Occupations, and Service Occupations. The long form includes supplemental sheets for respondents to report significant occupations that they could not place under specific titles, and thus reported in the "all other" residual data lines. Experience with previous surveys has shown that the supplemental sheets can be a valuable tool in improving the occupational lists and definitions, as well as clarifying and correcting reported data.

The short form includes abbreviated occupational lists with accompanying definitions. No broad groups are specified. Respondents are asked to identify and briefly describe jobs that cannot be matched to the occupations listed on the forms. When the questionnaires are returned, these additional occupations are coded according to the corresponding long-form occupational content preparatory to making estimates of employment by occupation.

Data are collected from respondents primarily by mail, but visits are made to many large employers and to other respondents who indicate particular difficulty in completing the questionnaires. Normally, two mailings follow the initial mailing and a subsample of residual nonrespondents is contacted further by telephone.

Occupational employment data are requested for the pay period including the 12th day of April, May, or June, depending upon the industry surveyed.

Sampling

The OES sample is designed to yield reliable industry occupational estimates for the participating States and areas within those States. The sample members are selected primarily from the lists of establishments reporting to the State unemployment insurance program.

The sample design initially stratifies the universe of establishments by industry. All establishments employing 250 employees or more are included in the sample. In some industries and States, the level of employment for establishments included with certainty is less than 250 employees. For establishments not included in the sample with certainty, an optimum allocation design is obtained by stratifying the industry by size class and sampling the size classes with probability proportionate to the amount of employment contained in those size classes. Within each industry size stratum, the sample members are randomly selected.

Estimating Procedures

The occupational distribution of the respondents in each industry by size class is determined by deriving the ratio of the sum of the employment in each occupation to the sum of the total employment of the corresponding reporting establishments. These distributions are multiplied by the corresponding benchmark estimates of total employment in that size class. Estimates for occupations in each industry group are derived by summing all of the occupational size class estimates within that industry group. Similarly, the estimates of combined industry groups are derived by summing the individual industry components.

Presentation

A report on the results of each OES survey is published by the cooperating State employment security agencies. BLS published national estimates for the survey years 1971 and 1977–86, inclusive. Each report consisted of an

analytical interpretation of the findings supported by statistical tables showing estimates of occupational employment and measurements of the sampling error associated with the estimates.

Uses and Limitations

The data enable analysis of the occupational composition of different industries, of different plants in the same industry, or of changes in an industry over time. Such information is used in projecting employment requirements by occupation and for vocational and educational guidance. The occupational composition of various industries is also needed to estimate the employment implications of proposed new Government programs, such as those in the fields of defense procurement, health, or mass transit. Local employment service offices use information on the occupational patterns of industries to locate employment opportunities. Finally, occupational employment and patterns data are used in analysis by the firms and in industrial management.

All surveys are subject to response and processing errors, although these are reduced through reviewing, editing, and screening procedures and through contact with respondents whose data are internally inconsistent or appear to involve misinterpretation of definitions or other instructions. In addition, estimates derived from sample surveys are subject to sampling error. Sampling errors for occupational employment estimates are calculated and normally published with the estimates.

Technical References

Thompson, John. "BLS Job Cross-classification System Relates Information From Six Sources," *Monthly Labor Review,* November 1981.
Describes the relationships of several major classification systems to the Occupational Employment Statistics classification system.

U.S. Department of Commerce, Bureau of the Census. *1970 Census of Population Classified Index of Industries and Occupations,* September 1971.

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U.S. Department of Commerce, Office of Federal Statistical Policy and Standards. *Standard Occupational Classification Manual,* 1980.

U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics. *A Classification of International Programs,* 1981.

U.S. Department of Labor, Bureau of Labor Statistics. *Crosswalk of OES Occupations to Other Occupational Classification Systems,* 1987 (available upon request).

Bureau of Labor Statistics. *Occupational Employment in Manufacturing Industries, 1983*, Bulletin 2248, 1985.
Presents occupational employment data collected in 1983 for manufacturing industries.

Bureau of Labor Statistics. *Occupational Employment in Selected Nonmanufacturing Industries,* Bulletin 2264, 1986.
Presents occupational employment data collected in 1984 for mining; construction; finance, insurance, and real estate; and services industries.

Bureau of Labor Statistics. *Occupational Employment in Selected Nonmanufacturing Industries,* Bulletin 2284, forthcoming.
Presents occupational employment data collected in 1985 for the transportation, communications, utilities, trade, educational services, and State and local government industries.

U.S. Department of Labor, Employment and Training Administration. *Dictionary of Occupational Titles,* fourth edition, 1977, and its 1986 supplement.
Comprehensive descriptions of more than 13,000 jobs coded by work requirements and duties performed.

Chapter 4. Measurement of Unemployment In States and Local Areas

Unemployment estimates for States and local areas are developed by State employment security agencies to measure local labor market activity. These estimates are a key indicator of local economic conditions and are used by State and local governments for planning and budgetary purposes and as an indication of the need for local employment and training services and programs.

Local area unemployment estimates are also used to determine the eligibility of an area for benefits in various Federal assistance programs. Under the Federal-State cooperative program, the Department of Labor develops the concepts, definitions, and technical procedures which are used by State agencies for the preparation of labor force and unemployment estimates.

Background

Unemployment estimates have been developed for Labor Market Areas (LMA's) for over 40 years. The program began during World War II under the War Manpower Commission to identify areas where labor market imbalance was created as a result of an inadequate labor supply, material shortages, and transportation difficulties. After World War II, emphasis was placed on identifying areas of labor surplus, and the program of classifying areas in accordance with the severity of unemployment was established.

In 1950, the Department of Labor's Bureau of Employment Security (now Employment and Training Administration) published a handbook, *Techniques for Estimating Unemployment,* in order that comparable estimates of the unemployment rate could be produced among the States. During the late 1950's, their experiences led to the formulation of the Handbook method, which is a series of computational steps designed to produce total employment and unemployment estimates and relies heavily on data derived from the unemployment insurance (UI) system.

In 1972, the Bureau of Labor Statistics was assigned the responsibility for developing the concepts and methods used by States to estimate labor force, employment, and unemployment. In 1973, after extensive research, a new system for developing labor force estimates was introduced which combined the Handbook method with the concepts, definitions, and estimation controls from the Current Population Survey (CPS), the Bureau of Census survey used to measure the labor force status of individuals.

To improve the quality of State labor force estimates, the CPS State samples have been increased in size several times, beginning in 1976 when the use of the CPS as an estimation control was extended to all States. BLS established, as a criterion for direct use of CPS data, a maximum expected relative error of 10 percent for unemployment given an expected unemployment rate of 6 percent. Based on this criterion, in January 1978, monthly CPS data were introduced as the official labor force estimates at the statewide level for the 10 largest States—California, Florida, Illinois, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, and Texas; and for two areas—Los Angeles–Long Beach Standard Metropolitan Statistical Area (SMSA) and New York City. With the redesign of the CPS to reflect the 1980 census, an 11th State, North Carolina, was added to those States with direct monthly use of CPS data. Sample design efficiencies resulted in a reduction in the maximum expected relative error to 8 percent monthly for the 11 largest States. All other State and area estimates are based on the Handbook method controlled to CPS statewide estimates as explained below.

BLS and the States also engaged in the UI data base project to standardize for all States and areas the UI claims data used in the Handbook method so that these data would be more consistent with the concept and definition of unemployment used in the CPS. The result was the regular development, from computer files, of data on UI claimants, based on their State/county/city of residence, who certified to unemployment in the week including the 12th of the month (the CPS reference week), without earnings from employment in the certification week. Currently, monthly estimates of employment and unemployment are prepared in the State agencies for some 5,400 geographic areas which include all States, LMA's, and counties and cities with 25,000 or more population.

Handbook Method

Until 1973, the Handbook method was the only means used in developing State and local area labor force and unemployment estimates. It is an effort to estimate unemployment for a State or area, comparable to what would be produced by a random sample of households in the area, using available information without the expense of the CPS. The Handbook presents a series of estimating "building blocks" where categories of unemployed workers are classified by their previous status. Three broad categories of unemployed persons are: (1) those who were last employed in industries covered by State UI laws; (2) those who were last employed in noncovered industries; and (3) those who either entered the labor force for the first time, or re-entered after a period of separation.

In the current month, the estimate of unemployment is an aggregate of the estimates for each of the three building-block categories. The covered category consists of those unemployed workers who are currently collecting UI benefits, have exhausted their benefits, have been disqualified from receiving benefits, and have delayed filing for benefits.

Within the covered category, only the insured unemployed are derived directly from an actual count of current UI claimants for the reference week. All other components in this and the other two covered categories are based on special estimating equations. The estimates of persons who have exhausted their benefits and those in a disqualified status are based on the number actually counted in the current period, plus an estimate of those expected still to be unemployed from previous periods.

For the noncovered category, an estimate of unemployment is developed for each industry or class-of-worker subgroup based primarily on the "State covered unemployment rate" (the ratio of covered unemployment to covered employment), and the estimate of employment for the subgroup.

The third category, new entrants and reentrants into the labor force, cannot be estimated directly from UI statistics because unemployment for these persons is not immediately preceded by the period of employment required to receive UI benefits. Instead, total entrants into the labor force are estimated on the basis of the national historical relationship of entrants to the experienced unemployed and the experienced labor force. The Handbook estimate of entrants into the labor force is a function of: (1) the particular month of the year; (2) the level of the experienced unemployed; (3) the level of the experienced labor force; and (4) the youth proportion of the working-age population. The estimate of total entrants for a given month is derived from the following equation:

$$ENT = A(X+E) + BX$$

where:

ENT = total entrant unemployment
E = total employment
X = total experienced unemployment
A, B = synthetic factors incorporating seasonal variation, and assumed relationship between the proportion of youths in the working-age population and the historical relationship of entrants to either the experienced unemployed (B factor) or the experienced labor force (A factor).

The total employment estimate is based on data from several sources. The primary source is a survey of establishments designed to produce an estimate of the total number of employees on payrolls in nonagricultural industries. Estimates of agricultural workers, the self-employed, unpaid family workers, and domestic workers are developed synthetically.

Methodological Improvements—Adjustments to the Handbook

Research has established that the Handbook procedures alone produce seriously biased estimates of unemployment and employment as measured by the CPS. These biases are caused, in part, by methodological and definitional problems. For example, the employment estimates in the Handbook method are based primarily on establishment payroll data and are place-of-work estimates. The CPS estimates are based on a survey of households in the area and are place-of-residence estimates. Also, a person on an unpaid absence is excluded from the payroll estimate in the Handbook method but is considered employed in the CPS. Further, a person holding two jobs within the reference week is counted twice in the payroll estimate but only once in the CPS estimate.

The definitional and methodological differences between the Handbook and CPS estimate of unemployment are more difficult to reconcile. The Handbook method does not count (or estimate) the number of persons in covered industries who do not have sufficient time on the job or earnings to qualify for benefits. Since UI laws vary from State to State, the criteria for the determination of eligibility for benefits and the treatment of persons who fail to qualify for benefits for nonmonetary reasons (quits, discharges, etc.), also vary from State to State. More importantly, the CPS estimates are based on a household sample selected in a way to provide unbiased estimates. The Handbook is a nonsurvey method that uses counts of UI claims at the area level and estimates other unobservable components of unemployment using equations developed primarily from historical national data. These special equations are subject to numerous errors related to the specification of functional form, the

method of estimation, and the use of national data which do not reflect interarea differences in labor markets. While the differences between the CPS and Handbook estimates are often very large, as can be determined by a comparison in selected areas where the CPS sample size is adequate, it is not possible to measure the error in most of the individual Handbook components since no comparable CPS data exist.

In order to reduce the bias resulting from the use of the Handbook method alone, and produce more consistent estimates across States and areas, BLS has introduced a number of adjustment procedures and changes in the previous estimating methodology. These are described below.

Direct use of CPS data

The most fundamental change was the use of CPS data at the State level for controlling estimation error in the Handbook method and Handbook estimates to distribute the CPS-based State estimates to the LMA's that each State comprises. In the 11 largest States (and 2 large areas mentioned above), CPS data are used directly on a monthly basis. In the 39 remaining States and the District of Columbia, where the sample will not support the direct monthly use of the CPS data, they are used as follows.

Monthly adjustment to CPS. Each month, during the current estimating year, Handbook employment and unemployment estimates are adjusted to conform more closely with the CPS estimates. The adjustment consists of multiplying the current statewide Handbook estimates by the ratio of a 6-month moving average of the CPS estimate ending in the current month to the corresponding moving average for the Handbook estimate. This is the so-called moving-average-ratio adjustment procedure.

This adjustment is illustrated below using unemployment as an example:

$$U_s(t) = UHB_s(t) * \frac{\sum_{K=0}^{5} UCPS_s\,(t\text{-}K)}{\sum_{K=0}^{5} UHB_s(t\text{-}K)}$$

where:

t = time period
s = State
$U_s(t)$ = official State estimate
$UHB_s(t)$ = Handbook State estimate
$UCPS_s(t)$ = CPS State estimate

Annual benchmark adjustments. Each year, monthly State employment and unemployment estimates prepared by State employment security agencies using the Handbook estimating procedure are adjusted, or benchmarked, to the annual average CPS State estimate. This is accomplished in three stages. First, the monthly Handbook estimates in each year are adjusted by the ratio of the CPS to the Handbook annual averages for that year. Second, the difference between the ratios of annual averages for 2 consecutive years is wedged into the monthly estimates in order to minimize the disturbance to (month-to-month change in) the original series from the first step. Finally, the second-stage monthly estimates are adjusted to yield the CPS annual average for each year.

Place-of-work adjustment

Another important modification is a procedure for adjusting the place-of-work employment estimates used in the Handbook method to place-of-residence estimates, as in the CPS. Estimated adjustment factors for the major categories of employment in the Handbook method have been developed on the basis of employment relationships which existed at the time of the 1980 decennial census. These factors are applied to the preliminary employment estimates for the current period to obtain the adjusted estimates, which are then used in the Handbook method.

Consistency/additivity adjustment

Each month, Handbook estimates are prepared for Labor Market Areas that exhaust the entire State area. To obtain an estimate for a given area, a "Handbook share" is computed for that area which is defined as the ratio of that area's Handbook estimate to the sum of the Handbook estimates for all LMA's in the State. This ratio is then multiplied by the current, CPS-based statewide estimate—either the moving-average-ratio-adjusted Handbook estimate for 39 States or the CPS estimate for the 11 largest States—to produce the final adjusted LMA estimates:

$$U_a(t) = U_s(t) * \left[\frac{UHB_a(t)}{\Sigma UHB_a(t)} \right]$$

where:

a = area
s = State
t = time

The Handbook share procedure allocates the CPS adjusted level to the LMA's within the State and insures that area estimates of employment and unemployment add to the more accurately estimated State total. In California and New York, which also have areas taken directly from the CPS, the Handbook share ratio for the remaining areas is applied to the State total minus the CPS area.

Producing estimates for parts of LMA's

Current labor force estimates at the sub-LMA level are required by several Federal programs. However, for areas this small, the data required to compute independent Handbook estimates are generally not available. Based on data availability, two alternative methods are used to disaggregate the LMA estimates to the subarea level.

The population-claims method is the preferred technique. If residence-based UI claims data are available for the subareas within the LMA, the ratio of the subarea to the total number of claims within the LMA is used to disaggregate the Handbook estimate of experienced unemployed to the subarea level. The Handbook estimates of unemployed entrants are allocated based on the latest available census distribution of adult and teenage population groups. Employment is disaggregated using current population distributions prepared by the Bureau of the Census and weighted by each area's 1980 census relative share of employment to population.

If the necessary UI claims data are not available, the census-share method is used. This method utilizes each disaggregated area's 1980 census shares of total LMA employment and unemployment in order to disaggregate Handbook employment and unemployment.

Uses and Limitations

Estimates of unemployment and the unemployment rate are used by Federal agencies to determine the eligibility of an area for benefits in various Federal programs. These include the Job Training Partnership Act (JTPA), the Emergency Food and Shelter Program (EFSP), the Public Works and Economic Development Act (PWEDA), the Urban Development Action Grant Program (UDAGP), and Labor Surplus Area designations. Under JTPA and EFSP, unemployment data are used with other data to determine the distribution of funds to be allocated to each eligible area. In the case of the PWEDA, the UDAGP, and Labor Surplus Area designations, the data are used in the determination of area eligibility for benefits.

The CPS estimates used on an annual average basis to control labor force estimates, at the State level for 39 States and monthly for 11 States and 2 areas, are based on a random sample of households and are subject to sampling error. BLS does not accept sample estimates unless the coefficient of variation (standard error divided by the mean) of the estimate is 10 percent or less at 1 standard error. However, other types of nonsampling errors and biases do occur that make these estimates less reliable than what could be produced from the CPS, given an adequate sample size.

Technical References

U.S. Department of Labor, Bureau of Employment Security. *Handbook on Estimating Unemployment,* Employment Security Research Methods, Handbook Series (BLS Reprint No. R-185), 1960.

U.S. Department of Labor, Bureau of Labor Statistics. *Manual for Developing Local Area Unemployment Statistics,* July 1979.

Chapter 5. Employment and Wages Covered by Unemployment Insurance

The Employment and Wages program, commonly called the ES-202 program, is a cooperative endeavor of BLS and the employment security agencies of the 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands. Using quarterly reports submitted by the agencies, BLS summarizes employment and wage data for workers covered by State unemployment insurance (UI) laws and for civilian workers covered by the program of Unemployment Compensation for Federal Employees (UCFE).

The program is a comprehensive and accurate source of employment and wage data, by industry, at the national, State, and county levels. It provides a virtual census of nonagricultural employees and their wages. In addition, about 40 percent of all workers in agriculture are covered.

Background

The ES-202 program can trace its origins back to the Social Security Act of 1935, which authorized collection of information to determine if State unemployment compensation programs were in compliance with the act. From the inception of the national UI system in 1938, when the Federal Unemployment Insurance Tax Act became effective, until 1972, collection of the data, publication, and technical expertise were the responsibilities of the U.S. Department of Labor's Manpower Administration or its predecessor agencies. Semiannual reports summarizing the data were issued until 1950, when the periodical *Employment and Wages* began quarterly publication. In 1972, BLS assumed responsibility and continued quarterly publication until 1975. *Employment and Wages* then became an annual publication.

Concepts and Methodology

Scope of coverage

In 1938, UI coverage and, consequently, ES-202 reporting requirements, extended only to private firms employing eight or more persons at least 20 weeks a year; certain employee groups were exempt. Insurance coverage was successively broadened, to include Federal civilian employees[1] (1955); firms employing four to seven employees and ex-military personnel[2] (1958); and firms employing one to three employees, and State colleges, universities, and hospitals (1972). In 1978, coverage was extended to nearly all other State and local public employees; to agricultural firms employing a minimum of 10 workers or having a $20,000 quarterly payroll; and to employers paying a quarterly minimum of $1,000 to domestic workers.

UI coverage is broad and basically comparable from State to State. In 1986, UI and UCFE covered just under 100 million workers, or 90 percent of civilian employment. Covered workers received $1,848 billion in pay or 94.3 percent of the wage and salary component of personal income.

Over the years, many States have legislated unemployment insurance protection for additional categories of workers above the base established through Federal legislation. Details on coverage laws are provided in *Comparisons of State Unemployment Insurance Laws,* available upon request from the Employment and Training Administration of the Department of Labor.

When UI-covered private industry employment data are compared directly with other employment series, the industry exclusions also should be taken into account. Excluded from private sector coverage in 1986 were approximately 0.4 million wage and salary agricultural employees, 1.4 million self-employed farmers, 7.9 million nonagricultural workers, 0.8 million domestic workers, and 0.4 million unpaid family workers. Also excluded were 1.7 million members of the Armed Forces stationed in the United States, 0.4 million workers covered by the railroad unemployment insurance system, and about 0.6 million State and local government workers. In addition, certain types of nonprofit employers, e.g., religious organizations, are given a choice of coverage or noncoverage in a number of States.

[1] Under the Unemployment Compensation for Federal Employees (UCFE) program.

[2] Under the Unemployment Compensation for Ex-Servicemen (UCX) program.

Establishment

An establishment is an economic unit, such as a farm, mine, factory, or store, which produces goods or provides services. It usually is at a single physical location and engaged in one, or predominantly one, type of economic activity, for which a single industrial classification may be applied. Occasionally, a single physical location encompasses two or more distinct and significant activities. Each activity should be reported as a separate establishment if separate records are kept and the various activities are classified under different 4-digit SIC codes.

Reporting units

A reporting unit is the economic unit for which the employer submits a contribution report or provides employment and wage data for separate locations on a supplemental form that is included with the regular contribution report.

Most employers covered under State UI laws operate at only one location and primarily or entirely engage in one activity. In such instances, the establishment and the reporting unit are identical. Multiunit employers having establishments in more than one county or classifiable in more than one 4-digit industry ordinarily must submit separate reports for each establishment. However, employers having a total of fewer than 50 employees in all secondary counties or industries may combine these units with the primary county or industry report.

Employers having a number of similar units, particularly in industries characterized by small branch establishments (food stores, drug stores, banks) are allowed to combine all branch establishments within a county on a single report, regardless of employment.

In government, the reporting unit is the installation (a single location at which a department, agency, or other government instrumentality has civilian employees). Federal agencies follow slightly different criteria from private employers in breaking down their reports by installation. They are permitted to combine as a single statewide unit (1) all installations with 10 workers or fewer, and (2) all installations which have a combined total in the State of fewer than 50 workers. Also, when there are fewer than 25 workers in all secondary installations in a State, they may be combined and reported with the major installations.

As a result of these reporting rules, the number of reporting units is always larger than the number of employers (or government agencies) but smaller than the number of establishments (or installations).

Employment

Employment data represent the number of workers on the payroll during the pay period including the 12th of the month. The pay period varies in length from employer to employer; for most employers, it is a 7-day period, but not necessarily a calendar week. An employer who pays on more than one basis (such as weekly for production employees and semimonthly for office employees) reports the sum of the number of workers on each type of payroll for the period.

The employment count includes all corporation officials, executives, supervisory personnel, clerical workers, wage earners, pieceworkers, and part-time workers. Workers are reported in the State and county of the physical location of their job. Persons on paid sick leave, paid holiday, paid vacation, and so forth are included, but those on leave without pay for the entire payroll period are excluded.

Persons on the payroll of more than one establishment are counted each time reported. Workers are counted even though their wages may be nontaxable for UI purposes during that period (having reached the taxable limit for the year).

The employment count excludes employees who earned no wages during the entire applicable period because of work stoppages, temporary layoffs, illness, or unpaid vacations; and employees who earned wages during the month but not during the applicable pay period.

Total wages

Total wages, for purposes of the quarterly UI reports submitted by employers in private industry in most States, include gross wages and salaries, bonuses, tips and other gratuities, and the value of meals and lodging, where supplied. In a majority of the States, employer contributions to certain deferred compensation plans, such as 401 (k) plans, were included in total wages. Total wages, however, do not include employer contributions to old-age, survivors', disability, and health insurance (OASDHI); unemployment insurance; workers' compensation; and private pension and welfare funds.[3]

In most States, firms report the total wages paid during the calendar quarter, regardless of the timing of the services performed. Under laws of a few States, however, the employers report total wages earned during the quarter (payable) rather than actual amounts paid.

For Federal workers, wages represent the gross amount of all payrolls for all pay periods ending within the quarter. This gross amount includes cash allowances and the cash equivalent of any type of remuneration. It includes all lump-sum payments for terminal leave, withholding taxes, and retirement deductions. Federal employee remuneration generally covers the same types of services as those for workers in private industry.

[3] Employee contributions for the same purposes, as well as money withheld from the employee's gross pay for income taxes, union dues, etc., are excluded in the UI reports.

Taxable wages and contributions

Taxable wages are that part of wages subject to the State unemployment insurance tax. Contributions are calculated on taxable wages and are reported quarterly.

Under Federal law, certain units of State and local governments and certain nonprofit establishments may elect to reimburse the State for any unemployment insurance claims that have been filed against them. These reimbursable accounts are not subject to the quarterly assessment for unemployment insurance funds and, therefore, their taxable wages and contributions are not reported.

In mid-1986, approximately one-third of the States required that employers pay UI taxes on the first $7,000 of employee wages—the minimum established by Federal law. The remaining States established higher limits on taxable earnings. The portion of wages subject to taxation has varied substantially over time. In mid-1986 also, about two-fifths of the States allowed employers to obtain lower tax rates by making voluntary contributions to the unemployment tax fund. The few States which tax employees in addition to employers are requested to include employee contributions in their ES-202 report.

Industrial classification

State employment security agencies use the current *Standard Industrial Classification* (SIC) *Manual* to classify each reporting unit according to its primary activity. States assign a 4-digit industrial code to all new units and review and update codes, where necessary, on a 3-year cycle. Establishments or government installations reporting more than one activity allocate the proper proportion of total production, revenue, sales, or payroll costs (depending on the industry group) to each activity. The State agency designates the proportionately largest activity as the primary activity. Occasionally, two or more relatively minor activities may be determined to fall within the same industry classification and, when combined, become the primary activity.

In some industries, separate establishments of the same employer often carry on the same activities, in the same proportions, and may be combined at the county level. Sometimes, however, the proportions vary to such a degree that the units must be classified in differing industries and file separate reports.

Since 1938, the industrial classification of business establishments and government installations has undergone a number of modifications. (See table 1.) Until 1945, classification was based on the *Social Security Board* (SSB) *Classification Manual.* At that time, the basis was changed to the SIC manual, which since has been revised several times. Originally, establishments were classified into 20 manufacturing and 60 nonmanufacturing groups, on a 2-digit basis. The number of such groups has remained fairly constant. Three-digit groupings were added in 1942, and 4-digit groupings were added for manufacturing in 1956 and for nonmanufacturing in 1968. Statewide 4-digit classifying for nonmanufacturing

Table 1. Industrial classification of employment and wage data, 1938-88

Period	Number of industry groups by:			Basis of industrial classification							
				Social Security Board (SSB)		Standard Industrial Classification (SIC)					
	2-digit code	3-digit code	4-digit code	1939 edition	1942 edition	1945 edition	1957 edition	1967 edition	1972 edition	1977 supplement	1987 edition
Manufacturing											
1938-41	20			X							
1942-46	21	146			X						
1947-55	21	150				X					
1956-57	21	150	[1]469			X					
1958-67	21	148	[1]433				X				
1968-74	21	148	[1]417					X			
1975-78	20	143	451						X		
1979-87	20	143	452							X	
1988	20	140	459								X
Nonmanufacturing											
1938-41	60			X							
1942-57	56	256			X						
1958-67	58	236					X				
1968-74	62	235	[2]494					X			
1975-77	64	277	[2]553						X		
1978	64	277	553						X	X	
1979-87	64	277	553							X	
1988	63	276	546						X		X

[1] January-March quarter only.

[2] Not coded on a mandatory basis.

did not become mandatory until 1978. A few industry exceptions allow 3-digit coding (34 4-digit SIC's are collapsed into 9 3-digit SIC's). These few exceptions are coded at the 3-digit level because it is difficult to get systematic and accurate information sufficient to code at the 4-digit level.

Beginning with the first quarter 1988 ES-202 report, State agencies will be using the 1987 edition of the SIC manual (See appendix B for more information on the new SIC manual.)

Collection methods

State agencies send to BLS each quarter the ES-202 report for approximately 5.5 million reporting units. These reporting units are classified under 1 of 5 ownership categories—private industry, 5.3 million reports; Federal Government, 42,000; State government, 52,000; local government, 98,000; and international government, about 25.

The State agencies summarize and codify the raw data; check for missing information and errors; prepare estimates of data for delinquent reports; and finally, machine process the data onto magnetic tapes. Five months following the end of each quarter, the agencies are scheduled to send the tapes to Washington.

In order to assure accurate data, BLS conducts several edits of the data each quarter and then requests State agencies to review questionable entries and correct errors. Furthermore, an exportable macro-edit system was developed by BLS for State agency use so that there may be consistent and efficient review of the ES-202 report. The macro-edit permits State agencies to use effectively their EDP resources in the processing, review, and correction of data.

Comparison of the ES-202 Program with Other Series

A number of other statistical data series are comparable in some respects to those obtained in the ES-202 program. These series all have certain applications, strengths, and shortcomings. Because of its broad universe coverage, continuity, and currency, the ES-202 program is one of the most useful.

County Business Patterns Reports

The Bureau of the Census conducts a census of most industries every 5 years. These data, along with data from the Internal Revenue Service and Social Security Administration are combined to develop *County Business Patterns* (CBP) reports. The Census information is similar to ES-202 data, although various differences in concepts and methodology make comparisons difficult, particularly in some measurements, such as size of firm. The Bureau of the Census separately tabulates central administrative offices and auxiliaries at the division level only. Therefore, industry breakouts of private sector data at the 2-digit, 3-digit, or 4-digit level will exclude these groups. The ES-202 data are more frequently updated and consequently the program maintains more continuity.

Current Employment Statistics

The Current Employment Statistics (CES) or 790 program of BLS employs a sample of approximately 290,000 establishments to provide current estimates of monthly nonagricultural employment, average hourly earnings, average weekly earnings, and average weekly hours. The 790 program's employment estimates are benchmarked primarily to ES-202 records, which cover about 98 percent of all nonagricultural employees and 97 percent of those in the private nonagricultural sector. For the remaining industries, the CES program uses other sources to estimate employment not covered by State UI laws.

In addition to being sample-based as opposed to being a universe count, the 790 program differs from ES-202 in that it provides hourly earnings for production (nonsupervisory) workers only whereas ES-202 provides total payroll data for all employees, unrelated to hours.

Office of Personnel Management

The Office of Personnel Management (OPM) maintains a statistical series on Federal employment and payroll information by agency, type of position and appointment, and employee demographic characteristics. Both the OPM and ES-202 series exclude the Central Intelligence Agency and the National Security Agency, the Armed Forces, temporary emergency workers, and crews of certain vessels. The OPM, but not ES-202, includes employees working in foreign countries, workers paid on a fee or commission basis, and paid patients, inmates, and certain employees of Federal institutions, whereas the ES-202, but not OPM, includes Department of Defense employees paid from nonappropriated funds, employees with Federal appointments of the Agricultural Extension Service, County Agricultural Stabilization and Conservation Committees, and State and Area Marketing Committees.

In comparison with the OPM data, ES-202 data provide more industry and local employment and wage detail, and more frequently updated detail on employment by State. OPM, of course, has certain statistics that have no parallel in ES-202.

Current Population Survey

The Current Population Survey (CPS) is a sample survey of about 59,500 households chosen to represent the entire civilian noninstitutional population. Therefore,

the sample includes categories of workers which are entirely or partly excluded from the ES-202 program—certain farm and domestic workers, the self-employed, persons working 15 hours or more in the survey week as unpaid workers in an enterprise operated by a member of the family, employees of certain nonprofit organizations, and railroads. The CPS also counts employees uncompensated because of temporary absence, but excludes workers under 16 years old. Because the CPS is a sample and surveys households rather than establishments, it cannot present employment and wage data in the industrial and geographical detail available under the ES-202 program, but it does provide demographic characteristics.

When providing geographic information, the CPS program tabulates data by the location of the residence. On the other hand, the ES-202 program provides its State and county data by the location of the job.

Presentation

Employment and Wages, an annual BLS publication, presents State and national totals for covered employment and wages by broad industry division, major industry group, and detailed 4-digit industry. Data for Federal workers also are shown by agency, industry, and State.

The publication includes distributions of employment and wages by size of reporting unit for each major industry division for the United States as a whole. These data are distributed into 10 employment-size categories.

To preserve the anonymity of establishments, BLS withholds publication of data for any geographic industry level in which there are fewer than three reporting units, or in which the employment of a single installation or establishment accounts for over 80 percent of the industry. At the request of a State, data are also withheld where there is reason to believe that the "fewer than three" rule would not prevent disclosure of information pertaining to an individual reporting unit or would otherwise violate the State's disclosure provisions. Information concerning Federal employees, however, is fully disclosable.

In addition to published information, county-level data and historical data are available from the BLS Washington office either on hard copy or on a computer medium such as ADP tapes and floppy disks on a cost-reimbursable basis. The charge for this service varies according to the complexity and volume of the request. Write to the Division of Occupational and Administrative Statistics, Office of Employment and Unemployment Statistics, U.S. Department of Labor, Bureau of Labor Statistics, 441 G Street NW., Washington, DC 20212.

The individual States, which have a wide variety of users for the data, usually publish their own reports using ES-202 data.

Uses

As the most complete universe of monthly employment and quarterly wage information by industry, county, and State, the ES-202 series has broad economic significance in evaluating labor trends and major industry developments in time series analyses and industry comparisons, and in special studies such as analyses of wages by size of unit.

The program provides data necessary to both the Employment and Training Administration and the various State employment security agencies in administering the employment security program. The data accurately reflect the extent of coverage of the State unemployment laws and are used to measure UI revenues and disbursements; national, State, and local area employment; and total and taxable wage trends. The information allows actuarial studies, determination of experience ratings, maximum benefit levels, areas needing Federal assistance, and also helps ensure the solvency of unemployment insurance funds.

The ES-202 data are used by a variety of other BLS programs. They serve, for example, as the basic source of benchmark information for employment by industry and by size of firm in the Current Employment Statistics Program (BLS 790). The Unemployment Insurance Name and Address File, compiled from ES-202 reports, also serves as a national sampling frame for establishment surveys by the Industry/Area Wage, Producer Price Index, and Occupational Safety and Health Statistics programs.

Additionally, the Bureau of Economic Analysis of the Department of Commerce uses ES-202 wage data as a base for estimating a large part of the wage and salary component of national personal income and gross national product. These estimates are instrumental in Federal allocation of revenue-sharing funds to State and local governments. The Social Security Administration also uses ES-202 data in updating economic assumptions and forecasting trends in the taxable wage base.

Finally, business and public and private research organizations find the ES-202 program one of the best sources of detailed employment and wage statistics.

Technical References

U.S. Department of Labor, Bureau of Labor Statistics. *Employment and Wages, Annual Averages, 1985,* Bulletin 2272, November 1986.

Bureau of Labor Statistics. "ES-202, Operating Manual," *Employment Security Manual,* Part III, Sections 0400–0599, revised on a regular basis.

U.S. Department of Labor, Employment and Training Administration. "Comparison of State Unemployment Insurance Laws," revised on a regular basis.

Chapter 6. Occupational Pay and Supplementary Benefits

Background

For many decades, the Bureau of Labor Statistics has conducted studies of wages by occupation and industry. The best known of its early studies stemmed from a Senate resolution of March 3, 1891, which instructed its Committee on Finance to investigate the effects of tariff legislation on wages and prices. At the request of the committee, the Bureau developed detailed data for 1889–91 and a more limited wage rate history extending back continuously to 1860, and in some cases to 1840. Systematic collection of wage data by occupation and industry has continued since the turn of the century; changes in coverage have been dictated mainly by government requirements. Thus, a large survey program undertaken for the War Industries Board in 1919 produced occupational pay rates by industry and State, and (for some industries) by city. Between 1934 and 1940, the selection of industries studied was determined largely by administrative needs under the National Industrial Recovery Act, the Public Contracts Act, and the Fair Labor Standards Act, with emphasis on nationwide data for relatively low-wage industries.

Survey activity shifted in the early 1940's defense period to heavy industries essential to war production. Implementation of wage stabilization policy during the war required a large-scale program of occupational wage studies by industry and locality. The emphasis on data by locality has continued since 1945 within the framework of industry studies generally designed to yield national and regional estimates. In addition, since World War II the Bureau has developed two new types of occupational wage surveys.

Area wage surveys, initiated in the late 1940's, were designed to meet the growing demand for pay data related to office clerical and manual jobs that are common to a wide variety of manufacturing and nonmanufacturing industries within a metropolitan area. This survey program was firmly established and temporarily expanded for use in the wage stabilization effort during the Korean emergency. In 1960, the program was converted from a study of metropolitan areas of special interest to a statistically selected group of areas from which data could be projected to represent all metropolitan areas of the United States, excluding Alaska and Hawaii.

Also in 1960, the Bureau began conducting an annual nationwide survey of professional, administrative, technical, and clerical jobs in a broad spectrum of private industries. The survey was begun in preparation for the Federal Salary Reform Act of 1962 and is currently being used in administering the Federal Pay Comparability Act of 1970, which governs adjustments in salaries of most Federal white-collar employees.

Description of Surveys

Although differing in industrial, geographic, and occupational coverage, these surveys form an integrated program of occupational wage studies based upon a common set of administrative forms, a single manual of procedures, and common concepts and definitions. Survey data, collected largely by personal visits, are provided by employers on a voluntary basis. In return, the Bureau pledges confidentiality for the information and publishes it in a manner that will avoid possible disclosure of an establishment's pay rates. In all surveys, establishments are classified by industry as defined in the *Standard Industrial Classification Manual* (SIC) prepared by the U.S. Office of Management and Budget.[1] Survey reports identify the minimum size of the establishments (measured by total employment) studied. Metropolitan Statistical Area definitions are employed in all programs.[2]

Industry Wage Surveys, conducted in selected manufacturing and nonmanufacturing industries, provide data for occupations selected to represent a range of activities performed by workers in the industry during a specified payroll month. In selecting the occupations, primarily nonsupervisory, consideration is given to their prevalence in the industry, definiteness and clarity of duties, use as reference points in collective bargaining, and importance in representing the industry's wage structure.

[1] See appendix B.

[2] The Office of Management and Budget replaced the designation "Standard Metropolitan Statistical Areas" with "Metropolitan Statistical Areas" (MSA's) and "Primary Metropolitan Statistical Areas" (PMSA's) in June 1983. These new designations are being gradually introduced into the occupational wage surveys as the program schedules permit.

In addition to reporting straight-time first-shift wage rates of individuals in the selected occupations (or hours and earnings for incentive workers), surveys in most industries also provide pay distributions for broad employee groups, such as all production and related workers or all nonsupervisory workers.

Weekly work schedules; shift operations and shift pay differentials; paid holiday and vacation practices; and incidence of health, insurance, and retirement plans are included in the information collected, along with other items of interest in a particular industry, for example, incidence of cost-of-living adjustment (COLA) provisions or company-provided work clothing. The studies also provide estimates of workers covered by labor-management agreements, proportions employed under incentive pay plans, and the extent to which establishments have a single pay rate or a range of rates for individual job categories.

Twenty-five manufacturing and fifteen nonmanufacturing industry surveys, accounting for about 22 million employees, are conducted at the 3- or 4-digit SIC level of industry detail. A majority are on a 5-year cycle, but a number of comparatively low-wage industries are on a 3-year cycle. The program covers a broad cross-section of the Nation's economy, including automobile and steel manufacturing as well as banking, computer data services, and hospitals.

Nearly all of the manufacturing, utility, and mining industries are studied on a nationwide basis, and estimates are provided also for broad regions and major local areas of employment concentration wherever possible. Surveys in trade, finance, and service industries usually are limited to about two dozen metropolitan areas. Nationwide surveys generally develop separate employment and wage estimates by size of establishment, type of area (metropolitan or nonmetropolitan), labor-management agreement coverage status, and type of product or plant group.

Area Wage Surveys, conducted in a sample of metropolitan areas, provide wage data annually or every second year for selected office clerical, professional, technical, maintenance, toolroom, powerplant, material movement, and custodial occupations common to a wide variety of industries in the areas surveyed. The occupations studied provide representation of the range of duties and responsibilities associated with white-collar jobs, skilled maintenance trades, and custodial and material movement jobs. Weekly salaries reported for individuals in white-collar jobs relate to regular straight-time salaries paid for standard workweeks. Earnings information for plant workers excludes late-shift differentials and premium pay for overtime.

Industry divisions included in these surveys are: (1) manufacturing; (2) transportation, communication, and other public utilities; (3) wholesale trade; (4) retail trade; (5) finance, insurance, and real estate; and (6) selected service industries. Establishments employing fewer than 50 workers are excluded. However, in the 19 largest areas, establishments in manufacturing; transportation, communication, and other public utilities; and retail trade must employ a minimum of 100 workers to be included in the survey.

In addition to the all-industry pay averages and distributions of workers by earnings classes, separate data are provided for manufacturing and nonmanufacturing in each area, and for transportation, communication, and other public utilities in all but nine areas. In 31 of the larger areas, wage data are presented separately for establishments that have 500 workers or more. In 1987, the program increased its sample of areas from 70 to 90, with 61 being studied each year. The 32 largest areas, in terms of nonagricultural employment, are surveyed annually, and two groups of 29 areas each are surveyed in alternate years. All of the areas are Metropolitan Statistical Areas or Primary Metropolitan Statistical Areas as defined by the Office of Management and Budget through October 1984.

Data on weekly work schedules; paid holiday and vacation practices; and health, insurance, and retirement plans are recorded separately for nonsupervisory office workers and production and related workers. Information relating to shift operations and shift pay differentials is published for production workers in manufacturing, while data on minimum entrance rates are collected for inexperienced office workers in all industries. While the wage data are collected annually or every 2 years, establishment practices and benefit items are studied every 3 or 4 years.

Area type wage surveys have also been conducted since 1967 at the request of the Employment Standards Administration of the U.S. Department of Labor for use in administering the Service Contract Act of 1965. Survey scope and method are the same as for the Bureau's regular area surveys, but a more limited number of occupations and benefits are studied. In some cases, surveys relate to geographic areas other than Metropolitan Statistical Areas. Wage data are published annually or every second year and benefits data every 3 or 4 years for all industries combined.

Both programs of area wage surveys are conducted throughout the calendar year, with each survey relating to a specific month.

The National Survey of Professional, Administrative, Technical, and Clerical Pay (PATC) provides broadly based information on white-collar salary levels and distributions in private employment, as of March each year. Approximately 110 occupational work levels were studied in 1985 selected from the following fields: Accounting, legal services, personnel management, engineering and chemistry, purchasing, photography, drafting, computer science, and clerical. Definitions for

these occupations provide for classification of employees into appropriate work levels. Although reflecting duties and responsibilities in private industry, the definitions are designed to be translatable to specific pay grades of Federal white-collar employees. As a result, this survey provides information suitable for use in comparing pay of salaried employees in the Federal civil service with pay of their counterparts in private industry.

Monthly and annual average salaries are reported by occupational work level. Data relate to the straight-time salary corresponding to the employee's normal work schedule, excluding overtime hours. Salary averages are presented for all establishments covered by the survey, establishments employing 2,500 workers or more, and for metropolitan areas as a group.

Industry divisions included in the PATC survey are: (1) mining; (2) construction; (3) manufacturing; (4) transportation, communications, electric, gas, and sanitary services; (5) wholesale trade; (6) retail trade; (7) finance, insurance, and real estate; and (8) services.

Limited to the Nation's metropolitan areas during 1960–64, the annual survey was expanded in 1965 to include nonmetropolitan counties. In 1985, the minimum establishment size included in the survey was 50, 100, or 250 employees, depending on the industry. This minimum has been adjusted at various times since 1961 in response to the specifications of the President's Pay Agent (the Secretary of Labor and the Directors of the Office of Personnel Management and the Office of Management and Budget).[3] Because the survey scope is subject to change, users are directed to the published bulletins for a description of current practice.

Concepts

The Bureau's occupational wage surveys summarize a highly specific wage measure—the rate of pay for individual workers, excluding premium pay for overtime and for work on weekends, holidays, and late shifts. Also excluded are performance bonuses and lump-sum payments of the type negotiated in the auto and aerospace industries, as well as profit-sharing payments, attendance bonuses, Christmas or year-end bonuses, and other nonproduction bonuses. Pay increases—but not bonuses—under cost-of-living allowance clauses and incentive payments, however, are included. For workers paid under piecework or other types of production incentive pay plans, an hourly earnings figure serves as a proxy for the wage rate; it is computed by dividing straight-time earnings over a time period by corresponding hours worked.

[3] The agent has responsibility for making salary comparisons between Federal white-collar workers and their private-sector counterparts and recommending pay increases for Federal white-collar workers based on these comparisons.

Unless stated otherwise, rates do not include tips or allowances for the value of meals, room, uniforms, etc. The earnings figures, thus, represent cash wages (prior to deductions for Social Security and income taxes, savings bonds, premium payments for group insurance, meals, room, or uniforms) after the exclusion of premium pay for overtime, weekend, holiday, or late-shift work.

Hours shown for salaried occupations relate to standard weekly hours for which the employee receives regular straight-time salary.

Survey occupations are defined in advance in a uniform set of job descriptions. Because of the emphasis on comparability of occupational content across establishments, the Bureau's job descriptions may differ significantly from those in use in individual establishments or those used for other purposes. The primary objective of the description is to identify the essential elements of skill, difficulty, and responsibility that establish the basic concept of the job. In general, the Bureau's survey job descriptions are more specific than those published in the *Standard Occupational Classification Manual,* prepared by the U.S. Office of Management and Budget.[4]

Although work arrangements in any one establishment may not correspond precisely to those described, workers meeting the basic requirements established for the job are included.[5]

In applying the survey job descriptions, the Bureau's field representatives exclude working supervisors and those paid less than the established job rate, such as apprentices, learners, beginners, trainees, handicapped workers whose rates are reduced because of their handicap, part-time or temporary workers, and probationary workers unless provision for their inclusion is specifically stated.

[4] An example of a job description: Maintenance Machinist: Produces replacement parts and new parts in making repairs of metal parts of mechanical equipment. Work involves most of the following: Interpreting written instructions and specifications; planning and laying out of work; using a variety of machinists' handtools and precision measuring instruments; setting up and operating standard machine tools; shaping of metal parts to close tolerances; making standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining; knowledge of the working properties of the common metals; selecting standard materials, parts, and equipment required for this work; and fitting and assembling parts into mechanical equipment. In general, the machinist's work normally requires a rounded training in machine-shop practice usually acquired through a formal apprenticeship or equivalent training and experience.

[5] In general, workers are included in a classification if the described duties are performed a major part of the time and the remainder is spent on related duties requiring similar or lesser skill and responsibility. However, in some jobs, particularly office and skilled production-worker categories, workers may regularly perform a combination of duties involving more than one occupation. Unless indicated otherwise in the description, in these situations consideration for classification purposes is given to those elements of the job which are most important in determining its level for pay purposes. Thus, a worker meets the basic concept of the stenographer classification if taking dictation is a regular requirement of the job even though a majority of the time is spent on routine typing.

Tabulations of the incidence of paid holidays, paid vacations, and health, insurance, and retirement plans are based on the assumption that plans are applicable to all covered nonsupervisory production or office workers if a majority of such workers are eligible or can expect eventually to qualify for the practices listed. Data for health, insurance, and retirement plans are limited to plans for which at least a part of the cost is borne by the employer. Informal provisions are excluded. (For a description of the Bureau's comprehensive study of employee benefits in medium and large firms, see chapter 9 of this bulletin.)

Survey Methods

Planning. The needs of major users are a prime consideration in designing the Bureau's multipurpose occupational wage surveys. Consultations are held with appropriate management, labor, and government representatives to obtain views and recommendations related to scope, timing, selection and definitions of survey items, and types of tabulations. Particularly in planning surveys in specific industries, these discussions supplement feedback received from the Bureau's regional offices on their experiences in collecting data for the previous study. Reflecting its use in evaluation of Federal white-collar pay, the design of the National Survey of Professional, Administrative, Technical, and Clerical Pay was developed in conjunction with the Office of Management and Budget and the Office of Personnel Management. Changes in the survey scope, item coverage, and job definitions are initiated by these agencies.

The industrial scope of each survey is identified in terms of the classification system provided in the *Standard Industrial Classification Manual.* The scope may range from part of a 4-digit code for an industry study to a uniform combination of broad industry divisions and specific industries for the area wage surveys or the national survey of professional, administrative, technical, and clerical jobs.

The minimum establishment size included in a survey is set at a point where the possible contribution of the excluded establishments to the pay averages is regarded as negligible for most of the occupations surveyed. Another practical reason for the adoption of size limitations is the difficulty encountered in classifying workers in small establishments where they do not perform the specialized duties indicated in the survey job definitions.

Considerations in timing of industry wage surveys include expiration dates of major labor-management agreements, deferred wage adjustments, seasonality of production, and special needs of users. Wherever possible, area wage surveys are timed to follow major wage settlements as well as to meet the needs of government agencies administering various wage statutes.

The types of occupations studied and the criteria used in their selection are identified in the descriptions of the various types of surveys. The job list for each survey is selected to represent a reasonably complete range of rates in the wage structure for the employment categories involved; e.g., production and related workers in a specific manufacturing industry or nonsupervisory office, maintenance, material handling, and custodial workers in a metropolitan area. The established hierarchy of job rates to be found within establishments and industries permits the use of pay data for such key or benchmark jobs for interpolating rates for other jobs. Technological developments or user interests may dictate changes over time in the job lists and definitions. New definitions for jobs usually are pretested in a variety of establishments prior to their use in a full-scale survey.

Questionnaires. Two basic reporting forms are used in all surveys. The first (BLS 2751A) includes items relating to products or services, employment, shift operations and differentials, work schedules, wage payment plans, minimum entrance rates, paid holidays and vacations, insurance and retirement plans, union contract coverage, and other items applicable to the establishments. The second (BLS 2753G) is used in recording such information as occupation, sex, method of wage payment, hours, and pay rate or earnings for each worker studied. Supplementary forms are used to meet particular needs.

Data collection. Bureau field representatives typically visit the sample establishments in a survey and collect data for a specified payroll period. They carefully compare job functions and factors in the establishment with those included in the Bureau job definitions. This job-matching process may involve review of records (such as pay structure plans, organizational charts, and company position descriptions), interviews with appropriate officials, and, on occasion, observation of jobs within establishments. A satisfactory completion of job matching permits acceptance of company-prepared reports where this procedure is preferred by the respondent. Generally, however, the field representative secures wage or salary rates (or hours and earnings data, when needed) from payroll or other records, and data on the selected employer practices and employee benefits from company officials, company booklets, or labor-management agreements.

Area wage surveys in each locality are conducted by personal visits every third or fourth year, with partial collection by mail or telephone in the intervening years. Establishments participating in the mail collection receive a transcript of the job-matching and wage data obtained previously, together with the job definitions. The returns are scrutinized, and questionable entries are checked with the respondent. Visits are made to establishments not suitable for other types of collection, those not responding to the mail or telephone request, and those reporting unusual changes from previous survey data.

The work of field representatives is checked for completeness and quality of reporting and accuracy in job matching. Revisits are made by supervisory and senior representatives on a selective basis. Systematic technical audits of the validity of survey definitions, made by staff with specialized training, also are maintained for the technically complex nationwide white-collar salary survey.

Sampling

All surveys are conducted on a sample basis using a suitable sampling "frame," that is, a list of establishments which fall within the designated scope of the survey. The frame is as close to the universe as possible but is often incomplete. BLS uses frames primarily compiled from lists provided by administrative or regulatory government agencies (primarily State unemployment insurance agencies). These may be supplemented by data from directories, trade associations, labor unions, and other sources as needed. For survey purposes, an "establishment" generally refers to a single physical location in manufacturing industries and to all outlets of a company within an area or county in nonmanufacturing industries.

The survey design employs a high degree of stratification. Each geographic-industry unit for which a separate analysis is to be presented is sampled independently. Within these broad groupings, a finer stratification by product (or other pertinent attribute) and size of establishment is made. Stratification may be carried still further in certain industries: Coal mines, for instance, are classified into underground and surface mines. Such stratification is important if the occupational structure differs widely among the various industry segments.

The sample for each industry-area group is a probability sample, that is, each establishment has a predetermined chance of selection. However, in order to secure maximum accuracy at a fixed level of cost (or a fixed level of accuracy at minimum cost) the sampling fraction used in the various strata, or sampling cells, ranges downward from all large establishments through progressively declining proportions of the establishments in each smaller size group. This procedure follows the principles of optimum allocation using the average employment in the stratum as the design variable. Thus, each sampled stratum will be represented in the sample by a number of establishments roughly proportionate to its share of total employment. The method of estimation employed yields unbiased estimates by the assignment of proper weights to the sampled establishments.

The size of the sample in a particular survey depends on the size of the universe, the diversity of occupations and their distribution, the relative dispersion of earnings among establishments, the distribution of the establishments by size, and the degree of accuracy required.

Area wage surveys are limited to selected metropolitan areas, which form a sample of all such areas and, when properly combined (weighted), yield employment and wage estimates at the national and regional levels. The sample of areas is based on the selection of one area from a stratum of similar areas. The criteria for stratification are region, type of industrial activity as measured by percent of employment in manufacturing, and major industries. Each area within a stratum is selected with its probability of selection proportionate to its nonagricultural employment. The larger metropolitan areas are self-representing; i.e., each one forms a stratum by itself and is certain of inclusion in the area sample.

Estimating Procedures

Estimated average earnings (hourly, weekly, monthly, or annual) for an industry or an occupation are computed as the arithmetic mean of individual employee earnings.

All estimates are derived from the sample data. The averages for occupations, as well as for industries, are weighted averages of individual earnings and are not computed on an establishment basis. Employee benefit provisions which apply to a majority of the production or office workers in an establishment are considered to apply to all production or office workers in that establishment and are considered nonexistent when they apply to less than a majority.

To obtain unbiased estimates, each establishment is assigned a weight that is the inverse of the sampling ratio for the stratum from which it was selected; e.g., if a third of the establishments in one stratum are selected, each of the sampled establishments is given a weight of 3.

To illustrate the use of weights, suppose the universe was seven establishments, from which a sample of three was selected. Assume that establishment A was 1 of 2 establishments in its stratum. It is chosen for the sample and is given a weight of 2. Establishment B, on the other hand, was taken with certainty (or a probability of 1) and is thus given a weight of 1. Establishment C was taken from the remaining group where 1 of the 4 establishments was used in the sample, and hence is given a weight of 4. The following calculations are made in estimating average earnings for a given occupation:

		Workers in occupation in sample establishments		*Estimates of total in stratum*	
Establishment	*Weight*	*Actual employment in occupation*	*Average hourly earnings*	*Workers*	*Earnings*
A	2	40	$10.40	2x40	2x40x$10.40
B	1	50	11.20	1x50	1x50x 11.20
C	4	10	10.60	4x10	4x10x 10.60
Estimated universe				170	$1,816.00

A similar method applies to any characteristic estimated from the sample. To estimate the proportion of employees in establishments granting paid vacations of 2 weeks after 2 years of service, for instance, the establishments are classified according to the length of vacation granted after 2 years' service, establishment weights are applied to employment, as in the previous example, and the proportion of the estimated employment in the 2-week category is computed. Using the three establishments in the previous example, this can be illustrated as follows:

Establishment	*Weight*	*Actual total establishment employment*	*Weighted employment*	*Vacation provisions after 2 years*
A	2	100	200	1 week
B	1	500	500	2 weeks
C	4	75	300	1 week
Estimated universe			1,000	

Thus, the estimated percentage of workers in establishments granting 2 weeks' vacation after 2 years of service is $\frac{500}{1,000}$ or 50 percent.

In the area wage survey program, where a sample of selected metropolitan areas is used to represent the totality of such areas, a second stage of weighting is used to expand the individual area estimates to regional and national levels. Since each area represents a stratum of similar areas, the total from each area is weighted to the estimated stratum totals by multiplying by the inverse of the chance of selection. Summing all such estimated stratum totals yields the earnings and employment totals for the regional and the national estimates.

BLS occupational wage surveys have response rates generally exceeding 80 percent of establishments contacted. However, when a sample establishment does not provide data, the weights of responding sample establishments from the same stratum are increased to adjust for the missing data. Establishments that are out of business or outside the scope of a survey, and their sampling weights, are dropped from survey estimates.

Analysis and Presentation

Survey results are published in BLS bulletins, reports, news releases, and the Bureau's *Monthly Labor Review*. Industry wage and area wage survey reports and bulletins are issued throughout the year as the surveys are completed. The bulletin on the national survey of professional, administrative, technical, and clerical pay, preceded by a news release in July or August, becomes available each fall. Copies of BLS reports and releases are available upon request. Bulletins are sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; GPO bookstores; and the BLS Chicago Regional Office, Publications Sales Center, P.O. Box 2145, Chicago, IL 60690. A brief discussion of some features related to these publications follows.

Where an industry survey is designed to yield estimates for selected States or areas, summary reports are published separately as this local information becomes available. Industry surveys limited to selected areas do not provide pay tabulations by type of area, size of establishment, product, or labor-management agreement coverage that generally are included in reports on nationwide surveys. Regardless of geographic scope, industry reports record the incidence of incentive pay plans and, to the extent possible, show pay data separately for time and incentive workers.

Area wage survey reports and bulletins provide percentage pay increases, adjusted for changes in employment, for industrial nurses and four broad occupational groups: Office clerical, electronic data processing, skilled maintenance, and unskilled plant workers. These increases are computed for all industries, manufacturing, and nonmanufacturing, for each metropolitan area studied. The computations include data only from establishments included in both years of the survey being compared.

Pay relatives for the same broad occupational categories, expressing area average pay as a percentage of the national average, are published each summer in two reports: *Wage Differences Among Metropolitan Areas* and *Wage Differences Among Selected Areas.* (The first of these reports covers the areas in the area wage survey program; the latter covers areas surveyed for the Employment Standards Administration.) These reports permit ready comparisons of average pay levels among areas.

Estimates of labor-management agreement coverage of plant and office workers are included every third or fourth year in each area wage survey. Occupational pay relationships within individual establishments are summarized in the individual area bulletins.

The annual bulletins, *National Survey of Professional, Administrative, Technical, and Clerical Pay,* present occupational salary averages and distributions on an all-industry basis, nationwide and separately for all metropolitan areas combined, and for establishments employing 2,500 workers or more. Average pay levels by industry division are shown as percentages of the all-industry averages. Salary trend estimates for the occupations studied are included as a byproduct of the survey. Prior to 1987, survey coverage extended fully to all private-sector industry divisions except services, in which coverage was limited.[6] The 1987 survey, in contrast, was restricted to services but covered the entire industry division.

[6] The 1986 coverage of services was limited to engineering, architectural, and surveying services; commercially operated research, development, and testing laboratories; credit reporting and collection agencies; computer and data processing services; management, consulting, and public relations services; noncommercial educational, scientific, and research organizations; and accounting, auditing, and bookkeeping services.

The *Monthly Labor Review* regularly publishes articles on the occupational wage surveys in two forms. Research summaries alert interested parties to a survey that has been completed by providing highlights of the findings. Special topical articles provide in-depth analyses of wages and related benefits. (See references at the end of this chapter for specific *MLR* articles.)

In addition to the survey publications, BLS regularly makes computer tapes available for sale on the area wage and PATC surveys. Requests for computer tapes on industry wage surveys are considered on an individual survey basis. Filling such requests primarily depends upon the Bureau's ability to protect the identity of respondents and their data.

Uses and Limitations

Occupational wage data developed in BLS surveys have a variety of uses. They are used by Federal, State, and local agencies in wage and salary administration and in the formulation of public policy on wages, as in minimum wage legislation. They are of value to Federal and State mediation and conciliation services and to State unemployment compensation agencies in judging the suitability of job offers. Knowledge of levels, structures, and trends of pay rates by occupation, industry, locality, and region is required in the analysis of current economic developments and in studies relating to wage dispersion and differentials.

Bureau data are used in private wage or salary determinations by employers or through the collective bargaining process. To the extent that wages are a factor, survey data also are considered by employers in selecting locations for new facilities and in cost estimating related to contract work.

Occupational wage survey programs are not designed to supply mechanical answers to questions of pay policy. As suggested earlier, limitations are imposed in the selection and definition of industries, of geographic units for which estimates are developed, of occupations and associated items studied, and in determination of periodicity and timing of particular surveys. Depending upon user needs, it may be necessary to interpolate for occupations or areas missing from a survey on the basis of knowledge of pay relationships.

Because of variation among establishments in the proportion of workers in the jobs studied and in the general level of pay, the survey averages do not necessarily reflect either the absolute or relative relationship found within the majority of establishments. As mentioned earlier, however, area wage survey bulletins provide some insights into pay relationships within establishments through special analytical tables.

The incidence of incentive pay systems may vary greatly among the occupations and establishments studied. Because average hourly earnings of incentive workers generally exceed those of time-rated workers in the same job, data are shown separately wherever possible for the two groups in industry surveys. Incentive plans apply to only a very small proportion of the workers in the indirect plant jobs studied in the area wage program.

Although survey-to-survey changes in pay averages for a job or job group primarily reflect general wage and salary changes or merit increases received by individuals, these averages also may be affected by other factors. Common among these are labor turnover, labor force expansions and reductions for other reasons, and changes in the proportion of workers employed in high- and low-paying establishments. A labor force expansion might increase the proportion of workers in lower paid, entry type jobs and thereby tend to lower the average; or the closing of a relatively high-paying establishment could cause average earnings in the area to drop.

Much of this problem has been overcome for area wage survey measures of pay change by holding establishment employment constant while computing percent increases in earnings. That is, the previous and current survey earnings of each establishment are weighted by that establishment's employment at the time of the previous survey. Under this system, measurement of change is limited to establishments included in two consecutive surveys.

The effect of employment shifts among occupations between survey dates also is eliminated in measuring average earnings increases for workers covered by the PATC survey and by the machinery industry wage survey. Employment shifts among establishments or turnover of establishments included in survey samples, however, are not controlled in these computations, as they are in calculating area wage survey trends.

In general, the occupational wage survey programs are designed to measure pay levels and pay structures at specified points of time, rather than wage trends. For this reason, users are directed to other BLS series that are more appropriate indicators of wage change, such as the Employment Cost Index (see chapter 8 of this bulletin).

Reliability of surveys. Results of the surveys are subject to both sampling and nonsampling error. Sampling errors occur because observations come from a sample, not the entire population or universe defined for a survey. They will not be uniform for the occupations studied because the dispersion of earnings among establishments and the frequency of occurrence of the occupations differ. The sample is designed so that the chances are 9 out of 10 that the published estimates on average earnings generally do not differ by more than 5 percent from the average that would be obtained by studying all establishments in the survey universe.

The sampling error of the percentage of workers receiving any given employee benefit differs with the size of the percentage. However, the error is such that rankings of predominant practices almost always will appear in

their true position. Small percentages may be subject to considerable error but will always remain in the same scale of magnitude. For instance, the proportion of employees in establishments providing more than 5 weeks' paid vacation to long-service employees may be given as 2 percent, when the percentage for all establishments might be only 1 percent. Such a sampling error, while considerable, does not affect the essential inference that the practice is a rare one.

Estimates of the number of workers in a given occupation may have considerable sampling error, due to the wide variation among establishments in the proportion of workers found in individual occupations. (It is not unusual to find sampling errors of as much as 20 percent.) Hence, the estimated number of workers can be interpreted only as a rough indicator of the relative importance of various occupations. The greatest degree of accuracy in these employment counts is for occupations found principally in large establishments.

Since completely current and accurate information regarding establishment products and the creation of new establishments is not available, the universe from which the sample is drawn may be incomplete. Sample firms incorrectly classified are accounted for in the actual field work, and the universe estimates are revised accordingly. Those firms which should have been included but were classified erroneously in other industries cannot be accounted for.

Since some measure of judgment enters into the classification of occupations and other characteristics, there is some reporting variability in the results. A repetition of the survey in an establishment with different interviewers and respondents would undoubtedly produce slightly different results. Hence, analyses based on a small number of respondents must be used with care, even when all eligible establishments are included. However, when spread over a large number of establishments the differences, being random, would tend to balance out. No evidence of any consistent error has been uncovered.

Nonsampling errors can come from a number of other sources, including inability to obtain information from some establishments, definitional difficulties, inability of respondents to provide correct information, and errors in recording and coding the data obtained or estimating for missing data. Although not specifically measured, the surveys' nonsampling errors are likely to be minimal due to relatively high response rates, well-trained field representatives, careful review of the data, and other survey controls and procedures.

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Chapter 7. Negotiated Wage and Benefit Changes

The Bureau of Labor Statistics prepares information on current changes in wages and supplementary benefits agreed to in collective bargaining. The information includes monthly listings of companies, employer associations, or governmental units in which such changes have occurred, the unions involved, and the nature of the change. BLS also prepares quarterly and annual statistical summaries of negotiated wage changes in all major collective bargaining situations in private industry, and semiannual summaries for State and local government bargaining units.

Background

BLS began publication of the monthly listing of settlements in 1948, when prices and wage rates were rising rapidly and interest grew in determining the extent to which settlement patterns spread from industry to industry. The statistical series summarizing wage changes was initiated in 1949; regular quarterly publication was begun in 1954. In 1964, with the increasing importance of supplementary benefits such as various forms of premium pay, paid leave, and employer payments for health, insurance, and pension benefits, the Bureau began to estimate the size of negotiated changes in total compensation—the wage and benefit package. Beginning with 1979, similar data have been published for State and local government bargaining units.

Description of Statistical Series

Coverage

Private industry agreements. The series summarizes wage rate changes in major collective bargaining settlements (settlements covering 1,000 workers or more) for production and related workers in manufacturing and nonsupervisory workers in nonmanufacturing. BLS currently follows about 1,350 bargaining situations, for virtually complete coverage of major agreements. Changes in total compensation are measured for agreements covering 5,000 workers or more in all industries and 1,000 workers or more in construction.

Contracts covering multiplant firms are included if the agreement as a whole covers 1,000 workers even though each plant employs fewer workers. Also included are contracts with trade associations or with groups of firms that bargain jointly with a union or unions even though the firms are not associated formally and each has fewer than the minimum number of workers within the scope of the series. When two or more unions, together representing at least 1,000 workers but individually representing fewer than 1,000, negotiate essentially identical contracts with one or more firms, the workers involved are considered to constitute one bargaining unit.

State and local government agreements. This series summarizes wage and benefit changes for workers in State and local governments where: (1) a labor organization is recognized as the bargaining agent for a group of workers; (2) the settlements are embodied in signed, mutually binding contracts; and (3) wages are determined by collective bargaining. When introduced in 1979, this series presented wage and benefit measures for units of 5,000 workers or more. Beginning with 1984 data, the coverage for wage data was expanded to units of 1,000 workers or more. As of 1986, this series covers 2.3 million workers in 612 bargaining units. About one-half of all State and local government employees covered by collective bargaining agreements are included in the series.

Data presented

Wages. Two types of information are presented on wages. Settlement data measure wage adjustments specified in the bargaining settlements reached during a particular time period (e.g., quarter or year). They reflect decisions to increase, decrease, or not change wages. These data exclude wage changes that may occur under cost-of-living adjustment (COLA) clauses which link the size of future wage adjustments to changes in the Consumer Price Index. Lump-sum payments, which are typically negotiated instead of wage increases or to offset wage decreases, are also excluded. Both the adjustments scheduled during the first 12 months of the contract (first-year changes) and the total of wage adjustments scheduled over the life of the contract, expressed as an annual rate, are presented. There are two measures of wage changes that are implemented in a reference period. The *effective wage adjustment* measure includes increases, decreases, and no change in wages during

the reference period for all workers in the series. The increases and decreases, which stem from settlements reached in the period, agreements reached in a prior period, and COLA clauses, are reflected in the *effective wage change* measure, which relates only to workers whose wages change.

Compensation. Although at one time the economic terms of collective bargaining settlements involved wage rates almost exclusively, today, a wide variety of benefits are also involved. "Compensation" refers to the total of pay and benefits. As with wage data, the Bureau publishes compensation data for settlements reached during a period, but limited to settlements covering at least 5,000 workers in all industries and at least 1,000 workers in construction. Adjustments scheduled for the first year of the contract, and those scheduled over the entire contract term, expressed as an annual rate, are published. The compensation measures exclude COLA adjustments and lump-sum payments.

Data Sources

Calculations of the size of negotiated wage and benefit changes are based on actual characteristics of the work force affected by the settlements. These include the distribution of workers by occupation, earnings, and length of service. When estimates of compensation changes are made, data are also obtained on employer costs for various benefits. The data on work force characteristics and benefit costs are usually obtained directly from the companies as part of a variety of BLS surveys. (Data for these surveys are collected under a pledge that they will be kept confidential and not released outside the Bureau.) Other data sources for these calculations include the file of union contracts maintained by BLS, the file of pension and insurance benefit agreements and financial information maintained by the Department of Labor's Labor-Management Services Administration, and secondary sources. Secondary sources, including general circulation newspapers and periodicals and union, management, and trade publications, are used in producing listings of agreements.

Estimating Procedures

Procedures for pricing settlements center around three questions: (1) For which items in a collective bargaining settlement are costs to be determined? (2) How are the costs to be determined? (3) How are the costs to be expressed?

Items included in pricing

Many terms of a union-management agreement besides wage and benefit provisions may affect an employer's costs. For example, seniority provisions may influence costs through their effect on employee efficiency. Such effects, however, are not measurable. Consequently, the BLS program is confined to measuring the wage and benefit components; i.e., to measuring the effect of settlements on employer outlays for employee compensation. Included are: Changes in wage rates; modifications in premium pay, paid leave, and severance pay; and adjustments in employer payments for pension, health and welfare, and supplemental unemployment benefits, excluding the costs of administering these benefits. Also included are changes in contract provisions specifying paid time for clothes change, washup, and lunch periods. Excluded are items which, although related to compensation, are not normally considered part of compensation such as per diem payments, moving expense reimbursements, payments for safety clothing, and provision of facilities or services such as parking lots and health units.

Indirect effects of settlements are ignored; factors such as possible extension of settlement terms to nonunion workers in the same firm or to members of other bargaining units are not considered. Similarly, although the cost of providing lengthened vacations is measured (by the wages and salaries paid for the additional time off), the cost of hiring vacation replacements, if necessary, is not measured. Moreover, effects on unit labor costs, which involve consideration of employee efficiency as well as employer payments, are disregarded.

Determination of costs

Since a value is placed on settlements at the time they are reached, the costs attributed to them are estimates of outlays to be made in the future; they cannot be taken from employers' accounting records. The estimates are made on the assumption that conditions existing at the time the contract is negotiated will not change. For example, analysts assume that methods of financing pensions will not change, and that expenditures for insurance will not change except as a result of altered benefit provisions or modified participation because of changes in company contributions. They also assume that the composition of the labor force will not change.

Except for any guaranteed increases, which are treated as deferred adjustments, possible wage rate changes that may result from COLA clauses are excluded because it is impossible to predict changes in the Consumer Price Index. Lump-sum payments (e.g., those made instead of wage increases, performance bonuses, and attendance bonuses) are also excluded.

Estimates of compensation changes attempt to measure the costs associated with actual characteristics of the work force affected by the settlements, not the costs for some hypothetical employee group. Estimates based on the actual age, length of service, sex, and skill characteristics

of the workers involved recognize that the choice in incorporating alternative benefit changes into contracts is affected by their costs, which, in turn, are affected by the character of the work force. For example, an extra week of vacation after 15 years of service will cost very little when only 10 percent of the workers have that much service, but will add about 1 percent to the annual cost of straight-time pay for working time when half of the workers have been employed for 15 years or more.

Changes in wage rates affect costs for certain benefits that are linked to wage rates such as paid leave, Social Security, and pensions based on earnings. This effect, variously referred to as "creep," "bulge," or "rollup," is reflected in estimates of changes in compensation.

Many items in a collective bargaining agreement are priced without difficulty. This is particularly true when settlement terms are expressed as cents-per-hour adjustments; e.g., a 20-cent-an-hour general wage increase or a 5-cent increase in employer contributions to a health and welfare fund. These stipulated cents-per-hour figures are used as the costs of the settlement provisions. Percentage wage adjustments are converted to cents-per-hour figures on the basis of current average straight-time hourly earnings in the bargaining unit.

Although less direct, the cost of an additional holiday is estimated adequately by prorating 8 hours' average pay (if the normal workday is 8 hours) over the number of annual working hours per employee. The cost of an additional week of vacation for 25-year employees is estimated similarly, but one must know the number of employees with the required seniority.

Other settlement terms are more difficult to price. For example, the cost of an unfunded severance pay plan depends not only on plan provisions but on the frequency of layoffs, which at best, is hazardous to estimate. Pension improvement costs are particularly difficult to estimate because employers often have considerable discretion in funding their obligations. BLS assumes that a pension benefit change will change existing expenditures for current service proportionately. Since employer contributions for pensions frequently vary widely from year to year, outlays in several past years are examined to develop a measure of current payments.

For most provisions, BLS estimates are of actual cash outlays to be made by employers. In the case of paid leave provisions, however, an improvement may entail time off for workers, without additional cash payments by the employer. Since payment per hour worked will rise, this change is taken as the cost effect of the settlement provision. For a reduction in the basic workweek, the increase in hourly rates needed to maintain weekly pay is the major item priced. A reduced basic workweek may be accompanied by additional overtime work; unless this overtime is specified in the agreement, it is ignored in the cost estimate.

Expressing costs

The cost of a given settlement is obtained by summing the costs (in cents per hour worked) of each wage (and, if measured, benefit) change. This sum is then expressed as a percent of wages (or compensation) to facilitate comparisons of agreements by eliminating the influences of payroll size and wage level.

Expression of costs as a percent of wages (or compensation) requires estimation of an appropriate base (total wages or total compensation) as well as the cost of the settlement terms. The base used by the Bureau consists of current outlays per hour worked for wages (or for all negotiable items of employee compensation plus employer expenditures for legally required social insurance). The overall percentage change generated by each settlement is weighted by the number of workers affected (the pricing of individual settlements is not disclosed). The sum of the worker-weighted changes is divided by the total number of workers covered by settlements (including settlements that did not change wages or compensation) to determine the average percent adjustment. Effective wage adjustment data are handled in similar fashion. Since collective bargaining agreements generally are for 2-year periods or longer, BLS expresses the total percent adjustment over the contract term at an annual rate to permit comparison among agreements for differing time spans as well as to facilitate the use of the data in conjunction with other statistical series. The annual rates of adjustment take into account the compounding of successive changes. In addition, the Bureau computes first-year adjustments as a percent of current hourly wages (or compensation).

Contracts are considered to run from their effective dates to their termination dates. However, where there are wage reopening clauses, the reopening date is taken as the termination date, and any agreement under the reopening clause is treated as a new settlement. Sometimes, the parties to a contract agree to an unscheduled contract reopening. Beginning with full-year data for 1981 (published in January 1982), compensation changes negotiated under unscheduled reopenings are included in the data for new settlements. Their exclusion from earlier data on settlements made no noticeable difference because, prior to 1981, they were rare; and, when they occurred, they usually changed compensation for the balance of the contract that was already in place, typically no more than 1 year. In 1981, unscheduled reopenings became more frequent and usually resulted in new contracts that ran 2 to 3 years.

Presentation

The listing of current changes in wages and benefits is published monthly in the periodical *Current Wage*

Developments (CWD). Private industry summaries are grouped by industry, and government listings by function. The listings include the name of the employer and (when applicable) the union, the number of workers involved, the amount and effective date of the change, details of complex changes, and the reason for the change (i.e., whether it is a new settlement, a deferred increase, or a COLA).

Statistical summaries of preliminary data on settlements and total effective wage and benefit adjustments in private industry are issued first in news releases in the month following each quarter and then in CWD. Final quarterly and annual data are presented in a summary article published in the *Monthly Labor Review* and detailed data are published in CWD each year.

Statistical summaries of State and local government bargaining settlements are issued in news releases semiannually in February and August and also appear in CWD.

Uses and Limitations

The series on wage and compensation adjustments resulting from collective bargaining is one of the Federal Government's principal economic indicators. As such, it is used by a variety of Federal agencies including the Council of Economic Advisers, the Federal Reserve System, and the Congressional Budget Office, for a broad range of purposes including determining trends in compensation and forecasting changes in wage and salary income and gross national product. The statistics, as well as the monthly listings, are used by the Federal Mediation and Conciliation Service; State and local government agencies; employer and employee organizations; economic consultants; and researchers and practitioners in industrial relations, collective bargaining, and economic forecasting.

The user of the compensation data should remember that the series does not measure all changes in average hourly expenditures for employee compensation. In calculating compensation change estimates, a value is put on the benefit portion of the settlements at the time they are reached on the assumption that conditions existing at the time of settlement will not change. The data are estimates of negotiated change, not total changes in employer cost.

However, changes in the existing conditions do occur: In the volume of overtime and shift work, in the composition of the work force, in the level and stability of employment, and in factors affecting incentive earnings, for example. These changes influence outlays for employee compensation. In some instances, these changes are introduced by management specifically to offset costs of new labor agreements. In other cases, changes are the result of modified production schedules or of technological developments independent of collective bargaining, and may influence the cost of the union-management settlement.

Public and private sector negotiated compensation data are not strictly comparable because of differences in bargaining practices and settlement characteristics. Two differences are the incidence of lump-sum payments and cost-of-living (COLA) clauses. Lump-sum payments are rare in government but common in private industry. COLA clauses are included in no State and only a few local government settlements but are in a substantial number of private industry settlements. Both lump-sum payments and potential wage changes resulting from COLA clauses are excluded from the settlement data. Furthermore, State and local government bargaining frequently excludes pension benefits, which are often prescribed by law. In private industry, pensions are typically a bargaining issue.

Chapter 8. Employment Cost Index

The Employment Cost Index (ECI) measures the rate of change in employee compensation, which includes wages, salaries, and employers' cost for employee benefits. The ECI was developed in response to a frequently expressed need for such a statistical series. Existing measures, while adequate for specific purposes, were found to be fragmented, limited in industrial and occupational coverage, insufficiently timely or detailed, or subject to influences unrelated to the basic trend in employee compensation.

Several elements distinguish the ECI from other surveys of employee compensation. It is comprehensive in that it (1) includes costs incurred by employers for employee benefits in addition to wages and salaries; and (2) covers all establishments and occupations in both the private nonfarm and public sectors.[1] It measures the change in the cost of employing a fixed set of labor inputs, so it is not affected over time by changes in the composition of the labor force. The survey is timely in that statistics are published quarterly, approximately 1 month after their reference date. The ECI also enables users to compare rates of change in detailed occupational, industrial, geographic, union coverage, and ownership (public-private) submeasures.

Background

The ECI survey is being implemented in stages. Initially, beginning in 1976, published statistics covered quarterly changes in wages and salaries for the private nonfarm economy, excluding establishments in Alaska and Hawaii, and private household workers. In November 1978, the survey was expanded to include establishments in Alaska and Hawaii, and an additional 13 statistical series (union/nonunion manufacturing and nonmanufacturing, for example) were published.

The second major stage was completed in 1980 with the publication of quarterly changes in total employee compensation.

The third stage involved expansion of the survey to State and local government units. With the inclusion of these government units in November 1981, the overall series now represents the civilian nonfarm economy, excluding households and the Federal Government.

The most recent development of the ECI is the publication in 1987 of compensation cost levels. Data collected for the ECI can be used to calculate cost levels with no additional burden on survey respondents. The cost levels use current employment weights derived from BLS's Current Employment Statistics survey and the ECI sample. The cost levels, with a March reference date, are published annually during mid summer.

Future development of the ECI will include increases in the number of published series, especially in the service-producing sector of the economy, and expansion to include the Federal Government.

Description of the ECI

Major features

The ECI is a measure of change in the price of labor defined as compensation per employee hour worked. The self-employed, owner-managers, and unpaid family workers are excluded from coverage.

The ECI is designed as a Laspeyres, fixed-weight index at the occupational level, thus eliminating the effects of employment shifts among occupations. The index weights are derived from occupational employment for ECI industries reported in the 1980 Census of Population. The weights remain fixed from period to period pending a major index revision, next scheduled to occur when the results of the 1990 census are incorporated.

The index is computed from data on compensation by occupation collected from a sample of establishments and occupations weighted to represent the universe of establishments and occupations in the economy. The wage and salary component of the index is represented by average straight-time hourly earnings in an occupation. Straight-time earnings are defined as total earnings before deductions, excluding premium payments for overtime, weekend, and late-shift work. Earnings include production bonuses, commissions, and cost-of-living allowances but exclude nonproduction bonuses (which are considered a benefit in the ECI), payments in kind, room and board, and tips.

All earnings are computed on an hourly basis, whether or not this is the actual basis of payment. Earnings of

[1] Coverage of the private sector is limited to the private nonfarm economy, excluding private household workers. Public sector coverage includes employees of State and local governments, but excludes workers in the Federal Government.

salaried employees and those paid under incentive systems are converted to an hourly basis. Benefit cost data are also converted to an hourly basis. Thus, occupational hourly earnings plus the employer's cost per hour worked for employee benefits constitute the price of labor in the ECI.

Since pay rates generally relate to the job rather than to the incumbent workers, the basic unit of data collection is a job, as defined by the firm, in an establishment. Shifts in employment among jobs and establishments are controlled by measuring wage change for the same jobs in the same establishments and applying fixed employment weights to the results. The unit of observation is standardized to a certain extent below the job level by measuring only selected types of labor within the job; e.g., full or part time, incentive or time rated, depending on the predominant type.

The benefit data portion of the ECI encompasses 22 distinct benefit categories, which can be grouped as follows:

Paid leave benefits

1. Vacations
2. Holidays
3. Sick leave
4. Other paid leave

Supplemental pay

5. Premium pay for overtime and work on holidays and weekends
6. Shift differentials
7. Nonproduction bonuses

Insurance

8. Life insurance
9. Health benefits
10. Sickness and accident insurance

Pension and savings plans

11. Pension and retirement benefits
12. Savings and thrift plans

Legally required benefits

13. Social Security
14. Railroad retirement
15. Railroad supplemental retirement
16. Railroad unemployment insurance
17. Federal Unemployment Tax Act
18. State unemployment insurance
19. Workers' compensation
20. Other legally required benefits

Other benefits

21. Severance pay
22. Supplemental unemployment benefit funds

Merchandise discounts in department stores, currently included as a benefit, will be deleted from the group of benefits covered in September 1988.

The benefit data supplied by respondents normally consist of data elements which are used to compute the cents-per-hour-worked cost of each benefit provided employees in an occupation. For example, the data element for vacations might be expressed as follows: For an occupation in an establishment, the average worker received 2.8 weeks of paid vacation. In order to convert the data element to a cents-per-hour-worked cost, additional information covering workers in the occupation is needed. Therefore, data are also collected on scheduled daily and weekly hours and annual weeks. The following example illustrates the calculation of the cents-per-hour-worked cost for a benefit:

CALCULATING THE COST PER HOUR WORKED OF A BENEFIT—Example:

Data element—2.8 average weeks of vacation

Scheduled weekly hours—40

Straight-time average hourly rate—$6.95

Annual hours worked (computed by data processing system)—1,950

$$\frac{2.8 \text{ weeks/year} \times 40 \text{ hours/week} \times \$6.95/\text{hour}}{1{,}950 \text{ hours/year}} = \$0.399/\text{hour}$$

THIS EQUATION CAN BE BROKEN INTO THE FOLLOWING STEPS:

2.8 weeks/year × 40 hours/week = 112 (average annual hours of vacation)

112 hours/year × $6.95/hour = $778.40 (average annual cost of vacation)

($778.40/year) / (1,950 hours/year) = $0.399 (average cost per hour worked for vacation)

Note that average annual hours of vacation are also used by the data processing system to compute annual hours worked.

The nature of the data collected varies somewhat depending upon the particular benefit. For paid leave benefits, the data element is usually expressed in terms of average number of days, weeks, or hours per year. For the insurance benefits, the data element may consist of a rate per thousand dollars of life insurance coverage or of a rate per month for family medical insurance coverage. In the case of the legally required benefits, a tax rate and taxable earnings ceiling are usually collected. Whatever the form of the data element, the benefit cost is always converted to cents per hour worked.

Occupational classification

The ECI occupational classification system was originally based on the classification system used for the 1970 Census of Population. In June 1986, the occupations being surveyed were recoded to the classification system used in the 1980 census, which is based on the

Standard Occupational Classification (SOC) system.[2] The Census system classifies all occupations reported into 503 3-digit occupational categories (such as accountant, stockhandler, etc.) which are then combined into 13 major occupational groups.

For ECI purposes, four of the Census groups are combined into two groups (professional and technical workers are combined, as are two categories of service workers). Also, the Census groups covering private household occupations and some farming, forestry, and fishing occupations include workers outside the scope of the survey and are, therefore, excluded. As a result of these modifications, the ECI includes the following nine major occupational groups (MOG's):

1. Professional specialty and technical occupations
2. Executive, administrative, and managerial occupations
3. Sales occupations
4. Administrative support, including clerical occupations
5. Precision production, craft, and repair occupations
6. Machine operator, assembler, and inspector occupations
7. Transportation and material moving occupations
8. Handler, equipment cleaner, helper, and laborer occupations (including forestry and fishing occupations within the scope of the ECI)
9. Service occupations

The Census occupational classification system only lists occupations to be included under each of the 503 occupational categories. For data collection purposes, definitions of the Census occupations have been developed.[3]

Industrial classification

The ECI currently covers all nonfarm establishments classified in the 1972 edition of the *Standard Industrial Classification Manual* (SIC), with the exception of private households and the Federal Government. No minimum establishment size cutoff is used. The ECI publishes statistics for all major industry divisions with the exception of mining. Selected industry divisions are presented in more detail; for example, within manufacturing, durable and nondurable goods and within services, health services and hospitals. Statistics are also published for goods-producing and service-producing industries.

Geographic classification

The geographic coverage of the ECI includes all States and the District of Columbia. Rates of change in wages and salaries are published using the four-region classification system shown in appendix C. Statistics are also published for metropolitan areas (establishments located in a Metropolitan Statistical Area) and for other areas.

Union classification

Occupations surveyed within an establishment are classified as union if: (1) the majority of workers in the occupation are represented by a labor organization which is recognized as their bargaining agent; (2) wages are determined by collective bargaining; and (3) settlements are embodied in signed, mutually binding collective bargaining contracts.

Data Sources and Collection Methods

The wage, salary, and benefit cost data from which the ECI is computed are obtained from a sample of more than 3,000 establishments in private industry and about 700 establishments in State and local governments, and from a sample of jobs within those establishments.

Data collection is initiated by a BLS field representative who visits the reporting unit. The purposes of the initial visit are to: Introduce the ECI program and obtain cooperation; determine organizational unit or units for establishment coverage; select occupations; develop establishment reporting procedures; and complete the first schedule. Quarterly reports thereafter are normally collected by mail or telephone by the BLS regional office.

Prior to 1987, a major task in the initial contact by a BLS field representative was to classify all company jobs into major occupational groups (MOG's). The job-matching procedure sought to obtain at least one match for each of the nine MOG's surveyed by the ECI. Wage, salary, and benefit cost data were then collected for the selected jobs. In certain cases, data were requested for two or more company jobs within a single MOG if it accounted for a significant proportion of employment in an industry. Beginning with companies visited in 1987, the ECI uses a Reduced Job Match procedure which involves a request of data for four to eight company jobs, with the jobs selected strictly on a probability-proportionate-to-size basis. There is no longer an attempt to obtain at least one observation for each of the nine MOG's. The number of job matches sought varies with establishment employment size.

The job-matching process results in the selection of company jobs which are at the most detailed level recognized by that company. Examples would be clerk III and senior attorney–litigation. During the job-matching process, characteristics of the company jobs are also determined—whether the groups selected consist of full- or part-time workers, time or incentive workers, and whether they are covered by collective bargaining agreements.

The wage data are collected on a "shuttle" form which is sent to the respondent each quarter for the addition

[2] *Classified Index of Industries and Occupations, 1980 Census of Population* (Bureau of the Census, 1980).

[3] *Employment Cost Index Occupation Classification System Manual–1980* (Bureau of Labor Statistics, January 1985).

of new data (see ECI Wage Data Form at the end of this chapter). The survey months are March, June, September, and December; the data relate to the pay period which includes the 12th day of the month.

Benefit data are initially reported in detail, including such information as vacation provisions by length-of-service categories; the length-of-service distribution of occupational employment (used to compute the cost of vacations); and employer contributions for pensions, insurance, and other benefits. Then, each quarter, the information on benefit provisions is summarized and sent to the respondents to review and to report any changes which have occurred since the prior quarter. For example, in the prior quarter, the respondent might have reported that 9 of the 10 employees in a surveyed occupation subscribed to a health insurance plan which cost $115 per month. During the quarterly update, the respondent indicates that the cost of the plan has increased to $129 per month. In both the prior and current quarter, the employer assumed 50 percent of the plan's cost.

For ECI purposes, the average cost for workers in the prior quarter equaled $51.75 per month. (The employer's share of the cost for each worker participating in the plan is $57.50. Ninety percent of the workers participate, $57.50 \times 0.90 = $51.75.) The current quarter's cost of the plan would equal $58.05 ($64.50 \times 0.90 = $58.05). Note that the 90-percent participation rate was held constant. This would be changed only if the employee contribution rate (50 percent of plan cost) increased or decreased. Holding the participation rate constant eliminates the effects of forces such as shifts in work force composition on the measurement of the cost change.

Similarly, when an employer changes an overtime pay provision, new overtime hours worked are not normally collected. Instead, the base period overtime hours worked pertaining to the altered provision are repriced using the new overtime rate. This practice restricts changes in overtime cost to changes caused only by the adoption of a new overtime rate and eliminates the effect of changes in the number of hours of overtime worked.

Survey Design

The ECI sample design has evolved over the 12-year history of the program. Separate designs have been used for the public and private sectors of the economy, although, starting in 1987, the designs of all replacement samples are similar.

Private sector—respondent universe and sample design

The original sample design used for the selection of the ECI sample in 1975 consisted of a two-phase controlled selection.[4] In the first phase, approximately 23 occupations were identified for each 2-digit SIC. Using the 1970 Census of Population, the largest five occupations in each 2-digit SIC were selected with certainty. Then one to four, but generally two, occupations were selected from each major occupational group within the 2-digit SIC using a probability-proportionate-to-size method. A sample of approximately 10,000 establishments[5] was selected from a larger BLS survey of approximately 200,000 establishments drawn primarily from the unemployment insurance universe. The first phase of the ECI survey determined the occupational employment within each of the 10,000 sampled establishments for each of the 23 selected occupations for the 2-digit SIC. Imputation was used for partial and complete nonrespondents. Using measures of size designed to enhance the probability of selection of establishments with a large proportion of the employment in any of the 23 occupations, a subsample of approximately 2,000 establishments was selected, the selection being done separately within each 2-digit SIC. Data were collected for the selected occupations within the selected establishments.

Beginning in 1981, the ECI began replacing the entire private sector sample using a new sample design. Within each 2-digit SIC, all detailed Census occupations were assigned to one of 9 to 15 occupational groups, each consisting either of all of the occupations within a major occupational group (MOG), one or more closely related occupations within a MOG, or the residual occupations within a MOG. The 2-digit SIC's were divided into 12 groups that replaced the existing samples over a 4-year period. The new design was completely implemented in 1986. Allocation of the sample was made proportionate to the employment of each 2-digit SIC with an initial total sample size of about 2,000 establishments.[6] Within each establishment, one occupation was selected from each occupational group with probability of selection proportionate to the employment of the occupation within the group. This was the sample in use at the time of publication in 1987.

Beginning in 1987, the within-establishment occupation selection methodology was changed to eliminate the initial classification of all establishment jobs into groups. This change reduced the collection burden on both respondents and BLS and improved weight computation. With the new Reduced Job Match procedure, a sample of four to eight

[4] R. Goodman and L. Kish, "Controlled Selection, a Technique in Probability Sampling," *Journal of the American Statistical Association,* Vol. 45, 1950, pp. 350–72.

[5] The term establishment generally indicates a single physical location. In the public sector, many of the establishments have units at more than one location. For example, school districts meet the SIC manual's criteria for an establishment, but the majority of school districts are comprised of units in several different locations.

[6] The total private sector sample size had grown to about 3,000 establishments by 1987. Allocation to 2-digit SIC's is now based partly on generalized variance estimates so as to minimize the variance of national estimates of annual relatives of total compensation.

jobs, the number depending on the size of the establishment, is selected. The jobs are selected from either a list of establishment employees or a list of establishment employment by job title, using probability proportionate to employment in the selection of the jobs. Data are collected for a homogeneous group of employees, matching characteristics of either a selected individual or a selected job. The first data collected using this new methodology will be introduced into the ECI in 1988. The entire private sector sample will be replaced using this methodology by 1992.

Public sector—respondent universe and sample design

Because of the nature of the available sampling frames, the public sector was divided into four parts: Schools, hospitals, State and large local governments (all SIC's except schools and hospitals), and small local governments. Each has a somewhat different survey design.

As in the first series of private industry replacement samples, Census occupations were combined into occupational groups. When a group is matched in an establishment, a single, detailed job title is selected using probability-proportionate-to-employment sampling procedures. The use of occupational groups and the sampling of a specific job title increase the probability of finding occupational matches while retaining the advantages of surveying narrowly defined occupations.

The procedures described below apply only to the government sector samples through 1987. Recent improvements in the public sector coverage of the unemployment insurance (UI) universe will permit the selection of replacement samples for most of this sector directly from the UI files. The replacement sample for public sector hospitals will be entered into index estimation in 1988, with the remaining State and local government sectors following within 2 years. Also, these public sector replacement samples will use the Reduced Job Match selection procedure described above.

Schools

The sampling frame for public elementary and secondary schools was the 1973–74 National Center for Education Statistics (NCES) listing of all State and local schools. The frame included most of SIC 821 (elementary and secondary schools); the remainder of SIC 821 is covered in the other parts of the public sector sample. The sampling frame for higher education was the 1973–74 NCES list of all higher education schools, which covered all of SIC 822 (colleges, universities, professional schools, and junior colleges).

Establishments were stratified by 3-digit SIC; then, with a certainty cutoff,[7] a sample was selected with probability of selection proportionate to enrollment within the school. The sampling frame was ordered by region, and within region, by size of enrollment. When occupational groups for schools were defined, a phase I survey was conducted by mail to determine the employment within each of the groups for the selected schools.

The next stage was to calculate employment estimates for units not responding to the mail survey. The balance of the survey design was similar to that of the private sector, with the exception of the subsampling of occupational groups at the time of initiation. The final sample consisted of 260 establishments.

Hospitals

No survey of occupational employment was undertaken for public hospitals because of potential nonresponse. Instead, public hospitals were stratified by ownership and Census region and selected in a single stage, again with probability of selection proportionate to size and with a certainty cutoff. The establishment sampling frame was the 1976 Department of Health, Education, and Welfare list of public hospitals. The occupational selection was essentially a systematic sample within each of the 106 establishments in the final sample.

States and large local governments

No universe listing of establishments was available for State and local governments; it was, therefore, necessary to conduct a refinement survey to develop a list of potential sample units. This survey was accomplished through personal visits and allowed for the selection, based on the respondent's criteria, of identifiable units within each jurisdiction and the assignment of major industry division designations to each unit.

The local government jurisdictions in the refinement survey (cities, counties, special districts, etc.) were selected from the 1972 Census of Governments file provided by the Bureau of the Census. Only jurisdictions with more than 100 employees were deemed to need refinement. (See "Small local governments" below.)

The 3,729 such local jurisdictions were divided into three size classes: 100–999, 1,000–29,999, and 30,000 employees and over. The 30,000-and-over units were picked with certainty and the other two groups were further classified into four Census regions. This provided eight probability strata from which a probability-proportionate-to-size selection of the jurisdictions that would undergo refinement was made. Fourteen jurisdictions were selected from the 100–999 size group, and 26 jurisdictions were selected from the 1,000–29,999 size group. Six jurisdictions were selected with certainty from the 30,000-and-over group.

[7] Certainty cutoff indicates that all units with a measure of size greater than a specified figure are automatically selected.

The selection of States in the refinement survey was based on size of public employment as well as the need to have each of the nine Census regions represented. Five States were selected with certainty based on the number of State employees, and 11 others were picked with probability of selection proportionate to size.

The above procedures resulted in the selection of approximately 780 units for which a phase I survey on occupational employment was conducted. Occupational employment was requested for nine occupational groups within each of these 780 units. These units were stratified by jurisdiction and industry size. The final sample was randomly selected in such a way that every jurisdiction in the original refinement sample had at least one of its establishments selected.

The final step in the sampling process was the selection of occupations for each selected establishment. The final sample consisted of about 350 establishments, with approximately seven occupations per establishment.

Small local governments

Due to their small size, no refinement or phase I survey was done for small local governments (units with fewer than 100 employees). Any refinement required was accomplished by BLS field representatives at the time the data were collected. The universe of small local governments contained about 10,000 units. These units were first stratified by Census region and ordered by type of local jurisdiction: Municipalities, counties, townships, and special districts. A probability-proportionate-to-size sample selection was done in each stratum. Thirty final sample units were selected.

Sample replacement

Beginning in 1981, the existing sample of private sector establishments was gradually replaced by a new sample. A few large establishments were included in both the old and new sample. Sample replacement is necessary to ensure that sample sizes remain adequate for publication and that new establishments are represented in the sample, and to limit the burden on individual establishments. The entire sample will be replaced every 4 to 5 years. Replacement will be done in stages, with part of the sample being replaced each quarter.

Adjustments for sample nonresponse

When base-period data collection is completed, nonresponse adjustment factors are calculated for permanent refusals and applied to the sample weights of responding establishment/occupations in the same major industry division, MOG, and size class. The application of the nonresponse adjustment factors compensates for the loss of data due to base-period refusals only. Because the adjustment factors are calculated and applied only once, their effects on the estimates are constant for the duration of the sample.

For wage change estimation after the base period, values are imputed when there is a temporary nonresponse. The basic assumption is that nonrespondents have, on the average, the same wage movement that respondents have. Therefore, for a temporary nonresponse, the prior-quarter data for an establishment/occupation are moved by the average occupational wage change estimated from similar establishment/occupations. Establishment/occupations are considered similar if the establishments are in the same 2-digit SIC and the occupations are in the same MOG. If there are not sufficient data at this level, a broader level of aggregation is used. Prior-quarter data are not adjusted when nonresponse is the result of seasonal closing of an establishment.

Imputations are also made to fill in any gaps in a respondent's benefit data. Imputation for benefits is done separately for each benefit both in the base period and on a quarterly basis. A benefit cost is imputed based on the average cost for the same benefit in similar establishment/occupations.

Index Computation

The basic computational framework is the standard formula for an index number with fixed weights, as modified by the special statistical conditions that apply to the ECI.[8] This discussion focuses on the ECI measure of wage changes, but indexes of compensation changes are calculated in essentially the same fashion.

An index for the ECI is simply a weighted average of the cumulative average wage changes within each establishment cell, with base-period wage bills as the fixed weights. The simplified formula is:

$$I_t = \frac{\Sigma W_{o,i} M_{t,i}}{\Sigma W_{o,i}} * 100$$

where:

$M_{t,i} = M_{t-1,i} * R_{t,i}$, and

I_t is the symbol for the index.

The other variables are defined as follows:

$W_{o,i}$ is the estimated base-period wage bill for the i^{th} cell. A cell generally is an occupation in a 2-digit SIC industry, while the wage bill is the average wage of workers in the cell times the number of workers represented by the cell.

$M_{t,i}$ is the cumulative average wage change in the i^{th} cell from time o (base period) to time t (current quarter).

$R_{t,i}$ is the ratio of the current-quarter weighted average wage in the cell to the prior-quarter weighted average

[8] The actual ECI computational formulas and procedures differ somewhat from those presented here, which have been simplified for illustrative purposes.

wage in the cell, both calculated in the current quarter using matched establishment/occupation wage quotations. The weights applied are the sample weights described in the next section.

All wage indexes are computed from the following data:

Average straight-time hourly earnings for 3-digit Census code occupations, or groups of those occupations, in those sample establishments for which data are available for both the current and prior survey periods. The occupational wage data are identified by major occupational group, industry, geographic location, metropolitan area, and union status.

Employment, in 1980, in the 3-digit Census code occupation or group of occupations in an industry, obtained from the decennial census.

Sample weights derived from an occupational employment survey or the initial employment reported on the survey schedule. These weights reflect both employment in each establishment/occupation surveyed and the probability of selection of that establishment/occupation.

The index computation involves essentially five steps:

1. Establishment/occupation sample weights are applied to the occupational earnings to obtain weighted average earnings for each estimation cell for the current and prior survey periods. The estimation cell is defined on the basis of owner/industry/occupation. For the private sector, 67 SIC industries have been identified, most at the 2-digit level. For the public sector, separate cells are identified for State and local governments. Industries as broad as "public administration" and as narrow as "colleges and universities" are treated as separate estimation cell industries. For example, one estimation cell is identified as State government/public administration/clerical workers.
2. Each quarter, the ratio of the current-quarter weighted average wage to the prior-quarter weighted average wage is, in effect, multiplied by the prior-quarter cumulative average wage change for the cell. The product is a measure of the cumulative percentage wage change in the cell since the base period.
3. This measure of cumulative percentage wage change is multiplied by the base-period wage bill to generate an estimate of the current-quarter wage bill for the cell.
4. Both the current-quarter and the base-period wage bills are then summed over all cells within the scope of the index.
5. The summed current-quarter wage bill is divided by the summed base-period wage bill. The result, when multiplied by 100, is the current-quarter index. That index is divided by the prior-quarter index to provide a measure of quarter-to-quarter change, the link relative.

The following example illustrates the procedures for a particular industry:

The computations for the occupation and industry groups follow the same procedures as those for all overall indexes except for the summation. The wage bills for the occupational groups are summed across industries and regions for each group; the wage bills for the industry division are summed across occupational groups and regions for each industry division.

Computational procedures for the regional, union/nonunion, and metropolitan/nonmetropolitan measures of change differ from those of the national indexes because the current sample is not large enough to hold constant the wage bills at that level of detail. For these nonnational series, each quarter, the prevailing distribution in the sample between, for example, union and nonunion within each industry/occupation cell, is used to apportion the prior-quarter wage bill in that cell between the union and nonunion series. The portion of the wage bill assigned to the union sector is then moved by the percentage change in union wages in the cell, and similarly for the nonunion sector. Thus, the relative employment of the union sector in each cell is not held constant over time. Since the relative weights of the region, the union, and the metropolitan area subcells are allowed to vary over time, it is not possible to calculate Laspeyres indexes for the nonnational series.

Occupation	Prior-quarter cumulative change (a)	Current-quarter weighted average earnings (b)	Prior-quarter weighted average earnings (c)	Relative (b/c) (d)	Current-quarter cumulative change (a x d) (e)	Base-period wage bill (f)	Current-quarter wage bill (f x e) (g)	Prior-quarter wage bill (f x a) (h)
Electricians	1.23567	$5.50	$5.25	1.04762	1.29451	$12,613.40	$16,328.17	$15,586.00
Carpenters	1.15435	7.20	7.15	1.00699	1.16242	8,316.37	9,667.11	9,600.00
Total						20,929.77	25,995.28	25,186.00

Variance computation

Work on variance estimation has been under way since 1984. Release of the variance estimates is scheduled for 1988. Variance estimates are computed by a method called "balanced repeated replication." Starting with the replacement samples in 1981, all 2-digit SIC samples have been divided into a number of variance strata, and the sample in each variance stratum has been divided into two half-samples, sometimes referred to as panels. The computations made for quarterly and annual relatives are replicated 64 times using the data from one half-sample from each stratum instead of the data from both half-samples. The variance is then given by:

$$\text{VAR}\ (R_{s,t,o}) = \sum_{i=1}^{64} \left[(R_{s,t,o} - R_{s,t,i})^2 \right] / 64$$

where:

$R_{s,t,o}$ is a quarterly or annual relative for some cell from time s to time t calculated using the full sample, and

$R_{s,t,i}$ is the quarterly or annual relative for the same cell from time s to time t calculated using i^{th} balanced half-sample.

The ECI half-sample estimates are approximately normally distributed. Therefore, approximate 95-percent confidence intervals can be obtained by adding or subtracting twice the square root of the variance estimates to or from the estimate of the relative.

Presentation

ECI statistics are published quarterly in the month after the survey period. For example, statistics computed from the survey data for June are published in July. Initially, the statistics are presented in a news release which includes descriptions of quarter-to-quarter and year-to-year trends, tables, and an explanatory note about the survey. The data are published later in *Current Wage Developments* and the *Monthly Labor Review,* monthly BLS periodicals. The data are also available on IBM-compatible microcomputer diskettes.

Uses and Limitations

The Employment Cost Index has been designated as a principal Federal economic indicator by the Office of Management and Budget. It is the only measure of labor costs that treats wages and salaries and total compensation consistently, and provides consistent subseries by occupation and industry. Special wage and salary indexes are also provided for union status, geographic region, and metropolitan area status. The ECI is used by the Federal Reserve Board in monitoring the effects of monetary and fiscal policies and in formulating those policies. It enables analysts and policymakers to assess the impact of labor cost changes on the economy, both in the aggregate and by sectors. The ECI is particularly important in studies of the relationships between prices, productivity, labor costs, and employment. It is also used as an escalator of labor costs. For example, the Federal Health Care Financing Administration uses the ECI as part of an input price index in determining allowable increases in hospital charges under Medicare's Inpatient Hospital Prospective Payment System.

The limitations of the index must be kept in mind. The index is not a measure of change in the total cost of employing labor. Not all labor costs (e.g., training expenses, retroactive pay, etc.) fall under the ECI definition of compensation. Currently, the ECI does not cover all employers and employees, although it does cover nearly all workers in the civilian (non-Federal) nonfarm economy. Finally, the index is not an exact measure of wage or compensation change. It is subject to sampling errors which may cause it to deviate from the results which would be obtained if the actual records of all establishments could be used in the index calculation.

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Bureau of Labor Statistics
ECI Wage Data Form

Establishment Name _____

Schedule Number ☐☐☐☐☐ ☐ ☐

Page ____ of ____

Line No.	BLS Occ. Code	Identification of Survey Occupations, Establishment Jobs, or Individuals for whom Wage Information is being reported on each line (1)	Reference Date , 19 ____			
			Hourly Rate (2)	OR	Hours and Earnings (3)	Number of Workers Per Line (4)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

* Please use the back page of this form to explain significant earnings changes (i.e., decreases or large increases in the average rate of pay for an occupation) from one reporting period to the next.

BLS 3038B (Rev. June 1984)

VACATION

Plan | Company Plan Identification | Eligibility Requirement | Most Recent Change

1. Description

Occupational Distribution

Occu. code																					
Length of Service	Weeks ☐ or Percent ☐	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.	Wkrs.	Wt. Wks.
Totals																					
Average vacation weeks																					

2. Data Entries

(1-9) Control Information

Occupational Code	Benefit Code	Status Code	Value Entry	Conversion Code	Average Vacation Weeks
(10-13)	(14-15)	(16-18)	(19-27)	(28-29)	(30-35)
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.
	02		.		.

End of card → 80 | 07

Chapter 9. The Employee Benefits Survey

Background

By 1940, many employees received paid vacations, but relatively few—especially blue-collar workers—received other employee benefits, such as paid holidays or employer-provided protection against the financial consequences of accident, sickness, death, and old age. The adoption of pension and welfare plans was encouraged through favorable tax treatment offered by the Federal Government as early as 1921. However, the phenomenal increase in plans after 1940 resulted chiefly from three factors: (1) wage controls during World War II and the early postwar period that permitted supplementary benefit improvements while denying wage increases, (2) National Labor Relations Board decisions bringing pensions and other benefits within the scope of compulsory collective bargaining, and (3) the 1949 report of the Steel Industry Fact Finding Board which maintained that industry had an obligation to provide workers with social insurance and pensions. Before 1940, key developments in the growth of benefit plans occurred in nonunion environments; after the outbreak of World War II, many initiatives in employee benefits emerged through collective bargaining.

As early as the 1920's, the Bureau reviewed employee benefit plans in its analyses of collective bargaining agreements and trade union activities.[1] By the mid-1940's, occupational wage studies yielded data on the incidence and provisions of paid vacation and sick leave plans and the incidence of insurance and pension plans for plant and office workers.[2]

Analysis of employee benefit plans continued to expand. One group of studies emphasized provisions of individual plans. Based on small samples, these analyses were designed to provide information about the particular benefit plans studied rather than to report on the overall incidence of plans or plan provisions.[3] For example, major provisions of selected health, insurance, and pension plans were summarized periodically and published in *Digest of Selected Health and Insurance Plans* and *Digest of Selected Pension Plans* every 3 or 4 years until 1978, when the program was discontinued.

After the universe of welfare and pension plans became known (as a result of the Welfare and Pension Plans Disclosure Act of 1958),[4] studies were made based on samples representative of all plans filed under the act.[5]

In 1959, the Bureau initiated a series of surveys of employer expenditures for employee compensation. This program, which continued until 1977, measured outlays for individual elements of compensation, including pay for leave and contributions to private and public welfare and retirement plans.[6] The occupational wage studies, which include limited information on benefit plan provisions, have added incidence of such benefits as dental insurance and health maintenance organization coverage in recent years.[7]

The most recent development in the Bureau's analysis of employee benefit plans occurred in the late 1970's at the request of the U.S. Civil Service Commission (now the Office of Personnel Management). The Federal Salary Reform Act of 1962 and its successor, the Federal Pay Comparability Act of 1970, provided for annual adjustments in salaries of Federal white-collar employees to achieve comparability with pay rates in private enterprise for the same levels of work. The Bureau's National Survey of Professional, Administrative, Technical, and Clerical Pay (PATC) provides the data on private industry salaries used in administering this legislation.

The rapid growth of employee benefits has raised questions about the validity of a comparability process limited

[1] *Trade Agreements in 1923 and 1924*, Bulletin 393 (Bureau of Labor Statistics, 1925); and *Beneficial Activities of American Trade Unions*, Bulletin 465 (Bureau of Labor Statistics, 1928). Some detail on contract provisions for supplementary benefits is contained in *Union Agreement Provisions*, Bulletin 686 (Bureau of Labor Statistics, 1942).

[2] *Wage Structure of the Machinery Industries, January 1945*, Series 2, No. 1 (Bureau of Labor Statistics, 1946).

[3] *Health-Benefit Programs Established Through Collective Bargaining*, Bulletin 841 (Bureau of Labor Statistics, 1945).

[4] In accordance with the act, administrators of welfare and pension plans, excluding those for government workers and employees of nonprofit organizations, having at least 26 participants, filed with the Department of Labor detailed descriptions of their plans, including all amendments. Administrators of plans having at least 100 participants also had to file annual statistical reports on the financial status of their plans. In general, similar filings are now required under the Employee Retirement Income Security Act of 1974 (ERISA), which replaced the Welfare and Pension Plans Disclosure Act.

[5] *Early Retirement Provisions of Pension Plans, 1971*, Report 429 (Bureau of Labor Statistics, 1974).

[6] *Employee Compensation in the Private Nonfarm Economy, 1977*, Summary 80-5 (Bureau of Labor Statistics, 1980).

[7] For a description of the occupational wage studies, see chapter 6.

to wages and salaries alone. In the 1970's, the General Accounting Office and two Presidential review groups recommended that the Federal pay comparability system be expanded to include both pay and benefits.

In response to these recommendations, the Office of Personnel Management (OPM) initiated its Total Compensation Comparability (TCC) project. Computer models were developed which determined the annual cost per employee to the Federal Government—given the characteristics of its work force—if it were to adopt the various benefit plans in private industry. These costs could then be compared with costs for Federal plans, as determined by the same computer models.

Because of the Bureau's long experience in studying employee benefits, OPM asked the Bureau to participate in the gathering of data on plan provisions and characteristics. The Employee Benefits Survey (EBS) was then developed. In 1979, a test survey was conducted in conjunction with the PATC survey. A full-scale survey in medium and large private sector firms was conducted annually from 1980 to 1986. In 1987, the survey examined employee benefit plans in State and local governments. Although OPM no longer uses the cost estimating models developed for the TCC project, survey findings are examined by OPM, other government agencies, Congress, and the private sector as a key source of information on the provisions of employee benefit plans.

Description of the Survey

Private sector surveys conducted between 1979 and 1986 covered establishments[8] in the United States, excluding Alaska and Hawaii, employing at least 50, 100, or 250 workers, depending on the industry. Industrial coverage included: Mining; construction; manufacturing; transportation, communications, electric, gas, and sanitary services; wholesale trade; retail trade; finance, insurance, and real estate; and selected services. The 1987 public sector survey covered State and local governments with 50 or more employees in the contiguous 48 States. (The 1988 private sector survey will cover establishments with 100 or more employees in all nonfarm industries.)

Excluded from the survey are executive management employees (defined as those whose decisions have direct and substantial effects on an organization's policymaking); part-time, temporary, and seasonal employees; and operating employees in continuous travel status, such as airline flight crews and long-distance truckdrivers.

[8] For this survey, an establishment is an economic unit(s) which produces goods or services, a central administrative office, or an auxiliary unit providing support services to a company. In manufacturing industries, the establishment is usually a single physical location. In nonmanufacturing industries, all locations of an individual company within a Metropolitan Statistical Area (MSA), a Primary Metropolitan Statistical Area (PMSA), or a nonmetropolitan county are usually considered a single establishment.

Sampled establishments are requested to provide data on work schedules and details of plans financed wholly or partly by employers in each of the following benefit areas: Flexible benefit plans and reimbursement accounts; paid lunch periods; paid rest periods; paid holidays; paid vacations; personal leave; funeral leave; military leave; jury-duty leave; sick leave; sickness and accident insurance; long-term disability insurance; health insurance; life insurance; defined benefit pension plans; and defined contribution retirement and capital accumulation plans.

BLS also collects limited data on the incidence of several additional benefits such as: Severance pay; employee discounts; nonproduction bonuses; gifts; relocation allowances; recreation facilities; subsidized meals; educational assistance; parking; personal use of company-owned car; in-house infirmaries; and child care.

Data Sources and Collection Methods

Data for the survey are collected primarily by visits of Bureau field representatives to a sample of establishments within the scope of the survey. To reduce the reporting burden, respondents are asked to provide documents describing their retirement plans, capital accumulation plans, and plans covering the four insured benefit areas surveyed (sickness and accident, long-term disability, health, and life insurance). These documents are analyzed by BLS staff in Washington to obtain the required data on plan provisions. With a few exceptions, plans which are fully employee paid are not reported. Data on paid leave and other paid time off generally are obtained directly from the employer at the time of the visit. Since the survey does not develop information on the cost to the employer of providing benefits, respondents are seldom asked to provide cost data. However, employer contribution rates are requested for certain collectively bargained multiemployer health, welfare, and pension plans where benefit amounts are tied directly to the negotiated contribution level, such as in the construction and trucking industries. Data are collected separately for three occupational groups—professional-administrative, technical-clerical, and production workers in the private sector, and regular employees, teachers, and police and firefighters in the public sector.

Information obtained from respondents and plan documents is entered on computer files. Three data bases are created—one for establishment control data, another for paid leave plan provisions, and a third for retirement and insurance plan provisions. The control data base contains information on the establishments surveyed, including: Number of employees, number of plan participants, industry, geographic location, and sampling weight.

The plan data bases contain the provisions of each plan for which information was obtained. Plan identification

codes are such that a plan, once analyzed, need not be analyzed again regardless of how many establishments report it (e.g., a companywide health insurance program or a multiemployer pension plan).

Survey Design

The scope of the private sector survey is similar to that of the Bureau's PATC survey. The list of establishments from which the sample is selected (called the sampling frame) is, therefore, related to that developed for the PATC. This sampling frame is developed by refining data from the most recently available State unemployment insurance (UI) reports for the 48 States covered by the survey and the District of Columbia. The refinement procedures include an effort to ensure that sampling frame units correspond to the definition of an establishment adopted for this survey.

The private sector sample for this survey primarily is a subsample of the PATC sample to reduce the costs and resources required for data collection. The sample of establishments is selected by first stratifying the sampling frame by broad industry group and establishment size group based on the total employment in the establishment.

The sample size is allocated to each stratum (defined by industry and size) approximately proportional to the total employment of all sampling frame establishments in the stratum. Thus, a stratum which contains 1 percent of the total employment within the scope of the survey receives approximately 1 percent of the total sample. The result of this allocation procedure is that each stratum has a sampling fraction (the ratio of the number of units in the sample to the number in the sampling frame) which is proportionate to the average employment of the units in the stratum.

Within each stratum, a random sample is selected using a probability technique to maximize the probability of retaining establishments which were selected in the previous survey. This method of selection reduces collection costs by decreasing the number of new establishments in the sample.

Similar procedures are used to select the 24 States and 850 local governments in the public sector sample. The 48 States within the scope of the survey are stratified into the four Census Economic Regions, and a sample is then selected with probability of inclusion being proportional to employment. Local governments are selected in a three-stage procedure. First, a sample of Metropolitan Statistical Areas and nonmetropolitan counties is selected. Next, within each area or county selected, governmental units are stratified into four broad industrial groups—general government, schools, health services, and special districts. Finally, within each of these industrial groups, a sample of governments is selected, with probability proportional to employment.

Each of the combinations of occupational groups and work schedule or benefit areas (e.g., health insurance for production employees) is treated as an individual survey, and separate estimates are developed for each. This treatment facilitates the use of partially completed establishment reports in the survey. Therefore, the actual number of responses for the survey varies for each of the combinations.

Two procedures are used to adjust for missing data from partial reports and total refusals. First, imputations are made for the number of plan participants or plan details when the data are not reported. These imputations are made by randomly selecting a similar plan from another establishment in a similar industry and size class. For other forms of missing data (or nonresponse), an adjustment is made using a weight adjustment technique based on sample unit employment. Establishments are grouped together in cells similar to those used in sample selection. Using the assumption that, on the average, nonrespondents' data would be similar to that reported by respondents in each cell, the weight of each respondent is multiplied by a factor equal to the total employment in the cell divided by the employment of the responding units. The weight adjustments for missing data used in this survey are calculated in four stages for each occupational group and work schedule or benefit area combination. This allows a maximum amount of data from partially completed establishment schedules to be incorporated into survey estimates.

The survey design uses an unbiased estimator (the Horvitz-Thompson) which assigns the inverse of each sample unit's probability of selection as a weight to the unit's data. The estimator is modified to account for a weight adjustment factor, f_i, developed during the adjustment for nonresponse. The estimator is:

$$Y = \sum_{i=1}^{n} \frac{f_i Y_i}{P_i}$$

where:

n = number of responding units
f_i = weight adjustment factor for the i^{th} unit
Y_i = value for the characteristic of the i^{th} unit
P_i = the probability of including the i^{th} unit in the sample

Sampling and estimating procedures are designed to yield national data for all studied industries combined. Survey findings do not yield reliable estimates for individual industries or geographic regions. Data are, however, reported separately for three occupational groups.

Presentation

Summary survey results are published in a news release in the spring following the survey year, and an annual BLS bulletin[9] includes major survey findings. Estimates in these publications show the percent of employees that are covered by paid leave plans; participate in insurance, defined contribution, and pension plans; or are eligible for other benefits. Counts of participants in benefit plans include those who have not met possible minimum length-of-service requirements at the time of the survey. Workers are counted as participants in employee benefit plans that require the employee to pay part of the cost only if they elect the plan and pay their share. With a few exceptions (such as retiree health insurance), plans for which the employee pays the full premium are outside the scope of the survey, even if the employer pays administrative costs.

Tabulations show the percent of workers covered by individual benefit plans or plan provisions. Percentages are calculated in three ways. One technique shows the number of covered workers as a percent of all workers within the scope of the survey. It is designed to show the incidence of the individual employee benefits.

The second approach shows the number of workers covered by specific features in a benefit area as a percent of all employees who participate in that general benefit area. These tables answer questions concerning typical coverages provided to persons with a given insurance benefit or a private pension plan; for example, what percent of all employees with health insurance receive dental coverage?

The third approach provides a closeup look at an important feature of the plan; for example, what percent of all employees with dental coverage in their health insurance are covered for orthodontic work?

The benefit plan data bases contain additional detailed information for which estimates and tabulations are not routinely developed by BLS. These data are used for in-depth analyses of specific aspects of employee benefits that are occasionally published in *Monthly Labor Review* articles (see references).

Employee benefit data collected during the annual survey, including detailed provisions of plans and the number of participants, are available on magnetic tapes.[10] In accordance with a pledge of confidentiality to survey respondents, all information that could identify a specific reporting establishment is removed. The tapes may be used to derive national estimates, similar to those presented in the bulletin, for those provisions in the data base that are not regularly tabulated by BLS.

[9] The most recent bulletin is *Employee Benefits in Medium and Large Firms, 1986*, Bulletin 2281, June 1987.

[10] The tapes may be purchased from the Office of Wages and Industrial Relations, Bureau of Labor Statistics, Washington, DC 20212. They are available in 6250 BPI. Lists of data items on the computer files are available upon request.

Uses and Limitations

The extensive body of information on employee benefits generated in this survey provides a unique data resource. It is a major source of information for labor and management representatives involved in contract negotiations. Employers frequently seek information permitting comparison of their benefit plans with prevailing practices. Labor unions also use benefit data to assess potential areas for increasing nonwage compensation. Other users of the data are State and Federal conciliators and mediators, public and private arbitrators, Members of Congress and congressional staff considering legislation affecting the welfare of workers, and government officials responsible for recommending legislation and reviewing proposed legislation. For example, Congress and the Administration need data to evaluate the revenue implications of the favorable tax treatment accorded many types of benefits. Also, social welfare planners use data on private benefit plans to assess the ability of employees to provide for the current and future health and welfare needs of themselves and their dependents.

In addition, BLS tabulations and analyses of employee benefits can also be of use to teachers, students, and others in the academic field; private consultants; researchers; writers; and those not directly involved in legislation or collective bargaining but concerned with the development, status, and trends in employee benefits.

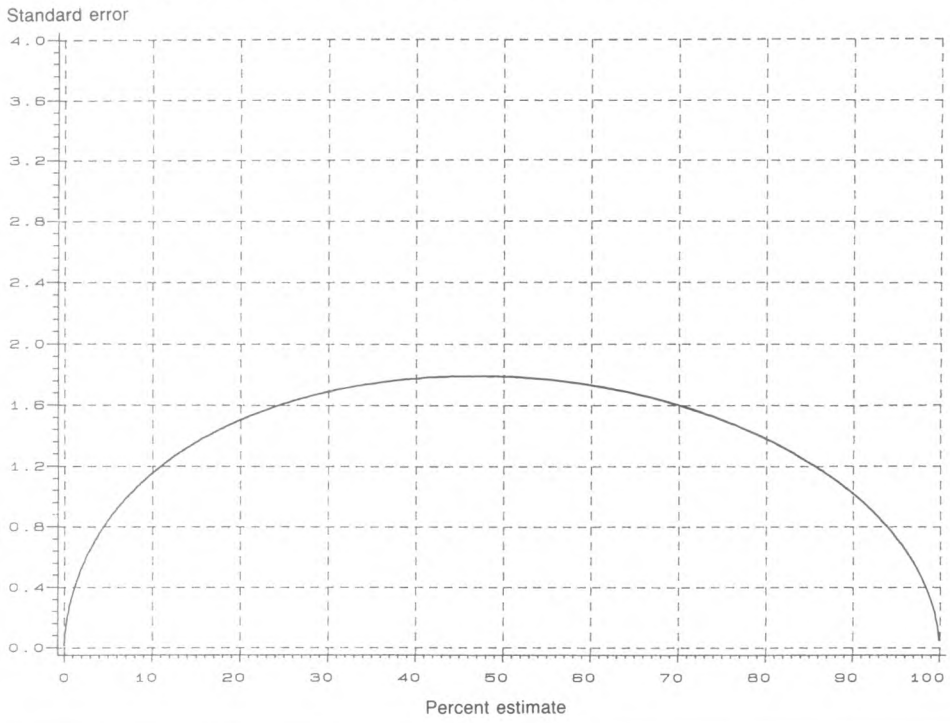
A limitation of the data is that, since data collection is restricted to provisions of formal plans, the extent of such benefits as rest periods and personal leave may be understated. Furthermore, the data show the coverage of benefit plans but not the actual use of these benefits; for example, that part of paid sick leave actually taken.

Users of the EBS data should keep in mind that the survey does not measure employer costs for benefits. In addition, the current scope of the survey excludes small firms. Studies of employee benefits that include all firms typically report lower participation rates for most benefits. Also, reliable estimates can be produced only at the national level, with no geographic or industry detail. Data for selected industries are available from industry wage surveys and, for selected geographic regions, from area wage surveys. These occupational wage surveys, which include some small firms, provide data on paid holiday and vacation practices and the incidence of welfare and pension plans, but not detailed provisions of the benefits (see chapter 6).

Since data gathered in Bureau surveys are confidential, specific plan provisions cannot be published.[11]

[11] The *Digest of Selected Health and Insurance Plans* and the *Digest of Selected Pension Plans,* mentioned earlier, identified the plans analyzed. The information, however, was obtained with the plan sponsor's consent for the specific purpose of the publications.

Chart 1. Employee Benefits Survey generalized standard errors



However, details of benefits provided under large negotiated agreements are published in *Current Wage Developments* (see chapter 7) and are available in the Bureau's public-use file of negotiated contracts. Besides small firms, the survey also excludes executive management and operating employees in constant travel status (such as airline pilots), as well as part-time, temporary, and seasonal employees. Alaska and Hawaii are not surveyed; neither are the Federal Government, agriculture, and private households. The data, therefore, do not statistically represent all employees in the United States, or even all employees in private industry. Nevertheless, the survey provides the most extensive information available on the provisions of employee benefits.

The EBS is designed to yield estimates of the percent of employees with specific benefit provisions in the survey year, not the change in plan provisions over time. Some plan provisions are found mainly in one or two industries. When employment changes do not occur evenly across industries, shifts in survey findings regarding relative incidence of types of benefit plans may stem, not from changes in plans, but from disproportionate changes in the number of employees covered by different types of plans.

Reliability of Estimates

The statistics in the EBS bulletins are estimates from samples rather than tabulations based on all units within scope of the surveys. Consequently, the data are subject to sampling errors, as well as nonsampling errors.

Sampling errors are the differences that can arise between results derived from a sample and those computed from observations of all units in the population being studied. When probability techniques are used to select a sample, as in the Employee Benefits Survey, statistical measures called "standard errors" can be calculated to measure possible sampling errors.

This evaluation of survey results involves the formation of confidence intervals that can be interpreted in the following manner: Assume that repeated random samples of the same size were drawn from a given population and an estimate of some value, such as a mean or percentage, was made from each sample. Then, the intervals described by one standard error below each sample's estimate and one standard error above would include the population's value for 68 percent of the samples. Confidence rises to 90 percent if the intervals surrounding the sample estimates are widened to plus and minus 1.6 standard errors, and to 95 percent if the intervals are increased to plus and minus 2 standard errors.

Chart 1 provides standard errors for use in evaluating the private sector estimates in tables of the bulletins containing percentage estimates. Standard errors for tables containing nonpercentage estimates could not be generalized into graphic representation. They are presented as tables of standard errors in the bulletins, starting in 1986.

Nonsampling errors also affect survey results. They can be attributed to many sources: Inability to obtain information about all establishments in the sample; definitional difficulties; differences in the interpretation of

questions; inability or unwillingness of respondents to provide correct information; mistakes in recording or coding the data; and other errors of collection, response, processing, coverage, and estimation for missing data. Through the use of computer edits of the data and professional review of both individual and summarized data, efforts are made to reduce the nonsampling errors in recording, coding, and processing the data. However, to the extent that the characteristics of nonrespondents are not the same as those of respondents, nonsampling errors are introduced in the development of estimates. Because the impact of these limitations on the EBS estimates is unknown, reliability measurements are incomplete.

For those readers interested in further mathematical details, the next section describes how chart 1 was derived from 1982 survey data.

Mathematical details on estimates and generalized standard errors chart

Each estimator used in the production of the tables in the bulletins is approximately normally distributed.

Standard errors for the percentage estimates were originally computed from the 1982 survey data, using a random group method. To simplify their presentation, a curve was fitted to the standard error estimates, by regression techniques.

The curve's equation is:

$$S = e^{[a+b\{\ln(P)\}^2 + c\{\ln(100-P)\}^2 + d\ln(P)\ln(100-P)]}$$

where:

S = standard error
P = percentage estimate from the bulletin
e = exponential function
ln = natural logarithm function

For the 1982 Employee Benefits Survey,

$a = -0.64683$, $b = -0.02603$, $c = -0.017458$, and $d = 0.123726$

These are regression coefficients. The curve fits the data with $R^2 = 0.85$ and no pattern in the residuals. Moreover, differences between curves using 1982 and 1983 data are negligible.

The equation of the curve was obtained empirically, by starting with the equation:

$$S = a\,P^b\,(100 - P)^c.$$

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Chapter 10. Productivity Measures: Business Sector and Major Subsectors

Background

Indexes of labor productivity, multifactor productivity, and related measures for broad economic sectors and manufacturing industries are published by the Bureau of Labor Statistics. Measures of output per hour have been developed for the business sector, and nonfarm and farm subsectors, from 1909 to the present. For the period after 1947, these data have been supplemented with comparable measures of compensation and costs and corresponding series for manufacturing (total, durable, and nondurable) and nonfinancial corporations. For the latter period, indexes are available quarterly as well as annually (table 1). These productivity measures, first published in 1959, represent the culmination of a long series of developments in productivity measurement in the Bureau.[1]

The multifactor productivity indexes for major sectors measure output per combined unit of labor and capital input in private business, private nonfarm business, and manufacturing. Multifactor productivity indexes for 20 manufacturing industries measure output per combined unit of capital, labor, energy, materials, and purchased services inputs—KLEMS inputs.

Productivity measures, related inputs, and how often the indexes are available are shown in table 1 for selected sectors of the U.S. economy.

Table 1. Availability of productivity measures for major sectors and subsectors of the economy

Productivity measure	Input	Index available
Output per hour of all persons:		
Business[1]	Labor	Quarterly
Nonfarm business	Labor	Quarterly
Nonfinancial corporations	Labor	Quarterly
Manufacturing	Labor	Quarterly
Durable	Labor	Quarterly
Nondurable	Labor	Quarterly
Multifactor productivity:		
Private business	Labor, capital	Annually
Private nonfarm business	Labor, capital	Annually
Manufacturing	Labor, capital	Annually
KLEMS[2] multifactor productivity:		
Manufacturing and 20 2-digit SIC manufacturing industries	Labor, capital, energy, materials, services	Annually

[1] Includes government enterprises; multifactor productivity measures exclude such enterprises.

[2] Capital (K), labor (L), energy (E), materials (M), and purchased services (S) inputs.

Description of Measures

The Bureau's productivity measures are constructed as the ratio of real gross product originating (GPO) in a sector to the corresponding inputs engaged in the sector. The changes through time in these ratios reflect changes in output per unit of the corresponding inputs. The changes in productivity and related measures during the course of the business cycle typically show patterns which differ substantially from long-term movements and, therefore, are the objects of special analytic studies.

The Bureau's multifactor productivity measures supplement the labor productivity series and provide additional insights into labor productivity growth and economic change.[2] The GPO-based multifactor productivity measures for the private business, private nonfarm business, and manufacturing sectors are based on capital and labor inputs. Measures for 2-digit Standard Industrial Classification (SIC) manufacturing industries are based on the real value of production and capital, labor, energy, materials, and services inputs. For all these multifactor productivity measures, labor input is the same as in the labor productivity measures.

No single productivity ratio can be regarded as best for all purposes. The BLS approach makes available a number of alternative measures together with detailed descriptions of the methods used.

[1] *Trends in Output per Man-Hour in the Private Economy, 1909–58*, Bulletin 1249, 1959 (Bureau of Labor Statistics, 1959).

[2] J. R. Norsworthy, Michael Harper, and Kent Kunze, "The Slowdown in Productivity Growth: Analysis of Some Contributing Factors," *Brookings Papers on Economic Activity*, Fall, 1979.

Data Sources and Estimating Procedures

Output Per Hour Measures

Output

Real gross domestic product originating in the business sector and subsectors is the basis of the output components of the major sector labor productivity measures. These output components are based on and are consistent with the National Income and Product Accounts (NIPA), including the gross national product (GNP) accounts, prepared by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.

Computation of business sector GPO begins with GNP, which equals income received by labor and property owners for services rendered in the current production of goods and services, in addition to capital consumption allowances, indirect business taxes, and several other minor items. Gross domestic product (GDP) is simply GNP less "rest-of-world" output, that is, less net factor payments to domestic owners of factors of production located outside the United States.

Business sector output is equal to GDP less general government, output of nonprofit institutions, output of paid employees of private households, rental value of owner-occupied dwellings, and the statistical discrepancy.

Gross domestic product in current dollars cannot be used directly as the output measure because it reflects price changes as well as changes in physical volume. The Bureau of Economic Analysis prepares measures of constant-dollar GDP for the business economy and its major sectors. These measures exclude changes in the value of production resulting from price changes. They reflect only changes in real product, which is the basis for productivity measures.[3]

Output data for the manufacturing sector based on gross product are computed by the BEA on an annual basis only. In order to achieve quarterly estimates of manufacturing output consistent with the BEA's gross product concept, BLS uses the quarterly changes in the Federal Reserve Board index of manufacturing production to move the gross product data. The results are benchmarked annually to the published BEA output levels. Thus, the output data used for all major sectors are consistent with the output concepts embodied in the National Income and Product Accounts.

Labor input

The primary source of hours and employment data is the BLS Current Employment Statistics (CES) program, which provides monthly survey data on total employment and average weekly hours of production and nonsupervisory workers in nonagricultural establishments. Jobs rather than persons are counted, so that multiple jobholders are counted more than once. Weekly hours are measured as hours paid rather than hours at work. A survey has been introduced to develop a set of labor input measures based on hours at work and will be used to extend the present series.[4] (See BLS form 2000P at end of this chapter.)

The CES data are based on payroll records from a sample of establishments in which the probability of sample selection is related to the establishment size: Large establishments (relative to the sector) fall into the sample with certainty, whereas smaller establishments are sampled on a probability basis. Data on employment, hours, and earnings are collected monthly; the reference period for these data is the payroll period including the 12th of the month. (The CES methods are described in chapter 2.) Establishment data are published monthly in *Employment and Earnings.*

Since CES data include only nonfarm wage and salary workers, data from the Current Population Survey (CPS) are used for farm employment; in the nonfarm sector, the National Income and Product Accounts and the CPS are used for government enterprise employment, proprietors, unpaid family workers, and paid employees of private households.

Separate estimates for employment and hours paid are developed for each major sector and are aggregated to business and nonfarm business levels. Hours of labor input are treated as homogeneous units; no distinction is made among workers with different skill levels or wages.

For nonmanufacturing sectors, employment and average weekly hours are computed from the CES, CPS, and NIPA sources. Although CES data on average weekly hours refer only to nonsupervisory workers, it is assumed for hours computation that the length of the workweek in each nonmanufacturing industry is the same for all wage and salary workers.

In manufacturing, separate measures for production and nonproduction workers' hours are derived and aggregated to the manufacturing total. Employment and average weekly hours for production workers and employment for nonproduction workers are taken directly from CES data. Average weekly hours for nonproduction workers are developed from BLS studies of wages and supplements in manufacturing which provide data on the regularly scheduled workweek of white-collar employees.

[3] A detailed description of the methods and procedures for estimating GNP and GDP in current and constant dollars is given in Carol S. Carson, "GNP: An Overview of Sources Data and Estimating Methods," *Survey of Current Business,* July 1987, pg. 103–26. Also see Methodology Paper No. 1 "Introduction to National Income Accounting" (Bureau of Economic Analysis, 1985). Further information on estimates for major industry sectors is presented in the October 1962 issue of the *Survey of Current Business.*

[4] Kent Kunze, "A New BLS Survey Measures the Ratio of Hours Worked to Hours Paid," *Monthly Labor Review,* June 1984, pp. 3–7.

Compensation and labor costs

Indexes of compensation per hour measure the hourly cost to employers of wages and salaries, as well as supplemental payments, which include employers' contributions to Social Security, unemployment insurance taxes, and payments for private health insurance and pension plans. Measures of real compensation per hour reflect the adjustment of hourly compensation for changes in the Consumer Price Index for All Urban Consumers (CPI-U).

Unit labor costs measure the cost of labor input required to produce one unit of output and are derived by dividing compensation in current dollars by output in constant dollars. Unit nonlabor payments measure the cost of nonlabor items such as depreciation, rent, interest, and indirect business taxes, in addition to corporate profits and profit-type income of proprietorships and partnerships.

Multifactor Productivity Measures for Major Sectors

The multifactor productivity (MFP) indexes for major sectors measure output per combined unit of labor and capital input in private business, private nonfarm business, and manufacturing.[5] The output measure is identical to the output used in the measures of output per hour with the exception that the output of government enterprises is eliminated from the MFP measures because of inadequate information on capital used in these enterprises. Labor input is also identical to that used in the output per hour measures, with the same exception.

Capital inputs for the MFP measures are computed using the service-flow concept. BLS measures of capital services inputs are prepared using national accounts data on real gross investment in depreciable assets and inventories. Capital stocks for 43 types of depreciable assets are constructed using the perpetual inventory method and by assuming that services decline as a function of age. These "age/efficiency" schedules, which are based in part on empirical evidence on capital depreciation, are applied to real investment by type of asset.

These measures of depreciable stocks are combined with stock estimates for inventories and land using the Tornquist aggregation method. Asset weights are based on estimates of implicit rental prices which are indicative of marginal products. Rental prices are estimated with a user-cost-of-capital formula consisting of the real rate of return plus the rate of economic depreciation adjusted for tax incentives.

Total input is computed by weighting capital and labor using the Tornquist weighting formula. For each input, the weight is the income share of the input in total income. The major sector MFP measures are available for the years 1948 to the present.

[5] The measures themselves and the underlying methods and procedures are explained in *Trends in Multifactor Productivity, 1948–81,* Bulletin 2178 (Bureau of Labor Statistics, 1983).

Multifactor Productivity Measures for Manufacturing Industries

Multifactor productivity indexes for 20 manufacturing industries measure output per unit of weighted and combined capital, labor, energy, nonenergy materials, and purchased business services inputs.[6]

For the manufacturing industries MFP measures, output is the deflated value of production of an industry; hence it differs from the GPO output measures used for the major sector output per hour and MFP indexes. The value of production is shipments, adjusted for inventory change, to purchasers outside the industry. Capital is measured as it is for the major sector MFP indexes; rental prices of capital are computed for each industry. Labor is also measured as it is for major sector MFP.

The inclusion in the industry MFP measures of all intermediate inputs—energy, nonenergy materials, and purchased business services—is consistent with the use of total value of production as the output measure. Energy input is constructed using data on price and quantity of fuels purchased for use as heat or power. Nonenergy materials input includes all commodity inputs exclusive of fuels but inclusive of fuel-type inputs used as raw materials in manufacturing. The purchased business services input series is constructed using price and value data on services purchased by manufacturing industries from service industries. Data sources used in constructing these three inputs include input-output tables, surveys of establishments in manufacturing and other industries, and price indexes.

Total input is computed by weighting all inputs using the Tornquist formula. For each input, the weight is the cost share of the input in total costs. The industry MFP measures are available for 1949 to the present.

Analysis and Presentation

Indexes of labor productivity show changes in the ratio of output to hours of labor input. Similarly, indexes of multifactor productivity show changes in the ratio of output to combined inputs. However, these indexes should not be interpreted as presenting the contribution of a single input, or a combination of inputs, to production. Changes over time in these indexes reflect many influences, including variations in output (especially in the short term since most inputs are partially fixed), the utilization of capacity, changes in the characteristics

[6] An explanation of the methods and some results are found in an article by William Gullickson and Michael J. Harper, "Multifactor Productivity in 20 U.S. Manufacturing Industries, 1949–83," *Monthly Labor Review,* October 1987, pp. 18–28.

and efforts of the work force, changes in managerial skill, and technological developments.

Compensation and labor costs

BEA develops employee compensation data as part of the national income accounts. These quarterly data include direct payments to labor—wages and salaries (including executive compensation), commissions, tips, bonuses, and payments in kind representing income to the recipients—and supplements to these direct payments. Supplements consist of employer contributions to funds for social insurance, private pension and health and welfare plans, compensation for injuries, etc.

The compensation measures taken from establishment payrolls refer exclusively to wage and salary workers. Labor cost would be seriously understated by this measure of employee compensation alone in sectors such as farm and retail trade, where hours worked by proprietors represent a substantial portion of total labor input. BLS, therefore, imputes a compensation cost for labor services of proprietors and includes the hours of unpaid family workers in the hours of all employees engaged in a sector. Labor compensation per hour for proprietors is assumed to be the same as that of the average employee in that sector.

Unit labor and nonlabor costs

The Bureau also prepares data on labor and nonlabor costs per unit of output for the business sector and its major components. Unit labor costs relate hourly compensation of all persons to output per hour and is defined as compensation per unit of constant-dollar output. Nonlabor payments are the excess of gross product originating in an economic sector over corresponding labor compensation, and include corporate profits and the profit-type income of proprietors. Nonlabor costs include interest, depreciation, rent, and indirect business taxes.

In aggregate sectors, productivity changes through time reflect movements within the various component industries as well as shifts in the relative importance of each of the industries. For example, changes in labor productivity and multifactor productivity are influenced by the relative shift of inputs (labor and capital) from low- to high-productivity industries and by productivity changes in the component subsectors.[7]

Short-term movements in productivity and unit labor costs often result from cyclical variaton in output; this tends to distort the long-term relationship between output and labor input, as noted below, or output and multifactor input.

[7] The farm-nonfarm shift is examined in some detail by J. R. Norsworthy and L. J. Fulco in "Productivity and Costs in the Private Economy," *Monthly Labor Review,* June 1974, pp. 3-9.

Indexes of output per hour, compensation per hour, and related cost data are published quarterly in the BLS news release, "Productivity and Costs." In addition, quarterly and annual analyses are published from time to time in the *Monthly Labor Review.* Historical indexes of these and related data are available on request, as are detailed descriptions of data sources and computational procedures.

Multifactor productivity measures are announced each October for the preceding calendar year in the "Multifactor Productivity Measures" news release. Included are annual indexes of multifactor productivity and related measures for private business, private nonfarm business, and manufacturing.

Indexes of productivity and related cost data are available monthly in *Employment and Earnings* and the *Monthly Labor Review,* in the *Handbook of Labor Statistics,* on LABSTAT data tapes, and BLS data diskettes.

Calculation Procedures

Labor productivity

Labor productivity, or output per hour, is computed as:

$$\text{Labor productivity} = \frac{\text{Constant-dollar output}}{\text{Hours of labor input}}$$

or

$$P = O/H$$

In instances where several sectors are involved, labor productivity can be computed equivalently as:

$$P = (\Sigma_i O_i)/\Sigma_i H_i$$

or as

$$P = \Sigma_i W_i (O_i/H_i)$$

where:

O_i is constant-dollar output in sector i
H_i is hours of labor input in sector i
$W_i = H_i/\Sigma_i H_i$ is the hours-based weighting factor for sector i
P is average labor productivity for the aggregate sector

The computation of labor compensation per hour parallels the computation of output per hour. Unit labor costs (ULC) are computed as labor compensation (C) per unit of (constant-dollar) output, but is often represented as:

$$ULC = (C/H) \div (O/H)$$

This form highlights the relationships between unit labor costs, hourly compensation, and labor productivity.

Real compensation per hour (RC) is computed as hourly compensation deflated by the seasonally adjusted Consumer Price Index for All Urban Consumers (CPI-U):

$$RC = (C/H) \div \text{CPI-U}$$

Unit nonlabor payments (UNLP) include all nonlabor components of gross product originating in a given sector—depreciation, rent, interest, and indirect business taxes as well as profits and profit-type income—whereas unit nonlabor cost excludes profit. These measures are computed as:

$$UNLP = (CU - C)/O$$

and

$$UNLC = (CU - C - PR)/O$$

where:

CU is current-dollar gross product originating
C is current-dollar compensation
O is constant-dollar output
PR is current-dollar profits

Labor's share in gross product originating in a given sector is simply the ratio of labor compensation paid in that sector to the gross product, both measured in current dollars:

$$LS = C/CU$$

and, analogously, the nonlabor or capital share is defined as:

$$NLS = (CU - C)/CU = 1 - LS$$

Most of the measures noted above are prepared quarterly in index form for the major sectors of the private sector. In addition, quarterly percentage changes at a compound annual rate and percentage changes from the same quarter in the previous year are computed:[8]

$$Q_t = 100\ (V_t/V_{t-1})^4 - 100$$

$$Y_t = 100\ (V_t/V_{t-4}) - 100$$

where:

t is a time subscript denoting the quarter
V is a series described above
Q_t is the quarterly percentage change in series V from quarter t–1 to quarter t, measured at a compound annual rate
Y_t is the percentage change in series V from quarter t–4 (the same quarter 1 year before) to quarter t

In order to achieve greater precision, all computations are made from the measures themselves rather than from their corresponding indexes.

[8] The estimation of quarterly (or subannual) changes at compound annual rates as the differences between movements in the underlying series involves approximations. For changes in the neighborhood of 1 or 2 percent, these approximations are good; however, the inexactness of these approximations is amplified by relatively large changes in the economic measures such as those experienced during periods of inflation, sharp recession, and rapid recovery.

Since most of the productivity and costs measures are reported as percentages to one decimal place, e.g., 2.6 percent, questions sometimes arise because the greater precision carried in the automated computation results in differences in related measures in the final decimal place.

Multifactor productivity

The computational method used by BLS for its multifactor productivity measures is the Tornquist index. Some of the basic properties of this index are: It is calculated as a weighted average of growth rates of the components; the weights are allowed to vary for each time period; and, for productivity measures, the weights are defined as the mean of the relative compensation shares of the components in two adjacent time periods. Hence, the growth rate of the index ($\dot{I}/I$) is the proportional change over time (the dot notation refers to continuous change with respect to time), such that:

$$\dot{I}/I = \Sigma_i w_{it}(\dot{x}_{it}/x_{it})$$

where $\dot{x}_{it}/x_{it}$ is the growth rate of the i^{th} input calculated as:

$$\dot{x}_{it}/x_{it} = \ln x_{it} - \ln x_{it-1}$$

The weights (w_{it}) are defined as the means of the relative compensation shares of all the inputs:

$$w_{it} = (s_{it} + s_{it-1})/2$$

$$s_{it} = \frac{p_{it}x_{it}}{\Sigma_i p_{it}x_{it}}$$

p_{it} = price or wage of input x_i in period t.

Multifactor productivity growth is defined as the growth rate in output ($\dot{O}/O$) less the growth rate in aggregated inputs:

$$MFP = \dot{O}/O - \dot{I}/I$$

For MFP measures of output per combined unit of labor and capital inputs, this formula is implemented as:

$$\dot{I}/I = w_k\dot{K}/K + w_l\,\dot{L}/L$$

where:

$\dot{I}/I = w_k\dot{K}/K + w_l\,\dot{L}/L$
w_k = relative compensation share of capital
w_l = relative compensation share of labor
$\dot{K}/K$ = growth in capital services
$\dot{L}/L$ = growth in hours

Uses and Limitations

Measures of output per hour, output per unit of capital, and output per combined unit of multifactor input (multifactor productivity) and related measures of costs are designed for use in economic analysis and public and private policy planning. The data are used in forecasting and analysis of prices, wages, and technological change.

The labor productivity, multifactor productivity, and related cost measures are useful in investigating the relationships between productivity, wages, prices, profits,

and costs of production. As noted above, gross domestic product represents the sum of all production costs: Labor compensation, profits, depreciation, interest, rent, indirect business taxes, and other minor items. Unit labor costs, or compensation per unit of output, represent a major portion of total unit costs and reflect the combined effect of changes in output per hour and compensation per hour; thus, an increase in compensation per hour tends to increase unit labor costs while an increase in output per hour tends to reduce it, other things being equal. Therefore, through its impact on unit labor costs, output per hour is an important element in the wage-price relationship because it is an indicator of the extent to which compensation gains can occur without putting pressure on prices or reducing payments to other input factors.

Certain characteristics of the productivity and related cost data should be recognized in order to apply them appropriately to specific situations. First, the data for aggregate sectors reflect changes within various constituent industries as well as shifts in the relative importance of these industries: a portion of labor productivity growth from 1947 to the present is attributable to the shift of workers from farm to nonfarm occupations. Second, the measures are often linked by lead or lag relationships, particularly during the business cycle when inventories, overtime hours, and the rate of capital utilization are used to buffer the effects of short-term swings in product demand. Third, data and other resources available for their preparation somewhat limit the productivity, output, compensation, and employment measures which can be constructed. In several sectors where output is difficult to define in a satisfactory way, productivity measures are correspondingly weak. Examples are the construction industry and the financial services sector, where output is an imputed value of labor and other inputs. The productivity and costs measures for these sectors should be interpreted with caution.

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Mark, Jerome A. "Problems Encountered in Measuring Single-Factor and Multifactor Productivity," *Monthly Labor Review,* December 1986.

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Waldorf, William H.; Kunze, Kent; Rosenblum, Larry S.; and Tannen, Michael B. "New Measures of the Contribution of Education and Experience to U.S. Productivity Growth," prepared for American Economic Association Meetings, December 1986.

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Other publications

Caves, Douglas W.; Christensen, Laurits R.; and Diewert, W. Erwin. "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity," *Econometrica,* Vol. 50, No.6, 1983, pp. 1393–1414.

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Kendrick, John W., and Vaccara, Beatrice N., editors. *New Developments in Productivity Measurement and Analysis.* Chicago, The University of Chicago Press, 1980.

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Usher, Dan, ed. *The Measurement of Capital.* Chicago, The University of Chicago Press, 1980.

Bureau of Labor Statistics
Hours At Work
Production Workers

U.S. Department of Labor

This report is authorized by law, 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely. The information collected on this form by the Bureau of Labor Statistics will be held in confidence and will be used for statistical purposes only.

Form Approved
O.M.B. No. 1220-0076
Approval Expires 8-31-87

RETURN TO:
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Room 2068, MAIL CODE 13
441 G STREET, N.W.
WASHINGTON, D.C. 20212

Telephone No. 202-523-5931

Call collect if you need any help in completing this form.

BLS Use Only
RC (8-10)

(Change name & mailing address if incorrect)

PLEASE READ INSTRUCTIONS ON THE BACK BEFORE ENTERING DATA

- **ALL EMPLOYEES/PRODUCTION WORKERS-**Enter the total number of **All Employees** and **Production Workers** during payroll period which includes **March 12, 1986.**
- **HOURS PAID**—Enter into the table below, the total number of hours that **Production Workers** were paid during **each quarter.** This includes all hours actually worked plus hours for paid vacations, paid sick leave, paid holidays and other paid personal or administrative leave.
- **HOURS AT WORK**—Subtract from the "HOURS PAID" entry for **each quarter** the paid leave time (vacation, sick leave, holidays, and other personal or administrative leave) and enter the difference in this column.

Number of Employees During Payroll Period which Includes March 12, 1986	**All Employees** 11-15	**Production Workers** 16-20	**BLS Use Only** 21-22

Hours Information for Production Workers Only			
Quarterly Period	**Hours Paid** *(omit fractions)*	**Hours at Work** *(omit fractions)*	
First Quarter 1986 January—March	23-30	31-38	39-40
Second Quarter 1986 April—June	41-48	49-56	57-58
Third Quarter 1986 July—September	59-66	67-74	75-76
Fourth Quarter 1986 October—December	77-84	85-92	93-94
Annual Total 1986 January—December	95-103	104-112	113-114

1a. What records did you use to compile the above information? 115
1 ☐ Payroll 2 ☐ Personnel 3 ☐ Other _____

b. Are these records computerized? 1 ☐ Yes 2 ☐ No 116

2. What types of paid leave do you offer? 117-121
1 ☐ Vacation 2 ☐ Sick 3 ☐ Holiday 4 ☐ Personal/Administrative 5 ☐ Other 6 ☐ None

3. If unable to complete for the establishment(s) identified above, **please call collect.**

4. Enter below any unusual factors responsible for significant differences from normal hours worked during any quarter. Please indicate in which quarter these factors occurred. Examples are: more business, layoffs, strikes, fire, weather, seasonal, etc.

If questions arise concerning this report, whom should we contact? *(Please Print)*

Name 122-146 Title Date Area Code Telephone 147-157

BLS 2000P (Rev. Nov. 1986)

1-BLS COPY

INSTRUCTIONS FOR COMPLETING REPORT (BLS 2000P)

DATA REQUEST IS FOR CALENDAR YEAR 1986

ALL EMPLOYEES

Enter the total number of persons on the payroll(s) who worked full or part-time or received pay for any part of the pay period which includes March 12, 1986. If the establishment(s) closed down (either temporarily or permanently) during 1986, please provide data for the time the establishment(s) was operational. If the establishment(s) was closed down during 1986, please indicate below, the dates of closure.

From _____/_____/_____ To _____/_____/_____
Month Day Year Month Day Year

PRODUCTION WORKERS

Enter the total number of production workers, both full and part-time, on your payroll(s), whether wage or salaried, who worked during or received pay for any part of the pay period which includes March 12.

The term "production worker" refers to all occupational groups whose work is not primarily administrative or managerial, regardless of skill level within the following industries: Mining and Quarrying, Crude Petroleum, Natural Gas and Gasoline Production, and the Construction and Manufacturing industries. These occupational groups include: Working supervisors and all nonsupervisory workers, ***(including group leaders and trainees)*** engaged in excavation, hauling, trucking, hoisting, ventilation, drainage, pumping, drilling, blasting, loading, crushing, processing, inspection, storage, handling, warehousing, shipping, maintenance, repair, janitorial, record keeping, fabricating and assembly, as well as craft workers, mechanics, apprentices, helpers, laborers, plumbers, painters, plasterers, carpenters, masons, welders or any of the special trades. Also include all other nonsupervisory employees whose services are closely associated with those employees above.

The term "production worker" **excludes** employees engaged in the following activities: Executive, purchasing, finance, accounting, legal, personnel, cafeteria, medical, professional and technical activities, sales, advertising, credit collection, and in the installation and servicing of own products, routine office functions and factory supervision ***(above working supervisor's level). (Employees in the above activities, however, should be included in the ALL EMPLOYEES figure.)***

Period: Normally, data will refer to calendar quarter, i.e., from January 1 through March 31; April 1 through June 30; July 1 through September 30; and October 1 through December 31. If your records relate to a period other than the calendar quarter, please indicate beginning and closing dates.

Hours Paid: Include all hours for which pay is received directly from the employer. **Include** paid vacation time, paid sick leave, paid holidays and other paid personal or administrative leave. If payments are made in lieu of time off, report the hours equivalent to the payments made. For example, three hours leave time at two-thirds the regular rate should be reported as two hours paid. **Exclude** hours associated with unpaid leave, normal travel time from home to work, unpaid washup time, and unpaid meal time.

Hours at Work: Include all time an employee is **required** to be on the employer's premises, on duty, or at a prescribed work place. **Include,** besides normal working hours, rest periods, stand-by time, downtime, travel time from job site during working day and travel time away from home if it cuts across working day. Do not convert overtime or premium paid hours to straight-time equivalent hours.

NOTE: For survey purposes HOURS AT WORK equals HOURS PAID less paid leave time (vacation, sick leave, holidays, and other paid personal or administrative leave).

Annual Total: The sum of HOURS PAID for each quarter should equal the ANNUAL TOTAL, HOURS PAID figure. Likewise, the sum of HOURS AT WORK for each quarter should equal the ANNUAL TOTAL HOURS AT WORK figure.

Chapter 11. Productivity Measures: Industries and Government

Background

Studies of output per employee hour in individual industries have long been a part of the BLS program. A study of 60 manufacturing industries in 1898, prompted by congressional concern that human labor was being displaced by machinery, was presented in the report *Hand and Machine Labor*; this provided striking evidence of the savings in labor resulting from mechanization in the last half of the 19th century. The impact of productivity advance upon employment remained an important focus of BLS throughout the 1920's and 1930's. Also during this period, the Bureau began the preparation and publication of industry indexes of output per employee hour, which were based on available production data from the periodic *Census of Manufactures* and employment statistics collected by BLS.

In 1940, Congress authorized the Bureau of Labor Statistics to undertake continuing studies of productivity and technological changes. The Bureau extended earlier indexes of output per employee hour developed by the National Research Project of the Works Progress Administration, and published measures for selected industries. This work, however, was reduced in volume during World War II, owing to the lack of meaningful production and employee hour data for many manufacturing industries.

The advent of World War II also caused a change in the emphasis of the program from problems of unemployment to concern with the most efficient utilization of scarce labor resources. BLS undertook a number of studies of labor requirements for defense industries, such as synthetic rubber and shipbuilding. After the war, the industry studies program resumed on a regular basis, and was supplemented by a number of industry studies based on the direct collection of data from employers. Budget restrictions after 1952 prevented the continuation of direct collection of data. Consequently, the preparation of industry measures is largely limited to those industries where data are readily available.

In recent years, public interest in productivity has grown, and increases in output per employee hour have been recognized as important indicators of economic progress and a means to higher income levels, rather than merely a threat to job opportunities.

The industry studies cover a variety of manufacturing and nonmanufacturing industries at the 2-, 3-, and 4-digit Standard Industrial Classification level. Measures for these industries are published on an annual basis and are provided for most years beginning in 1947 or 1958 and continuing through the most recent year for which data are available.

Coverage includes industries in the manufacturing, mining, trade, transportation, communication, public utilities, finance, and business and personal services sectors. In addition, productivity measures for various functional areas in the Federal Government are published annually. Recently, studies were initiated to develop productivity measures for State and local governments, which employ 80 percent of all civilian government employees.

The Bureau has been expanding its industry productivity measurement program by developing measures which include other inputs besides labor. The industry multifactor productivity indexes measure changes in an industry's output in relation to changes in labor, capital, and intermediate purchases. In addition to providing indicators of productivity change useful for analysis in their own right, such measures also are helpful in analyzing the causes of change in output per hour.

Labor Productivity Measures

Concepts

Indexes of output per employee hour measure changes in the relationship between the physical volume of an industry's output and the employee hours expended in that output. BLS computes an index of output per employee hour by dividing an output index by an index of aggregate employee hours. For most industries, measures are prepared separately relating output to (a) all employee hours, (b) production worker hours, and (c) nonproduction worker hours. (The standard definitions of production workers and nonproduction workers are used.) Three corresponding measures also are computed relating output to the number of employees. For industries in trade and services, measures are prepared relating output to the hours of all persons involved in producing that output, including self-employed and unpaid family workers.

The output per employee hour measures relate output to one input—labor time; they do not measure the specific contribution of labor, capital, or any other factor of production. Rather, they reflect the joint effect of a number of interrelated influences such as changes in technology, capital investment per worker, utilization of capacity, layout and flow of material, skill and effort of the work force, managerial skill, and labor-management relations. Also, indexes which relate output to one group of employees represent the total output of the industry resulting from all employees; they are not representative of the specific contribution of that group of employees.

For an industry producing a single uniform output, this index of productivity may be expressed as follows:

$$P_i = \frac{q_i}{q_o} \div \frac{L_i}{L_o} = \frac{q_i(q_o l_o)}{q_o(q_i l_i)} = \frac{l_o}{l_i}$$

where:

P_i = the index of productivity or output per employee hour in the current year

q_i and q_o = the output quantities in the current and base years respectively

L_i = the aggregate employee hours in the current year

L_o = the aggregate employee hours in the base year

l_i = unit labor requirement in current year

l_o = unit labor requirement in base year

Thus, for an industry producing a single uniform output, the index of productivity turns out to be simply the ratio of the unit labor requirement in the base year to the unit labor requirement in the current year. If l_o is greater (less) than l_i, the ratio (or productivity) is said to have increased (decreased) over the time period studied.

For an industry producing a number of different products or services (the more typical case), the output per employee hour index is the ratio for two periods of the total hours required to produce a given composite of products or services. Indexes of such industries vary with the composite and can take many forms. Two of these forms are:

a. Using a current-period composite

$$P_i = \frac{\Sigma q_i l_o}{\Sigma q_i l_i}$$

b. Using a base-period composite

$$P_i = \frac{\Sigma q_o l_o}{\Sigma q_o l_i}$$

An index constructed according to (a) compares the employee hours that would have been required in the base year to produce the current composite with the hours actually expended in their production. An index constructed according to (b) compares the employee hours that were expended in the base year to produce the base-year composite with the hours that would have been required in the current year to produce the same composite. Thus, these composite indexes eliminate the effects of shifts, over time, in the relative importance of products or services on output per hour.

In either form, an index of output per employee hour expressed as the quotient of an index of weighted output and an index of employee hours becomes:

Output index (Laspeyres) ÷ Employee hours index = Output per employee hour index (Paasche)

$$P_i = \frac{\Sigma l_o q_i}{\Sigma l_o q_o} \div \frac{\Sigma l_i q_i}{\Sigma l_o q_o} = \frac{\Sigma l_o q_i}{\Sigma l_i q_i}$$

Output index (Paasche) ÷ Employee hours index = Output per employee hour index (Laspeyres)

$$P_i = \frac{\Sigma l_i q_i}{\Sigma l_i q_o} \div \frac{\Sigma l_i q_i}{\Sigma l_o q_o} = \frac{\Sigma l_o q_o}{\Sigma l_i q_o}$$

The employee hours index measures the change in aggregate employee hours between the base and current periods. The employee hours data are the total hours expended by employees in establishments classified in the industry to produce the base-period and current-period composites.

As can be seen in the formulas, the appropriate output index is one which compares the quantities of the various products or services in the current and the base periods, each weighted by the employee hours expended per unit produced in a given period. A current-period weighted output per hour index uses a base-period weighted output index divided by the employee hours index. Conversely, a base-period weighted output per employee hour index is consistent with an output index which utilizes current-period weights.

Methods and Sources

Industries

Output

BLS industry output indexes are based on quantifiable units of products or services of the industry combined with fixed-period weights. Whenever possible, physical quantities are used as the unit of measurement. For those industries lacking quantity data, constant-dollar value of shipments, sales, or revenue data are used to develop the output series. Quantity data on physical output are usually most comprehensive for years covered by an economic census. To make maximum use of the comprehensive census data, output indexes are derived from data for two consecutive censuses; these indexes are

referred to as benchmark indexes. For intercensal years, annual indexes are based on either physical output data (generally in less detail than for census years) or, if such data are not available, value of output adjusted for price change (the value of output in constant dollars). The annual series subsequently are adjusted to the benchmark levels for the census years.

Weights. In order to derive a labor productivity index for an industry that is a mean of the productivity movements of the component outputs, the various products are combined with unit employee hour weights. Such weights are derived from special surveys or from data for specialized establishments published in the *Census of Manufactures*. In some industries, however, unit employee hour information is not available for individual products. In these cases, BLS uses substitute weights when it is believed that they are proportional to unit employee hour weights; these are usually unit value weights. Unit value weights are computed from census or survey data on the quantity and value of shipments of the primary products of the industry. The introduction of these substitute weights results in an industry output per employee hour index which reflects shifts in value per employee hour of the various products in the industry. Thus, a change can occur in the index without any change in the output per employee hour for any product of the industry.

The extent to which error or bias may be introduced by the use of unit value weights is not known. The index is equivalent to one weighted with unit employee hours if the unit employee hours and unit values among the products are proportional, or if there is no correlation between the relative change in quantity and value per employee hour.[1] There is evidence that unit values are fairly reliable approximations for individual products in instances where wages constitute a large proportion of total value of output. An error generated in the output index by an error in the weights usually is considerably smaller than the error in the weights themselves.

In some industries, unit value weights for specific products and unit employee hour weights for product groups are used at different stages in constructing the industry output indexes. When this procedure is used, the individual products are first aggregated into primary product group indexes with unit value weights. These indexes are then combined into an industry output index with primary product group employee hours. The primary product group employee hours relate to a base period, as do the value weights.

To obtain primary product group employee hour weights, total employee hours for plants specializing in each primary product class, derived from published census data on production worker hours and nonproduction worker employment, are supplemented by unpublished BLS estimates of nonproduction worker hours. (See section on employee hours later in this chapter for the procedures used to estimate nonproduction worker employee hours.) Ratios of employee hours to value of shipments are multiplied by the corresponding value of primary products shipped by the entire industry to provide the estimated primary product group employee hour weights. This procedure assumes that employee hours per dollar for each product class shipped by the entire industry are the same as those for plants specializing in the product group. This procedure is used only when the "specialization" and "coverage" ratios of the industry are high, and specialization data for all or most of the product groups are available.[2]

Most published industry indexes have used: 1947 weights for the 1947–58 period, 1958 weights for 1959–63, 1963 weights for 1964–67, 1967 weights for 1968–72, 1972 weights for 1973–77, 1977 weights for 1978–82, and 1982 weights for years after 1982. The Bureau updates the weights as data become available from the periodic censuses.

Benchmark indexes. For many manufacturing, mining, trade, and service industries, indexes reflecting changes in output between census years are constructed. These are called benchmark indexes and are generally available for the nonregulated industries for which census data are collected.

For manufacturing industries, benchmark indexes are developed through the use of the following procedure: Price indexes for each primary product class are generated from data on the value of each individual product within the class, whether made in the industry or elsewhere. Producer price indexes are used wherever possible to convert the product values to constant-dollar estimates. If a producer price index is not available, a price index is developed using both the quantity and value data reported for the product in the *Census of Manufactures*. The primary product class price indexes are derived from the sum of the current-dollar values and the sum of the constant-dollar values.

These "wherever made" primary product class price indexes are used to deflate the value of primary products produced only by the industry. This procedure assumes that the price movements of the primary products within the industry are the same as the price movements for all primary products wherever made. These constant-dollar values are related to corresponding base-year values in

[1] Irving H. Siegel, "Further Notes on the Difference Between Index Number Formulas," *Journal of the American Statistical Association*, December 1941, pp. 519–24.

[2] The "specialization ratio" is the value of shipments of primary products of plants in the industry expressed as a percent of total shipments of all products (primary plus secondary) made by these same establishments. The "coverage ratio" is the value of shipments of the primary products made by plants classified in the industry as a percent of the total shipments of the industry's primary products made by all producers, both in and out of the specified industry.

order to derive separate primary product indexes within the industry.

These separate primary product indexes are then combined with employee hour weights to derive the total industry primary product output index. The index of primary products of the industry is multiplied by a "coverage" adjustment to represent the total output of the industry. This adjustment is the ratio of the index of value of industry shipments (after inclusion of net additions to inventories) to the index of value of shipments of primary products. The final industry output index thus reflects inventory buildups and changing proportions of secondary products.

Benchmark indexes for the mining industries are computed from data as reported in the *Census of Mineral Industries*. For trade and service industries, benchmark indexes are computed from sales data reported in the *Census of Business*.

Annual indexes. Annual output indexes are constructed by the following procedures. The annual indexes are adjusted, if necessary, to the levels of the benchmark indexes previously described. The adjustment factors for 2 census years are used to determine the adjustment factors for the intervening years by linear interpolation.

1. *Physical output.* Most annual output indexes are based on physical quantities of products combined with fixed-period unit employee hour or unit value weights. The basic quantity data are generally primary products of an industry classified into product groups; the finest level of detail available is used. The quantity data relate to primary products "wherever made" and, in some cases, to shipments of the products.

The Bureau's annual measures of production are constructed from data on physical quantities of products which comprise a high percent of the total value of an industry's output. Coverage varies between 80 and 100 percent.

2. *Deflated value.* When adequate annual physical quantity data are not available, indexes are derived from data on the value of industry output adjusted for price change. Since the adjustment for price change is most often downward, the indexes usually are called "deflated value" indexes. Such indexes are conceptually equivalent to indexes which use data on physical quantities of products combined with unit value weights. This index is derived by dividing the value of the industry's output by an industry price index. An index of these deflated values shows the change in the real value of output between the past and current periods.[3]

For manufacturing industries, data on value of production are often not directly available, and data on value of shipments must be used. In this case, data on value of shipments for each year are divided by an industry price index representing the average annual price for the year. Beginning and end-of-year finished goods and work-in-process inventories are also deflated. The estimated value of shipments in constant dollars is then adjusted by the net change in inventories—also in constant dollars—to yield an estimate of the constant-dollar value of production. For industries in trade and services, data on the value of sales for each year are divided by a specially constructed industry price index to derive a measure of the change in the industries' real output.

Sources. Industry output indexes are prepared from basic data published by various public and private agencies, using the greatest level of detail available.

Data from the Bureau of the Census, U.S. Department of Commerce, are used extensively in developing output statistics for manufacturing, trade, and service industries. The Bureau of Mines, U.S. Department of the Interior, compiles most of the information for the mining and cement industries. Other important Government sources include the U.S. Department of Energy, the U.S. Department of Agriculture, the Fish and Wildlife Service, U.S. Department of the Interior, the Interstate Commerce Commission, the Internal Revenue Service, and the Department of Transportation. Important sources of trade association data include the Textile Economics Bureau, Inc., National Association of Hosiery Manufacturers, Inc., National Canners Association, Rubber Manufacturers Association, and the American Iron and Steel Institute.

For deflated value series, industry price indexes are derived from producer and consumer price indexes developed by the Bureau of Labor Statistics.

Employee hours

An index of employee hours is computed by dividing the aggregate employee hours for each year by the base-period aggregate. Because of data limitations, employee hours are treated as homogeneous and additive with no distinction made between hours of different groups of employees. For industries in which the self-employed are important, indexes are constructed for the hours of all

[3] For example:

Value index/Price index (Paasche) = Output index (Laspeyres)

$$\frac{\Sigma p_i q_i}{\Sigma p_o q_o} \div \frac{\Sigma p_i q_i}{\Sigma p_o q_i} = \frac{\Sigma p_o q_i}{\Sigma p_o q_o}$$

where p_i and p_o represent prices of products in the industry in the current and base periods, respectively. This index requires quantities of all items produced in each year. These data are not available for the particular industries where this measure is used, and quantity data are usually available for the base year only. Accordingly, the deflated value indexes employed usually take the following form:

Value index/Price index (Laspeyres) = Output index (Paasche)

$$\frac{\Sigma p_i q_i}{\Sigma p_o q_o} \div \frac{\Sigma p_i q_o}{\Sigma p_o q_o} = \frac{\Sigma p_i q_i}{\Sigma p_i q_o}$$

persons, which includes paid employees, partners, proprietors, and unpaid family workers.

Sources. Industry employment and employee hour indexes are developed from basic data compiled by the Bureau of Labor Statistics, the Bureau of the Census, and other sources. For most private nonagricultural industries, BLS publishes employment and average weekly hours data for production or nonsupervisory workers and employment data for all employees. The Bureau of the Census publishes employment and aggregate hours data for production workers and employment data for all employees.

BLS and the Bureau of the Census differ in their definition of employee hours and in their sampling and reporting methods. In general, BLS data are the preferred source for measuring industry employment and hours. Census employment is the average of production workers plus the number of other employees in mid-March. The number of production workers is the average for the payroll periods for the 12th of March, May, August, and November. In contrast, the BLS (790) employment statistics program is a cooperative Federal and State project. Employment and hours are collected monthly and are benchmarked each year to comprehensive data from the State unemployment insurance programs.

Nonproduction worker hours. Only employment data are available for nonproduction workers. The average annual hours of these workers must be estimated. The estimates of aggregate nonproduction worker employee hours for the manufacturing industries are derived from published employment data, and estimates of average annual hours worked or paid per nonproduction worker.

For years prior to 1968, the estimates of average annual hours worked were calculated by multiplying the number of workweeks in the year times the scheduled weekly hours. This produced an estimate of annual hours paid. Estimated hours for vacations, holidays, disability, and personal time off were subtracted from average annual hours paid to obtain an estimate for average annual hours worked.

Estimated hours for vacations, holidays, and disabilities were based on data from various BLS surveys and studies of the U.S. Department of Health and Human Services. Personal time off was estimated as a constant from references in relevant publications.

From 1968 to 1977, the estimates of average annual hours paid and hours worked were based on data collected in the BLS biennial surveys of employee compensation in the private nonfarm economy. Since these surveys are no longer conducted, the 1977 levels are being carried forward until other data become available.

For the mining industries, estimates for the hours of nonproduction workers are based on data collected by the Mine Safety and Health Administration. For the trade and service industries, estimates are made for the hours of partners, proprietors, and unpaid family workers using unpublished data collected in the Current Population Survey, and for supervisory workers using data from the *Census of Population.*

All-employee hours estimates for manufacturing industries are derived by summing the aggregate hours for production workers and the estimated aggregate hours for nonproduction workers. For trade and service industries, all-person hours estimates are derived by summing the aggregate hours for paid employees and the estimated aggregate hours for partners, proprietors, and unpaid family workers.

Comparability of output and employee hours data

For manufacturing industries, employee hours data are based on total employee hours of establishments classified in an industry. Annual physical output data, on the other hand, usually include the products which are primary to an industry that are reported on a "wherever made" basis. Thus, there can be some discrepancy in the coverage of output and employee hours measures. This is not a serious problem unless there is considerable variation from year to year in the proportion of primary products to total products of an industry, or if there is a change in the proportion of primary products which are made in other industries. The comparability of the employee hours and output data is indicated by the specialization and coverage ratios which the Bureau of the Census publishes. All industries in the BLS industry measurement program have high and stable specialization and coverage ratios.

In selecting industries for the measurement program, attention is also given to changes in the degree of vertical integration. Employee hours relate to all operations performed by establishments of an industry, while output usually is measured in terms of the final product. If establishments undertake additional operations (such as the manufacture of components which had previously been purchased from suppliers) employee hours will increase but there will be no corresponding increase in final output. Thus, output per employee hour indexes would be biased. In developing industry indexes, BLS examines data such as the ratio of cost of materials to value of shipments for any indication of a change in the degree of vertical integration.

Government

Federal

Indexes of output per employee year, output, and employee years for selected functional areas of Government

activity[4] and for approximately 400 participating organizations are constructed in a manner similar to that described for industries. At the present time, these measures cover about 69 percent (2.1 million employee years) of the Federal civilian work force.

Ideally, a productivity index should relate final outputs to their associated direct and indirect input(s), and, in fact, the output data are final from the perspective of the functional areas within which these data are classified. However, since the outputs of one organization may be consumed wholly or partially by another Federal organization in the production of its final outputs, all output indicators in the Federal sample may not be final from the perspective of a higher level of organization; for example, the entire Federal Government. Therefore, the overall statistics do not represent "Federal productivity" but rather, the weighted average of the productivity changes of the measured Federal organizations included in the sample.

Through an annual collection process, most data are submitted directly by agencies to BLS, but in some cases data are obtained from secondary sources such as agency budgets and annual reports. In the Federal sample, more than 3,000 products and services are aggregated into output indexes by combining the quantities of each type of output by their respective base-year labor requirements. These unit employee year weights are constructed from the detailed output and input data provided by each organization. Although the weights relate to fixed periods, they are updated every 5 years. The output segments are linked and referenced to a fiscal year 1977 base.

The organizational indexes are grouped into 28 functional categories, based on similarity of activity. Some of these categories, such as printing and duplication, are more homogeneous than others, such as general support services, which include many diverse activities. Nonetheless, these categories provide insight into the trends for the major functional areas underlying the overall sample. Although productivity, output, and input indexes are also constructed for each participating organization, these are not published but are returned to each organization for its own use (for example, to stimulate further examination of the causes of productivity change within each organization). This is one method used by BLS to validate the basic data (that is, by examining the reasonableness of the derived trends).

[4] The 28 functions are: Audit of operations; buildings and grounds; communications; education and training; electric power production and distribution; equipment maintenance; finance and accounting; general support services; information services; legal and judicial activities; library services; loans and grants; medical services; military base services; natural resources and environmental management; personnel investigations; personnel management; postal services; printing and duplication; procurement; records management; regulation—compliance and enforcement; regulation—rulemaking and licensing; social services and benefits; specialized manufacturing; supply and inventory control; traffic management; and transportation.

Employee year indexes are developed from agency data submissions and secondary sources. As in all labor input measures used by the Bureau to develop productivity indexes, employee years are considered homogeneous and additive. Each employee year reflects the regularly scheduled time, overtime, and leave time of all full-time, part-time, or intermittent employees. An employee year is equivalent to one individual paid for 2,087 hours.

State and local

Government measurements are being extended to include indexes of output per employee year, output, and employee years for selected State and local services. A cross-section of services is being examined and indexes computed using concepts and methods similar to those for industries and the Federal Government. This research, which uses published and readily available secondary data, is keyed to the Standard Industrial Classification system.

Output indexes reflect final services to the public. The consequences or effectiveness of government service are not measured. The focus is on government production. Prison system outputs, for example, are the number of prisoners housed and to whom treatment is administered, not the effectiveness of rehabilitation or community safety. Output data are taken from Federal agencies such as the Departments of Labor, Justice, and Transportation and industry groups such as the American Public Power Association, American Public Transit Association, and Distilled Spirits Council of the U.S.

Employee year index computations use the same general concepts as those used in the Federal measurements. The primary source of employment data is the Bureau of the Census' annual public employment survey. This is supplemented by data from Federal agencies and industry associations when available.

Multifactor Productivity Measures

Concepts

The industry multifactor productivity indexes measure productivity growth by measuring changes in the relationship between the quantity of an industry's physical output and the quantity of inputs consumed in producing that output, where measured inputs include capital and intermediate purchases (including raw materials, purchased services, and purchased energy) as well as labor input.

The index used to calculate multifactor productivity is the Tornquist index and is of the form:

$$\ln \frac{A_t}{A_{t-1}} = \ln \frac{Q_t}{Q_{t-1}} - \left(W_k \left(\ln \frac{K_t}{K_{t-1}} \right) + W_L \left(\ln \frac{L_t}{L_{t-1}} \right) + W_{IP} \left(\ln \frac{IP_t}{IP_{t-1}} \right) \right)$$

where:

ln = the natural logarithm of the variable
A = multifactor productivity
Q = output
K = capital input
L = labor input
IP = intermediate purchases input
W_K, W_L, W_{IP} = compensation share weights

The weights are the means of the compensation shares in two adjoining time periods.

$$W_i^t = \frac{(S_i^t + S_i^{t-1})}{2}$$

where:

$$S_i^t = \frac{P_i^t X_i^t}{\Sigma(P_i^t X_i^t)}$$

P_i^t = price of input X_i in period t

The Tornquist formula yields growth rates which are differences in logarithms. The antilogs of these rates are taken to get the percent changes in multifactor productivity. These percent changes are chained together to form the index.

Methods and Sources

Output

The multifactor productivity output measures are calculated using, whenever possible, the same units of products or services of the industry as are used in measuring output for the industry labor productivity measures. Whenever possible, physical quantities are used as the unit of measurement; when physical quantities are unavailable, constant-dollar value of shipments, sales, or revenue data are used. The multifactor productivity output measures differ from the labor productivity output measures primarily in the method used for weighting together the various categories of output, as explained below.

Weights. The multifactor productivity output measure utilizes price weights for combining the various categories of output of an industry. Generally, census value data for each detailed output category are divided by the physical quantity of output for that category to obtain the unit value (or price) estimates. The price of each output category is multiplied by its corresponding quantity and then expressed as a share of the total value of output. These value shares are averaged at time t and t–1.

Sources. Data sources are the same as those used in calculating indexes for the labor productivity measures.

Employee hours

Employee hour indexes are calculated in the same way as those used in measuring industry labor productivity. As with the labor productivity measure, employee hours are treated as homogeneous and additive with no distinction made between hours of different groups of employees. The index is computed by simply dividing the aggregate employee hours for each year by the base-period total.

Sources. Data sources are the same as those used in calculating employee hour indexes for the labor productivity measures.

Capital

The measure of capital input is based on the flow of services derived from the stock of physical assets. Physical capital is composed of equipment, structures, land, and inventories. Financial capital is excluded. Capital services are estimated by calculating capital stocks; changes in the stocks are assumed proportional to changes in capital services for each asset. Stocks of different asset types are Tornquist-aggregated, using estimated rental prices to construct the weights for assets of different types.

Capital stocks are calculated using the perpetual inventory method, which takes into account the continual additions to and subtractions from the stock of capital as new investment and retirement of old capital take place. The perpetual inventory method measures stocks at the end of a year equal to a weighted sum of all past investments, where the weights are the asset's efficiency relative to a new asset. A hyperbolic age-efficiency function is used to calculate the relative efficiency of an asset at different ages. The hyperbolic age-efficiency function can be expressed:

$$S_t = (L - t) / (L - (B)t)$$

where:

S_t = the relative efficiency of a t-year-old asset
L = the service life
t = the age of the asset
B = the parameter of efficiency decline

The parameter of efficiency decline is assumed to be 0.5 for equipment and 0.75 for structures. These

parameters yield a function in which assets lose efficiency more slowly at first, then rapidly later in life.

Stocks of equipment, structures, inventories, and land are estimated separately. Individual price deflators for each asset category are constructed and used to convert the current-dollar investment to constant dollars. Industry-specific service lives are computed for each type of equipment asset for use in the perpetual inventory method.

Current-dollar values of inventory stocks are calculated for three separate categories of manufacturers' inventories: Finished goods, work in process, and materials and supplies. Inventory stocks for each year are calculated as the average of the end-of-year stocks in years t and t–1 to represent the average utilized during the year as a whole. This is also done with equipment, structures, and land. Current-dollar inventory values for the three categories of inventories are deflated with appropriate price indexes.

Land stocks are estimated as a function of the movement in constant-dollar gross structures stocks for the given industry.

Weights. The various equipment, structure, inventory, and land stock series in constant dollars are aggregated into one capital input measure using estimated rental prices as weights. Rental prices are calculated for each asset as:

$$RP = [(P \times R) + (P \times D) - (P^t - P^{t-1})] \times (1-uz-k)/(1-u)$$

where:

RP = the rental price

P = the deflator for the given asset type

R = the internal rate of return

D = the rate of depreciation for a given asset type

P^t-P^{t-1} = the capital gain term for the asset

(1–uz–k)/(1–u) reflects the effects of taxation and:

u = the corporate tax rate

z = the present value of $1 of depreciation deductions

k = the effective investment tax credit rate

This method of calculating rental prices is similar to that used in calculating multifactor productivity for major sectors of the economy except that no attempt is made to incorporate the effects of indirect business taxes, for which data are lacking at the industry level.

The rental prices are expressed in rates per constant dollar of productive capital stocks. Each rental price is multiplied by its constant-dollar capital stock to obtain current-dollar capital costs which are then converted to value shares for Tornquist aggregation.

Sources. Industry capital indexes are developed from basic data published and maintained by the Bureau of the Census, U.S. Department of Commerce; the Bureau of Economic Analysis, U.S. Department of Commerce; and the Office of Economic Growth, Bureau of Labor Statistics. Price indexes are derived from producer price indexes developed by the Bureau of Labor Statistics.

Intermediate purchases

The index of intermediate purchases input is a Tornquist aggregate of separate indexes of change in real materials, services, fuels, and electricity consumed by an industry. With the exception of electricity, for which both price and quantity data are available, the above indexes are calculated by dividing annual current-dollar values by appropriate price indexes to obtain constant-dollar annual estimates. Separate price deflators for materials and fuels for each industry are constructed using detailed price and value data for individual subcomponents of each group. The aggregate deflators are divided into the current-dollar values to derive constant-dollar estimates. The constant-dollar series for each component are indexed by dividing each year's estimate by the base-period aggregate.

Weights. The indexes of change in real materials, services, fuels, and electricity are weighted together with value share weights to derive an aggregate intermediate purchases index. These weights are derived by dividing the current-dollar values of each by the total combined value of intermediate purchases, and averaging these weights at times t and t–1.

Sources. Industry intermediate purchases indexes are developed from basic data published by the Bureau of the Census and the Bureau of Economic Analysis.

Weights for major input components

The indexes representing quantity change for each of the three major inputs are weighted together to compute the index of combined inputs. The relative weights for each year are derived from total costs for each input. All employee labor costs from census data are used for the labor weight. The sum of current-dollar values for materials, services, fuels, and electricity constitute the weight for intermediate purchases. The weight for capital is derived by subtracting labor costs and an estimate of purchased services from Census value-added data. These compensation shares are averaged at time t and t–1.

Presentation

BLS industry and government indexes are published annually in the bulletin, *Productivity Measures for Selected*

Industries and Government Services. A limited amount of the most current data is provided in an annual news release. As new industry indexes are developed, they are presented as articles in the *Monthly Labor Review*. The articles contain an analysis of productivity, output, and employment trends in the industry. Technical notes describing the methodology used to develop the indexes are available on request. Unpublished indexes for all 4-, 3-, and 2-digit SIC manufacturing industries are available for analytical purposes upon request.

Indexes of output per employee hour also are published in the *Statistical Abstract of the United States* and in the *Handbook of Labor Statistics*, on LABSTAT and on BLS data diskettes. Some indexes for earlier years are published in *Historical Statistics of the United States.*

BLS Federal Government indexes are also available in the *Handbook of Labor Statistics*, on LABSTAT data tapes and on BLS data diskettes. More detailed Federal data and State and local government data are available from BLS.

Uses and Limitations

Measures of output per employee hour are particularly useful for studying changes in labor utilization, projecting future employment requirements, analyzing trends in labor costs, comparing productivity progress among countries, examining the effects of technological improvements on employment and unemployment, and analyzing related economic and industrial activities. Such analysis usually requires that indexes of output per employee hour be used in conjunction with other data. Specifically, related data on production and employment are useful in studying technological effects; to study trends in labor costs, data on earnings and other labor expenditures are necessary.

These productivity measures of output per employee hour are subject to certain qualifications. First, existing techniques cannot fully take into account changes in the quality of goods and services produced. Second, although efforts have been made to maintain consistency of coverage between the output and labor input estimates, some statistical differences may remain. Third, changes in the degree of plant integration and specialization often are not reflected adequately in the production statistics. This may result in overstatement of productivity gains in some years and understatement in others. Fourth, indexes involving nonproduction worker hours are subject to a wider margin of error than are the indexes using production worker hours because of the technique for estimating average employee hours of nonproduction workers. Errors in estimating hours of nonproduction workers, however, have a relatively insignificant effect on the estimates of hours for all employees. Fifth, industries in which all person hours are used as the denominator are subject to a wider margin of error because of the limited data available for unpaid family workers, the self-employed, and paid managers. Finally, year-to-year changes in output per employee hour are irregular, and, therefore, are not necessarily indicative of basic changes in long-term trends. Conversely, long-term trends are not necessarily applicable to any one year or to any period in the future. Because of these and other statistical limitations, these indexes cannot be considered precise measures; instead they should be interpreted as general indicators of movements of output per employee hour.

Indexes of multifactor productivity are subject to many of the same limitations previously mentioned with the exception of the effects of changes in the ratio of other factor inputs to labor. Since the multifactor indexes relate output to inputs of labor, capital, and intermediate purchases, increases in one input relative to others are not reflected as productivity change. Indeed, one of the uses of multifactor productivity measures is in analyzing the effects of movements of capital and intermediate purchases, relative to labor, versus other influences on labor productivity change.

Technical References

Bureau of Labor Statistics

Fisk, Donald M. *Measuring Productivity in State and Local Government,* BLS Bulletin 2166, December 1983.

Reports on a study of ways that national labor productivity trends might be calculated for State and local government. Reviews past research and studies, examines available national data, and outlines a strategy for further work.

Kutscher, Ronald E., and Mark, Jerome A. "The Service-Producing Sector: Some Common Perceptions Reviewed," *Monthly Labor Review*, April 1983.

Compares the growth in output per hour in the service-producing industries to the goods-producing industries. Also examines the level of capital intensity in each sector and the underlying employment shifts between the two sectors.

Mark, Jerome A. "Industry Indexes of Output Per Man-Hour," *Monthly Labor Review*, November 1962.

Describes the methods used in constructing BLS indexes of output per employee hour. Covers methods and sources, construction of production and employee hour indexes, and limitations.

Mark, Jerome A. "Measuring Productivity in Service Industries," *Monthly Labor Review*, June 1982.

Surveys problems of measurement of output and input. Discusses BLS measures for such industries as retail food stores, eating and drinking places, intercity trucking and bus transportation, communications, banking, hotels and motels, and others.

Mark, Jerome A. "Measuring Productivity in Government—Federal, State, and Local," *Public Productivity Review*, March 1981.

Differentiates between measures of efficiency, intermediate work activity, and effectiveness; describes concepts, methods, and problems relevant to the measurement of government productivity; stresses the need for detailed product data and discusses examples of current efforts in the collection of, and the improvement in, pertinent data; and surveys problems of concepts, methods, and data adequacy in measuring productivity at the State and local government levels.

Sherwood, Mark. "Multifactor Productivity in Steel and Motor Vehicle Industries," *Monthly Labor Review*, August, 1987.

Describes new multifactor productivity measures for two industries. Explains the relationship of multifactor productivity to labor productivity and discusses underlying trends in output and inputs of labor, capital, and intermediate purchases.

Other publications

Kendrick, John W., and Vaccara, Beatrice N., eds. *New Developments in Productivity Measurement and Analysis.* Studies in Income and Wealth, Vol. 44. Chicago, The University of Chicago Press, 1980.

Collection of papers on such subjects as labor and multifactor productivity by industry; productivity in selected service sectors; and international comparisons of productivity. Includes a study of high and low productivity establishments; current efforts to measure productivity in the public sector; effects of research and development on industry productivity growth; and energy and pollution effects on productivity and international comparisons of economic growth.

National Academy of Sciences. *Measurement and Interpretation of Productivity.* Washington, 1979.

Collection of papers on such topics as the concepts and measurement of productivity; the limitations of productivity statistics; the measurement of outputs and inputs; the sources of economic growth; measures of company productivity; and international comparisons of productivity.

Chapter 12. Technological Change

Background

Studies of technological changes and their labor implications have been undertaken by BLS over the years for a variety of purposes. During the 1930's, public interest focused on the unemployed, and reports were prepared on displacement of workers resulting from technological change in various industries. During World War II, emerging technologies were studied for purposes of improving work force utilization.

Beginning in the mid-1950's, nationwide attention was focused on the implications of new developments classified under the general term "automation." BLS made a series of studies on a plant basis, in the insurance, petroleum refining, bakery, air lines, and electronics industries, to explore the labor implications of various changes. Later, broader studies were undertaken, including a survey of the labor impact of changeover to electronic computers in 20 large companies and intensive studies of technological change in the coal and paper industries.

These studies formed the basis, beginning in the early 1960's, for a more systematic investigation of likely future changes. The first report, entitled *Technological Trends in 36 Major American Industries*, was issued by the President's Advisory Committee on Labor-Management Policy in 1964. A revised edition covering 40 industries was published in 1966. More recent industry studies have been published as they are completed.

Description of Studies

The Bureau's research program on technological change involves preparing two basic types of studies: Summary reports surveying trends in major industries, and studies undertaken periodically of major technological innovations, such as computers, that affect workers in different industries.

Summary reports on major industries

To provide a broad overview of significant trends in the economy, the Bureau prepares a summary report, applying to key industries, on new types of machinery, processes, and products which are believed likely to have an important effect over the next 5 to 10 years. The industries covered comprise a cross-section of the economy and include those where the pace may be slow as well as those where rapid change is expected.

The emphasis of these studies is on technological developments within each industry in an early stage of the innovation's commercial use; i.e., the period after introduction on the market but before widespread adoption. Inventions and discoveries still in the "drawing board" stage are considered unlikely to have as much impact over the next decade as those already tested and are generally not discussed.

The report briefly describes recent technological developments, indicating insofar as practicable some economic advantages of various types of new equipment, processes, or products; their importance in terms of the employee hours engaged in the operations affected; estimated extent of use currently and in 5 to 10 years; and some factors affecting adoption such as the volume of investment and expenditures for research and development. The advantages described include not only labor savings per unit, but also quality improvements, fuel and material economies, greater accuracy, new markets, etc.

In assessing the employment implications of technological changes, account is taken of the possible rate of growth in output per employee hour and in the industry's total output. Appraisal also is made of the changes in occupational structure and of some issues and examples of adjustment of workers to technological change.

Technological innovation studies

Some technological innovations have applicability in many industries. Among these are such developments as computers, numerical control of machine tools, material handling equipment, and control instruments. Because of their far-reaching impact, special studies have been made of the nature, status, prospects for adoption, and implications for unit labor requirements, occupational change, training needs, and problems of industrial relations. In analyzing their impact in different industries, differences as well as similarities are revealed.

Data Sources and Collection Methods

A variety of data sources and collection methods are utilized in making studies of technological change and its impact.

Personal interviews

In making studies, analysts personally conduct intensive interviews with plant managers, personnel directors, and other officials who have direct knowledge of changes at their plant. Union officials at the plant and, in some cases, individual workers are interviewed. The analyst uses a checklist of questions in conducting informal interviews in order to elicit the maximum amount of data. Plants and offices included in these studies are selected on the basis of having recently made a major change in their equipment, products, or methods of production.

Personal interviews also are used to help determine industry trends. Informal interviews are conducted with engineers, scientists, economists, and other experts in companies which produce and use new technology, and with unions, trade associations, government agencies, universities, etc., who have specialized knowledge of a particular technological development or industry trend. One objective in these cases is to obtain their expert judgment about the nature, pace of introduction, and possible impact of developments with which few plants have had any experience. The emphasis in these interviews is on the technological change rather than on experiences in adjusting.

Trade and technical publications

Important sources of information concerning technological trends are trade journals, technical magazines and books, conference proceedings, government hearings, and company reports. Annual reports of leading corporations and company house organs often contain useful information on current technological developments in some industries. These publications are reviewed to obtain information about the status and prospects of important developments and to ascertain which companies and plants merit more intensive field visiting. Reports and publications of firms that produce particular types of equipment often are found useful in studies of industries that use such equipment.

Statistical data sources

Quantitative information about the status of specific technological developments is fragmentary and scarce. The Bureau makes use of available data from many public and private sources. These sources include: General Services Administration, annual inventory of computers in the Federal Government; International Trade Administration, *U.S. Industrial Outlook* (annual); International Data Corporation, *EDP Industry Report*; American Bankers' Association, survey of banking automation; and *American Machinist*, inventory of metalworking machinery.

Statistical information on industrywide trends is useful in analyzing the economic implications of technological change. Among the important sources used are the Bureau's indexes of output per employee hour and related series on production, employment, and hours; the Bureau of the Census' data on expenditures on plant and equipment; and the National Science Foundation's estimates of research and development.

Plant records

In making detailed studies of the impact of technological change on individual workers within a plant, analysts sometimes can obtain from employers' files data on such aspects as the age, sex, and related personal characteristics of employees whose jobs are eliminated and the jobs in the plant held by each individual affected before and after the change. Similar data are collected on individuals who are selected for the positions created in connection with automated equipment.

Expert review

In preparing forecasts of technological trends, a critical step is the review of preliminary reports by outstanding experts in each industry. Drafts of industry reports are mailed to company executives, union research directors, trade association officials, technical journal editors, and university and government specialists for their assessment of the validity and adequacy of projected trends. Over 450 persons were contacted in this way in the preparation of a report on technological trends in major industries. Some experts are visited personally to review draft statements in detail. Reports on technological prospects are designed to reflect, as much as possible, the authoritative views of a number of persons who have expert, firsthand knowledge of each industry.

Analysis and Interpretation

For a better understanding of research results in this field, it is important to keep in mind the meaning of certain key ideas and concepts. Some of the problems of interpretation and analysis, therefore, are set forth briefly.

Definition of technological change

Technological change is defined broadly in the BLS studies as encompassing significant changes in processes and equipment, products and services produced, and materials, fuels, and energy used. The term "automation," which is sometimes popularly used as a synonym for "technological change," designates, strictly speaking, a particular type of current development. It has been variously defined, for example, as "automatic operation," "the mechanization of sensory control and

thought processes," and "a concern with production processes as a system."

While BLS studies have been concerned with developments in automation, particularly in anticipating long-term trends, they are not the only technological changes taking place that affect labor requirements and labor relations. For example, new ways of generating power, piggybacking in transportation, use of synthetic materials in manufacturing, mechanized methods of material handling, and faster steelmaking processes are important technological developments not usually covered by technical definitions of automation, but having significant employment implications.

Impact on productivity

Since one of the principal consequences of technological change, so far as work force utilization is concerned, is an increase in productivity (output per employee hour), special attention is given in BLS studies to analyzing changes in industrial productivity. Such trend analysis is a useful method of measuring the pace of technological change. Changes in productivity, however, also reflect changes in capacity utilization and many other nontechnical factors. It is important to recognize that the productivity trend is only a partial measure of the rate of technological change.

In determining the impact of a specific technology, BLS studies try to indicate the reduction in unit labor requirements that the new process is designed to achieve. In some cases, estimates of labor savings are derived on the basis of comparisons with the estimated average technology of the industry under study; in others, with the best equipment that is available; or in actual plant studies, with the technology that is actually displaced.

It is also important to distinguish between the impact on productivity of the operation directly affected and on productivity of the plant as a whole. An advanced machine tool, for example, may result in a relatively large reduction in unit labor requirements in the machining operation, but would have little impact on finishing and assembling, and may even require additional labor in engineering and maintenance work. The impact on plant productivity, therefore, would be considerably less than the effect on productivity of any department or operation directly affected.

Impact on employment

In assessing the impact of technological change on employment, it is necessary to consider the implications of plant policies and the effects of economic changes with which technological changes interact. Analysis of the impact of technological change purely in terms of machinery is incomplete.

At the plant level, for example, the substitution of machinery for labor may substantially reduce job opportunities in operations directly affected. If efforts are made, however, to eliminate these jobs by not filling vacancies or by transfer of affected workers to other positions in the plant or office, labor savings could be achieved without displacing the workers affected.

Moreover, the employment impact of technological change is also interrelated with the effects of the business cycle. Thus, workers whose jobs are eliminated by technological changes may not be displaced from a plant until a decline in demand results in layoffs—a long time after the change has been made in some cases. In the subsequent recovery, however, they may not be hired back because their jobs no longer exist.

The employment trend for the industry as a whole must also be examined. The plant which reduces its unit costs through technological improvement may be able to gain a larger share of the market and increase its employment, but at the expense of the less technically advanced competing plants, which may be forced to shut down, displacing workers far from the location of the change.

Because of the complex of economic factors that operate through the market, including changes in demand, location, foreign competition, corporate organization, and consumer taste, it is very difficult to isolate the effects of technological change.

Impact on occupations

Two aspects of occupational change resulting from technological changes are examined. Changes in job structure—the distribution of the plant or office work force by function or broad skill grouping—are studied to determine the extent of upgrading or downgrading. Since the content of jobs may be altered as a result of changes in equipment or processes, attention also is directed to intensive before-and-after analysis of job duties and the knowledge and abilities required to perform these duties as indicated by job descriptions and observation. The content of newly created jobs also is studied, and the qualifications required and personal characteristics of individuals selected for these new positions are described, so far as possible.

Adjustment to technological change

Technological change has important implications for personnel management and collective bargaining within plants. The introduction of new machinery, products, or processes often requires movement of workers among jobs. Often the adjustment proceeds according to rules established in advance through collective bargaining. Provisions to assist workers whose jobs are eliminated include severance pay, retraining, and early retirement. Besides analyzing the operation of formal provisions under collective bargaining, Bureau studies describe informal

efforts to provide training, to utilize attrition, and to obtain jobs for displaced workers elsewhere. The limitations of these measures as well as their advantages are important matters studied.

Uses and Limitations

BLS studies and reports of technological change are useful to managers, union leaders, educators, economists, government officials, and others in planning policies to cushion the impact of change. The study of emerging technological trends and possible implications, moreover, provides a basis for more valid projections of productivity and economic growth. They also are useful in pinpointing employment problems and determining the most productive direction of future research to obtain possible solutions.

Some limitations of the Bureau's studies of technological change must be kept in mind in assessing their appropriateness for particular uses. In general, it is important to recognize that judgments about the future direction and pace of technological change and its implications are necessarily complex and difficult. The rate of introduction of new technology depends not only on technical advantages but also on many economic factors, such as the volume of investment, market prospects, and the availability of trained workers, all of which are subject to significant variations. Moreover, since the period of introduction generally spans a number of years, the outlook must be reappraised from time to time in the light of new information.

Finally, studies of the impact of technological change deal primarily with changes within individual industries. But these changes often involve changes in the type and amount of goods and services purchased from other industries and could, therefore, have important implications for production and employment in industries supplying inputs. The accumulation of information on interindustry relationships, through the Bureau's economic growth studies, provides a quantitative basis for analyzing this aspect of technological change.

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Mark, Jerome A. "Technology and Employment: Some Results of BLS Research," *Monthly Labor Review*, April 1987.
Highlights findings from the BLS research program on technological change including implications of new technology for employment and productivity.

Outlook for Computer Process Control, BLS Bulletin 1658, 1970.
Describes the impact of computer process control on employment, occupations, skills, training, and labor-management relations in six process industries. Discusses outlook for future and implications for production and productivity.

Technological Change and Its Labor Impact in Four Industries (hosiery, folding paperboard boxes, metal cans, laundry and cleaning), BLS Bulletin 2182, 1984.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technology and Its Impact on Labor in Four Industries (tires, aluminum, aerospace, banking), BLS Bulletin 2242, 1986.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technology and Labor Developments in Four Industries (lumber and wood products, footwear, hydraulic cement, wholesale trade), BLS Bulletin 2263, 1986.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technology and Labor in Four Industries (meat products, foundries, metalworking machinery, electrical and electronic equipment), BLS Bulletin 2104, 1982.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technology, Productivity, and Labor in the Bituminous Coal Industry, 1950–79, BLS Bulletin 2072, 1981.
Appraises some of the major structural and technological changes in the bituminous coal industry and their impact on labor in the industry.

The Impact of Technology on Labor in Five Industries (printing and publishing, water transportation, copper ore mining, fabricated structural metal, intercity trucking), BLS Bulletin 2137, 1982.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

The Impact of Technology on Labor in Four Industries (textiles, paper and paperboard, steel, motor vehicles), BLS Bulletin, 2228, 1985.
Appraises major technological changes emerging in key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

The Revised Workweek: Results of a Pilot Study of 16 Firms, BLS Bulletin 1846, 1975.
Explores the impact of changes in the workweek schedule to determine objectives and methods for introducing workweek changes and to assess the availability of data for further research on the implications for productivity and employment.

Chapter 13. Foreign Labor Statistics

Background

From its inception, the Bureau has collected and published statistical information on labor conditions and developments abroad. Foreign labor research and statistical analyses have been undertaken because (1) information on labor conditions published by a majority of foreign countries is not readily available to U.S. labor representatives, employers, Government officials, and others, and is often not available in English; (2) often, only an expert can judge the quality of foreign statistical sources; (3) comparisons between U.S. and foreign labor conditions shed light on U.S. economic performance relative to other industrial nations; and (4) comparisons provide information on the competitive position of the United States in foreign trade, which has an important influence on the U.S. economy and employment.

Description of Measures

The emphasis of the current program is on the development of international comparisons of the labor force, employment, and unemployment; productivity and labor costs; hourly compensation costs of manufacturing production workers; and trends in consumer prices and real compensation of manufacturing employees. The measures compiled relate primarily to the major industrial countries, but other countries of importance to U.S. foreign trade are included in the hourly compensation cost measures. Most of the series are prepared on an annual average basis; comparative figures on unemployment and consumer prices are prepared monthly.

Labor force, employment, and unemployment. Comparative measures of the labor force, employment, unemployment, and related indicators are prepared regularly for the United States, Canada, Japan, Australia, France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom. For most of the countries, the series begin with 1959. Unemployment rates, approximating U.S. concepts, are prepared monthly for most of the countries; the other measures are calculated annually. Current research is directed toward the development of a series of comparative unemployment measures ranging from relatively narrow measures to measures encompassing employed persons working part time for economic reasons and discouraged workers.

Productivity and labor costs. Comparative trends in manufacturing labor productivity (output per hour), hourly compensation, unit labor costs (labor compensation per unit of output), and related measures are compiled on an annual average basis for the United States, Canada, Japan, Korea, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, and the United Kingdom. The comparisons are limited to trend measures only; reliable comparisons of levels of manufacturing productivity and unit labor costs are not available. Trends are expressed in index form and as percentage changes at annual rates. For most countries, the series begin with 1950. Indexes of unit labor costs for foreign countries are calculated on a U.S. dollar basis as well as in national currency terms to take account of relative changes in currency exchange rates. Comparative measures by broad industry within manufacturing have also been developed for Japan, France, and Germany. Current research is directed toward the expansion of the measures for several countries, including Japan and Germany, to include capital as well as labor inputs in the productivity measures.

Comparative levels and trends in productivity and labor costs in the iron and steel industry in the United States, Japan, France, Germany, and the United Kingdom have been compiled annually beginning with 1964. The measures express levels of foreign output per hour, hourly compensation, and unit labor costs relative to the U.S. level (United States = 100). They also show trends in index form and at annual rates of change.

Comparative levels (United States = 100) and trends in gross domestic product (GDP), GDP per capita, and GDP per employed person are calculated on an annual average basis for the United States, Canada, Japan, Korea, and nine European countries beginning with 1950. The GDP level comparisons, which are based on estimated purchasing-power-parity (PPP) exchange rates, are benchmarked to data from the United Nations International Comparison Project. Purchasing-power-parity exchange rates represent the number of foreign currency units required to buy goods and services equivalent to what can be purchased with one unit of U.S. currency. A common practice has been to base such comparisons on official

market exchange rates. However, market exchange rates seldom reflect the relative purchasing power of different currencies.

Hourly compensation costs. Measures of total compensation per hour worked for production workers in all manufacturing and in 39 component manufacturing industries are computed for about 35 countries. The series are annual and begin with 1975. For all manufacturing, measures of hourly direct pay and pay for time worked are also computed. The measures are computed in national currency and converted into U.S. dollars at prevailing commercial currency exchange rates. Hourly compensation converted into U.S. dollars at commercial exchange rates provides a measure of comparative levels of employer labor costs. It does not indicate relative living standards of workers or the purchasing power of their income. Prices of goods and services vary greatly among countries, and commercial exchange rates are not reliable indicators of relative differences in prices.

Consumer prices. Indexes of consumer prices are compiled regularly for the United States and 14 foreign countries on a common base year. Annual indexes since 1950 and monthly or quarterly indexes since 1970 are available for most of the countries. Annual indexes for selected component series are also compiled for 12 countries.

Other measures. Other comparative measures, generally available on an annual basis, include indexes of real hourly and weekly compensation of manufacturing employees for 13 countries; the number of work stoppages resulting from industrial disputes and their severity rates, as measured by days lost per thousand employees in nonagricultural industries, for 15 countries; and selected producer price indexes for 8 countries.

Data Sources

Research on comparative labor statistics is based upon statistical data and other source materials from (a) statistical agencies of foreign countries; (b) international and supranational bodies such as the United Nations, International Labour Office (ILO), Organization for Economic Cooperation and Development (OECD), and the Statistical Office of the European Communities (EUROSTAT); and (c) private agencies such as banks, industry associations, and research institutions. All data are drawn from secondary sources; the Bureau does not initiate surveys or data collection programs abroad. The U.S. Department of State provides many of the foreign periodicals and publications used and provides assistance in obtaining answers to many technical questions about foreign data series.

Estimating Procedures

Because statistical concepts and methods vary from country to country, international comparisons of statistical data can be misleading. The Bureau attempts to derive meaningful comparisons by selecting a conceptual framework for comparative purposes; analyzing foreign statistical series and selecting those which most nearly match the desired concepts; and adjusting statistical series, where necessary and feasible, for greater intercountry comparability.

Labor force, employment, and unemployment. For these comparisons, the Bureau adjusts each country's published data, if necessary, to provide measures approximately consistent with U.S. definitions and standards. Although precise comparability may not be achieved, these adjusted figures provide a better basis for international comparisons than the figures regularly published by each country. The statistics for 6 of the 10 countries regularly studied—the United States, Canada, Australia, Japan, Italy, and Sweden—are obtained from monthly or quarterly household surveys. No adjustments are made to the published data for Canada and Australia, since their concepts and methods are virtually identical to those in the United States. Slight adjustments are made to the data for Japan and Sweden; a substantial adjustment is made to the Italian data.

Current unemployment measures for the other four countries studied—France, Germany, the Netherlands, and the United Kingdom—are derived from monthly administrative data on the number of registrants at public employment offices. These four countries also conduct periodic household surveys of the labor force (the United Kingdom conducts a monthly survey; however, because of the small sample size, figures are only published on an annual basis; France and Germany conduct annual surveys; and the Netherlands conducts a survey biennially) which contain benchmark data that are used to adjust the levels of the labor force, employment, and unemployment for greater comparability with U.S. concepts. Measures of current labor force, employment, and unemployment are obtained by applying adjustment factors from the most recent year's labor force surveys to published figures.

Productivity and labor costs. Indexes of manufacturing labor productivity, hourly compensation, and unit labor costs are constructed from three basic aggregative measures: Output, total hours, and total compensation. The hours and compensation measures refer to all employed persons including self-employed persons in the United States and Canada, and to all employees in the other countries. Hours refer to hours paid in the United States and to hours worked in the other countries. In general, the measures relate to total manufacturing as

defined by the International Standard Industrial Classification. However, the measures for France (beginning 1959), Italy (beginning 1970), and the United Kingdom (beginning 1971) refer to mining and manufacturing less energy-related products, and the figures for the Netherlands exclude petroleum refining from 1969 to 1976.

The long-term output measures are gross product originating in manufacturing (value added) in constant prices from the national accounts of each country—except those for Japan prior to 1970 and the Netherlands prior to 1960 and from 1969 to 1977, which are indexes of industrial production. While methods of deriving national accounts measures of manufacturing output differ substantially from country to country, and the British national accounts measures are essentially identical to their indexes of industrial production, the use of different procedures does not, in itself, connote lack of comparability—rather, it reflects differences among countries in the availability and reliability of underlying data series. For current measures, indexes of industrial production are used until national accounts data become available.

The aggregate hours measures are developed from statistics of manufacturing employment and average hours. The series used for Canada and Sweden are official series from their statistical agencies. For the other countries, the total hours measures are developed by the Bureau using employment data either published with the national accounts or from other comprehensive employment series, and estimates of annual hours worked.

The compensation (labor cost) measures are from national accounts—except those for Belgium, which are developed by the Bureau using statistics of employment, average hours, and hourly compensation. Compensation includes all payments in cash or kind made directly to employees plus employer expenditures for legally required insurance programs and contractual and private benefit plans. In addition, for some countries, compensation is adjusted for other significant taxes on payrolls or employment (or reduced to reflect subsidies), even if they are not for the direct benefit of workers, because such taxes are regarded as labor costs. However, compensation does not include all items of labor cost. The costs of recruitment, employee training, and plant facilities and services—such as cafeterias and medical clinics—are not covered because data are not available for most countries. Self-employed workers are included in the U.S. and Canadian figures by assuming that their hourly compensation is equal to the average for wage and salary employees.

For all countries, preliminary estimates of hours and compensation for recent years are generally based on current indicators of manufacturing employment, average hours, and hourly compensation until national accounts and other statistics used for the long-term measures become available.

The Bureau's 1964 and 1972 measures of comparative productivity and labor costs in the iron and steel industry, with the exception of the exclusion of wire products for Japan, wheels and axles for Germany, and wire and wire products for the United Kingdom, are based on the U.S. definition of the industry, which covers blast furnaces, steelworks, and rolling and finishing mills (SIC 331). In addition, each country's output has been measured using a common set of weights (U.S. 1977 labor requirements for about 70 products), and the labor input data have been carefully matched with the output figures. Measures for years subsequent to the latest benchmark are obtained by applying trend indexes to the benchmark measures. Except for the United States, the trend indexes are based on different output weights and less comprehensive data sources than those used for the benchmark years. The level comparisons for the four countries are presented in ranges, showing minimum and maximum estimates for each country relative to the United States, rather than as single best estimates, because of gaps in the available data.

The Bureau's measures of comparative levels and trends of gross domestic product per capita and per employed person are based on benchmark levels of GDP extrapolated or interpolated to other years, and on annual population and employment estimates. The GDP level comparisons are based on estimated purchasing-power-parity exchange rates. The employment figures for some countries have been adjusted for greater comparability with U.S. concepts.

The benchmark (currently 1985) level comparisons of GDP for all countries except Korea were derived from data produced for Phase V of the United Nations International Comparison Project (UNICP) by the OECD and EUROSTAT. The benchmark figures were derived by comparing relative prices at detailed levels of expenditure (PPP exchange rates by item of expenditure) and aggregating these price relatives to derive overall PPP exchange rates for GDP. Each country's current 1985 value of GDP was then converted to a real volume measure in U.S. dollars using the PPP exchange rate for total GDP. These original volume measures of GDP have been modified by BLS, where applicable, to take account of subsequent revisions by countries of their national accounts by applying the 1985 PPP exchange rates for total GDP to the revised country measures of 1985 GDP. The figures for Korea are based on a comparable set of 1980 benchmark comparisons for a group of Asian countries, including Japan, which were linked to the OECD countries at the level of total GDP using Japan as a "bridge" country. The benchmark-year comparisons of real GDP were extrapolated by BLS to other years using relative changes in GDP at constant market prices, as measured by each country.

Hourly compensation costs. Measures of hourly compensation costs are prepared because hourly compensation provides a better basis for international comparisons

of labor costs than the earnings statistics which are regularly published by most countries. Average earnings do not include all items of labor compensation, nor do they include the same items of compensation in each country. Hourly compensation is defined as all direct payments made to the worker (pay for time worked, pay for time not worked, all bonuses, and pay in kind) before payroll deductions of any kind, plus employer expenditures for legally required insurance programs and contractual and private benefit plans. In addition, for some countries, total compensation is adjusted for other taxes on payroll or employment (or reduced to reflect subsidies), even if they are not for the direct benefit of workers, because such taxes are regarded as labor costs. For consistency, compensation is measured on an hours-worked basis for every country.

The total compensation measures are derived by adjusting each country's published earnings series for items of direct pay not included in earnings and for employer expenditures for Social Security, contractual and private insurance programs, and other labor taxes or subsidies. For the United States and other countries that measure earnings on an hours-paid basis, the figures are also adjusted in order to approximate compensation per hour worked. Adjustment factors are obtained primarily from periodic labor cost surveys and interpolated or projected to nonsurvey years on the basis of other available information, or they are obtained from censuses of manufactures or reports on Social Security and fringe benefit systems. The underlying earnings statistics for some countries are also adjusted, where possible, to account for major differences in worker coverage; differences in industrial classification systems; and changes over time in survey coverage, sample benchmarks, or frequency of surveys. Compensation is converted to U.S. dollars using average daily exchange rates for the reference period, as published by the Federal Reserve Board or the International Monetary Fund.

Consumer prices. No adjustments are made to the overall consumer price indexes as published by each country except to convert them to a uniform base year. Indexes for selected component series are adjusted, where possible, for consistency of item coverage among countries.

Other measures. Indexes of real hourly or weekly compensation are constructed by deflating indexes of nominal compensation by each country's consumer price index. Work stoppages usually refer to strikes and lockouts, but the exact definition differs from country to country. The statistics are not adjusted for comparability. No adjustments are made to country producer price indexes except to link indexes published on different base years and to convert them to a common index base.

Analysis and Presentation

Analyses of international labor statistics focus upon comparisons with U.S. data. Wherever possible, foreign data are adjusted to U.S. definitions and concepts to facilitate comparisons; for example, the adjustment of foreign unemployment rates to approximate U.S. concepts and the adjustment of production worker earnings to total hourly compensation.

Labor force, employment, and unemployment data are analyzed to determine the sources or components of differences and changes in labor force measures. Shifts in labor force composition are analyzed by age, sex, and industrial sector. Productivity and unit labor cost data are analyzed to explain the relative contributions of changes in output, employment, average hours, compensation, and exchange rates upon changes in the measures. Changes in employee compensation are analyzed to determine the relative contributions of direct pay and other elements of compensation.

The presentation of foreign labor statistics varies with the degree of analysis and major use of the data. Comprehensive bulletins have been published, covering manufacturing productivity and labor cost trends, steel productivity and costs, unemployment and labor force comparisons, and youth unemployment comparisons. For more current developments, articles are published periodically in the *Monthly Labor Review*. Some series are published regularly in the statistical section of the *Monthly Labor Review*; an annual news release is issued on comparative trends in manufacturing productivity and labor costs; and the hourly compensation cost measures for total manufacturing are issued in BLS reports. The BLS's *Handbook of Labor Statistics* and the Bureau of the Census' *Statistical Abstract of the United States* publish many of the principal foreign data series, and some series are published in the annual *Economic Report of the President*. Many unpublished tabulations of current comparative data are available on request.

Uses and Limitations

The principal uses of information on foreign labor statistics are (a) to assess U.S. economic performance relative to other industrial countries; (b) to inform Government and private officials of foreign economic developments that may affect U.S. international economic policy; (c) to evaluate the competitive position of the United States in international trade; (d) to review foreign experience for possible application domestically; and (e) to provide labor statistics and related information to individuals, corporations, labor unions, and others concerned with foreign investment and development.

Although considerable progress has been made in

making international economic statistics more uniform among countries, e.g., through the work of international agencies such as the United Nations and the International Labour Office, international statistical comparisons should be used cautiously. Nevertheless, through careful analysis of each country's data, valid statistical comparisons can be made. Whenever possible, BLS adjusts foreign data, if necessary, for greater consistency with U.S. measures; in some cases, data are sufficiently similar in definition and concept for valid comparisons without adjustment. Moreover, when conceptual differences are substantial, the Bureau attempts to describe the differences in sufficient detail to provide guidance in the interpretation of the data.

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Chapter 14. Occupational Safety and Health Statistics

Part I. Annual Survey of Occupational Injuries and Illnesses

Background

The Bureau of Labor Statistics has long been interested in statistics on safety and health conditions for workers on the job and issued its first report on work injuries as early as 1893. Subsequent BLS publications reflected a growing concern for the worker disabled on the job and were helpful in the development of the present workers' compensation system

The Occupational Safety and Health Act of 1970 made recordkeeping and reporting of occupational safety and health data mandatory. In 1971, the Secretary of Labor delegated to the Commissioner of the Bureau of Labor Statistics the responsibility for "furthering the purposes of the Occupational Safety and Health Act by developing and maintaining an effective program of collection, compilation, analysis and publication of occupational safety and health statistics." The Secretary further directed the Commissioner to coordinate the above functions with the Assistant Secretary for Occupational Safety and Health.

The recordkeeping system, which is the foundation of the Bureau's statistical program in this field, was developed to aid the Occupational Safety and Health Administration (OSHA) in setting standards, to assist safety and health officers in identifying hazardous operations, to provide BLS and State agencies with uniform and reliable safety and health statistics, to provide employers and employees with information about conditions at their workplace, and to aid the National Institute for Occupational Safety and Health (NIOSH) in its research. The records must contain information suitable for use by Federal and State safety and health officers, and include sufficient data to help management and employees pinpoint problem areas.

Recordkeeping and Reporting Requirements

Several major changes in the recordkeeping system have taken place since it was first implemented in July 1971. First, in an effort to reduce the recordkeeping burden on employers with small-sized establishments, those with fewer than eight employees were administratively exempted from the recordkeeping requirements in January 1973. An exemption from recordkeeping requirements for employers with fewer than 11 employees was made a permanent part of the regulations in July 1977. In December 1982, the exemption from routine keeping of the log and supplementary record was extended to all low-risk industries in retail trade; finance, insurance, and real estate; and services (except SIC's 52–54, 70, 75–76, and 79–80). In January 1975, the classification of lost workdays was modified to include both days away from work and days of restricted work activity.

Recordkeeping form OSHA No. 200, Log and Summary of Occupational Injuries and Illnesses, designed to streamline OSHA recordkeeping and reporting, was implemented in January 1978. This form made it easier for employers, employees, and safety and health officers to identify the major injury and illness problems. (A facsimile of OSHA No. 200 is included at the end of the chapter.)

On April 24, 1986, OMB approved revised recordkeeping guidelines for occupational injuries and illnesses. These guidelines provide supplemental instructions for the recordkeeping forms and represent the Department of Labor's interpretation of employer recordkeeping requirements under the Occupational Safety and Health Act of 1970 and 29 CFR Part 1904.

The cases which must be recorded include all work-related deaths, illnesses, and those injuries which result

in: Loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment beyond first aid. Employers must record each case as either a fatality, an injury or illness with lost workdays, or an injury or illness without lost workdays in a one-line entry on the form. A case is recorded as a lost workday case if it involves 1 or more days following the day of injury or onset of illness on which the employee was away from work or unable to perform all or any part of his or her normal assignment during all or any part of the workday or shift. The number of such days is recorded in two categories: Days away from work or days of restricted work activity. Days of restricted work activity are days when the employee is assigned to another job on a temporary basis, works at a permanent job less than full time, or works at a permanently assigned job but cannot perform all duties normally connected with it. Chart 1 is a guide to the recordability of cases under the act.

Each case must also be described in detail on a supplementary record (OSHA No. 101) or equivalent, such as a State's workers' compensation form if it includes all necessary information. The annual summary of occupational injuries and illnesses must be posted at each establishment where notices to employees are customarily posted no later than February 1 and remain in place until March 1. (A copy of OSHA No. 101 is included at the end of the chapter.)

Concepts

Definitions used in the annual survey are the same as those used in the OSHA recordkeeping system. Reports for all recordable injuries and illnesses occurring during the year include information on the number of fatalities, injuries and illnesses with workdays lost, the number of workdays lost, and injuries and illnesses without workdays lost.

To determine priorities in the development of safety standards and in OSHA compliance activities, data must be collected and presented in a manner that allows for comparison among industries and establishments of varying sizes. Therefore, incidence rates are produced for each type of case reported under OSHA definitions. Incidence rates express various measures of injuries and illnesses in terms of a constant, i.e., exposure hours in the work environment (200,000 employee hours or the equivalent of 100 full-time employees working for 1 year), thus allowing for a common statistical base across industries regardless of employment size of establishments. In this way, the injury and illness experience of a firm with 5 cases recorded for 70 employees may be shown on the same base as that of an entire industry with 12,000 cases for 150,000 employees. (The method of calculating incidence rates is discussed in a later section.)

Comparisons may also be made to evaluate the performance of a particular industry over a period of time, similar establishments in the same industry, or establishments in the same industry but in different geographic areas. Further comparisons are possible using the different types of rates computed for each industry—rates for total cases, cases that involve lost workdays, cases that do not involve lost workdays, and the number of workdays lost. These measures are available for injuries, illnesses, and injuries and illnesses combined.

Scope of the Survey

The survey sample selected by BLS consists of approximately 280,000 units in private industry. Survey data are solicited from employers having 11 employees or more in agricultural production and from all employers in agricultural services, forestry, and fishing; oil and gas extraction; construction; manufacturing; transportation and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services industries (except private households). Data for employees covered by other Federal safety and health legislation are provided by the Mine Safety and Health Administration of the U.S. Department of Labor and the Federal Railroad Administration of the U.S. Department of Transportation. The Occupational Safety and Health Administration collects and compiles comparable data for Federal agencies. Although State and local government agencies are not surveyed for national estimates, several States have legislation which enables them to collect these data. Self-employed persons are not considered to be employees under the act.

State Participation

Federal grants covering about 50 percent of the operating cost permit States to develop estimates of occupational injuries and illnesses and to provide the data from which BLS produces national results. National data for selected States which do not have operational grants are collected directly by BLS and by the State agencies under contract. The participating State agencies collect and process the data and prepare estimates using standardized procedures established by BLS to insure uniformity and consistency among the States. To further insure comparability and reliability, BLS designs and identifies the survey sample for each State and, through its regional offices, validates the survey results and provides technical assistance to the State agencies on a continuing basis.

Data Collection

State agencies mail report forms (OSHA No. 200-S) to selected employers in February to cover the previous calendar year's experience. For those States not participating

in the program, reporting forms are mailed by BLS. Each employer completes a single report form which is used for both national and State estimates of occupational injuries and illnesses. This procedure eliminates duplicate reporting by respondents and, together with the use of identical survey techniques at the national and State levels, insures maximum comparability of estimates. (A copy of OSHA No. 200-S is included at the end of the chapter.)

Information for the injury and illness portion of the report form is copied directly from the Log and Summary of Occupational Injuries and Illnesses. The form also contains questions about the number of employee hours worked (needed in the calculation of incidence rates), the reporting unit's principal products or activity, and average employment to insure that the establishment is classified in the correct industry and employment-size class. State agency personnel edit the completed report forms and verify apparent inconsistencies through phone calls, correspondence, or visits. The data are keypunched and mechanically edited. Reports which do not meet the computer screening criteria are verified with the employer.

By midsummer, the active collection phase of the survey is completed and the preparation of data for both national and State estimates of occupational injuries and illnesses begins.

Sample

Because the survey is a Federal-State cooperative program and the data must meet the needs of participating State agencies, an independent sample is selected for each State. The sample is selected to represent all private industries in the States and territories. The sample size for the survey is dependent upon (1) the characteristics for which estimates are needed, (2) the industries for which estimates are desired, (3) the characteristics of the population being sampled, (4) the target reliability of the estimates, and (5) the survey design employed.

While there are many characteristics upon which the sample design could be based, the Bureau elected to use the total recorded case incidence rate. This is considered to be one of the most important characteristics and, importantly, the least variable; therefore, it requires the smallest sample size.

The salient features of the sample design employed are its use of stratified random sampling with a Neyman allocation and a ratio estimator. The characteristics used to stratify the establishments are the Standard Industrial Classification (SIC) code and employment. Since these characteristics are highly correlated with an establishment's number and rate of recorded injuries and illnesses, stratified sampling provides greater precision and, thus, results in a smaller sample size. The Neyman allocation produces the minimum sample size which will provide an estimate with a given sampling variance. For the larger employment-size classes, the allocation procedure places all of the establishments of the frame in the sample; as employment decreases, smaller and smaller proportions of establishments are included in the sample. The certainty strata are usually the size groups with more than 100 employees. The precision of the sample is further improved, hence permitting a reduction in sample size, by using the ratio estimator which utilizes available auxiliary information (employment) that is correlated with the characteristics which are to be measured.

The sample is designed to produce data at the 2-digit SIC industry level in agriculture, forestry, and fishing; the 3-digit level in oil and gas extraction, construction, and transportation and public utilities; the 4-digit level in manufacturing; and the 2-digit level in SIC's 50–89, except for some 3-digit estimates in this range of SIC's.

Estimating Procedures

Weighting

By means of a weighting procedure, sample units are made to represent all units in their size class for a particular industry. The weight is determined by the inverse of the sampling ratio for the industry/employment-size class from which the unit was selected. Because a small proportion of survey forms are not returned, weights of responding employers in a sampling cell are adjusted to account for the nonrespondents. The respondents are then shifted into the estimating cell determined by the employment and business activity reported. Data for each unit are multiplied by the appropriate weight and nonresponse adjustment factor. The products are then aggregated to obtain a total for the estimating cell.

Data for an individual estimating cell are weighted according to the following formula:

$$X_i = \sum_{j=1}^{n} W_{ij} X_{ij}$$

where:

X_i = weighted estimate of characteristics, e.g., number of cases reported, in size class i

W_{ij} = weight of sample unit (establishment) j in size class i, adjusted for nonresponse

X_{ij} = characteristics reported by sample unit j in size class i

Benchmarking

Since the universe file which provides the sample frame is not current to the reference year of the survey, it is necessary to adjust the data to reflect current employment levels. This procedure is known as benchmarking. In the annual survey, all estimates of totals are adjusted by the benchmark factor at the estimating cell level. The

benchmarking procedure requires a source of accurate employment data which can be converted into annual average employment figures for the cell level in which separate estimates are desired. Because industry/employment-size data are required for national estimates, benchmark factors are calculated using both industry level employment data and size class level employment data. The benchmark factors are applied to the size class "blow up" estimates.

Incidence rate calculation

Incidence rates are calculated using the total obtained through the weighting and benchmarking procedures. The adjusted estimates for a particular characteristic are aggregated to the appropriate level of industry detail. The total is multiplied by 200,000 (the base of hours worked by 100 full-time employees for 1 year). The product is then divided by the weighted and benchmarked estimate of hours worked as reported in the survey for the industry segment.

The formula for calculating the incidence rate at the lowest level of industry detail is:

$$\text{Incidence rate} = \frac{(\text{Sum of characteristic reported}) \times 200{,}000}{\text{Sum of number of hours worked}}$$

Incidence rates for higher levels of industry detail are produced using aggregated weighted and benchmarked totals. Rates may be computed by industry, employment size, geographic area, extent or outcome of case, number of lost workdays, etc.

Reliability of Estimates

All estimates derived from a sample survey are subject to sampling and nonsampling errors. Sampling errors occur because observations are made on a sample, not on the entire population. Estimates based on the different possible samples of the same size and sample design could differ. The relative standard errors, which are a measure of the sampling error in the estimates, are calculated as part of the survey's estimation process. For the all-industry estimate of the total occupational injuries and illnesses rate, the sample size is set to insure that a year-to-year difference of 0.10 or more will be statistically significant at the 95-percent confidence level. Target relative sampling errors for year-to-year changes in the total injury and illness rate are also set for each industry. These targets vary from 7 percent to 38 percent at the 95-percent confidence level, with the average being 11 percent. Both the estimates and the relative standard errors of the estimates are published in the BLS annual bulletin *Occupational Injuries and Illnesses in the United States by Industry*.

Nonsampling errors in the estimates can be attributed to many sources; e.g., inability to obtain information about all cases in the sample, mistakes in recording or coding the data, definitional difficulties, etc. To minimize the nonsampling errors in the estimates, the completed forms are edited and apparent inconsistencies are checked with the employer. Even with careful editing, errors caused by misinterpretation of definitions may not be uncovered. For this reason, a quality assurance program is conducted periodically to evaluate the extent of nonsampling errors in the estimates. A sample of the participating establishments is visited by survey personnel. The entries on the log and summary are compared with supplementary records (OSHA No. 101) and other available information to evaluate the reliability of the log entries which provide the basic data for the annual survey reports.

Presentation

Each year, BLS publishes a bulletin covering national results. Selected national data also are published in a news release and periodically in *Monthly Labor Review* articles. The data are also available on BLS data diskettes. The data are published in safety and trade journals and in the President's Annual Report on Occupational Safety and Health to the U.S. Congress.

In addition, State data on microfiche are available from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Uses and Limitations

National and State policymakers use the survey as an indicator of the magnitude of occupational safety and health problems. OSHA uses the statistics to help determine which industries have the greatest need to improve safety programs and to measure the effectiveness of the act in reducing work-related injuries and illnesses.

Both labor and management use the estimates in evaluating safety programs. Other users include insurance carriers involved in workers' compensation, industrial hygienists, manufacturers of safety equipment, researchers, and others concerned with job safety and health.

In terms of the recording and reporting of occupational illnesses, the statistics generated through the annual survey are a reliable measure of disease cases that are unequivocally visible. However, in terms of statistical validity, the data may be wanting because chronic and long latent diseases, although not totally excluded, are largely beyond the scope of the survey system. To this extent, an undercount exists in the illness estimates. There is, as yet, no reliable measure of that undercount. The only other comprehensive source of occupational disease statistics lies in State workers' compensation records. However, the same difficulties in establishing an occupational link apply to workers' compensation cases.

Part II. Supplementary Data System

The Bureau of Labor Statistics' Supplementary Data System (SDS) is a comprehensive effort to standardize occupational injury and illness data from State workers' compensation information to achieve some degree of comparability. The SDS data are unique in the detail available, providing analysts with opportunities for more extensive research than heretofore possible.

Background

While the annual survey program provided the information required by the Occupational Safety and Health (OSH) Act of 1970, there was an increasing demand for information about characteristics of the occupational injuries and illnesses and the workers to whom they were occurring. In 1973, in response to this demand, the Bureau began testing the feasibility of collecting such information through contracts with States.

Records routinely generated by State workers' compensation programs—employee and employer reports, medical reports, compensation award records, etc.—were long recognized as potentially valuable sources of information about occupational injuries and illnesses. However, most workers' compensation agencies were primarily concerned with administering claims systems, and were not particularly concerned with availability and accuracy of industry, occupation, or injury and illness data. Additionally, States processing such data had different coding systems, sometimes with identical terms being defined differently.

States were urged to supply the desired information in machine-readable form. However, the different classification systems and record formats resulted in noncomparabilities and processing difficulties. The Bureau revised the program to require participating States to use comparable record formats and classifications.

In 1976, the current structure of the Supplementary Data System was established, in cooperation with 27 States. The name was chosen from the role SDS plays of providing supplementary information to the annual survey of injuries and illnesses. Although the SDS does not affect the variations in coverage and reporting requirements among States, it requires that participating States provide prescribed data elements, and use specific classification systems, standard record formats, and uniform procedures.

Description of SDS

The primary source of information for the SDS is a first report of injury or illness, which employers and insurance carriers submit to State workers' compensation agencies. All jurisdictions require such reports. There are four basic types of information on the report. The first identifies the employer and permits classification of the case by industry and geographic location. The second lists characteristics of the employee such as age, sex, salary, and occupation. The third describes how the accident or exposure occurred, any objects or substances involved, the nature of the injury or illness, and the part of body affected. The fourth provides information on the workers' compensation carrier, possible disability, and other items needed to process the claim. Under 50–50 grant funding agreements, State agencies classify, code, and process the information from the various workers' compensation reports. Since these are administrative reports which employers, employees, or physicians must file under State regulations, the information does not constitute an additional burden on employers.

The prescribed data elements which must be uniformly defined and submitted by all participating States are:

State code
Reference year
Case number
Year and month of occurrence
Occupation
Industry
Ownership (public or private industry)
Nature of injury or illness
Part of body affected
Source of injury or illness
Type of accident or exposure
Sex of employee

At their option, States may also submit other data elements, such as duration of employment, extent of disability, indemnity compensation, and medical costs, some of which may be defined differently from State to State. For example, "duration of employment" may

refer to time with an employer, in a particular occupation, or in a particular job. The following optional items as of 1986 may be submitted by participating States. (The number in parentheses indicates the number of States providing that information.)

Day of occurrence (32)
Hour of shift (5)
Associated object or substance (16)
Age of employee (31)
Duration of employment (20)
Weekly wages (22)
Extent of disability (13)
Kind of insurance (14)
Indemnity compensation (8)
Medical payments (6)

The indemnity and medical costs of a case are particularly important optional items. Workers' compensation programs indemnify injured or ill workers with income-replacing cash benefits. These payments are awarded for fatalities, disfigurements, permanent disabilities, and for temporary disabilities which exceed some specified number of days (that is, a waiting period). Medical expenses associated with an injury or illness are usually paid in full without a waiting period. Although indemnity compensation and medical payments data are useful economic and social indicators, and some measure of severity, only a small number of the participating States are able to provide these data.

Classification systems used by all States in the SDS include: (1) the 1972 *Standard Industrial Classification Manual* to code industry; (2) the 1980 *Bureau of the Census Alphabetical Index of Industries and Occupations* to code the occupation of the injured or ill employee; (3) the American National Standards Institute Z16.2—1962 *Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries* (with codes expanded and modified by the Bureau) to classify the nature of the injury or illness, the part of body affected, the source of the injury or illness, and the type of accident or exposure; and (4) a newly developed classification, the associated object or substance, which provides additional information about the factors associated with the injury or illness.

The SDS requires close cooperation between the State agencies and the Bureau. In order to achieve uniform data, the Bureau establishes conceptual and operational standards which are developed in consultation with the State agencies. Federal/State cooperation is achieved through specific actions and groups tailored toward improving the SDS. For example, State coding is periodically reviewed by regional and national office personnel for uniformity among all States. Uniformity is also achieved through State participation on the SDS Interpretations Committee, which resolves differences in coding difficult cases, and the State task force on coding revisions, which is composed of nine State members and reviews classification systems and coding practices with the view to changing current procedures when necessary.

Presentation

SDS data are available from the National Technical Information Service (NTIS). Beginning in 1979, these data have included individual case records for 30 States organized into multi-State files which make a large body of data available at moderate cost on machine-readable magnetic tapes. Information on the tabulations available from each State can be obtained from the Office of Occupational Safety and Health Statistics, Bureau of Labor Statistics, Department of Labor.

Uses and Limitations

The Supplementary Data System provides valuable information in three general areas: (1) defining work-related safety and health problems for policymakers; (2) guiding professional investigations and research; and (3) making available information for the administration of workers' compensation programs. For example, *The Report of the National Commission on State Workmen's Compensation Laws* suggested that systematic collection and exchange of data would be a valuable source of information for both compensation and safety agencies.

The SDS is a step in this direction. Because SDS is a machine-readable categorization of workers' compensation information, a final product will be a State capability to analyze its cases in considerable detail, including the types of cases handled and the predominant types of affected workers and work situations. The data direct attention to problem areas which can be most effectively handled by safety and health standards, training, or compliance programs.

Although the Supplementary Data System standardizes the classification, processing, and tabulations of data, it is not a complete census of occupational injuries and illnesses; as of 1986, 33 States were participating. In addition, coverage and reporting requirements variations reflect differences in State workers' compensation laws. Differences also exist because of statutory and administrative variations in workers covered and reports processed, and in the kinds of cases required to be reported to workers' compensation agencies.

Finally, occupational illness data from the SDS suffer from the same low degree of identification as that experienced in the annual survey of occupational injuries and illnesses. Recognition of occupational illness depends on the "state of the art." As medical knowledge increases, illness identification will improve in both data collection systems.

Part III. Work Injury Report Program

The Bureau of Labor Statistics' Work Injury Report (WIR) survey program examines specific types of injuries (and illnesses) in the work environment or focuses on selected high-hazard jobs or industries to obtain information not available from the Annual Survey of Occupational Injuries and Illnesses and the Supplementary Data System. By surveying the injured worker directly, the WIR introduces a unique perspective to the pool of injury data, which has traditionally been provided by employers.

Background

The annual survey produces measures of the incidence and severity of work-related injuries and illnesses, while the SDS complements the annual survey by providing information on selected general characteristics of the injured worker as well as the injury. Neither program, however, provides extensive information on the numerous, more detailed factors associated with certain types of injuries. When the Occupational Safety and Health Administration (OSHA) indicated a need for this type of data in 1978, BLS established the WIR program.

The OSHA safety and health program must address a wide variety of topics, such as hazardous worksite conditions, the safe operation of tools or equipment, the use of protective equipment, and special industry standards. The WIR survey program provides OSHA with a broad spectrum of support information by allowing flexibility in both the survey subject matter and the data elements collected. A WIR survey is able to identify patterns of accident causes, as well as provide detail on such topics as the activity of the worker at the time of accident, the equipment used, the protective equipment worn, and the training given for the work being done.

Because it would be difficult, if not impossible, for employers to provide some of the needed information, the decision was made to survey the injured worker directly. For example, questions regarding worker activity are so specific that, in the absence of witnesses, employers would be required to question the injured workers. Similarly, only the workers could explain why they did or did not use protective equipment. Finally, by surveying the worker directly, it is possible to expand the scope of questions on training and work experience to include previous jobs held by the worker.

The Survey Process

Selection of the subject of a study is the first phase of the survey process and is based on OSHA's assessment of data requirements. The WIR program permits substantial flexibility in subject matter because it uses the SDS source document, the Employer's First Report of Injury, from which the following injury characteristics are available: Nature of injury, part of body affected, source of injury, and type of accident. Also identified are the industry and the worker's occupation. Any of the SDS data elements can be selected for study. WIR surveys have focused on specific industries (oil and gas drilling and well servicing, and logging), injuries to a particular part of the body (back, hand, eye, face, and head injuries), selected types of accidents (falls on stairs, falls from elevations, falls from scaffolds, and falls from ladders), specific nature of injuries (upper extremity amputations), and occupations (construction laborers, warehouse workers). The scope of a WIR survey, however, can be expanded beyond the SDS classification categories. Three surveys have used worker activity, which is not coded in SDS, as a selection criterion (workers injured while welding, using power saws, and servicing equipment). The range of the program is limited only by the amount of information provided on employers' first reports of injury and the geographic and industrial representation of the participating States.

The heart of the program is a questionnaire tailored to obtain information relevant to each area selected for study by OSHA. Because development of the survey questionnaire requires close interaction with OSHA, a WIR task force was formed of representatives from the BLS Office of Occupational Safety and Health Statistics and the OSHA Offices of Compliance, Standards Development, Training, and Regulatory Analysis. Also included on the task force are representatives of the National Institute for Occupational Safety and Health (NIOSH), who provide expertise in the area of occupational injury and illness epidemiology. Because of the wide variety of survey

topics, each study has a unique questionnaire. All proposed survey questions are discussed by the task force and, where possible, formatted with multiple choice responses. Each questionnaire developed is also designed to be brief in order to minimize the burden on respondents and encourage participation. In general, information is sought on how the injury occurred, the worker's activity and location, what hazardous conditions prevailed, the nature of the equipment involved, the safeguards used, and the extent of related safety training. Additionally, each questionnaire is tested on a small panel of workers before it becomes final.

Current surveys employ systematic random sampling, unless the expected population size is small enough to warrant a complete census. Survey estimates are derived using a Horwitz–Thompson estimator with a nonresponse adjustment procedure. Based on a predicted population size, the sample size is targeted so that any proportion estimate based on the entire universe will have a sampling error no greater than plus or minus 5 percent at the 2 sigma or 95-percent confidence level. Early WIR surveys were based on a purposive sample of about 750 respondents.

The universe of potential respondents generally includes all workers in the participating States who were classified through the SDS as being injured or made ill under the criteria established for the survey during the selected time period. The time frame is usually limited to 1 month, but may be longer if the expected population is very small or if seasonality is a concern.

Participating State agencies screen incoming first reports of injury, using BLS criteria for defining relevant cases, to identify the target population of injured workers to be surveyed. Excluded from the screening criteria for each survey are cases where the industry classification is coal and metallic and nonmetallic mining, or government, because these industries are not regulated by OSHA. Also excluded are cases involving fatalities or assaults.

A table of sample selection numbers, generated by BLS for each survey, determines which cases are to be sampled. If a case is selected for inclusion in the sample, a questionnaire is mailed directly to the injured worker's home address.

Returned questionnaires are matched with the appropriate first report of injury forms, and the primary SDS data elements, such as nature of injury, industry, occupation, age, and sex, are coded for each case. All information which could identify a worker or an employer is deleted from the questionnaire and first report by State agency personnel. At the completion of the data collection phase, all returned questionnaires are transmitted to BLS–Washington, along with refusals, nonmailables, and Post Office returns.

Questionnaires are screened by BLS–Washington for completion and consistency. Results of the survey are then keypunched and mechanically edited. Finally, estimates are generated and published in a bulletin, with an accompanying text which highlights the findings.

Weighting and Estimation Procedures

Unless a census has been taken, the sample of injured workers is weighted to account for all injured workers within the scope of the survey in the participating States. The weight assigned is the inverse of the probability of selection, and is applied to each sample member's response.

In each survey, a number of the selected injured workers do not return the questionnaires. These workers are referred to as unit nonrespondents. A weighting-class nonresponse adjustment procedure is used to reduce the potential bias due to nonresponse in the estimates. In this procedure, the sample is partitioned into cells, and a unit nonresponse adjustment factor is calculated within each cell. This procedure is based on the assumption that, within each cell, the distribution of the unit nonrespondents would be the same as the distribution of the respondents.

To determine the set of cells for unit nonresponse adjustment, a comparison of the following characteristics is made between respondents and nonrespondents: Age, sex, nature of injury, part of body affected, source of injury, type of accident, industry, and occupation. If it is determined that there are differences in the distribution of a particular characteristic between respondents and nonrespondents, a partition based on this characteristic is used to adjust for unit nonresponse.

In addition to workers not returning the questionnaire, a small number of workers respond to the survey but do not answer all of the questions. These are referred to as item nonrespondents. To account for this type of nonresponse, it is assumed that the response distribution of the item nonrespondents would be the same as the response distribution of the item respondents.

For each question, a final weight for each respondent is calculated as the product of the original weight, the unit nonresponse factor, and the item nonresponse factor. The estimate of the total number of in-scope injured workers for each question is equal to the sum of the final weights of the respondents. The estimate of the percent of workers giving a particular answer to a question is the sum of the final weights of the respondents giving a particular answer divided by the estimate of the total number of in-scope injured workers.

Reliability of Estimates

All estimates derived from a sample survey are subject to sampling and nonsampling errors. Sampling errors occur because observations are made on a sample, not on the entire universe. Estimates based on the different possible samples of the same size and sample design could

differ. The standard errors, which are a measure of the sampling error in the estimates, are calculated as part of the survey's estimation process and are available upon request.

Nonsampling errors in the estimates can be attributed to many sources, e.g., inability to obtain information about all cases in the sample, mistakes in recording or coding the data, definitional difficulties, etc. To minimize the nonsampling errors in the estimates, the completed questionnaires are edited, and apparent inconsistencies are checked.

Presentation

At the completion of each survey, the results are tabulated and published along with an analysis of the survey findings. Since 1979, 18 survey reports have been published. The following reports are available from the U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161:

Survey of Ladder Accidents Resulting in Injuries
Survey of Welding and Cutting Accidents Resulting in Injuries
Survey of Scaffold Accidents Resulting in Injuries
Survey of Power Saw Accidents Resulting in Injuries
Accidents Involving Eye Injuries
Accidents Involving Face Injuries
Accidents Involving Head Injuries
Accidents Involving Foot Injuries
Injuries Related to Servicing Equipment
Back Injuries Associated with Lifting
Work-Related Hand Injuries and Upper Extremity Amputations

Reports available to date from the U.S. Department of Labor, Bureau of Labor Statistics, Office of Occupational Safety and Health Statistics, Room 4014, 601 D Street NW., Washington, DC 20212 include:

Injuries in Oil and Gas Drilling and Services
Injuries Resulting From Falls From Elevations
Injuries in the Logging Industry
Injuries Resulting From Falls on Stairs
Injuries to Construction Laborers
Injuries to Warehouse Workers

Uses and Limitations

Because the design of the WIR program allows for flexibility in both the types of surveys done and the kinds of information collected, these surveys produce a broad range of data on work-related accidents. The ways in which the data can be used, as well as the people who use it, are as varied as the information itself. OSHA, of course, is the primary user of WIR data.

WIR surveys can be used by OSHA in the development or revision of safety standards and in the planning of compliance strategy and training programs. In standards setting, WIR data can be used to test the need for a particular standard and to support individual requirements of the standard. They can also be used to direct OSHA's attention to an area where a problem may exist and to assist in determining the corrective action that may need to be taken.

Once standards are approved, OSHA is responsible for their enforcement. Enforcement is carried out by compliance officers who inspect workplaces for adherence to standards. Because WIR survey data can provide specific information on how and why a particular type of accident occurs, these data have proven a valuable tool in training compliance officers to be aware of situations in which there have been a large number of injuries.

In training and education, OSHA needs information for targeting the workers who might benefit the most by knowing the injury potential inherent in certain work situations. Once these areas are identified, OSHA can tailor educational programs to increase awareness of these problems. Because of the detailed information provided by WIR surveys, OSHA has been able to incorporate data from several surveys into their educational programs.

Other data users include employers and safety officials throughout private industry, government, and labor organizations, as well as special interest groups such as lawyers, consumer organizations, and manufacturers of safety equipment. For example, NIOSH uses WIR data in conjunction with their testing procedures and special studies, while State government agencies use the data to evaluate standards specific to safety issues particular to their States.

In spite of the unprecedented amount of information provided through the WIR program, there are limitations associated with the survey data. Data collection procedures limit coverage, for the most part, to those States which participate in the SDS program. For this reason, the WIR program does not produce national estimates. The program is also subject to differences in State workers' compensation reporting requirements. At the present time, the program does not permit detailed comparisons between injured workers and the rest of the working population. For example, there are no data on the use of protective equipment for workers who were not injured. Lack of data on workers who were exposed to the same hazards but not injured precludes the development of incidence rates as a measure of the relative risk by activity, occupation, etc. In addition, the data reflect the injury experience for a particular reference period ranging from 1 to 6 months.

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Schauer, Lyle, and Ryder, Thomas. "New Approach to Occupational Safety and Health Statistics," *Monthly Labor Review*, March 1972.

U.S. Department of Labor, Bureau of Labor Statistics. *Occupational Injuries and Illnesses in the United States by Industry*. Bulletin issued yearly.

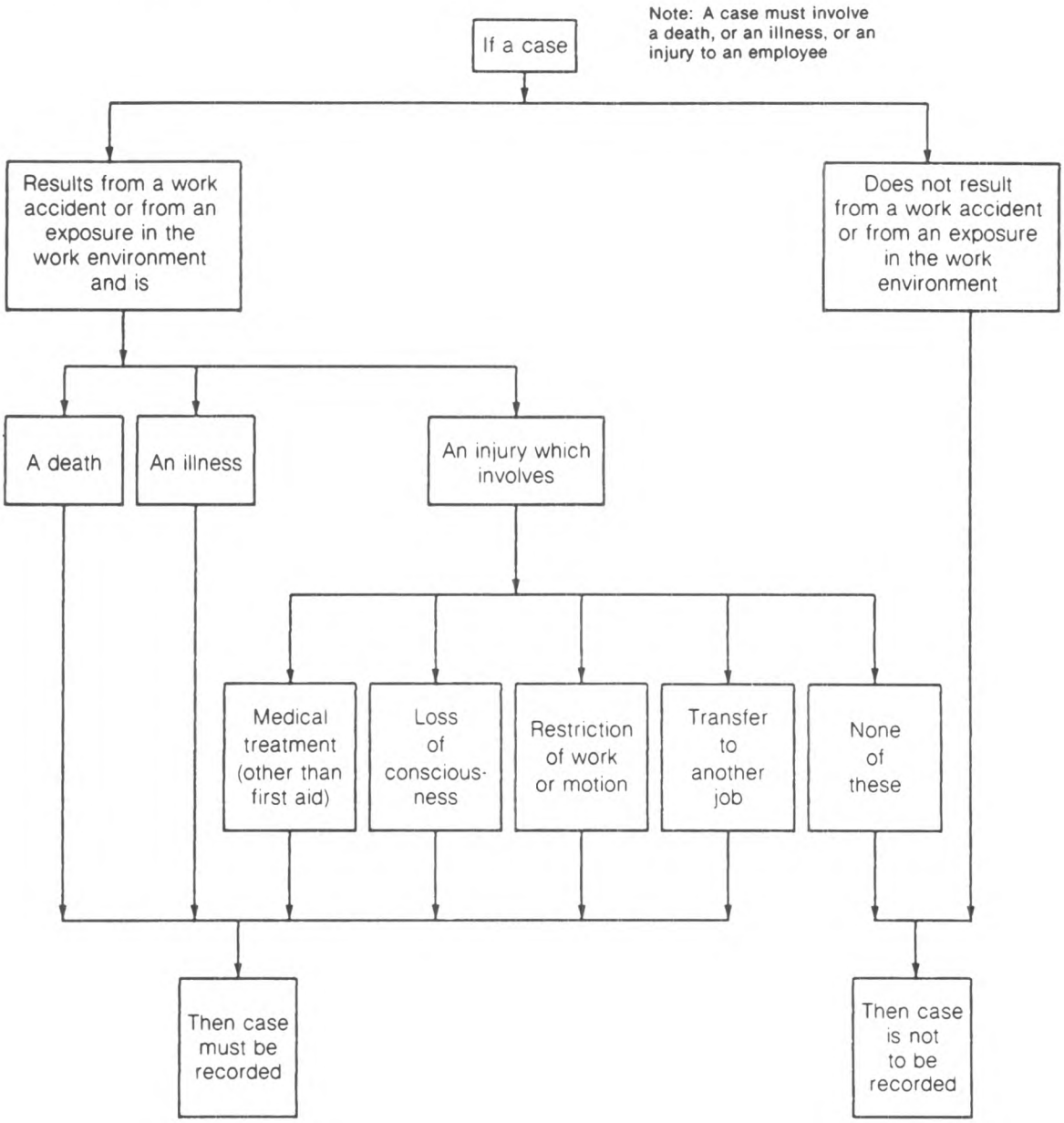
Bureau of Labor Statistics. *Recordkeeping Guidelines for Occupational Injuries and Illnesses*, September 1986 (Effective April 1986).

The official Department of Labor interpretation of employer recordkeeping requirements under the Occupational Safety and Health Act of 1970 and 29 CFR Part 1904. Provides supplemental instructions to the recordkeeping forms, OSHA Nos. 200 and 101.

Bureau of Labor Statistics. *A Brief Guide to Recordkeeping Requirements for Injuries and Illnesses*, June 1986 (Effective April 1986).

An abbreviated version of the guidelines to be used as a ready reference, and as an aid to plant managers and employers of small-size establishments or firms.

Chart 1. Guide to recordability of cases under the Occupational Safety and Health Act



Bureau of Labor Statistics
Log and Summary of Occupational
Injuries and Illnesses

U.S. Department of Labor

For Calendar Year 19 ____ Page ____ of ____

Form Approved
O.M.B. No. 1220-0029

NOTE: **This form is required by Public Law 91-596 and must be kept in the establishment for *5 years*. Failure to maintain and post can result in the issuance of citations and assessment of penalties.** ***(See posting requirements on the other side of form.)***

RECORDABLE CASES: You are required to record information about every occupational **death**; every nonfatal occupational **illness**; and those nonfatal occupational **injuries** which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid). ***(See definitions on the other side of form.)***

Company Name

Establishment Name

Establishment Address

Case or File Number	Date of Injury or Onset of Illness	Employee's Name	Occupation	Department	Description of Injury or Illness	Extent of and Outcome of INJURY						Type, Extent of, and Outcome of ILLNESS														
						Fatalities	Nonfatal Injuries					Type of Illness								Fatalities	Nonfatal Illnesses					
							Injuries With Lost Workdays				Injuries Without Lost Workdays	CHECK Only One Column for Each Illness *(See other side of form for terminations or permanent transfers.)*								Illness Related	Illnesses With Lost Workdays				Illnesses Without Lost Workdays
Enter a nonduplicating number which will facilitate comparisons with supplementary records.	Enter Mo./day.	Enter first name or initial, middle initial, last name.	Enter regular job title, not activity employee was performing when injured or at onset of illness. In the absence of a formal title, enter a brief description of the employee's duties.	Enter department in which the employee is regularly employed or a description of normal workplace to which employee is assigned, even though temporarily working in another department at the time of injury or illness.	Enter a brief description of the injury or illness and indicate the part or parts of body affected. Typical entries for this column might be: Amputation of 1st joint right forefinger; Strain of lower back; Contact dermatitis on both hands; Electrocution—body.	Injury Related	Enter a CHECK if injury involves days away from work, or days of restricted work activity, or both.	Enter a CHECK if injury involves days away from work.	Enter number of DAYS away from work.	Enter number of DAYS of *restricted work activity.*	Enter a CHECK if no entry was made in columns 1 or 2 but the injury is recordable as defined above.	Occupational skin diseases or disorders	Dust diseases of the lungs	Respiratory conditions due to toxic agents	Poisoning (systemic effects of toxic materials)	Disorders due to physical agents	Disorders associated with repeated trauma	All other occupational illnesses	Illness Related	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both.	Enter a CHECK if illness involves days away from work.	Enter number of DAYS away from work.	Enter number of DAYS of *restricted work activity.*	Enter a CHECK if no entry was made in column 8 or 9.
						Enter DATE of death. Mo./day/yr.													Enter DATE of death. Mo./day/yr.					
(A)	(B)	(C)	(D)	(E)	(F)	(1)	(2)	(3)	(4)	(5)	(6)	(7) (a)	(b)	(c)	(d)	(e)	(f)	(g)	(8)	(9)	(10)	(11)	(12)	(13)
					PREVIOUS PAGE TOTALS →																			
					TOTALS (Instructions on other side of form.) →																				

INJURIES

OSHA No. 200

Certification of Annual Summary Totals By _____ Title _____ Date _____

FOLD

OSHA No. 200

POST ONLY THIS PORTION OF THE LAST PAGE NO LATER THAN FEBRUARY 1.

I. **Log and Summary of Occupational Injuries and Illnesses**

Each employer who is subject to the recordkeeping requirements of the Occupational Safety and Health Act of 1970 must maintain for each establishment a log of all recordable occupational injuries and illnesses. This form (OSHA No. 200) may be used for that purpose. A substitute for the OSHA No. 200 is acceptable if it is as detailed, easily readable, and understandable as the OSHA No. 200.

Enter each recordable case on the log within six (6) workdays after learning of its occurrence. Although other records must be maintained at the establishment to which they refer, it is possible to prepare and maintain the log at another location, using data processing equipment if desired. If the log is prepared elsewhere, a copy updated to within 45 calendar days must be present at all times in the establishment.

Logs must be maintained and retained for five (5) years following the end of the calendar year to which they relate. Logs must be available (normally at the establishment) for inspection and copying by representatives of the Department of Labor, or the Department of Health and Human Services, or States accorded jurisdiction under the Act. Access to the log is also provided to employees, former employees and their representatives.

II. **Changes in Extent of or Outcome of Injury or Illness**

If, during the 5-year period the log must be retained, there is a change in an extent and outcome of an injury or illness which affects entries in columns 1, 2, 6, 8, 9, or 13, the first entry should be lined out and a new entry made. For example, if an injured employee at first required only medical treatment but later lost workdays away from work, the check in column 6 should be lined out, and checks entered in columns 2 and 3 and the number of lost workdays entered in column 4.

In another example, if an employee with an occupational illness lost workdays, returned to work, and then died of the illness, any entries in columns 9 through 12 should be lined out and the date of death entered in column 8.

The entire entry for an injury or illness should be lined out if later found to be nonrecordable. For example: an injury which is later determined not to be work related, or which was initially thought to involve medical treatment but later was determined to have involved only first aid.

III. **Posting Requirements**

A copy of the totals and information following the fold line of the last page for the year must be posted at each establishment in the place or places where notices to employees are customarily posted. This copy must be posted no later than ***February 1 and must remain in place until March 1.***

Even though there were no injuries or illnesses during the year, zeros must be entered on the totals line, and the form posted.

The person responsible for the ***annual summary totals*** shall certify that the totals are true and complete by signing at the bottom of the form.

IV. **Instructions for Completing Log and Summary of Occupational Injuries and Illnesses**

Column A – **CASE OR FILE NUMBER.** Self-explanatory.

Column B – **DATE OF INJURY OR ONSET OF ILLNESS.**
For occupational injuries, enter the date of the work accident which resulted in injury. For occupational illnesses, enter the date of initial diagnosis of illness, or, if absence from work occurred before diagnosis, enter the first day of the absence attributable to the illness which was later diagnosed or recognized.

Columns C through F – Self-explanatory.

Columns 1 and 8 – **INJURY OR ILLNESS-RELATED DEATHS.** Self-explanatory.

Columns 2 and 9 – **INJURIES OR ILLNESSES WITH LOST WORKDAYS.** Self-explanatory.

Any injury which involves days away from work, or days of restricted work activity, or both must be recorded since it always involves one or more of the criteria for recordability.

Columns 3 and 10 – **INJURIES OR ILLNESSES INVOLVING DAYS AWAY FROM WORK.** Self-explanatory.

Columns 4 and 11 – **LOST WORKDAYS—DAYS AWAY FROM WORK.**
Enter the number of workdays (consecutive or not) on which the employee would have worked but could not because of occupational injury or illness. The number of lost workdays should not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.
NOTE: For employees not having a regularly scheduled shift, such as certain truck drivers, construction workers, farm labor, casual labor, part-time employees, etc., it may be necessary to estimate the number of lost workdays. Estimates of lost workdays shall be based on prior work history of the employee AND days worked by employees, not ill or injured, working in the department and/or occupation of the ill or injured employee.

Columns 5 and 12 – **LOST WORKDAYS—DAYS OF RESTRICTED WORK ACTIVITY.**
Enter the number of workdays (consecutive or not) on which because of injury or illness:
(1) the employee was assigned to another job on a temporary basis, or
(2) the employee worked at a permanent job less than full time, or
(3) the employee worked at a permanently assigned job but could not perform all duties normally connected with it.

The number of lost workdays should not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.

Columns 6 and 13 – **INJURIES OR ILLNESSES WITHOUT LOST WORKDAYS.** Self-explanatory.

Columns 7a through 7g – **TYPE OF ILLNESS.**
Enter a check in only ***one*** column for each illness.

TERMINATION OR PERMANENT TRANSFER—Place an asterisk to the right of the entry in columns 7a through 7g (type of illness) which represented a termination of employment or permanent transfer.

V. **Totals**

Add number of entries in columns 1 and 8.
Add number of checks in columns 2, 3, 6, 7, 9, 10, and 13.
Add number of days in columns 4, 5, 11, and 12.
Yearly totals for each column (1-13) are required for posting. Running or page totals may be generated at the discretion of the employer.

If an employee's loss of workdays is continuing at the time the totals are summarized, estimate the number of future workdays the employee will lose and add that estimate to the workdays already lost and include this figure in the annual totals. No further entries are to be made with respect to such cases in the next year's log.

VI. **Definitions**

OCCUPATIONAL INJURY is any injury such as a cut, fracture, sprain, amputation, etc., which results from a work accident or from an exposure involving a single incident in the work environment.
NOTE: Conditions resulting from animal bites, such as insect or snake bites or from one-time exposure to chemicals, are considered to be injuries.

OCCUPATIONAL ILLNESS of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.

The following listing gives the categories of occupational illnesses and disorders that will be utilized for the purpose of classifying recordable illnesses. For purposes of information, examples of each category are given. These are typical examples, however, and are not to be considered the complete listing of the types of illnesses and disorders that are to be counted under each category.

7a. **Occupational Skin Diseases or Disorders**
Examples: Contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; chrome ulcers; chemical burns or inflammations; etc.

7b. **Dust Diseases of the Lungs (Pneumoconioses)**
Examples: Silicosis, asbestosis and other asbestos-related diseases, coal worker's pneumoconiosis, byssinosis, siderosis, and other pneumoconioses.

7c. **Respiratory Conditions Due to Toxic Agents**
Examples: Pneumonitis, pharyngitis, rhinitis or acute congestion due to chemicals, dusts, gases, or fumes; farmer's lung; etc.

7d. **Poisoning (Systemic Effect of Toxic Materials)**
Examples: Poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays such as parathion, lead arsenate; poisoning by other chemicals such as formaldehyde, plastics, and resins; etc.

7e. **Disorders Due to Physical Agents (Other than Toxic Materials)**
Examples: Heatstroke, sunstroke, heat exhaustion, and other effects of environmental heat; freezing, frostbite, and effects of exposure to low temperatures; caisson disease; effects of ionizing radiation (isotopes, X-rays, radium); effects of nonionizing radiation (welding flash, ultraviolet rays, microwaves, sunburn); etc.

7f. **Disorders Associated With Repeated Trauma**
Examples: Noise-induced hearing loss; synovitis, tenosynovitis, and bursitis; Raynaud's phenomena; and other conditions due to repeated motion, vibration, or pressure.

7g. **All Other Occupational Illnesses**
Examples: Anthrax, brucellosis, infectious hepatitis, malignant and benign tumors, food poisoning, histoplasmosis, coccidioidomycosis, etc.

MEDICAL TREATMENT includes treatment (other than first aid) administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does NOT include first-aid treatment (one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care) even though provided by a physician or registered professional personnel.

ESTABLISHMENT: A single physical location where business is conducted or where services or industrial operations are performed (for example: a factory, mill, store, hotel, restaurant, movie theater, farm, ranch, bank, sales office, warehouse, or central administrative office). Where distinctly separate activities are performed at a single physical location, such as construction activities operated from the same physical location as a lumber yard, each activity shall be treated as a separate establishment.

For firms engaged in activities which may be physically dispersed, such as agriculture; construction; transportation; communications; and electric, gas, and sanitary services, records may be maintained at a place to which employees report each day.

Records for personnel who do not primarily report or work at a single establishment, such as traveling salesmen, technicians, engineers, etc., shall be maintained at the location from which they are paid or the base from which personnel operate to carry out their activities.

WORK ENVIRONMENT is comprised of the physical location, equipment, materials processed or used, and the kinds of operations performed in the course of an employee's work, whether on or off the employer's premises.

Bureau of Labor Statistics
Supplementary Record of
Occupational Injuries and Illnesses

U.S. Department of Labor

This form is required by Public Law 91-596 and must be kept in the establishment for *5 years.* Failure to maintain can result in the issuance of citations and assessment of penalties.

Case or File No.

Form Approved
O.M.B. No. 1220-0029

Employer

1. Name

2. Mail address *(No. and street, city or town, State, and zip code)*

3. Location, if different from mail address

Injured or Ill Employee

4. Name *(First, middle, and last)* Social Security No.

5. Home address *(No. and street, city or town, State, and zip code)*

6. Age

7. Sex: *(Check one)* Male ☐ Female ☐

8. Occupation *(Enter regular job title, not the specific activity he was performing at time of injury.)*

9. Department *(Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.)*

The Accident or Exposure to Occupational Illness

If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.

10. Place of accident or exposure *(No. and street, city or town, State, and zip code)*

11. Was place of accident or exposure on employer's premises? Yes ☐ No ☐

12. What was the employee doing when injured? *(Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.)*

13. How did the accident occur? *(Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led or contributed to the accident. Use separate sheet for additional space.)*

Occupational Injury or Occupational Illness

14. Describe the injury or illness in detail and indicate the part of body affected. *(E.g., amputation of right index finger at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.)*

15. Name the object or substance which directly injured the employee. *(For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc., the thing he was lifting, pulling, etc.)*

16. Date of injury or initial diagnosis of occupational illness

17. Did employee die? *(Check one)* Yes ☐ No ☐

Other

18. Name and address of physician

19. If hospitalized, name and address of hospital

Date of report	Prepared by	Official position

OSHA No. 101 (Feb. 1981)

SUPPLEMENTARY RECORD OF OCCUPATIONAL INJURIES AND ILLNESSES

To supplement the Log and Summary of Occupational Injuries and Illnesses (OSHA No. 200), each establishment must maintain a record of each recordable occupational injury or illness. Worker's compensation, insurance, or other reports are acceptable as records if they contain all facts listed below or are supplemented to do so. If no suitable report is made for other purposes, this form (OSHA No. 101) may be used or the necessary facts can be listed on a separate plain sheet of paper. These records must also be available in the establishment without delay and at reasonable times for examination by representatives of the Department of Labor and the Department of Health and Human Services, and States accorded jurisdiction under the Act. The records must be maintained for a period of not less than five years following the end of the calendar year to which they relate.

Such records must contain at least the following facts:

1) *About the employer*—name, mail address, and location if different from mail address.

2) *About the injured or ill employee*—name, social security number, home address, age, sex, occupation, and department.

3) *About the accident or exposure to occupational illness*—place of accident or exposure, whether it was on employer's premises, what the employee was doing when injured, and how the accident occurred.

4) *About the occupational injury or illness*—description of the injury or illness, including part of body affected; name of the object or substance which directly injured the employee; and date of injury or diagnosis of illness.

5) *Other*—name and address of physician; if hospitalized, name and address of hospital; date of report; and name and position of person preparing the report.

SEE *DEFINITIONS* ON THE BACK OF OSHA FORM 200.

1986 OSHA No. 200-S
Annual Occupational Injuries and Illnesses Survey Covering Calendar Year 1986

U.S. Department of Labor
Bureau of Labor Statistics for the Occupational Safety and Health Administration

The information collected on this form will be used for statistical purposes only by the BLS, OSHA, and the cooperating State Agencies.

THIS REPORT IS MANDATORY UNDER PUBLIC LAW 91-596. FAILURE TO REPORT CAN RESULT IN THE ISSUANCE OF CITATIONS AND ASSESSMENT OF PENALTIES.

O.M.B. No. 1220-0045
Approval Exp. 6/30/87

St. Sch. No. Ck. Suf.

SIC
EDIT

Complete this report whether or not there were recordable occupational injuries or illnesses.

PLEASE READ THE ENCLOSED INSTRUCTIONS

EMPLOYER'S COPY DO NOT RETURN

I. ANNUAL AVERAGE EMPLOYMENT IN 1986

Enter the average number of employees who worked during calendar year 1986 in the establishment(s) covered by this report. Include all classes of employees: full-time, part-time, seasonal, temporary, etc. See the instructions for an example of an annual average employment calculation. ***(Round to the nearest whole number.)***

II. TOTAL HOURS WORKED IN 1986

Enter the total number of hours actually worked during 1986 by **all** employees covered by this report. DO NOT include any non-work time even though paid such as vacations, sick leave, etc. If employees worked few hours in 1986 due to layoffs, strikes, fires, etc., explain under Comments (section VII). ***(Round to the nearest whole number.)***

III. NATURE OF BUSINESS IN 1986

A. Check the box which best describes the general type of activity performed by the establishment(s) included in this report.

- ☐ Agriculture
- ☐ Forestry
- ☐ Fishing
- ☐ Mining
- ☐ Construction
- ☐ Manufacturing
- ☐ Transportation
- ☐ Communication
- ☐ Public Utilities
- ☐ Wholesale Trade
- ☐ Retail Trade
- ☐ Finance
- ☐ Insurance
- ☐ Real Estate
- ☐ Services
- ☐ Public Administration

B. Enter in order of importance the principal products, lines of trade, services or other activities. For each entry also include the approximate percent of total 1986 annual value of production, sales or receipts.

_____ %
_____ %
_____ %

C. If this report includes any establishment(s) which perform services for other units of your company, indicate the primary type of service or support provided. ***(Check as many as apply.)***

1. ☐ Central administration
2. ☐ Research, development and testing
3. ☐ Storage (warehouse)
4. ☐ Other (specify) _____

IV. MONTH OF OSHA INSPECTION

If the establishment(s) covered by this report had either a Federal or State OSHA compliance inspection during calendar year 1986, please enter the name of the month in which the *first* inspection occurred.

_____

(Leave this box blank.)

V. RECORDABLE INJURIES AND ILLNESSES

Did the establishment(s) have any recordable injuries or illnesses during calendar year 1986?

1. ☐ No (Please complete section VII.)
2. ☐ Yes (Please complete sections VI and VII.)

SEE REVERSE

REPORT LOCATION AND IDENTIFICATION

Complete this report for the establishment(s) covered by the description below:

Please indicate any address changes below.

For Information Call:

OSHA No. 200-S (Revised December 1986)

VI. OCCUPATIONAL INJURY AND ILLNESS SUMMARY (Covering Calendar Year 1986)

- ***Complete this section by copying totals from the annual summary of your 1986 OSHA No. 200.***
- Remember to reverse the carbon insert before completing this side.
- Leave section VI blank if there were no OSHA recordable injuries or illnesses during 1986.
- ***Note: First aid even when administered by a doctor or nurse is not recordable.***
- Please check your figures to be certain that the sum of entries in columns (7a) + (7b) + (7c) + (7d) + (7e) + (7f) + (7g) = the sum of entries in columns (8) + (9) + (13).
- If you listed fatalities in columns (1) and/or (8), please give a brief description of the object or event which caused each fatality in the "Comments" section.

OCCUPATIONAL INJURY CASES

INJURY RELATED FATALITIES** (DEATHS)	INJURIES WITH LOST WORKDAYS				INJURIES WITHOUT LOST WORKDAYS*
	Injury cases with days away from work and/or restricted workdays	Injury cases with days away from work	Total days away from work	Total days of restricted activity	
Number of DEATHS in col. 1 of the log (OSHA No. 200)	Number of CHECKS in col. 2 of the log (OSHA No. 200)	Number of CHECKS in col. 3 of the log (OSHA No. 200)	Sum of the DAYS in col. 4 of the log (OSHA No. 200)	Sum of the DAYS in col. 5 of the log (OSHA No. 200)	Number of CHECKS in col. 6 of the log (OSHA No. 200)
(1)	(2)	(3)	(4)	(5)	(6)
DEATHS					

OCCUPATIONAL ILLNESS CASES

TYPE OF ILLNESS Enter the number of checks from the appropriate columns of the log (OSHA No. 200).							
Occupational skin diseases or disorders	Dust diseases of the lungs	Respiratory conditions due to toxic agents	Poisoning (systemic effects of toxic materials)	Disorders due to physical agents	Disorders associated with repeated trauma	All other occupational illnesses	
(7)							
(a)	(b)	(c)	(d)	(e)	(f)	(g)	

ILLNESS RELATED FATALITIES** (DEATHS)	ILLNESSES WITH LOST WORKDAYS				ILLNESSES WITHOUT LOST WORKDAYS*
	Illness cases with days away from work and/or restricted workdays	Illness cases with days away from work	Total days away from work	Total days of restricted activity	
Number of DEATHS in col. 8 of the log (OSHA No. 200)	Number of CHECKS in col. 9 of the log (OSHA No. 200)	Number of CHECKS in col. 10 of the log (OSHA No. 200)	Sum of the DAYS in col. 11 of the log (OSHA No. 200)	Sum of the DAYS in col. 12 of the log (OSHA No. 200)	Number of CHECKS in col. 13 of the log (OSHA No. 200)
(8)	(9)	(10)	(11)	(12)	(13)
DEATHS					

* WITHOUT LOST WORKDAYS—CASES WITH NO DAYS LOST RESULTING IN EITHER DIAGNOSIS OF OCCUPATIONAL ILLNESS, LOSS OF CONSCIOUSNESS, RESTRICTION OF WORK OR MOTION, TRANSFER TO ANOTHER JOB, OR MEDICAL TREATMENT BEYOND FIRST AID.

VII. REPORT PREPARED BY (Please type or print)

NAME _____
TITLE _____
SIGNATURE _____
AREA CODE _____ PHONE _____
DATE _____

**IF YOU LISTED FATALITIES IN COLUMNS (1) AND/OR (8), PLEASE GIVE A BRIEF DESCRIPTION OF THE OBJECT OR EVENT WHICH CAUSED EACH FATALITY IN THE "COMMENTS" SECTION BELOW.

COMMENTS _____

SURVEY REPORTING REGULATIONS

Title 29, Part 1904.20-22 of the Code of Federal Regulations requires that: each employer shall return the completed survey form, OSHA No. 200-S, within 3 weeks of receipt in accordance with the instructions shown below.

INSTRUCTIONS FOR COMPLETING THE OSHA NO. 200-S FORM 1986 OCCUPATIONAL INJURIES AND ILLNESSES SURVEY (Covering Calendar Year 1986)

Change of Ownership—When there has been a change of ownership during the report period, only the records of the current owner are to be entered in the report. Explain fully under Comments (Section VII), and include the date of the ownership change and the time period this report covers.

Partial-Year Reporting—For any establishment(s) which was not in existence for the entire report year, the report should cover the portion of the period during which the establishment(s) was in existence. Explain fully under Comments (Section VII), including the time period this report covers.

ESTABLISHMENTS INCLUDED IN THE REPORT

This report should include only those establishments located in, or identified by, the Report Location and Identification designation which appears next to your mailing address. This designation may be a geographical area, usually a county or city, or it could be a brief description of your operation within a geographical area. If you have any questions concerning the coverage of this report, please contact the agency identified on the OSHA No. 200-S report form.

DEFINITION OF ESTABLISHMENT

An **ESTABLISHMENT** is defined as a single physical location where business is conducted or where services or industrial operations are performed. (For example: a factory, mill, store, hotel, restaurant, movie theatre, farm, ranch, bank, sales office, warehouse, or central administrative office.)

For firms engaged in activities such as construction, transportation, communication, or electric, gas and sanitary services, which may be physically dispersed, reports should cover the place to which employees normally report each day.

Reports for personnel who do not primarily report or work at a single establishment, such as traveling salespersons, technicians, engineers, etc., should cover the location from which they are paid or the base from which personnel operate to carry out their activities.

SECTION I. ANNUAL AVERAGE EMPLOYMENT IN 1986

Enter in Section I the **average** (not the total) number of full and part-time employees who worked during calendar year 1986 in the establishment(s) included in this report. If more than one establishment is included in this report, add together the annual average employment for each establishment and enter the sum. Include all classes of employees—-seasonal, temporary, administrative, supervisory, clerical, professional, technical, sales, delivery, installation, construction and service personnel, as well as operators and related workers.

Annual Average employment should be computed by summing the employment from all pay periods during 1986 and then dividing that sum by the total number of such pay periods throughout the entire year, including periods with no employment. For example, if you had the following monthly employment—-Jan.-10; Feb.-10; Mar.-10; Apr.-5; May-5; June 5; July-5; Aug.-0; Sept.-0; Oct.-0; Nov.-5; Dec.-5—-you would sum the number of employees for each monthly pay period (in this case, 60) and then divide that total by 12 (the number of pay periods during the year) to derive an annual average employment of 5.

SECTION II. TOTAL HOURS WORKED IN 1986

Enter in Section II the **total** number of hours actually **worked** by all classes of employees during **1986.** Be sure to include **ONLY** time on duty. **DO NOT include any non-work time** even though paid, such as vacations, sick leave, holidays, etc. The hours worked figure should be obtained from payroll or other time records wherever possible; if **hours worked** are not maintained separately from **hours paid**, please enter your best estimate. If actual hours worked are not available for employees paid on commission, salary, by the mile, etc., hours worked may be estimated on the basis of scheduled hours or 8 hours per workday.

For example, if a group of 10 salaried employees worked an average of 8 hours per day, 5 days a week, for 50 weeks of the report period, the total hours worked for this group would be 10 x 8 x 5 x 50 = 20,000 hours for the report period.

SECTION III. NATURE OF BUSINESS IN 1986

In order to verify the nature of business code, we must have information about the specific economic activity carried on by the establishment(s) included in your report during calendar year 1986.

Complete Parts A, B and C as indicated in Section III on the OSHA No. 200-S form. Complete Part C **only** if supporting services are provided to other establishments of **your** company. Leave Part C blank if a) supporting services are not the primary function of any establishment(s) included in this report or b) supporting services are provided but only on a **contract or fee basis** for the general public or for other business firms. **(Instructions continued on page 2.)**

NOTE: If more than one establishment is included, information in Section III should reflect the combined activities of all such establishments. One code will be assigned which best indicates the nature of business of the group of establishments as a whole.

SECTION IV. MONTH OF OSHA INSPECTION

Enter the name of the first month in 1986 during which your establishment(s) had an OSHA compliance inspection. Include inspections under the Federal or State equivalents of the Occupational Safety and Health Act by Federal or State inspectors and other inspections which may result in penalties for violations of safety and health standards. Do not include inspections limited to elevators, boilers, fire safety or those which are consultative in nature.

SECTION V. RECORDABLE INJURIES OR ILLNESSES

Check the appropriate box. If you checked "Yes," complete Sections VI and VII on the back of the form. If you checked "No," complete only Section VII.

SECTION VI. OCCUPATIONAL INJURY AND ILLNESS SUMMARY

This section can be completed easily by copying the totals from the annual summary of your **1986** OSHA No. 200 form (Log and Summary of Occupational Injuries and Illnesses). Please note that if this report covers **more** than one establishment, the final totals on the "Log" for each must be added and the sums entered in Section VI.

Leave Section VI **blank** if the employees covered in this report experienced no recordable injuries or illnesses during 1986.

If there were recordable injuries or illnesses during the year, please review your OSHA No. 200 form for each establishment to be included in this report to make sure that all entries are correct and complete before completing Section VI. Each recordable case should be included on the "Log" in only **one** of the six main categories of injuries or illnesses:

1. INJURY—related deaths (Log column 1)
2. INJURIES with days away from work and/or restricted days (Log column 2)
3. INJURIES without lost workdays (Log column 6)
4. ILLNESS—related deaths (Log column 8)
5. ILLNESSES with days away from work and/or restricted days (Log column 9)
6. ILLNESSES without lost workdays (Log column 13)

Also review each case to ensure that the appropriate entries have been made for the other columns if applicable. For example, if the case is an Injury with Lost Workdays, be sure that the check for an injury involving **days away from work** (Log column 3) is entered if necessary. Also verify that the correct number of days away from work (Log column 4) and/or days of restricted work activity (Log column 5) are recorded. A similar review should be made for a case which is an Illness with Lost Workdays (including Log columns 10, 11 and 12). Please remember that if your employees' loss of workdays is still continuing at the time the annual summary for the year is completed, you should estimate the number of future workdays they will lose and add this estimate to the actual workdays already lost. Each partial day away from work, other than the day of the occurrence of the injury or onset of illness, should be entered as one full restricted workday.

Also, for each case which is an Illness, make sure that the appropriate column indicating Type of Illness (Log columns 7a-7g) is checked.

After completing your review of the individual case entries on the "Log," please make sure that the "Totals" line has been completed by summarizing Columns 1 through 13 according to the instructions on the back of the "Log" form. Then, copy these "Totals" onto Section VI of the OSHA No. 200-S form. If you entered fatalities in columns (1) and/or (8), please include in the "Comments" section a brief description of the object or event which caused each fatality.

FIRST AID

Finally, please remember that all injuries which, in your judgement, required **only First Aid Treatment**, even when administered by a doctor or nurse, should not be included in this report. First Aid Treatment is defined as one-time treatment and subsequent observation of minor scratches.cuts, burns, splinters, etc., which do not ordinarily require medical care.

SECTION VII. COMMENTS AND IDENTIFICATION

Please complete all parts including your area code and telephone number. Then return the OSHA No. 200-S form in the pre-addressed envelope. **KEEP** your file copy.

Dear Employer:

The Occupational Safety and Health Act of 1970 requires the Secretary of Labor to collect, compile, and analyze statistics on occupational injuries and illnesses. This is accomplished through a joint Federal/State survey program with States that have received Federal grants for collecting and compiling statistics. Establishments are selected for this survey on a sample basis with varying probabilities depending upon size. Certain establishments may be included in each year's sample because of their importance to the statistics for their industry.

You have been selected to participate in the nationwide Occupational Injuries and Illnesses Survey for 1986. Under the Occupational Safety and Health Act, your report is mandatory.

The following items are enclosed for your use: (1) Instructions for completing the form; (2) The OSHA No. 200-S form and a copy for your files; and (3) An addressed return envelope. Please complete the OSHA No. 200-S form and return it within three weeks in the envelope provided.

If you have any questions about this survey, contact the survey collection agency indicated on the OSHA No. 200-S form.

Thank you for your cooperation with this important survey.

Sincerely,

JOHN A. PENDERGRASS
Assistant Secretary for
Occupational Safety and Health

Chapter 15. Economic Growth and Employment Projections

Part I. Overview

BLS develops and publishes 10- to 15-year projections of the U.S. economy on a 2-year cycle, with the initial results published in the fall of odd-numbered years. The projections cover the labor force, aggregate economy, final demand, output by industry, employment by industry, and employment by occupation. In recent years, alternative projections have been made based on differing assumptions with regard to basic economic activity—such as the level of business investment or path of government spending.

The basic principles underlying the procedures used to develop the projections have remained constant over the years, but many changes in procedures have been made as new series of data become available and as statistical tools improve. The current methodology has been relatively unchanged since the late 1970's.

Projections are made from a base year to a target year. The base year is the latest year for which data are available at the time the projections are being developed, usually the year immediately preceding publication. The target year is the last year of the period being projected, usually 10 to 15 years in the future. Generally, each set of projections has a single target year, but some projections are prepared for both the target year and an interim year. The projections do not attempt to measure year-to-year change; they only project levels of economic activity for the target year.

The BLS projections are developed in a series of six steps or stages, each of which is based on a separate model: (1) labor force, (2) aggregate economy, (3) industry final demand, (4) input-output, (5) industry employment, and (6) occupational employment. While each of these steps is taken separately, they are closely interrelated, the results of one usually being needed for the next; the third and fourth steps, in particular, are very tightly interwoven. Details on the data used in each model and the methods used for each projection appear in parts II through VII of this chapter; however, some general comments follow with regard to assumptions, procedures, presentation, and limitations of the projections.

Assumptions and Procedures

The development of projections requires analyzing large amounts of historical data, discovering trends, and determining a likely course for those trends in the future. The determination of the likely course of a trend is very problematic, and various factors contribute to each decision. Users of BLS projections, like the users of any projections, need to be aware of the underlying assumptions and should consider the projections as likely outcomes in the light of those assumptions and current and expected trends.

First, some assumptions are made concerning general economic or social conditions. These include the following: (1) work patterns will not change significantly over the projection period; for example, the average workweek will not change markedly; (2) broad social and educational trends will continue; (3) there will be no major war; (4) there will be no significant change in the size of the Armed Forces; and (5) fluctuations in economic activity due to the business cycle will occur. These assumptions have both an overall and a particular impact. For example, the assumption that social trends will continue implies that our society will continue to provide for the education of the young, which influences the projected level of local government demand and the demand for teachers.

Second, particular ranges in the target year are set for certain factors, such as unemployment—a factor that obviously affects the figure for total employment and thus the employment in each industry and occupation. The projections are particularly sensitive to such target ranges as real gross national product (GNP), GNP deflator, real disposable income, civilian labor force, civilian employment, real output per person, and the unemployment rate. For these, BLS specifies up to three alternatives rather than one, thus generating three scenarios, or projected levels of economic activity, for the target year.

Third, the analysis of the historical data calls for judgments as to influences on the past rate of change that will become more or less important in the future. During the 1970's and early 1980's, for example, employment of cashiers in retail stores grew at the expense of other sales occupations as these stores centralized their cashier services. However, this factor will no longer cause changes in the kinds of workers retail stores hire, in the judgment of BLS analysts, because most such stores now have centralized cashier operations.

To insure the consistency of the six models and many assumptions, goals, and variables, the BLS projection procedure encompasses detailed review and analysis of

the results at each stage for soundness of economic logic, reasonableness, and consistency. Preliminary projections made in each step are reviewed by both the analysts who work primarily on that projection and analysts who work primarily on other steps. As a result of detailed analyses, the models are rerun and reanalyzed several times until, in the judgment of the BLS staff, projections that are both reasonable and internally consistent are achieved for the entire system. In short, the final results reflect innumerable interactions among staff members who focus on particular variables in the models.

Presentation

The projections are first published in the *Monthly Labor Review*, usually in the fall of odd-numbered years, and subsequently appear in BLS bulletins and the *Occupational Outlook Quarterly*, which also prints articles on such topics as new and emerging occupations and changing job market conditions for existing occupations.

Three bulletins were published for the 1986–1995 projections: *BLS Economic Growth Model System Used for Projections for 1995: Data and Methods;* the *Occupational Outlook Handbook, 1986 Edition;* and *Occupational Projections and Training Data, 1986 Edition*. The first reprints the *Monthly Labor Review* articles and contains supplementary data, such as selected aggregate economic variables, the size of each labor force cohort, final demand by industry, gross output and employment by industry, and wage and salary employment by detailed industry. The *Occupational Outlook Handbook* discusses more than 200 occupations; besides outlook data, it includes information on the nature of the work, training requirements, working conditions, and earnings. The *Handbook* is available in the vast majority of career information centers in the country's high schools, colleges, and libraries, where it is used as a primary source of information for people in the process of choosing a career. *Occupational Projections and Training Data* presents detailed statistics on employment and education and training completions; most of the data are for the occupations included in the *Handbook*.

Data are also released in machine-readable form. Computer tapes in both IBM standard and unlabeled formats are prepared containing aggregate projections, input-output data, historical macro data, historical industry data, projected industry data, and occupational projections. A diskette for use with Lotus 1-2-3 contains industry data on output, total employment, wage and salary employment, and total hours. Both tapes and diskettes are sold through the BLS Division of Financial Planning and Management.

Limitations

Because of the nature of projections, misunderstandings may arise between users, who feel the need for exact numbers, and producers, who recognize their inability to predict with such precision. Such conflicts are all the more likely because the models used to develop the projections provide numerical answers to specific questions. Users are inevitably tempted to attribute to those numbers an exactness which they should not be accorded. The translation of analytical judgments, such as those concerning the impact of a specific technology on the need for workers with specific skills, into numerical estimates is especially subjective. For example, most analysts would agree that the use of robots will affect employment in manufacturing industries. Yet numerical estimates of the reduction in the proportion of assemblers and welders in an industry affected by robots could vary significantly among analysts. The Bureau attempts to address this dilemma by making clear all of the important assumptions underlying its projections, by developing alternative versions that reflect some of the uncertainties and differing policy decisions about the future, and by making projections on a regular 2-year cycle in order to incorporate new data and assumptions.

The Bureau also seeks to improve the projections process and to make users aware of their limitations by reviewing previous projections. Once the target year is reached, BLS evaluates the projections to determine the errors and to learn what changes in assumptions or models might have made them more accurate.

Part II. Labor Force

The labor force projections, the first step in the BLS projections sequence, depend upon an analysis of the current population and projections of its future size and composition. Projections are made for the labor force as a whole and for more than 80 separate age-sex-race groups and more than 20 age-sex groups for people of Hispanic origin.

Data Sources

Projections of the labor force require projections of the population and data on labor force participation. The Bureau of the Census prepares population projections by age, sex, and race, based on trends in birth rates, death rates, and migration. Data on participation rates are

based on the Current Population Survey (CPS), conducted for BLS by the Bureau of the Census. (A description of the CPS appears in chapter 1.)

Methods

Various assumptions can be made for either population growth or labor force participation. Because birth rates cause much uncertainty in projecting the population, the Bureau of the Census prepares three projections of the population based on differing assumptions with respect to birth rates. BLS selects one of these, generally the middle one.

In recent years, BLS developed three alternative sets of labor force projections by specifying different variables for certain trends of labor force participation. In the 1984–95 projections, for example, a high-growth scenario assumed rapid growth in the labor force participation of women in the 1980's and the convergence of participation rates of black and white men under age 65, rates that have been diverging since 1955; a middle-growth scenario assumed only the rapid growth of women's participation; a low-growth scenario assumed a moderate increase in women's participation and continued divergence in the participation rates of black and white men.

Using the Census Bureau's population projections, BLS projects labor force participation rates—the proportion of various groups in the population who will be working or seeking work. Projections for the 1986–2000 period were made for more than 110 separate demographic groups because both the level and trends of participation vary considerably by age, sex, race, and Hispanic origin.

The labor force participation projection for each age-sex-race group and for each group of Hispanic origin is developed by analyzing past rates of growth for that group and extrapolating it to the target year. Past participation rates may be generated from data for two different time periods, one of about 20 years and one of less than 10 years. The choice of period is based on a judgment of which period will prove to be a better predictor for the group. Groups whose participation rate is changing rapidly, for example, would be projected on the basis of the shorter period.

Cross-sectional and cohort analyses are also conducted for each group. In cases where these analyses show inconsistencies, the participation rate extrapolated from the time-series data is modified. The modification is greatest for black women and smallest for white men.

At each stage, the results for specific groups are reviewed and modified if not consistent with those for other demographic groups. The projected participation rate for each age-sex-race group is then multiplied by the corresponding population projection to obtain the labor force projection for that group. Because people of Hispanic origin may be of any race, the estimates for those age-sex groups are not added to the projections for the age-sex-race groups. The latter are summed to obtain the total labor force. The size of the civilian labor force is then derived by subtracting the Armed Forces from the total labor force.

Uses

Labor force projections are a basic factor in estimating the amount of economic growth necessary to achieve specified levels of employment. They provide insight into the demographic characteristics of future workers and the implications of these for education and training. In addition, along with other factors, they are used by planners in business and industry to estimate demand for their products, develop marketing plans, evaluate expansion programs, and build macroeconomic models. International organizations and Federal, State, and local government agencies also use the projections.

Part III. Aggregate Economy

Projections of the aggregate economy—the second stage in the BLS projection procedures—are made through use of a macroeconomic model referred to throughout this chapter as the macro model. The labor force projections made in the first stage of the BLS procedure are used along with many other variables to develop projections of GNP and major categories of demand and income. Because the variables are so numerous, sources of data are manifold. They include BLS itself, the U.S. Departments of Commerce and Energy, the Federal Reserve Board, and Wharton Econometric Forecasting Associates, Inc.

Methods

For the past few cycles of projections, BLS has used models of the economy—which are basically sets of equations that correlate different aspects of the economy with each other—created by other organizations. The specific equations used in a model may differ, but they work in similar ways to provide a framework for the preparation of a consistent set of economywide projections for a given set of assumptions and goals. The 1986–2000 projections were based on a macro model created by Wharton Econometric Forecasting Associates, Inc. The macro

model is a system of behavioral relationships and identities based on annual data and designed to allow an analyst to explore the determinants of growth in the U.S. economy. Made up of approximately 2,400 equations, the macro model is driven by a set of 900 exogenous variables—arithmetic values that can be manipulated by the equations in the macro model. BLS specifies the value of these variables.

The exogenous variables can be divided into three groups, according to the degree of certainty to which each can be determined. Reliable, generally accepted values are available for some variables, such as the future size of the population; Census population projections have proven to be highly accurate. Other variables involve policy decisions that, while subject to change, have remained fairly constant for many years; these include the amount of Federal transfer payments, the response of the monetary authority to economic growth, and the size of the Armed Forces. Finally, some exogenous variables do not follow predictable relationships; these include the inflation rates in the economies of the major trading partners of the United States, the exchange value of the U.S. dollar, and energy prices.

Besides being governed by general assumptions, the projections are generally approached with certain goals or targets in mind. Because the goals relate to variables that are, strictly speaking, results of the aggregate model rather than inputs to it, they are attained by changes to the structure of the model itself. Such goals or target variables include the unemployment rate, the rate of growth of labor productivity, inflation, and the sectoral distribution of employment.

Once the value of each variable has been determined, the macro model is run, that is, the equations are solved, producing projected values for numerous kinds of economic activity, such as GNP, purchases of consumer goods, and capital investment. BLS analysts review the aggregate results for soundness of logic and reasonableness. The review includes checks on internal consistency, evaluation of continuity with past trends, and comparisons with projections made by other organizations. Although the review tends to focus on such items as GNP, unemployment, and productivity, the macro model's framework ensures that other important measures of economic performance are not overlooked.

Uses

The values produced by the macro model for many variables are used at later stages in the BLS projection procedures. Among these are the values for GNP and several different categories of personal consumption expenditures, gross private domestic investment, exports, imports, government purchases, and employment.

The projections also form an important part of the U.S. Government's report to international organizations on the long-term economic outlook for the United States. In addition, other Government agencies use parts of the economic growth projections to develop projections for their program needs. State and local governments, area planning councils, outside research organizations, and universities use these data when planning programs, building their own models, or evaluating projections.

Part IV. Industry Final Demand

Projections of final demand are made in the third stage of the BLS projection procedures; these projections are made along with the creation of the input-output model described in the next section of this chapter. Final demand is one way to view GNP; it is GNP distributed among final users, broadly categorized into four groups: (1) personal consumption expenditures (PCE), (2) capital investment, (3) foreign trade, and (4) government.

(1) PCE represents demand on the part of persons and certain nonprofit institutions. Rent and the imputed rental value of owner-occupied dwellings are included in this category, but the purchase of dwellings is not.
(2) Capital investment represents demand on the part of business plus residential construction. Capital investment includes both fixed investment—such as the purchase of durable equipment and structures—and change in business inventories of raw materials, semifinished goods, and finished goods.
(3) Foreign trade includes both exports and imports. These are analyzed separately; imports are subtracted from exports at the final stage of the projections procedure.
(4) Government demand is defined as the goods and services purchased by all government units—local, State, and Federal. It does not include transfer payments such as those made in the Social Security program, interest, or subsidies, all of which are accounted for under personal consumption expenditures or capital investment.

Final demand determines the total output of the economy, which in turn determines the distribution of employment. Because the purpose of production is the satisfaction of demand, variation in the demand for goods and in the means of producing these goods changes the level and distribution of employment over time.

Data Sources

In general, projecting final demand entails the compilation of historical data in a form that helps determine the industry distribution of the economy for some future year. BLS uses "bridge" tables and bills of goods that show the industry composition of final demand components in order to perform this analysis. Projections made in the macro model and data from the economic censuses conducted by the Bureau of the Census provide the information needed. Data for the target year of the projections come from the macro model, which generates values for more than 40 different categories of final demand.

For past years, large amounts of data in various forms are available. Much of it is provided by the Bureau of Economic Analysis (BEA) of the Department of Commerce. Although considerable data are collected annually, the creation of a bill of goods requires a level of detail that is available only from the economic censuses, and BEA only produces a bill of goods for those years. The historical series depends heavily, therefore, on the census years; more recent economic trends are incorporated into the projections through supplementary data series.

Besides the economic censuses, BLS analysts use several other series of data produced by the Department of Commerce in order to project final demand. PCE are compiled by BEA in the National Income and Product Accounts (NIPA); they are available annually from 1929, disaggregated into more than 80 components of consumption expenditures. BEA also produces a bridge table for each year in which an economic census is held; the bridge table distributes the more than 80 PCE categories among over 500 producing industries. Two principle sources of data are available for capital investment: (1) investment by industry, collected annually by the Office of Business Analysis, which yields information on investment in capital goods; and (2) NIPA annual data, which yield information on both durable goods and structures. A capital flows matrix, produced by BEA for the years in which there is an economic census, distributes investment by industry into the producing industry. For foreign trade, plentiful data on exports and imports are available in the detailed merchandise trade statistics published annually by the Bureau of the Census. Data from the Department of Commerce and from specialized surveys allow for the construction of bills of goods for government demand.

Methods

Analytical judgments

In order to project final demand, the same kinds of judgments and assumptions must be made as those that enter into the macro model. For some components, the data available permit reasonable certainty. For example, the demand for education, a significant factor in State and local government demand, reflects the projected age structure of the population. Similarly, demand for residential construction depends heavily on demographic and income forecasts. Judgments must also be made, however, with regard to the effect of technological developments—such as computers and robots—and other factors for which data are less reliable.

Projections

The historical data and the initial projections of various categories of final demand generated by the early runs of the macro model provide a starting point for the analysts, who must study all aspects of demand to insure that the models remain balanced and consistent throughout the development of a new set of projections. Although the four categories of final demand—personal consumption expenditures, capital investment, foreign trade, and government—are subject to different procedures, each makes use of bridge tables.

The bridge tables distribute final demand to more than 500 producing industries that generally correspond to the 4-digit Standard Industrial Classification (SIC) codes. They provide a percent distribution of the industries supplying the various categories into which GNP is apportioned. Projected bridge tables are created by BLS for roughly 220 industries; most are at the 3-digit SIC level. The projections use this level of aggregation because of the nature of the data. The projected bridge tables reflect such factors as expected changes in technology, consumer tastes or buying patterns, the industrial pattern of exports and imports, and the future composition of each industry's business investment. Thus, the bridge tables allow the analyst to provide for shifts in the industrial makeup of a given demand category. Having the data at this level of allocation allows finer adjustment for technological and economic change.

Personal consumption expenditures are projected by aggregating the more than 80 categories in the bridge table into 15 major product groups. Some categories, such as gasoline and oil, are identical to a BEA category, but many are composites of several BEA categories. For example, the transportation services category in the BLS macro model includes all of the following BEA categories: Automobile repair, road tolls, automobile insurance less claims paid, bus and trolley car transportation, taxicabs, commuter rail transportation, railway transportation, intercity buses, airline transportation, and other intercity transportation. The projection for each of the 15 categories is then modified to reflect technological and economic assumptions as well as industry trends that are expected to continue over the projected time span.

Capital investment is initially projected by the macro model, which generates values for investment in durable goods and new structures for the whole economy and distributes these figures among aggregate industries. The investments by purchasing industries in durable goods and new structures can then be converted into the producing industries by use of the BEA capital flows tables. The results must be carefully reviewed by the staff because the capital flows tables are purely historical and do not take into account expected changes in technology or other factors. Changes that result from these reviews may necessitate complementary adjustments in other parts of the macro model. Adjustments to the macro model may also be necessary to reflect changes in inventories.

Foreign trade is initially projected by the macro model, which generates values for components of exports and imports, such as foods, feeds, and beverages, consumer goods, and autos and parts. These values are distributed across more than 200 industries in the light of past trends, existing and expected shares of the domestic market, expected world conditions, and trade agreements. Once this distribution has been made, it is reviewed by the staff and adjustments made as necessary. Total imports are divided into two categories: Those competitive with domestic products and those that have no domestic counterparts, such as coffee and diamonds. Competitive imports are subtracted from final demand in order to derive the domestic output. For example, the projected value of imported automobiles is subtracted from total demand for autos so that the demand-for-autos component of the macro model will reflect domestic products only. Noncompetitive imports are considered purchases of the industry that uses them; some noncompetitive imports that do not need any processing, such as bananas, are only included in the final user category.

Government demand is initially projected by the macro model for six categories: State and local education; State and local health, welfare, and sanitation; State and local safety; State and local other; Federal defense; and Federal nondefense. Projections of the size of the government labor force—State and local, Armed Forces, and Federal civilian—are also made at earlier stages of the BLS projection procedures. Consequently, the analyst is able to project at this stage the compensation that governments will provide their employees and subtract this amount from the value for government demand. The remainder is distributed across other industries in the economy by means of a bridge table.

Uses

Projections of final demand are used to refine the macro model and are major components of the input-output model described in the next section.

Part V. Input-Output

The creation of an input-output model is the fourth stage of the BLS projection procedure. Each industry within the economy relies on other industries to supply inputs—intermediate products or services—for further processing. The input-output model insures consistency between demand estimates and output estimates and permits analysis of technological change and product substitution.

The components and support services that enter into a product are frequently produced by industries other than the one that provides the final product. For example, an automobile is a final product and its value is part of the final demand model. However, the carmaker must purchase steel, glass, electricity, secretarial assistance, and financial services in order to produce the automobile; these intermediate products do not explicitly appear in the final demand model. The input-output model does show these purchases by the carmaker. Analysis of such interrelationships results in a more precise projection of each industry's production than is possible from the projection of final demand alone. This, in turn, allows for a better projection of employment by industry.

In addition to allowing the examination of technological change, the input-output model makes possible the analysis of changes in demand for secondary products of an industry. In the historical data, establishments are grouped into industries according to their primary product—those goods or services that produce the largest part of its revenue. Many establishments, however, produce more than one product. The input-output model enables analysts to look at changes in output for all the products of an industry and in all the industries that sell a product, allowing for projected changes in demand to be made proportionately across all relevant industries.

Data Sources

Historical data prepared by BEA, projections of final demand developed in the third stage of the procedure, and studies of particular industries and commodities are all needed to produce the input-output model. BEA creates historical input-output tables based on data contained in the *Census of Manufactures* and other economic censuses. Because the most recent of these is often somewhat outdated, BLS uses data from more recent surveys and other sources in order to construct input-output tables for more recent years.

Methods

The BLS input-output model consists of five matrices, or tables. The "use" table shows the sales in dollars of each commodity to every consuming industry and to final demand; rows sum to commodity output and columns to industry output. The "make" table shows, in dollars, the production of commodities by each industry; rows sum to industry output and columns sum to commodity output. The direct requirements table presents the values from the use table as coefficients. The market shares matrix presents the values from the make table as coefficients. The total requirements table combines data from the direct requirements table and the market shares matrix; it shows total requirements—direct and indirect—to produce a dollar of final demand.

After these adjustments are made, BLS converts the dollar values shown in the tables into coefficients showing relative values. These coefficients are used to generate the projected input-output tables.

Throughout the projection process, the coefficients used for the projected input-output matrices may be changed for several reasons, such as technological developments, changes in product mix or relative prices, and the availability of substitute inputs or more current data. The coefficients in the two matrices can be analyzed and adjusted on both an industry-by-industry and a commodity-by-commodity basis to insure that they reflect the best information available and are consistent with other projections. As with the other steps, several reviews and interim projections are required before the final matrices are produced.

Uses

The projected output of industries is an important part of the next stage of projections procedure, the projection of industry employment. The input-output model also permits other analytical uses. Specifically, the model can be used to generate labor requirements for various economic sectors or types of demand for recent years.

Part VI. Industry Employment

The fifth stage of the projection procedure is the analysis of trends in industry output and employment. Fast-growing and declining industries are identified, and employment is projected for each of more than 200 industries. Industry employment is projected through the use of a labor model, developed by BLS, that correlates productivity with industry output. An equation is specified for each industry, relating the demand for labor in that industry to the output of the industry and to certain other economic variables.

Data Sources

Historical data for the industry employment model are developed from a wide variety of sources. Time series on output (in constant dollars) for manufacturing industries are estimated from the Annual Survey of Manufactures conducted by the Department of Commerce and from BLS industry and producer price indexes. For nonmanufacturing industries, the sources for the output and price data are very diverse; they include NIPA, the Service Annual Survey, IRS business receipts, *Agricultural Statistics, Minerals Yearbook*, transportation statistics, and numerous others. Time series on employment and hours are derived from three BLS sources for different groups of workers: The establishment survey for nonagricultural wage and salary employment, production worker employment, and weekly hours (see chapter 2); The Current Population Survey for agricultural employment, self-employed and unpaid family worker jobs and hours, and private household workers (chapter 1); and unemployment insurance data for employment in industries not covered in the establishment survey (chapter 5).

Projected data for this model come from the input-output, labor force, final demand, and other BLS models. Projections of capital, ratio of output to capital, capacity utilization, average workweek, and total wage and salary employment in durable goods manufacturing, nondurable goods manufacturing, and nonmanufacturing come from the macro model.

Methods

Assumptions

Besides the general assumptions that govern the macro model, specific assumptions may be made for selected industries in order to project employment. For example, productivity in a particular industry may be assumed to equal, exceed, or fall short of the value determined by the labor model. Other assumptions that affect many industries also have to be made; recently, for example, an assumption has been made that new capital spending would be devoted in large part to high-technology innovations.

Projections

The BLS labor model contains, for each of more than

200 industries, a regression equation that estimates worker-hours as a function of four factors: Industry output, aggregate capacity utilization (as approximated by the unemployment rate), relative price of labor, and a technological variable as approximated by the ratio of output to capital. Worker-hours are then divided by projected average annual hours, yielding the projected number of wage and salary jobs for each industry. Estimates are then made, based on analysis of individual industries, for the self-employed and for unpaid family workers.

Many adjustments are made while the projections are being developed. Adjustments are usually required in situations such as the following: An industry does not operate near the conditions of maximum profit, historical and projected trends diverge widely, the output and employment time series data are inconsistent, new technology is expected, or the labor productivity trend implies negative employment. Adjustments to the labor model's initial estimate of productivity change are based on detailed analysis of historical and recent trends, special industry studies conducted by the staff, and industry technology studies from the Bureau's Office of Productivity and Technology (chapter 12). In order to make all these adjustments and to balance total employment from the aggregate projections with the sum of the industry employment projections, a number of iterations of the process are necessary.

Once the projections of employment by industry are final, they are further disaggregated using a time series regression model into 258 industries that, with few exceptions, correspond to the 3-digit SIC codes. The 258 resulting projections are reviewed in light of a broad range of economic information.

Uses

The projections of employment for industries are used in the industry-occupational matrix and in special studies and articles reporting on trends in specific industries. In addition, a labor requirements table is computed, showing the number of jobs in each detailed industry related to final demand for each of the commodities in the input-output table described in the previous section. The historical time series data on output and employment are also used extensively by researchers in universities, other government agencies, and businesses for market research, industry analysis, and economic impact studies.

Part VII. Occupational Employment

The final stage in the BLS projection procedure is the development of occupational projections. To generate the data on wage and salary workers, an industry-occupational matrix, or table, showing the distribution of occupational employment by industry is constructed for the base year and projected to the target year. Base-year data are also developed for self-employed workers and unpaid family workers. The projection for these workers, however, is made for the economy as a whole rather than by industry. The three classes of workers—wage and salary workers, self-employed, and unpaid family workers—are summed to derive the projections for each occupation. The 1986 matrix, which was projected to the year 2000, includes more than 400 occupations in 258 industries.

Data Sources

In order to project occupational employment, data are needed on staffing patterns of wage and salary workers by industry, employment of wage and salary workers by industry, and on self-employment and the employment of unpaid family workers.

Information on industry staffing patterns of wage and salary workers is available from several surveys. The Occupational Employment Statistics (OES) surveys conducted periodically by State employment security agencies under a BLS–State cooperative program provide information for all but a few industries (chapter 3). Information on agriculture and private household industries is available from the CPS and the Decennial Census of the Population. Economywide data on self-employed and unpaid family workers are also derived from the CPS and the decennial census. Information on staffing patterns for the Federal Government is developed by BLS from data compiled by the Office of Personnel Management (OPM).

Methods

Disaggregation and aggregation

Occupations in the industry-occupational matrix are classified according to the system used in the OES surveys, which is compatible with the *Standard Occupational Classification* (SOC) *Manual*. It is very similar to the system used for the census and the CPS. The OES survey, however, compiles data for broader groups of occupations in some industries. The development of economywide employment estimates for the detailed occupations in these industries requires disaggregation of the broader survey data. Data from the decennial census are used for these adjustments.

Adjustments also have to be made for the industries that are not included in the OES: Agriculture, private

households, and Federal Government. For example, the occupational classifications used by OPM are more detailed than the SOC, necessitating the aggregation of many occupations to make them comparable to the classification used in the matrix. Similarly, estimates of employment for self-employed and unpaid family workers derived from the CPS and decennial census must be adjusted to make them comparable to the other data in the matrix.

Once all the data have been reviewed, they are arrayed in a matrix that shows occupational employment distributed in percentages by industry. These percentages, however, are derived from surveys conducted in different years on a 3-year cycle. The percentages are, therefore, applied to total industry employment estimates for the base year in order to develop occupational employment estimates for the base year.

Projections

When a matrix for the base year has been developed, a projected matrix for the target year can be made. Changes in staffing patterns must, of course, be allowed for in the projections. This is done in several ways. Historical data are reviewed to identify trends; factors underlying the trends are identified through analytical studies of specific industries and occupations, technological change, and a wide variety of economic data; and judgments are made as to how the pattern will change. Factors underlying change are numerous, including technological developments affecting production and products, innovations in the ways business is conducted, modifications of organizational patterns, responses to government policies, and decisions to add new products and services or stop offering old ones.

Some expected trends may be too recent to be evident in the historical data. For example, an analysis of the past would not point toward the future impact of robots on staffing because this technology has not been used much in most industries. However, robots are expected to have a significant impact on some occupations, especially in the automobile industry. Information of this nature is identified by studies conducted by the Bureau's Office of Productivity and Technology and other organizations.

The industry-occupation matrix can display either the number employed or coefficients that show the proportion of workers in an industry that work in a particular occupation. The matrix of coefficients is used to project the staffing pattern of an industry. The change projected for a specific occupation may be small, moderate, significant, or very significant; the precise percentage reflects the analytical judgment of the staff members based on the analysis described above that relate to that occupation.

Several versions of the projected matrix are developed during the projection procedure. Each version is reviewed by members of the staff preparing the *Occupational Outlook Handbook* and economists working on other steps in the projection program; these reviews insure that all information available to the staff is brought to bear on the projections and that consistent assumptions are made for all the Bureau's projections. Knowledgeable people outside the Bureau are also asked to comment. The final matrix represents, therefore, a broad consensus on the part of all analysts working on the projections.

Uses

The occupational projections are very widely used by economists, counselors, students, and others concerned with the future of the economy.

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Chapter 16. Producer Prices

The Producer Price Index (PPI) measures average changes in selling prices received by domestic producers for their output. Most of the information used in calculating the Producer Price Index is obtained through the systematic sampling of virtually every industry in the mining and manufacturing sectors of the economy. The PPI program (also known as the industrial price program) includes some data from other sectors as well—agriculture, fishing, forestry, services, and gas and electricity. Thus the title "Producer Price Index" refers to an entire "family" or system of indexes.

As of January 1987, the PPI program contained:

- Price indexes for nearly 500 mining and manufacturing industries, including approximately 8,000 indexes for specific products and product categories;
- Over 3,000 commodity price indexes organized by type of product and end use; and
- Several major aggregate measures of price change organized by stage of processing.

Together, these elements constitute a system of price measures designed to meet the need for both aggregate information and detailed applications, such as following price trends in specific industries and products.

Measures of price change classified by industry, the most recent addition to the PPI system, now form the basis of the program. These indexes reflect the price trends of a constant set of goods and services which represent the total output of an industry. Industry index codes are based upon the Standard Industrial Classification (SIC) system and provide comparability with a wide assortment of industry-based data for other economic phenomena, including productivity, production, employment, wages, and earnings.

Background

Known until 1978 as the Wholesale Price Index or WPI, the Producer Price Index is one of the oldest continuous systems of statistical data published by the Bureau of Labor Statistics, as well as one of the oldest economic time series compiled by the Federal Government. First published in 1902, the index covered the years from 1890 through 1901. The origins of the index can be found in an 1891 U.S. Senate resolution authorizing the Senate Committee on Finance to investigate the effects of the tariff laws "upon the imports and exports, the growth, development, production, and prices of agricultural and manufactured articles at home and abroad."[1]

The first index, published on the base period 1890–99, was an unweighted average of price relatives for about 250 commodities. Since that time, many changes have been made in the sample of commodities, the base period, and the method of calculating the index. A system of weighting was first used in 1914, for example, and major sample expansions and reclassifications were implemented in 1952 and 1967.

When it was originally founded, the Wholesale Price Index program was intended to measure changes in prices received for goods sold in primary markets of this country. The conceptual framework and economic theory guiding the program's evolution, while more implicit than explicit, concentrated on obtaining the price received by either a domestic producer or an importer for the first commercial transaction.

A number of practical gaps, inconsistencies, and other weaknesses in the industrial price program, combined with increased development of the theory of price indexes in preretail markets, spurred several changes in terminology and operations during the 1970's. The 1978 program name change from Wholesale Price Index to Producer Price Index, for example, was prompted by widespread misconceptions about the meaning of "wholesale." When the program began at the turn of the century, "wholesale prices" was a term commonly understood to refer to prices for goods sold in large quantities. Because that connotation faded over time, however, many in the general public came to assume that the term "wholesale prices" referred to prices charged by wholesalers, jobbers, or other distributors. Adoption of the term "producer prices" was intended to reemphasize that the industrial price program continues to be based on prices received by producers from whoever makes the first purchase, rather than on prices paid to wholesalers by retailers or others further removed in the distribution chain. This new nomenclature was accompanied in 1978 by a shift in the Bureau's analytical focus from the all commodities price index (which was popularly called "the" Wholesale Price Index) to the Finished Goods Price Index and the other stage-of-processing price indexes.

[1] Senate Committee on Finance, *Wholesale Prices, Wages, and Transportation,* Senate Report No. 1394, "The Aldrich Report," Part I, 52nd Congress, 2d sess., March 3, 1893; and U. S. Department of Labor, *Course of Wholesale Prices, 1890–1901,* Bulletin No. 39, March 1902, pp. 205–09.

These changes were a prelude to the most comprehensive overhaul of industrial price methodology in the program's history. Also begun in 1978, this overhaul was phased in gradually until the transition to the methodology of what is called the Producer Price Index Revision (PPIR) was essentially completed in January 1986. This chapter describes this new methodology, which now is used throughout the PPI "family" of indexes. Elements of the traditional methodology remaining in effect are integrated into the following presentation. Differences between the PPIR and the traditional methodology are mentioned where appropriate. However, such contrasts are not highlighted as much as they had been in the previous edition of this *Handbook* (1982), prepared when the industrial price program was still in transition.[2]

Description of Survey

Universe

The Producer Price Index universe consists of the output of all industries in the goods-producing sectors of the American economy—mining, manufacturing, agriculture, fishing, and forestry—as well as gas and electricity and goods competitive with those made in the producing sectors, such as waste and scrap materials. The output of the services sector is also within the theoretical PPI universe; although coverage of services currently is minimal, planning is well underway for considerable expansion in this area. Imports are no longer included within the PPI universe; however, the BLS International Price Program currently publishes price indexes for both imports and exports. (See chapter 17.) Domestic production of specifically military goods is now included, as are goods shipped between establishments owned by the same company (termed interplant or intracompany transfers).

Prices

One of the most crucial tasks in preparing any price index is to define what constitutes the "price" whose changes are to be measured. A seemingly simple question such as "What is the price of steel?" is unanswerable until it is made more specific.

For the purposes of the industrial price program, a price is defined as the net revenue accruing to a specified producing establishment from a specified kind of buyer for a specified product shipped under specified transaction terms on a specified day of the month. This definition points up the several price-determining variables that must be clarified before a cooperating business establishment can report a meaningful price for any of its products to BLS. For example: If a company charges more for a red widget than a white one, color is one of the price-determining variables; if all widgets sell for the same price regardless of color, color is not a price-determining variable.

Because the PPI is meant to measure changes in net revenues received by producers, changes in excise taxes—revenues received by the government—are not reflected. But changes in rebate programs, low-interest financing plans, and other sales promotion techniques are reflected to the extent that these policies affect the net proceeds ultimately realized by the producer for a unit sale. If an auto manufacturer offers retail customers a rebate of $500, the manufacturer's net proceeds are reduced by $500, and the PPI for new cars would reflect a lower price. (Conversely, termination of a rebate program would be treated as a price increase.) But if a retail car dealer offers retail customers an additional rebate whose cost is absorbed by the dealer rather than the manufacturer, such a rebate would not affect the PPI. (The Consumer Price Index, of course, would reflect a customer rebate regardless of whether it was sponsored by the manufacturer or the dealer.)

The statistical accuracy of Producer Price Indexes depends heavily on the quality of the information voluntarily provided by respondents. BLS emphasizes to cooperating businesses the need for reports of realistic transaction prices, including all discounts, premiums, rebates, allowances, etc., rather than fictitious list or book prices. The use of list prices in the industrial price program has been the exception, not the rule. Even before the conversion to the methodology of the Producer Price Index Revision, a BLS survey showed that only about 20 percent of traditional commodity indexes were based on list prices. Inasmuch as the PPIR methodology is more systematic than the traditional methodology in concentrating on actual transaction prices, the use of list prices is even less frequent now.

Neither order prices nor "futures" prices are ordinarily included, because the PPI tries to capture the selling price for output being shipped in that same month, not some time in the future. Changes in transportation fees will be reflected in industry price indexes only when the producing company (rather than a commercial shipper or a contractor) receives revenues for delivering products to the buyer.

Most prices refer to one particular day of the month, viz., the Tuesday of the week containing the 13th of the month; this pricing date can range between the 9th and the 15th. There are some exceptions, however. Prices for a number of farm products are for a day of the week other than Tuesday. Prices for some refined petroleum products are commonly an average of prices during the first half of the month rather than the prices received by oil refineries on a given day. Price indexes for natural gas and some industrial chemicals are still based on data

[2] Bureau of Labor Statistics, *BLS Handbook of Methods*, Vol. 1, Bulletin 2134-1 (1982).

for the calendar month as a whole and, therefore, lag 1 month behind other indexes. A natural gas index for November, for example, would reflect price changes that actually occurred in October.

Although most prices reported to the Bureau are the selling prices of selected producers, free on board (f.o.b.) point of production, some prices are those quoted on organized commodity exchanges or at central markets; this practice is most often found among farm products.

Product change and quality adjustment

Although the same product usually is priced month after month, it is necessary to provide a means for bridging over changes in detailed specifications so that only real price change will be measured. An adjustment is especially important when one product is replaced by a new one. Even when companies report their selling prices based on altered transaction selling terms (e.g., price per 1,000 sold instead of price per 100), or when there is a change in the number or identity of companies reporting to BLS, routine steps can be taken to ensure that only true price changes influence the index.

When a company respondent reports a price that reflects a physical change in a product, the Bureau uses one of several quality adjustment methods. The direct comparison method is used when the change in the physical specification is so minor that no product cost differences result; in this instance, the new price is directly compared to the last reported price under the former specifications, and the affected index reflects any price difference.

When changes in physical characteristics of a product cause product cost differences, however, the Bureau attempts to make an accurate assessment of real price change by taking systematic account of quality differences. The explicit quality adjustment method is crucial for automobiles, machinery, and other types of goods that undergo periodic model changes. The usual method for quality adjustment involves the collection of data from reporting companies on the costs they have incurred in connection with the quality change. If the selling price of a new model car is $500 more than the previous model year's version, but $200 of that increase is due to the extra product cost and normal margin associated with the addition of government-mandated safety equipment, then the real price has only risen by $300; the change in the passenger car index will reflect only that amount, not the nominal price rise of $500. Admittedly, there are several problems in applying this procedure in an economically meaningful fashion; for example, some improvements in quality and performance may actually cost the producer less than the technology of an older, inferior product did. The Bureau has been actively exploring the use of alternative, hedonic quality adjustment procedures, but with limited results to date. Any inability to reflect technical change embodied in new products implicitly imparts a bias of unknown magnitude and direction to PPI data.

Unfortunately, it is not always possible to obtain a value for quality adjustment if, for example, the respondent is unable to estimate the production cost difference between an old item and a new one, or if an explicit comparison between an entirely new product and a previous product is not feasible. In such cases, the Bureau may have to assume that any difference in price between the old and the new items is entirely due to quality adjustment; the Bureau, therefore, employs the "overlap" method (if possible). Under this method, the Bureau collects prices for both the old and the new item over a period of time and chooses 1 month as the overlap month. In this overlap month, any difference between the price levels of the two items is factored out. For purposes of calculating the official price index, the Bureau uses price changes for the old item through the overlap month but thereafter follows price changes only for the new item.

Data Sources and Collection Methods

One of the fundamental differences between the traditional PPI methodology and the PPIR methodology is the switch from judgmental selection of companies and products to probability sampling. Under the traditional methodology, BLS would normally ask the largest companies producing a given type of commodity to report prices for their best-selling products. The PPI was, therefore, too heavily composed of volume-selling products made by major producers. This selection system, while convenient, missed much of the economy's flexibility and dynamism by overlooking the behavior of medium- and small-sized firms and the strategies for pricing medium- and small-volume products.

Under the sample design procedures of the Producer Price Index Revision, the industry as a whole is the basic starting point for sampling. Each industry has an individually designed and tailored sample. The first step in selecting a sample is to construct a universe frame of establishments classified within that industry. The primary source for compiling this universe of establishments is the data from the Unemployment Insurance System, because virtually every employer is legally required to be a member. Supplementary information from multiple, publicly available lists is used to refine the industry's frame of establishments, e.g., by eliminating firms that have gone out of business.

An establishment is defined as a production entity in a single location. Two establishments may occupy the same or adjacent space if they are separable by physical identification, recordkeeping, or both. Establishments are the units for which production and employment data are collected; however, establishments may frequently not be the appropriate unit for the collection of producer price

data. An establishment may be one of several owned by a single business firm and operated as a cluster, constituting a profit center; in such cases, the business maximizes profit over the cluster as a whole rather than for any one establishment.

The second step in constructing an industry sample consists of clustering establishments into price-forming units. Each member of a price-forming unit must belong to the same industry; establishments in a profit center that belong to other industries must be excluded in this step.

Once a list of price-forming units in an industry has been constructed, the list must be stratified by variables appropriate for that industry. The criterion for identifying the sampling strata is whether price trends may be different for different values of a variable. For example, the size of the production unit may cause differences in production technologies and, thus, different responses to changes in demand or input costs. Some industries may be characterized by geographically independent markets, which should become strata. Within each stratum, units are usually ordered by size to ensure a proportionate distribution of the sample.

The fourth step is to assign the number of units to be selected in each stratum. Normally, this assignment is in direct proportion to the value of shipments by units in each stratum. However, if there is evidence that some strata have more heterogeneity in price change, these strata will be assigned a greater proportion of the total sample than their simple shipment values would require. Each price-forming unit is selected systematically with a probability proportionate to its size. Ideally, the proper measure of size would be the total revenue of the unit; however, in practice, employment is used as a proxy because employment information is usually more readily available.

Once an establishment or cluster of establishments is selected for pricing, a BLS field economist visits the unit to solicit its cooperation. The officials of the unit are assured that their assistance is completely voluntary, and that any information they agree to provide to BLS will be safeguarded under the strictest guarantees of confidentiality. If the officials agree to participate in the Producer Price Index program, the BLS field economist proceeds to select those transactions to be priced through time from among all the unit's revenue-producing activities. A probability technique called disaggregation is used to select those transactions. The disaggregation procedure assigns to each category of items shipped, and to each category of other types of receipts, a probability of selection proportionate to its value within the reporting unit. The categories selected are broken into additional detail in subsequent stages until unique items, or unique types of other receipts, are identified.

Even after a physically unique item has been determined, it may be necessary to disaggregate further. If the same physical item is sold at more than one price, then the conditions that determine that price—such as the size of the order, the type of customer, etc.—must also be selected on the basis of probability. This method for identification of terms of sale (or transaction terms) both ensures that the same type of transaction is priced over time and eliminates any bias in the selection of the sales terms.

To minimize the reporting burden on cooperating companies, the disaggregation process described above usually is completed within 2 hours in the initiation interview. Subsequently, reporting companies agree to supply prices for those items selected on an agreed-upon schedule, usually monthly but sometimes less often. BLS Form 473P, shown at the end of this chapter, is used for reporting producer prices; it generally takes less than 30 minutes to fill out these repricing forms. Cooperation generally remains high, although some companies decline to participate from the beginning and others may drop out of the program.

The BLS sample of each industry's producers and output must be updated every few years to take account of changing market conditions. This procedure, called "resampling," takes place relatively often for industries marked by dynamic changes in production technology or industry structure. More stable industries need to undergo resampling less frequently. In practice, many of the reporting companies may be the same both before and after resampling; likewise, some individual products in the sample may also be the same. The resampling process gives the Bureau the systematic opportunity to keep the PPI system as up to date and useful as possible.

Estimating Procedures

Weights

If the Producer Price Index system were composed merely of indexes for individual products, with no grouping or summarization, there would be no need to devise a comprehensive weight structure. However, given the desire for numerous indexes for groupings of individual products, there is a need for a weight system that will let more important products have a greater impact on movements of groupings. Without a weighting structure, a 10-percent rise in automobile prices would have the same significance as a 10-percent rise in apple prices.

This section first describes the weighting policies for the industry and product indexes of the Producer Price Index Revision. The remainder of the section discusses the weighting structure of the traditional commodity groupings portion of the PPI family of indexes.

Item and product aggregation weights. A price index for even the most finely detailed product (usually termed a "cell index") cannot be calculated without applying a

policy for weighting the individual price reports received by BLS for each item. Under the current PPIR methodology, reports of some establishments are given more weight than those from others in calculating each cell index. Item weights are assigned by BLS on the basis of data on shipment values provided to BLS field representatives during the initiation interviews with cooperating establishments, adjusted by BLS probability selection techniques. (Prior to 1978, almost all price reports used to calculate any given cell index would implicitly be weighted equally, regardless of any differences in size among the reporters; if, for example, five companies provided prices for a certain commodity each month, each of these five reports would have had a weight of one-fifth.)

To calculate price indexes for levels of aggregation above the cell index, BLS compiles weights based on values of shipments for those aggregations of products made within the same industry; thus, shipment values for the same products made in other industries do not enter the weighting structure. Data on values of shipments are derived from information provided by the Bureau of the Census and a few other sources.[3] The total value of shipments for each industry is distributed among the products or other revenue sources produced by that industry, thereby eliminating the need for any indirect imputations of weight, a common practice under the pre-1978 methodology of the Producer Price Index.

Industry net output weights. In compiling price indexes for 4-digit SIC industries, as well as for even more highly aggregated industry group indexes, BLS employs net output values of shipments as weights. Net output shipment values refer to the value of shipments from establishments in one industry to establishments classified in another industry. By definition, then, net output shipment values differ from gross shipment values by excluding shipments among establishments within the same industry, even if those establishments are owned by separate and independent firms. The meaning of "net output" depends on the context of the index grouping. The net output for total manufacturing, for example, would be the value of manufactured output shipped outside the entire manufacturing sector, e.g., to the construction sector or to consumers. In addition to the value of shipments data supplied by the *Census of Manufactures,* BLS also constructs appropriate net output price indexes through the use of information on the value of materials consumed (also from the Census Bureau), data on detailed industry flows from the input-output tables compiled by the Bureau of Economic Analysis of the U.S. Department of Commerce, and other detailed industry data. Currently, industry price indexes continue to be calculated primarily with 1977 net output weights and input-output relationships.

Weights for traditional commodity groupings. Weights for individual commodity price indexes, and in turn for commodity grouping price indexes, are based on gross value of shipments data, as compiled by the Bureau of the Census and a few other sources. These weights represent the total net selling value of goods produced or processed in the United States, f.o.b. production point, exclusive of excise taxes. Since January 1987, shipment values between establishments owned by the same company (termed interplant transfers) have been included in commodity and commodity grouping weights; interplant transfers had been excluded from the weight structure before then.

Commodity and commodity grouping weights are updated periodically to take into account changing production patterns. Since January 1987, these weights have been derived from the total net selling value of commodities reported in the 1982 economic censuses. From January 1976 through December 1986, 1972 shipment values formed the foundation for commodity and commodity grouping weights. Updated weights are incorporated into the PPI system in a manner that does not require recalculation of indexes for earlier periods.

BLS does not publish the actual values used as weights, but does publish what is called a relative importance for each commodity and commodity grouping. The relative importance of an item represents its basic value weight, including any imputations, multiplied by the relative of price change from the weight date to the date of the relative importance calculation. The result is expressed as a percentage of the total for all commodities. Data showing the relative importance of commodity groupings with respect to the three major stage-of-processing groupings are also available.

BLS calculates relative importance data each December, so that the impact of any additions or deletions to the sample can be reflected. Except when entirely new weights are introduced from the latest industrial censuses, or when there are sample changes affecting a given grouping at midyear, relative importance data usually change from one December to another because of relative price movements. A commodity whose price rises faster than the all commodities index from one December to the next will have a higher relative importance (abstracting from any sample changes); conversely, a commodity whose price falls or rises less than the all commodities index will show a smaller relative importance. Relative importance data are not used, however, as fixed inputs by the Bureau to calculate monthly price indexes. Rather, each commodity's actual weight value fluctuates each month in

[3] Information currently used for calculating weights throughout the PPI family of indexes is largely taken from the following censuses conducted by the Bureau of the Census of the U. S. Department of Commerce: (1) the *Census of Manufactures*; (2) the *Census of Mineral Industries* (which includes oil and gas production); (3) the *Census of Agriculture*; and (4) the *Census of Wholesale Trade.* Other current weight sources include the Edison Electric Institute and the National Marine Fisheries Service.

accordance with its price movements. Theoretically, the Bureau could calculate and publish a new set of relative importance data every month. Relative importance data for any given commodity grouping also change when its components are subjected to a sample change.

Index calculation

In concept, the Producer Price Index is calculated according to a modified Laspeyres formula:

$$I_i = (\Sigma Q_a P_i / \Sigma Q_a P_o) \times 100$$

where:

P_o is the price of a commodity in the comparison period;

P_i is its price currently; and

Q_a represents the quantity shipped during the weight-base period.

An alternative formula more closely approximates the actual computation procedure:

$$I_i = \left[\left(\Sigma Q_a P_o \left(P_i / P_o \right) \right) / \Sigma Q_a P_o \right] \times 100$$

In this form, the index is the weighted average of price relatives, i.e., price ratios for each item (P_i / P_o). The expression ($Q_a P_o$) represents the weights in value form, and the P and Q elements (both of which originally relate to period "a" but are adjusted for price change to period "o") are not derived separately. When specifications or samples change, the item relatives must be computed by linking (multiplying) the relatives for the separate periods for which the data are precisely comparable.

Analysis and Presentation

Classification

The Producer Price Index family of indexes consists of several major classification systems, each with its own structure, history, and uses. However, indexes in all classification systems now draw from the same pool of price information provided to BLS by cooperating company reporters, and virtually all indexes are now calculated consistent with the methodology of the Producer Price Index Revision. The three most important classification structures are: (1) industry; (2) commodity; and (3) stage of processing.

Industry classification. A Producer Price Index for an industry is a measure of changes in prices received for the industry's output sold outside the industry (that is, its net output). As previously stated, the SIC 4-digit industry code is the basis for the industry price index system. Price indexes have also been available since 1985 for many more highly aggregated industry series at the 3- and 2-digit levels, as well as for total mining industries and total manufacturing industries.

From the beginning of the transition to the PPIR methodology nearly every 4-digit industry price index has been accompanied by detailed indexes representing price movements for the various products made in that industry. Code numbers for these indexes at the 5-digit (product class) and the 7-digit (individual product) levels often follow the codes and titles established by the Census Bureau as of 1977 as extensions of the SIC structure. Sometimes, however, BLS assigns its own codes and titles.

In general, there may be as many as three kinds of product price indexes for a given industry. Every industry has primary product indexes to show changes in prices received by establishments classified in the industry for products made primarily, but not necessarily exclusively, by that industry. The industry under which an establishment is classified is determined by those products accounting for the largest share of its total value of shipments. In addition, most industries have secondary product indexes to show changes in prices received by establishments classified in the industry for products chiefly made in some other industry. Finally, some industries may have miscellaneous receipts indexes to show price changes in other sources of revenue received by establishments within the industry.

Commodity classification. The commodity classification structure of the Producer Price Index organizes products by similarity of end use or material composition, regardless of whether these products are classified as primary or secondary in their industry of origin. This system is unique to the PPI and does not match any other standard coding structure such as the SIC or the United Nations Standard International Trade Classification. Historical continuity, the needs of index users, and a variety of ad hoc factors were important in developing the PPI commodity classifications.

Fifteen major commodity groupings (2-digit level) make up the all commodities index. Of these, 2 major commodity groupings form the index for farm products and processed foods and feeds, while the other 13 are grouped into the industrial commodities price index. Each major commodity grouping includes (in descending order of aggregation) subgroups (3-digit), product classes (4-digit), subproduct classes (6-digit), and individual items (8-digit). The structure of the traditional commodity classification system thus follows a strict, consistent hierarchy.

Corresponding indexes. Nearly all 8-digit commodities under the traditional commodity coding system are now derived from corresponding industry-classified product indexes. In such instances, movements in the traditional commodity price indexes are identical to movements of their counterparts. Although most traditional commodity price indexes continue to be published on their own original base period, the corresponding industry product

price indexes are published on a base of the month of their introduction. Therefore, monthly percent changes for corresponding indexes will be virtually identical even though their respective index levels may differ.

Specifications for products priced under the current methodology follow Census Bureau definitions and are considerably broader than those formerly used for traditional commodity indexes. Because companies are now reporting prices for a broader range of commodity and transaction-term specifications within a given commodity index, it is no longer feasible to publish meaningful average prices for individual commodities, as was sometimes possible with the traditional methodology. Price indexes are now usually calculated by constructing an index for each reporting establishment's price and then averaging these indexes, with appropriate establishment weights, to derive the commodity index. Under the former methodology, an average price could be computed directly from individual company prices. But despite the broadening of specifications, industry-classified product indexes are now available in much greater abundance and detail than was the case with the traditional commodity price indexes calculated before the conversion to the new methodology.

Stage-of-processing classification. Stage-of-processing (SOP) price indexes regroup commodities at the subproduct class (6-digit) level according to: (1) the class of buyer; and (2) the amount of physical processing or assembling the products have undergone.

Within the stage-of-processing system, finished goods are defined as commodities that are ready for sale to the final-demand user, either an individual consumer or a business firm. In national income accounting terminology, the Finished Goods Price Index roughly measures changes in prices received by producers for two portions of the gross national product: (1) personal consumption expenditures on goods, and (2) capital investment expenditures on equipment.[4] Within the Finished Goods Price Index, the consumer foods category includes unprocessed foods, such as eggs and fresh fruits, as well as processed foods, such as bakery products and meats. The finished energy goods component includes those types of energy to be sold to households—primarily gasoline, home heating oil, and natural gas. The category for consumer goods other than foods and energy includes durables such as passenger cars and household furniture, and nondurables such as apparel and prescription drugs. The capital equipment index measures changes in prices received by producers of durable investment goods such as heavy motor trucks, tractors, and machine tools.

The stage-of-processing category for intermediate materials, supplies, and components consists partly of commodities that have been processed that still require further processing. Examples of such semifinished goods include flour, cotton yarn, steel mill products, and lumber. The intermediate goods category also encompasses nondurable, physically complete goods purchased by business firms as inputs for their operations. Examples include diesel fuel, belts and belting, paper boxes, and fertilizers.

Crude materials for further processing are defined as unprocessed commodities not sold directly to consumers. Crude foodstuffs and feedstuffs include items such as grains and livestock. The crude energy goods category consists of crude petroleum, natural gas, and coal. Examples of crude nonfood materials other than energy include raw cotton, construction sand and gravel, and iron and steel scrap.

The value-weight of a single subproduct class may be allocated among several different SOP categories to reflect different classes of buyers. For example, a portion of the value-weight of the citrus fruits index has been assigned to the index for crude foodstuffs and feedstuffs to represent the proportion of citrus fruit sold to food processors; most of the rest of the value-weight for this grouping has been assigned to the index for finished consumer foods. The value-weights are the same as those for the subproduct classes within the commodity classification scheme. The allocations of these value-weights to various SOP categories are currently based on input-output studies for 1972 conducted by the Bureau of Economic Analysis.

Many major stage-of-processing price indexes exist continuously back to 1947. However, some special groupings within the SOP system (such as finished goods less foods and energy) were first calculated in the 1970's and have no historical record before then.

Other. There are several additional classification structures within the PPI family of indexes. For example, Producer Price Indexes are available by durability of product. Allocation of individual commodities to durability-of-product categories (such as durable manufactured goods and total nondurable goods) is based on the Census Bureau definition: Products with an expected lifetime of less than 3 years are classified as nondurable, while products with a longer life expectancy are considered durable goods. Special commodity grouping indexes (such as fabricated metal products and selected textile mill products) rearrange PPI commodity data into different combinations of price series. In 1986, BLS began publication of indexes measuring changes in prices of material inputs to construction industries.

Most Producer Price Indexes, whether commodity-oriented or industry-oriented, are based on a national sample of producers because most output is destined for a national market. Differences in transportation costs to buyers in different parts of the country are normally excluded by definition. However, regional price indexes

[4] The Producer Price Index universe excludes the consumer services portion of personal consumption expenditures and the structures portion of investment expenditures.

are published for a few selected items, such as electric power, coal, sand and gravel, scrap metals, and cement, where regional markets are the rule rather than the exception.

Analysis

In 1978, as the transition from the traditional methodology to the methodology of the Producer Price Index Revision began, BLS decided to shift its analytical focus. Prior to that time, the Bureau's economic analysis had focused on the all commodities index, the industrial commodities index, and other highly aggregated major commodity groupings. During the 1970's, however, it became clear that these indexes are subject to a major defect: The multiple counting of price changes. This problem is common among highly aggregated traditional commodity groupings because they are calculated from price changes of commodities at several stages of processing, where each individual price change is weighted by its total gross value of shipments in the weight-base year.

To illustrate the multiple-counting problem, suppose that the price of cotton rises sharply. If this price increase is passed through by spinners of cotton yarn, then by weavers of gray cotton fabric, then by producers of finished cotton fabric, and finally by shirt manufacturers, the single price increase for the raw material cotton would have been included five times in the all commodities index and four times in both the industrial commodities category and in the major commodity group for textile products and apparel. As long as prices for all items at all stages of processing are changing at about the same rate, this multiple counting will not lead to any major distortions. But if, as is more usually the case, prices are rising at different rates, multiple counting can result in rates of change for aggregated price indexes that are highly misleading, because material prices tend to be more volatile than finished goods prices are, and because gross output values are used as weights for major commodity groups. The rate of increase indicated by the all commodities index would probably be exaggerated upwards during inflationary times. When prices are falling, the rate of decrease for that index would probably be similarly off-target. In addition, at any given time, there will be many items showing price increases while other items are registering price declines; both kinds of changes probably will be exaggerated (by different degrees) in the all commodities index. Thus, the net effect of these many different biases will be difficult to discern when the economy is characterized by mixed price movements. (Less aggregated commodity grouping indexes that cover only a single stage of processing are not affected by this multiple-counting defect.)

Stage-of-processing indexes have, therefore, become the central classification structure used by the Bureau for analyzing price trends in the general economy. In particular, the single most important index now stressed by the Bureau is the Finished Goods Price Index. This index is crucial because it measures inflation in consumer and capital goods, upon which demand for materials and other inputs depends. Both this index and the index of Crude Materials for Further Processing are largely free of multiple-counting problems because they are rather strictly defined. The index for Intermediate Materials, Supplies, and Components, however, is a residual, encompassing everything that cannot fit into one of the other two major stage-of-processing categories. This index, therefore, includes several different stages of processing (three such stages in the shirt example above) and is affected by the multiple-counting problem.

The Bureau is focusing more on the price indexes for the net output of industries as a better solution to the problems inherent in aggregated price indexes based upon a weighting structure using gross shipment values.

Presentation

Producer Price Indexes are usually issued on the second or third Friday of the month following the reference month. The monthly PPI news release, available without charge from the Bureau, shows the most recent originally released and revised data for all stage-of-processing indexes and for selected major commodity groupings that comprise the bulk of the SOP indexes. All indexes in the news release are presented as not seasonally adjusted, but seasonally adjusted monthly percent changes are shown for many series as well; price changes over the last 12 months are also included. Even though the news release can display only a limited number of PPI series, all Producer Price Indexes are available and considered officially published at the time of the release.

The monthly detailed report, *Producer Price Indexes*, is printed 3 or 4 weeks after the news release date and is available to the public from the Superintendent of Documents, U.S. Government Printing Office, on a subscription basis. The monthly detailed report currently includes every not seasonally adjusted index within the PPI family that is publishable, along with some monthly and annual percent change calculations. Some seasonally adjusted indexes and monthly percent changes are also shown. The report also contains a narrative section explaining the most significant price movements within major stage-of-processing and industry groups for that month. When appropriate, additional narratives explain the latest sample changes (usually effective in January and July), updates in seasonal adjustment factors or weights, or other changes in methodology or presentation. Occasionally, a longer narrative section delves more deeply into the economic background underlying recently observed price movements. A subscription to this periodical also includes an annual supplement. This supplement, commonly mailed to subscribers in the summer

the year after the reference year, provides all publishable indexes and their annual averages for the calendar year, as well as tables of relative importance data effective for December of that year. Neither the monthly periodical nor the annual supplement includes information on actual dollar prices for any item.

Printouts of tables of historical price indexes for any PPI series are available, usually without charge, from the Bureau on request. Two computer tapes are available at cost; one shows complete historical tables for all individual commodities and commodity groupings, stage-of-processing groupings, durability-of-product groupings, and other indexes from traditional PPI structures, and the other shows complete historical records for industry and product indexes classified according to the SIC and the Census product codes. Complete historical records are also available on microfiche at cost. BLS has recently made available to the public monthly diskettes showing the latest monthly values and the previous 12 months of data for most series included within the PPI news release. PPI data may now also be accessed electronically on an on-line basis through the BLS Electronic News Service or through a variety of data bases maintained by private firms.

Seasonally adjusted data. Because price data are used for different purposes by different groups, BLS publishes seasonally adjusted as well as unadjusted data each month. For analyzing general price trends in the economy, seasonally adjusted data are usually preferred because they are designed to eliminate the effect of changes that normally occur at about the same time and in about the same magnitude each year—such as price movements resulting from normal weather patterns, regular production and marketing cycles, model changeovers, seasonal discounts, and holidays. Seasonally adjusted data, therefore, reveal more clearly the underlying cyclical trends or unusual disturbances in normal seasonal patterns (such as severe weather conditions). Data that are not seasonally adjusted are of primary interest to those who need information which can be more readily related to the dollar values of transactions. For example, unadjusted data are normally used in price escalation clauses of long-term sales or purchase contracts.

Producer Price Indexes may be seasonally adjusted at various levels of aggregation if statistical tests show there is a significant pattern of seasonal price changes, and there is a genuine economic rationale supporting the perceived seasonality. The Bureau's economic analysis of the PPI is normally based on seasonally adjusted data, although unadjusted data are used when tests show an absence of significant seasonality. Seasonal adjustment factors are recalculated when January indexes are released each February, as data for the most recent calendar year are reflected for the first time and data for more distant periods are disregarded. This recalculation of seasonal factors leads to the revision of all seasonally adjusted indexes for the immediately preceding 5 years. BLS uses the X–11 seasonal adjustment method to compute seasonal factors.

Because seasonal adjustment is a tool for enhancing economic analysis, some indexes that are affected by the multiple-counting problem described earlier (such as the all commodities index and the indexes for the major commodity groups) are deliberately not calculated on a seasonally adjusted basis.

Revised data. All Producer Price Indexes are routinely subject to revision only once, 4 months after original publication, to reflect late reports and corrections by company respondents. Once revised, indexes are considered final. The Bureau does not use the term "preliminary" to describe the originally released PPI numbers, because "preliminary" usually describes data that are based on a small sample of information and that are typically subject to large revisions. When Producer Price Indexes are first released, they are typically based on a substantial portion of returns from respondents; hence, subsequent revisions are normally minor, especially at the more highly aggregated grouping levels. Either "first published" or "originally released" would be a more appropriate term than "preliminary." Changes in previously published data caused by a processing error are so indicated in a subsequent news release and/or detailed report.

Calculating index changes. Movements of price indexes from one month to another should usually be expressed as percent changes rather than as changes in index points because index point changes are affected by the level of the index in relation to its base period, while percent changes are not. Each index measures price changes from a reference period which is defined to equal 100.0; at this writing, 1967 is the standard base period for most PPI series, but many indexes that began after 1967 are based on the month of their introduction. The following tabulation shows the computation of index point and percent changes.

Index point change

Finished Goods Price Index	288.5
Less previous index	285.0
Equals index point change	3.5

Index percent change

Index point change	3.5
Divided by previous index	285.0
Equals	0.012
Results multiplied by 100	0.012 × 100
Equals percent change	1.2

An increase of 188.5 percent from the reference base period in the Finished Goods Price Index, for example, is shown as 288.5. This change can be expressed in

dollars as follows: Prices received by domestic producers of a systematic sample of finished goods have risen from $100 in 1967 to $288.50 today. Likewise, a current index of 300.0 would indicate that prices received by producers of finished goods today are triple what they were in 1967.

From time to time, the Bureau updates its standard reference base period. The switch to the 1967=100 base occurred in January 1971; before that, the years 1957–59 were used as the standard reference base. For reasons explained above, any switch of standard reference base periods does not affect calculations of percent change for any index. However, care must be taken to ensure that indexes on one base period are not being incorrectly compared against indexes for the same series expressed on a different base period. In 1988, the new standard reference base period for the Producer Price Index family of indexes is scheduled to become 1982=100. Index series that began after January 1982, however, will continue to be based on the month of their introduction.

Uses and Limitations

Producer Price Indexes are used for many purposes by government, business, labor, universities, and other kinds of organizations, as well as by members of the general public.

The Finished Goods Price Index is one of the Nation's most closely watched indicators of economic health. Movements in this index are often considered to presage similar changes in inflation rates for retail markets, as measured by the Bureau's Consumer Price Index. While this may sometimes be the case, there are many reasons why short-term movements in the PPI and the CPI may diverge. For example, the Finished Goods Price Index by definition excludes services, which constitute a major portion of the CPI. The Producer Price Index does not measure changes in prices for imported goods, but the Consumer Price Index does include imports. Conversely, the CPI does not capture changes in capital equipment prices, a major component of the Finished Goods Price Index. Large swings in producer prices for foods and other items may be considerably dampened by the time retail prices are measured, as retailers or other distributors absorb price volatility rather than pass through wide price variations to consumers.

Other stage-of-processing price indexes besides the Finished Goods Price Index are used for general economic analysis. Because prices for food and energy have tended to be so erratic in recent years, some economists prefer to focus attention on an index such as finished goods other than foods and energy as a better measure of the so-called "underlying rate of inflation." The index for Intermediate Materials, Supplies, and Components is closely followed as an indicator of material cost pressures that may later appear in the Finished Goods Price Index and/or the CPI. The index for crude materials other than foods and energy is quite sensitive to shifts in total demand and can be a leading indicator of the state of the economy; its limited scope, however, makes it less reliable as an indicator of the future status of inflation in general. The stage-of-processing structure is especially well suited for facilitating economic analysis of the inflation transmission process. Hence, it can be used for analyzing the impact of government stabilization policies.

Producer Price Index data for capital equipment are used by the U.S. Department of Commerce to help calculate the gross national product (GNP) deflator and many of its component deflators. PPI data at all levels of industry and commodity aggregation can be used to deflate dollar values expressed in current dollars to constant-dollar values for a variety of economic time series, such as inventories, sales, shipments, and capital equipment replacement costs. To illustrate the deflation concept, suppose that nominal shipment values for a given industry have doubled over a 10-year span. If the Producer Price Index for that same industry has tripled over the same span, then the "real" (i.e., inflation-adjusted) value of shipments for that industry has actually declined; higher prices more than account for the doubling of dollar shipment values, and physical volume has implicitly fallen.

Private business firms use PPI data to assist their operations in a variety of ways, in addition to using these figures for general economic analysis or deflation as discussed above. Producer Price Indexes are frequently cited in price escalation clauses of long-term sales or purchase contracts as a means to protect both the buyer and the seller from unanticipated inflation or deflation. Typically, an escalation clause will specify that the price for x number of widgets being sold by company A to company B each year will go up or down by a specified fraction of the percentage of change in material costs, as measured by one or more specified Producer Price Indexes (often in conjunction with the change in an average hourly earnings indicator, used to measure labor costs). Hundreds of billions of dollars in contract values are tied to Producer Price Indexes through these price escalation clauses; such clauses are common in both government and private sector contracts.

Private companies can also use PPI data to compare changes in material costs they incur against changes in the PPI for that material. By the same token, they can compare changes in the selling prices they charge for their own output to changes in the PPI for the same kind of product. PPI information may be employed in econometric models, in forecasting, in market analysis, and in academic research. PPI's are frequently used in LIFO (Last-In, First-Out) inventory accounting systems by firms wishing to avoid the kind of "phantom profits" that might appear on their books with a FIFO (First-In, First-Out) system.

Those wishing to follow PPI data for a particular series over a prolonged time span should be aware that highly detailed indexes are more vulnerable to being discontinued by BLS than aggregated indexes. During the industry resampling process described earlier, for example, the industry index (4-digit level) is commonly kept continuous before and after the resampling process is completed, while indexes for detailed products within that industry may be discontinued and replaced by items that are new or that had not been selected for pricing before. Finely detailed indexes are also vulnerable to temporary suspension of publication. The Bureau's rules against disclosure of confidential information preclude publication of indexes when fewer than three companies report prices for a given product. Even if there are three reported prices for a given product in any given month, the Bureau will ordinarily publish that index only if at least two of those prices are considered good (i.e., not estimated) and if a single reporter does not account for more than half of the market for that product. When a detailed index disappears either temporarily or permanently, the Bureau routinely recommends that users who had been following that index either choose another detailed index within the same product grouping or else switch their attention to a more highly aggregated grouping index.

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Bureau of Labor Statistics
Information for the Producer Price Indexes

U. S. Department of Labor

The Information collected on this form by the Bureau of Labor Statistics will be held in the strictest confidence and will be used for statistical purposes only.

This report is authorized by law, 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely.

Form Approved
O. M. B. No. 1220-0008

INSTRUCTIONS

ITEM DESCRIPTION
Please determine if the information your company previously provided is currently applicable or requires update. If revision is required, please indicate the changes in the open areas.

If you revise the description, indicate the date on which the change became effective and the estimated value of the change (change in cost plus standard markup.)

Please review the Adjustments to Price area to determine if the adjustments and related terms are current as shown.

Additional instructions appear on the reverse side of this form.

If you have any questions concerning completion of this form, please call:

REMARKS

PREVIOUS PRICE INFORMATION — Please review the Previous Price Information below. Enter missing prices if available. Correct any incorrect prices that are shown. Net transaction prices are the most desirable type of price. If incorrect or if you change to a different type of price, indicate the current type of price.

Type of price you report →

Did the price change between

Have you made any changes to the Item Description or the Previous Price Information described above?

Please enter the price in the boxes below if there has been a change. Use black pen or pencil only, writing the number as shown. Please do not type. **DO NOT USE BLUE.** If there was not a shipment, estimate the price that would have been charged on

1 2 3 4 5 6 7 8 9 0

Check if this is a CLOSEOUT price on an item which is being phased out.

Dear Respondent,

Thank you for your continuing participation in the Producer Price Index (PPI) program. The data which you provide are used in computing the Producer Price Indexes and constitute the basis for analyzing industrial price changes.

Please use the enclosed postage free envelope to return the pricing forms. Your continued cooperation is greatly appreciated.

Commissioner of Labor Statistics

Instructions for completing a PPI pricing form:

The information contained on this form was furnished by your firm in previous pricing periods. Review the information carefully to verify that it remains current. Cross out any incorrect information and write in all corrections and additions that are necessary. Any information concerning the item which exceeds the space limitation imposed by the form is continued on the subsequent page and should also be verified.

Item and Transaction Description

If the Item Description or the Transaction Terms, or both, no longer apply, a substitute item or substitute transaction terms should be selected by you. Item substitution should only occur when the item previously reported is no longer available because it is being or has been permanently discontinued. The substitute item should be as similar as possible to the current item and should be expected to remain available for some time. The substitute transaction terms should likewise be as similar as possible to the discontinued transaction terms.

Report these changes in the closest open area and provide current price information.

Adjustments to Price

Following is a list of the more common adjustments to price. The specific adjustments on the pricing form were selected originally and should be changed only when either the level of an existing adjustment changes or a new adjustment becomes applicable to the product and transaction described.

Deductions from price include:

1. Standard discounts (Cash, Seasonal, Cumulative Volume, Quantity, and Trade)
2. Rebates
3. Other recurring discounts
4. Other nonrecurring discounts (Competitive and Negotiated)

Additions to price include:

1. Surcharges
2. Other recurring charges added to price
3. Other nonrecurring charges added to price

Taxes should always be excluded from the price. If this exclusion is not possible, note this in Remarks.

Freight charges should be excluded from the price unless delivery was selected originally as part of the product. Make changes if the currently described freight terms no longer exist.

QUESTIONS

Answer whether you have ("YES") or have not ("NO") made any changes or entries to the item description or previous price information.

Answer YES or NO depending on whether the shipment price of the item described changed ("YES") between the two dates listed or whether the shipment price did not change ("NO") during this time period.

If the answer is NO, the form has been completed and is ready for mailing. DO NOT ENTER A PRICE IF THE PRICE HAS NOT CHANGED. If the answer is YES, please enter the new price.

If there has been a change in the name or address to whom this form should be sent in the future, enter an (X) in the box. It is necessary to make the name and address change on only one form.

Please complete and return within 5 business days all of the pricing forms that are mailed to you even if there are no changes.

If you are anticipating a change in any of the information that you provide, please indicate in Remarks. List the anticipated change and when it will occur.

Any questions that you have regarding the pricing forms or their completion may be resolved by calling the Bureau of Labor Statistics, Division of Industrial Prices and Price Indexes, Washington, D.C.; by using the telephone number at the top of the pricing forms.

REMARKS:

Chapter 17. International Price Indexes

Background

The International Price Program (IPP) provides, as its primary output, price indexes for the U.S. merchandise foreign trade sector. Additional outputs include international service sector indexes and international trade comparison measures. They play a crucial role in the analysis of trends in U.S. trade and are also used in the analysis of domestic price levels.

Although the Bureau has collected international price data for some time, the complete series has only been published since the early 1980's. The first collection of import prices took place nearly 100 years ago as part of a one-time study of U.S. price competitiveness. The next effort occurred immediately following World War II. To meet the need for accurate measures of price change within the expanding U.S. foreign trade sector, BLS initiated the limited development of export and import price indexes. However, budget restrictions in 1948 led to the termination of this effort. As a result, the development of foreign trade sector price indexes lay dormant until 1967 when BLS began research on the feasibility of producing U.S. export and import price indexes. This research was among the early major products of the Division of Price and Index Number Research established in 1966 on the recommendation of the Price Statistics Review Committee of the National Bureau of Economic Research. This research resulted in congressional allocation of funds for IPP in fiscal year 1970.

A limited number of export price indexes were first published in June 1971 and selected import indexes followed in 1972. Each of these introductory index series presented annual values until 1974 when collection and publication of quarterly price data began.

During the remainder of the 1970's and into the early 1980's, IPP steadily expanded its product coverage and the publication of export-import price indexes. The IPP goal of 100-percent coverage of the value of exported and imported goods was reached with the publication of an index covering all imports in February 1983 and an all-export index in February 1984.

In addition to its coverage of product classification, IPP has embarked on a project to track price movement in the services area of the foreign trade sector. Late 1986 saw the initial publication of service sector indexes representing export air passenger fares and import electricity. Further expansion is planned in this area. Import tanker freight indexes were first available in 1987, and development is underway on measuring price change in the import air freight, import liner freight, and import air passenger markets.

The indexes for both exports and imports are reflective of the market basket of internationally traded goods in the base year 1980. With the release of indexes representing the first quarter of 1988, weights will be updated to reflect the market basket of goods traded in 1985.

Description of Survey

Concepts

The U.S. export and import price indexes are general-purpose indexes that measure changes in price levels within the foreign trade sector. The all-export index provides a measure of price change for domestically produced U.S. products shipped to other countries; the all-import index measures price change of goods purchased from other countries by U.S. residents. Since the indexes are intended to be used as a deflator in the National Income and Product Accounts (NIPA), the Bureau has used balance-of-payments definitions, where appropriate, in its methodology.

In addition to the all-export and all-import indexes, indexes are published for a wide variety of product categories with several levels of detail. Currently, the Bureau publishes indexes for product categories which recorded at least $400 million of imports or exports in 1980. Beginning in 1988, the export trade minimum will be raised to cover product categories with a 1985 value of $500 million for exports and $700 million for imports. Indexes that represent areas of trade with smaller dollar values are incorporated into the calculation of higher level indexes but are generally not published separately.

Product universe

The product universe of the export-import price indexes consists of all commodities exchanged between U.S. residents and foreign residents. ("Residents" refers to the NIPA definition; it includes corporations, businesses,

and individuals but does not require either specific ownership or citizenship.) The export universe consists of products sold by U.S. residents to foreign buyers. The import universe covers products purchased from abroad by U.S. residents. The universe in each case includes raw materials, agricultural products, semifinished manufactures, and finished manufactures, including both capital goods (electrical machinery, agricultural equipment, textile equipment, etc.) and consumer goods (appliances, electronic equipment, clothing, etc.).

Ideally, the total breadth of U.S. trade would be represented in the product universe. However, items that present difficulties in obtaining consistent time series (works of art, commercial aircraft, ships, etc.) for comparable products are not included. Also, military goods are not priced in the indexes except to the extent that some products are purchased on the open market for military use; e.g., automobiles, clothing, nonspecialized hardware, fuel, etc.

Pricing basis

Most prices are collected directly from cooperating exporters and importers (reporters). To the extent possible, they are prices at the U.S. border for exports and at both the foreign border and the U.S. border for imports. The targeted reference period for transaction prices in the survey is the third month of each calendar quarter; e.g., March, June, September, and December. Generally, the Bureau is seeking the first transaction in the appropriate month, and the vast majority of prices in the survey fall within the first week of the reference month. If a firm is unable to provide a price quote for the targeted reference period, prices for a transaction from the previous month may be substituted.

Reporters are requested on the price reporting forms to indicate all discounts, allowances, rebates, etc., applicable to the reported prices so that the price used in the calculation of the indexes is the actual transaction (or net) price for which the product was bought or sold. (See copy of the form at the end of this chapter.) During the quarterly repricing process, respondents are reminded of this requirement in their repricing mail package and, if necessary, by a phone contact from an industry analyst on the IPP staff.

All prices collected are representative of actual transactions in the foreign trade market. Average prices are not accepted in the IPP survey, with the exception of selected commodities where secondary source data is used.

IPP's preferred pricing basis for exports is f.a.s. (free alongside ship) U.S. port of exportation. When reporters supply export prices that are on an f.o.b. (free on board) factory basis, information on production point and freight is collected to enable the Bureau to calculate a shipment cost to the specified port of U.S. exportation. This information includes location of production point and port of exportation, size and weight of shipment, name of carrier, and routing. This shipment cost can then be appended to the reported f.o.b. factory price in order to create a "net" price that is usable in an f.a.s. index. These adjustments are reviewed quarterly for significant changes in transport costs. In addition, to the extent that f.o.b. factory price data are collected and if shipping costs are deemed negligible by a freight analyst, f.o.b. factory price data can be included in an f.a.s. index.

In some product areas, for instance finished manufactures, reporters frequently provide prices only on an f.o.b. factory basis and are unable to supply freight information. As a result, many of the export price indexes for these products can only be calculated and published on an f.o.b. factory basis. Consequently, more aggregated series may be constructed from detailed categories with differing price bases.

For imports, IPP's preferred pricing basis has been c.i.f. (cost, insurance, freight) at the U.S. port of importation. However, in product areas where c.i.f. prices are not generally available, indexes are published on an f.o.b. foreign port basis. As with exports, aggregated import series will frequently be produced using detailed groups with differing price bases. IPP does attempt to collect import price data on both the c.i.f. and the f.o.b. foreign port bases. The price on a c.i.f. basis consists of the foreign selling price plus the other costs (insurance and freight) associated with bringing the product to the U.S. border. F.o.b. foreign port prices represent the cost of the item at the foreign port of exportation, and are consistent with the basis for valuation of imports in NIPA, where insurance and freight costs are tabulated separately in the services accounts. Import index calculation is performed on a duty excluded basis. Import duty information, if necessary, is collected separately and, where appropriate, is deducted from the reported price.

Price index calculation requires that collected price data reflect the same item from period to period. To ensure this, the specifications for each product in the IPP survey include detailed physical and functional characteristics as well as the terms of transaction; e.g., number of units bought or sold, class of buyer or seller, etc. Any change in a product's specifications or terms of trade is appraised to ascertain the significance of these changes. If the changes are cosmetic, product substitution is effected by direct price comparison, and any reported price change is reflected in the index. If the changes are substantive, product substitution is made by linking which ensures that the index reflects only actual or "pure" price changes and is not affected by quality changes. The following simplified example illustrates the principle of linking: The June reference period price for a specific imported automobile was $9,250.88. In the September reference period, a price of $10,108.77 was supplied for a new model of this automobile. It was determined that the new

model was essentially comparable with the old, except that it had a bumper assembly that could only withstand a 2½ m.p.h. impact without structural damage to the vehicle, whereas the former model was equipped with a 5 m.p.h. bumper. For linking purposes, the object is to determine the "appropriate" price that the new model would have commanded in the marketplace in the previous reference period. In this example, the new model was estimated to have a June price of $8,955.50 ($9,250.88, the June price of the former model, minus a $295.38 decrease in the value of the bumper assembly). The price comparison between June and September was based on the estimated June price of $8,955.50 and the reported September price of 10,108.77. Thus, a 12.9-percent increase was reflected in the September index, but the price change including the quality decrease (poorer quality bumper) was not reflected.

Linking is also used when products are added to or deleted from an index. When a completely new product series is added to a commodity grouping, the linking procedure discussed above is not feasible. Instead, the relative importance of each item in the commodity group is redistributed to include the new item, and the historical movement of the index is attributed to the new product. A change in the relative importance of a product also occurs when products are dropped from an index without being replaced.

Classification

Export-import price indexes are based on the nomenclature of Revision 2 of the Standard International Trade Classification (SITC) of the United Nations.[1] The SITC is made up of 10 sections at the 1-digit level, 63 divisions at the 2-digit level, 233 groups at the 3-digit level, and 786 subgroups at the 4-digit level. Additional subsidiary classes are available, raising to 1,924 the number of "basic terms" in the SITC.

The lowest level of publication is usually the 4-digit level across the spectrum of the SITC. Currently, the BLS publishes 209 export indexes and 236 import indexes.

Although primary indexes are calculated under the SITC, prices collected for the survey are classified by the basic product classification systems used for recording U.S. foreign trade: For exports—the 7-digit Schedule B classification system of the U.S. Department of Commerce;[2] for imports—the 7-digit Tariff Schedule of the United States Annotated (TSUSA).[3] Concordance schemes are used for classifying Schedule B and TSUSA categories into the appropriate SITC's.[4]

By maintaining these detailed 7-digit product classifications, BLS is able to prepare alternative indexes for groupings other than those afforded by the SITC. Alternative groupings in published indexes include the industry-oriented Standard Industrial Classification based (SIC-based) system and the Bureau of Economic Analysis' end-use system. These additional indexes offer a wider variety of analytical uses for the international price index data.

Data Sources and Calculation Methods

Collection

Normally, price data are collected by mail questionnaire; in some cases the information is collected by telephone. Most prices are collected quarterly; however, where a product has a seasonal pattern, collection is adjusted accordingly. In the overwhelming majority of cases, prices are collected directly from the exporter or importer, although in a few cases prices are obtained from secondary sources.

Price reporting by firms is initiated by a visit from a Bureau representative. At this time, the reporting requirements are explained verbally and in writing, and the selection of products for which the firm will report price information is made. Information initially provided by a firm usually contains data for the current and previous quarter.

Subsequent repricing is conducted quarterly by mail. However, if data clarification is required, the individual at the firm who is responsible for providing the price information is contacted by telephone.

Sampling

The objective of the IPP sample design is to provide an unbiased measure of price change in each published index. A multistage survey design is employed to provide a sample of exporters and importers for specific product strata as well as specific items which can be repriced over time. The survey design is responsive to the constraints of both cost and the burden on reporters. The cost constraints impose limits on the number of establishments selected in a sample, while the number of items priced in each establishment is controlled to limit respondent burden.

The two universes for the IPP are all exporters and all importers (and their respective products). A sampling frame for each universe is constructed from all documents filed during a specified reference period (generally 1 year). In the case of exports, these are the Shipper's Export

[1] United Nations Statistical Office, *Standard International Trade Classification, Revised,* Statistical Papers, Series M, No. 34/Rev. 2 (New York, United Nations, 1975).

[2] U.S. Bureau of the Census, *Statistical Classification of Domestic and Foreign Commodities Exported From the United States, Schedule B,* January 1, 1978, edition and revisions.

[3] U.S. International Trade Commission, *Tariff Schedule of the United States Annotated,* 1980 edition and revisions.

[4] U.S. Bureau of the Census, *U.S. Foreign Trade Statistics Classifications and Cross Classifications,* 1980.

Declarations (SED's) and, in the case of imports, the Consumption Entry Documents (CED). These documents contain brief product descriptions, 7-digit product classification codes, value, quantity (where required), date, origin or destination, company name and address, and an establishment identification code.

The availability of an establishment identification code on both export and import records makes it possible to incorporate frequency of trade (consistency) into the sample design. Companies can be designated as either consistent or inconsistent exporters/importers of particular products. This information is used in each stage of sampling with the result being an increased yield of usable time series prices.

The import frame, obtained from the Customs Bureau, contains a record of every import transaction. Correspondingly, the export frame, provided by the Bureau of the Census, contains a record of every export transaction.

The sample design for both exports and imports consists of three stages. The first stage is the selection of establishments. The second stage is the selection of Entry Level Items (ELI's—commodity classes within a sampling stratum). The third stage is the selection of specific items (products) in the ELI. The system is identical for both exports and imports unless otherwise noted below.

The first step is to generate the measure of size (max-prob) for an establishment, as follows. The dollar value on each document is aggregated to company-ELI, company-sample stratum, and company levels. It is also aggregated within an ELI, and within a stratum across all companies. A proportion is then calculated for each company-stratum by dividing the aggregated company-stratum dollar value by the aggregated dollar value within the stratum. This "company-stratum prob" is the proportion of dollar value that the company contributes to the particular stratum. The max-prob for each company is the maximum "company-stratum prob" for that company over all strata. In addition to a max-prob, a max-prob stratum (the stratum associated with the max-prob) is assigned to a company. The companies are then implicitly stratified by max-prob strata, and a systematic probability proportionate to size (PPS) selection of companies is made using the max-prob as the company's measure of size. The principal advantage of max-prob here is that a company's chance of selection is based on the product category for which it is most important; this is desirable since the indexes are calculated and published by product category.

When a company is selected in the first stage, it is selected for all its products, including those outside its max-prob stratum. In order to lessen the burden on respondents, it is then necessary to select a second-stage sample of ELI's within each company. The first step of this second stage is to ensure that publication requirements are met by selecting company ELI's with certainty in some strata. The remaining ELI's in each company are then sampled using a systematic PPS technique. The measure of size is the ELI-prob (the company-stratum probability distributed among the ELI's in the company in proportion to their dollar value contributions). This constitutes the sample of respondents and their selected ELI's.

After the sample of companies and ELI's has been selected, further sampling is needed to obtain a specific item for repricing. Beginning in 1982, a probability selection method, referred to as disaggregation, was introduced. Under this method, the ELI is partitioned into subclasses, and a PPS selection is made among the subclasses using their proportion of trade in the establishment as the measure of size.[5] The process continues through the successive subdivisions of each selected subclass until an identifiable item that can be priced over time is obtained.

Probability sampling techniques have been used in IPP since 1976. Prior to that time, samples were based on nonstatistical, judgment samples of commodity groups. The judgmental criteria required that items selected in each company be repriceable and that their price movement be representative of the respondent's other products in that same ELI. Approximately 10 percent of the currently repriced items in the IPP survey are from this earlier sampling era; eventually, they will be replaced by probability-selected products.

Estimating Procedures

Formula

The export and import price indexes are weighted indexes of the Laspeyres type. Individual product price relatives are assigned equal importance within each weight-group category, and the weight-group relatives are then aggregated to the successive stratum index levels.

$$I_{x,t} = \frac{\Sigma_j \Sigma_i \left[\frac{P_i^t}{P_i^o}\right] \frac{w_j}{n_j}}{\Sigma_j w_j}$$

where:

- x = SITC group for which index is calculated
- j = the weight categories within x (they are the Schedule B categories for exports, and the TSUSA categories for imports)
- i = product within j
- n = number of price relatives within j
- t = time
- w_j = share of the value of jth category in group x in the base year
- P_i^t/P_i^o = price relative of product i in year t to base year o

[5] This "proportion of trade" estimate is provided by the respondent.

Weights

The IPP weights represent the total dollar value of U.S. foreign trade in a designated base year and are distributed among several thousand 7-digit weight-group categories. Values assigned to each of these weight-group categories are based on trade value figures compiled by the Bureau of the Census for the base year.[6] In the case of the export price index, the 7-digit weight-group category is the Schedule B, and, in the case of the import price index, it is the TSUSA. Currently, IPP calculates indexes based upon 1980 trade figures.

Although earlier published indexes used weights from either 1969, 1970, 1973, or 1975, all historical data were revised in February 1982 to reflect 1980 trade weights. Beginning with the release of the first quarter 1988 indexes, the base period will be updated to 1985, but most historical data will continue to use 1980 weights.

Each 7-digit weight-group category is considered to be a relatively homogeneous commodity classification. Therefore, each product, or group of products, selected for the IPP survey within a weight-group category represents not only itself, but all products that fall within that weight-group. Due to budgetary limitations, not all weight-group categories are represented. Consequently, index trends of the represented categories are used to impute the movement of weight groups which are not covered.

As the IPP product base is strengthened, new weight-group categories can be introduced into an index. When this occurs, the new groups are linked to the earlier indexes.

Presentation

All reporting is voluntary and confidential, and, therefore, no index is published in such a way as to reveal the name, price, or price behavior of any respondent. No index is published when fewer than three companies provide data; for the vast majority of indexes there are considerably more.

The export and import price indexes are published quarterly in BLS news releases 5 weeks after the reference month. The release includes a narrative summary as well as the SITC end-use product indexes, service sector indexes, and, beginning with the fourth quarter 1987 release, the new average rate and nominal currency indexes. In addition, comprehensive and specific historical tables are available for export-import price index data in its SITC form as well as in its end-use and SIC-based counterparts. Summary tables are also published in the *Monthly Labor Review* as well as in machine-readable form and on data diskettes. Where possible, the index base is 1977=100. However, in numerous cases where the price data are not supportive of a 1977 index base period, the indexes are presented with a more recent period. With the switch to 1985 weights in 1988, the index base will be shifted to 1985=100 for most series.

In addition to the export and import price indexes, a quarterly report is prepared that updates BLS Bulletin 2046, *Comparisons of United States, German, and Japanese Export Indexes.* These data present index comparisons between the United States and the Federal Republic of Germany, and between the United States and Japan. These comparisons measure price movements of U.S. exports relative to those of its major world competitors for similar commodities.

Uses and Limitations

The indexes published in this program are the only indexes of prices related to the U.S. foreign trade sector. They provide quarterly measures of the price trend of U.S. products sold abroad and of products imported to the United States from other countries. The series enables analysts and policymakers to assess the effect of export and import price changes on the U.S. economy and its industrial sectors, as well as to analyze the effects of price changes on the balance of payments. The price measures provide a basis for calculating changes in the volume of exports and imports in the aggregate and for product groups.

The export price indexes provide a basis for measuring changes in the prices of U.S. products in relation to price trends of comparable products of other major industrial countries with which the United States competes for markets, and for assessing changes in U.S. price competitiveness. However, prices collected for exports do not include overseas transportation, foreign duties, or other charges outside the United States. Presented in their end-use form, the indexes are used as a deflator for the National Income and Product Accounts, while their SIC-based form serves as a tool in conducting industry comparison analyses.

Since the import price indexes only measure the value of a product at a port (either domestic or foreign), special care must be taken in using this data to assess the impact of import prices on domestic inflation levels. First, an f.o.b. foreign port series excludes international freight charges. Second, both an f.o.b. foreign port and a c.i.f. U.S. port price series exclude duty as well as costs associated with domestic middlemen (e.g., wholesalers and retailers). All of these factors may affect the final selling price.

It should also be noted that the indexes are not seasonally adjusted. Consequently, price trends for commodities with seasonal patterns may require longer time spans for proper analysis.

[6] The value data for 7-digit categories are compiled by the Bureau of the Census using Shipper's Export Declarations and Consumption Entry Documents. This information is available on magnetic tape and can be found in the following Bureau of the Census publications:

Exports: *U.S. Exports—Schedule B Commodity by Country,* Report FT-410, December each year.

Imports: *U.S. Imports For Consumption and General Imports—TSUSA Commodity by Country of Origin,* Report FT-246, annual.

Technical References

Pratt, Richard J., and Ferguson, Gwyn R. "Alternative Sample Designs in the International Price Program," *Proceedings of the Section on Survey Research Methods*. Washington, American Statistical Association, 1980.

U.S. Department of Labor, Bureau of Labor Statistics. *Comparisons of United States, German, and Japanese Export Price Indexes,* Bulletin 2046, February 1980.

Bureau of Labor Statistics
U.S. Import Product Information

U.S. Department of Labor

The information collected on this form by the Bureau of Labor Statistics will be held in the strictest confidence and will be used for statistical purposes only.

This report is authorized by law 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely.

Form Approved
O.M.B. No. 1220-0026
Approval expires: 11/30/85

If you have any questions concerning the completion of this form OR if the product described below is no longer traded, please CALL
COLLECT MR. BECKER AT (202)272-5034

PLEASE DO NOT WRITE IN THE BLUE SHADED AREAS - BLS OFFICE USE ONLY 212 555 1212

(1)

10002
BIKES UNLIMITED
MR. JERRY EVERS
V.P. SALES
367 48TH STREET
NEW YORK, NY 10011

(2)

(3)

I. PRODUCT DESCRIPTION If any changes are necessary, cross out the incorrect portions, write the new information in the open space below and see the instructions for Column 7 in Section II.

BICYCLE CHAIN, MODEL # 123, FOR GENERAL BICYCLE APPLICATIONS, PITCH 1/2 INCH, WIDTH ~~1/2~~ 3/4 INCH
WEIGHT= ~~.1~~ .20 LBS./FT.

(4)

SIZE OF ORDER: PRICE RELATED; 10,000 FEET
CLASS OF SELLER: PRICE NOT RELATED

II. IMPORT PRICES

Cols. 3–6 – Enter the import prices closest to the first day of the reference month and the appropriate currency. If the product has not been imported since the last report, enter 'NA' (no activity) in lieu of the price.

Col. 7 - If applicable, enter your cost difference (plus or minus) caused by any change in the quality or specifications and describe those changes in the 'Remarks' below.

(1)	REFERENCE MONTH (2)	CIF U.S. PORT PRICE (3)	CURRENCY OF CIF PRICE (4)	FOB FOREIGN PORT PRICE (5)	CURRENCY OF FOB PRICE (6)	COST OF QUALITY CHANGE (+ or –) (7)
	MAR. 82	300.00	U.S. DOLLAR	2,100.00	FRANCE FRANC	
	JUNE 82	300.00	U.S. DOLLAR	2,100.00	FRANCE FRANC	
	SEP. 82	350.00	U.S. DOLLAR	2,450.00	FRANCE FRANC	
	DEC. 82	NA		NA		(7)
5	MAR. 83	$375.00 (6)	U.S. DOLLAR	2704.00 (7)	FR. FRANC	$10.00 (8)

REMARKS
(8) IMPROVED THE QUALITY OF THE CHAIN. CASH DISCOUNT NO LONGER APPLIES.

(5) (6)

Continue remarks on reverse

(10) **III. PRICE FACTORS** Please indicate any changes in the price factors listed below. If unchanged, check the 'NO CHANGE' box.

PRICE FACTORS	PREVIOUSLY REPORTED DATA	NO CHANGE	CURRENT DATA (if changed)	OFFICE USE ONLY
UNIT PRICED	EACH	✓ (11)	(9)	(12)
COUNTRY FROM WHICH PRODUCT WAS IMPORTED	FRANCE	✓ (13)		(14)
MOST FREQUENTLY USED U.S. PORT OF ENTRY	NEW YORK, NY	✓ (15)		(16)
DUTY (complete only if cif price reported above)	PRODUCT IS DUTY FREE	✓ (17)	CHECK ONE: (18) DUTY INCLUDED IN CIF PRICE; Amount ____; (19) DUTY EXCLUDED FROM CIF PRICE; (20) PRODUCT IS DUTY FREE	(19a) (21) (22); (19b) (23) (24); (19c) (25); (19d) (26) (27)
DISCOUNTS APPLICABLE TO PRODUCT SPECIFIED ABOVE	DEDUCTED FROM PRICE: 2.00% DISTRIBUTOR; 5.00% CASH; 7.00% QUANTITY	(28)	☐ NONE — ALREADY DEDUCTED TO ARRIVE AT THE PRICE IN SECTION II? YES NO 2 % DISTRIBUTOR ☑ ☐ ____ % CASH ☐ ☐ 5 % QUANTITY ☑ ☐ ____ % OTHER (specify) ☐ ☐	(29) (30); (31); (32); (33); (34); (35)

*** PLEASE RETURN WITHIN TWO WEEKS ***

(37) Date	(38) CIF Link	(39) CIF Net	(40) (41) FOB Link	(42) FOB Net	(43) Curr-CIF (44)	Curr-FOB (45) (46) (47)
MAR. 83						

Explanation of Footnotes

1. Industry Analyst - Please do not hesitate to call your Industry Analyst (collect) if you have any questions, problems, or comments.

2. Company name, representative, address - Please review this information and correct if necessary.

3. Company phone number - Please review this information and correct if necessary.

4. Product Description - Any corrections to this product description should be made to the right of the current description. If the product described is no longer traded, please call the Industry Analyst given in the top-left corner of the form for information about choosing a replacement product.

   If the SIZE OF ORDER and CLASS OF SELLER were previously reported, the response will be preprinted on the repricing form. If they are not preprinted, or the response has changed, please complete these items according to the following guidelines:

   If the Size of Order has no bearing on the reported import price, enter "Price not related". If the import price changes in accordance with changes in the quantity ordered, enter "Price related" and indicate the quantity range that applies to the import price provided in Section II.

   Class of seller refers to the relationship (if any) existing between your company and the seller of the reported product if that relationship has any effect on the price of the product. If there is no relationship or if the relationship does not affect the price, enter "Price not related". If there is a relationship and the selling firm gives you a price discount because of this relationship, enter "Price related" and indicate whether the foreign seller is a subsidiary, parent, licensee, licensor, contractor, etc.

5. Import Prices - Note that both the cif U.S. Port Price and the fob Foreign Port Price should be given if available. When possible, exclude applicable duties when quoting prices. If the product was not traded during the quarter (the reference month plus the two preceding months), please enter "NA" for "no activity".

6. Currency - Please report the currency in which the cif and fob prices in columns (3) and (5) are reported. Include the name of the country with the currency name.

7. Cost of Quality Change - This column should be completed if there has been a physical change in the product affecting quality-related areas such as performance, durability and range of capabilities. Mere styling or model changes are not necessarily quality changes. Rather, changes such as the horsepower of an engine or the addition of certain operations in a calculator represent quality changes for which we need to know the cost. A detailed description of the change should be entered in the "Remarks" section at the bottom of Section II. Please note that this column should not be used to report simple price differences from period to period.

8. Remarks - Enter any remarks or comments here.

9. Price factors - Check the NO CHANGE box for each price factor that has not changed. If a particular price factor has changed, please provide the new information for that factor in the CURRENT DATA area.

   NOTES: a. Complete the duty section only if a cif price is reported in Section II.
   b. If any part of the discount package has changed, please enter in the CURRENT DATA area all of the discounts which are now included in the package. In addition, indicate if each discount in the new package is already deducted to arrive at the current price provided in Section II.

Bureau of Labor Statistics
U.S. Export Product Information

U.S. Department of Labor

The information collected on this form by the Bureau of Labor Statistics will be held in the strictest confidence and will be used for statistical purposes only.

This report is authorized by law 29 U.S.C. 2. Your voluntary cooperation is needed to make the results of this survey comprehensive, accurate, and timely.

Form Approved
O.M.B. No. 1220-0025
Approval Expires 11/30/88

If you have any questions concerning the completion of this form OR if the product described below is no longer traded, please CALL
COLLECT MR. YAGER AT (202)272-5034

PLEASE DO NOT WRITE IN THE BLUE SHADED AREAS - BLS OFFICE USE ONLY 312 555 1212

J0002
JONES COMPANY
MRS. JANE FREDERICK
V. P. INTERNATIONAL SALES
987 EUCLID STREET
DECATUR, IL 62521

I PRODUCT DESCRIPTION If any changes are necessary, cross out the incorrect portions, write the new information in the open space below and see the instructions for Column 5 in Section II.

PLUG FUSE, MODEL # ~~76512~~ 76513, UL APPROVED, 15 AMP, VISUAL DISPLAY, HEAT RESISTANT GLASS, MAGNIFYING GLASS, 500 PER CONTAINER (BULK PACKAGE), SHP WT=30 LB

SIZE OF ORDER: PRICE NOT RELATED
CLASS OF BUYER: PRICE RELATED; DISTRIBUTOR

II EXPORT PRICES

Col. 3 - Enter the export price closest to the first day of the reference month (fas price preferred). If the product has not been exported since the last report, enter 'NA' (no activity) in Col. 3.

Col. 4 - Enter a code for the appropriate price basis:
1 - fas / fob port / fob border
2 - fob factory / fob distribution center / fob mill / fob mine
3 - fly away factory (faf) / fob factory, freight allowed to port or border
4 - other (if code 4 is entered, specify ----------)

Col. 5 - If applicable, enter your cost difference (plus or minus) caused by any change in the quality or specifications and describe those changes in the 'Remarks' below.

(1)	REFERENCE MONTH (2)	EXPORT PRICE (3)	PRICE BASIS (4)	COST OF QUALITY CHANGE (+ or −) (5)
	MAR. 82	$13.00	2	
	JUNE 82	$13.00	2	
	SEP. 82	$13.00	2	
	DEC. 82	$13.25	2	
5	MAR. 83	#13.50 6	2 7	6 8

REMARKS 7 CORRECTED MODEL NUMBER

Continue remarks on reverse

III PRICE FACTORS Please indicate any changes in the price factors listed. If unchanged, check the 'NO CHANGE' box

PRICE FACTORS	PREVIOUSLY REPORTED DATA	NO CHANGE	CURRENT DATA (If changed)	OFFICE USE ONLY
COUNTRY OR AREA OF DESTINATION	FRANCE	✓ 11	8	12
UNIT PRICED	EACH	✓ 13		14
DISCOUNTS APPLICABLE TO PRODUCT SPECIFIED ABOVE	NOT DEDUCTED FROM PRICE: 10.00% DISTRIBUTOR	15	☐ NONE ALREADY DEDUCTED TO ARRIVE AT THE PRICE IN SECTION II? YES NO 5 % DISTRIBUTOR ☐ ☑ % CASH ✓ ☐ % QUANTITY ☐ ☐ % OTHER (specify) ☐ ☐	16 17 18 19 20 21

IV SHIPPING INFORMATION 23 The following information is necessary to adjust your reported price to a U.S. port or border basis. Previously reported data are shown in Col. 2. If the data are the same for the current pricing period, write 'SAME' in Col. 3. If the data in Col. 2 are no longer applicable (or Col. 2 is blank), please supply the new data in Col. 3.

(1) SHIPPING INFORMATION	(2) PREVIOUSLY REPORTED DATA	(3) CURRENT DATA	(4)
FREIGHT CHARGES OF A TYPICAL SHIPMENT FROM FACTORY OR DISTRIBUTION CENTER TO U.S. PORT OR BORDER (IF KNOWN)	$155.75 PER SHIPMENT	SAME 26	24 25
NUMBER OF UNITS IN A TYPICAL SHIPMENT	NOT AVAILABLE	SAME 29	27 28
WEIGHT OF A TYPICAL SHIPMENT	500 POUND	SAME 32	30 31
NAME OF THE ORIGINAL CARRIER (IF KNOWN)	CO. TRUCK	9 SAME 35	34
MODE OF TRANSPORTATION TO PORT (See Transportation codes below.)	MOTOR	SAME 37	36
METHOD TYPICALLY USED TO SHIP PRODUCT (See Shipping codes below.)	LESS THAN TRUCK LOAD	SAME 39	38
LOCATION (CITY, STATE, ZIP) OF FACTORY OR DISTRIBUTION CENTER	DECATUR, IL 62521	SAME zip 41	40
U.S. PORT (CITY, STATE, ZIP) MOST FREQUENTLY USED FOR EXPORT OF THIS PRODUCT	CHICAGO, IL 60607	SAME zip 43	42

TRANSPORTATION CODES
1 - motor 5 - freight forwarder
2 - rail 6 - UPS
3 - air 7 - U.S. Parcel Post
4 - barge 8 - pipeline
9 - other (specify)

SHIPPING CODES
1 - car load lot 4 - less than truck load lot
2 - less than car load lot 5 - air freight
3 - truck load lot 6 - container
7 - other (specify)

44 Net Freight Adjustment	45	46 Freight Code	47

49 Date	50	Link Price	51	Net Price	52	53	FAS Link Price	54	FAS Net Price	55
MAR. 83										

BLS 2794C January 1983

*** PLEASE RETURN WITHIN TWO WEEKS ***

Explanation of Footnotes

1. Industry Analyst - Please do not hesitate to call your Industry Analyst (collect) if you have any questions, problems, or comments.

2. Company name, representative, address - Please review this information and correct if necessary.

3. Company phone number - Please review this information and correct if necessary.

4. Product Description - Any corrections to this product description should be made to the right of the current description. If the product described is no longer traded, please call the Industry Analyst given in the top-left corner of the form for information about choosing a replacement product.

   If the SIZE OF ORDER and CLASS OF BUYER were previously reported, the response will be preprinted on the repricing form. If they are not preprinted, or the response has changed, please complete these items according to the following guidelines:

   If the Size of Order has no bearing on the reported export price, enter "Price not related". If the export price changes in accordance with changes in the quantity ordered, enter "Price related" and indicate the quantity range that applies to the export price provided in Section II.

   Class of Buyer refers to the relationship (if any) existing between your company and the buyer of the reported product if that relationship has any effect on the price of the product. If there is no relationship or if the relationship does not affect the price, enter "Price not related". If there is a relationship and the buying firm receives a price discount because of this relationship, enter "Price related" and indicate whether the foreign buyer is a subsidiary, parent, licensee, licensor, contractor, etc.

5. Export price and price basis - Enter the current quarter price and price basis. The price entered should reflect a transaction price closest to the first day of the reference month. If the product was not traded during the quarter (the reference month plus the two preceding months), please enter "NA" for "no activity".

6. Cost of Quality Change - This column should be completed if there has been a physical change in the product affecting quality-related areas such as performance, durability and range of capabilities. Mere styling or model changes are not necessarily quality changes. Rather, changes such as the horsepower of an engine or the addition of certain operations in a calculator represent quality changes for which we need to know the cost. A detailed description of the change should be entered in the "Remarks" section at the bottom of Section II. Please note that this column should not be used to report simple price differences from period to period.

7. Remarks - Enter any remarks or comments here.

8. Price factors - Check the NO CHANGE box for each price factor that has not changed. If a particular price factor has changed, please provide the new information for that factor in the CURRENT DATA area.

   NOTES: a. Provide data on sales to the same country or area each quarter, if possible.
   b. If you previously indicated that the price of the product described in Section I was the same to all buyers, regardless of country, the entry "WORLD-WIDE" will be preprinted in the PREVIOUSLY REPORTED DATA area for the country or area of destination. If this pricing policy has changed, please enter in the CURRENT DATA area the name of the country or area to which most exports of the product are currently sold. Select any country if your exports of the product are equally distributed to several countries.
   c. If any part of the discount package has changed, please enter in the CURRENT DATA area all of the discounts which are now included in the package. In addition, indicate if each discount in the new package is already deducted to arrive at the current price provided in Section II.

9. If the price provided in Section II does not include shipping costs to the U.S. point of exportation, please complete Section IV. Please note that if the PREVIOUSLY REPORTED DATA (printed in column 2) have not changed, the word "Same" should be entered in the appropriate CURRENT DATA boxes (column 3). If the current data differ, please provide the new information in column (3).

Chapter 18. Consumer Expenditures and Income

Consumer expenditure surveys are specialized studies in which the primary emphasis is on collecting data relating to family expenditures for goods and services used in day-to-day living. Expenditure surveys of the Bureau of Labor Statistics (BLS) also collect information on the amount and sources of family income, changes in savings and debts, and major demographic and economic characteristics of family members.

Background

The Bureau's studies of family living conditions rank among its oldest data-collecting functions. The first nationwide expenditure survey was conducted in 1888–91 to study workers' spending patterns as elements of production costs. With special reference to competition in foreign trade, it emphasized the worker's role as a producer rather than as a consumer. In response to rapid price changes prior to the turn of the century, a second survey was conducted in 1901. These data provided the weights for an index of prices of food purchased by workers, which was used as a deflator for workers' incomes and expenditures for all kinds of goods until World War I. A third survey, spanning 1917–19, provided weights for computing a cost-of-living index, now known as the Consumer Price Index (CPI). The next major survey, covering only urban wage earners and clerical workers, was conducted in 1934–36, primarily to revise these weights.

During the economic depression of the 1930's, the use of consumer surveys extended from the study of the welfare of selected groups to more general economic analysis. Concurrent with its 1934–36 investigation, the Bureau cooperated with four other Federal agencies in a fifth survey, the 1935–36 study of consumer purchases, which presented consumption estimates for both urban and rural segments of the population. The sixth survey, in 1950, was an abbreviated version of the 1935–36 study, covering only urban consumers. The seventh survey, the 1960–61 Survey of Consumer Expenditures, which once again included both urban and rural families, provided the basis for revising the CPI weights, and also supplied material for broader economic, social, and market analysis.

The next major survey to collect information on expenditures of householders in the United States was conducted in 1972–73. That survey, while providing continuity with the content of the Bureau's previous survey, departed from the past in its collection techniques. Unlike earlier surveys, the Bureau of the Census, under contract with BLS, conducted all sample selection and field work. Another significant change was the use of two independent surveys, a Diary Survey and an Interview Panel Survey, to collect the information. A third major change was the switch from an annual recall to a quarterly recall (Interview Survey) and a daily recall (Diary Survey) of expenditures. These data were again used to revise the CPI weights.

It had been apparent for a long time that there was a need for more timely data than could be supplied by surveys conducted every 10–12 years. The rapidly changing economic conditions of the 1970's intensified this requirement. The new continuing survey that was initiated in 1979 extended the BLS tradition of providing data describing the consumption behavior of American families.

Description of the Ongoing Survey

Unlike previous surveys, the latest survey, initiated in late 1979, is ongoing. Data are, therefore, available at least annually and possibly more frequently as the survey continues. The collection of data is carried out by the Bureau of the Census under contract with BLS. The objectives of the survey remain the same: To provide the basis for revising the weights and associated pricing samples for the CPI and to meet the need for timely and detailed information on consumption patterns of different types of families.

Like the 1972–73 survey, the ongoing survey consists of two separate surveys, each with a different data collection technique and sample. In the Interview Survey, each consumer unit (CU) in the sample is interviewed every 3 months over five calendar quarters. The sample for each quarter is divided into three panels, with CU's being interviewed every 3 months in the same panel of every quarter. The Diary (or recordkeeping) Survey is completed at home by the respondent family for two consecutive 1-week periods.

The sample housing unit is notified in advance by a letter informing the occupants about the purpose of the

survey and the upcoming visit by the interviewer. Both surveys are conducted by personal visits with telephone usage limited to appointment scheduling. The interviewer uses a structured questionnaire to collect both the demographic and expenditure data in the Interview Survey. The demographic data in the Diary Survey are collected by the interviewer whereas the expenditure data are entered on the diary form by the respondent. Both surveys accept proxy responses from any eligible household member who is at least 16 years old if an adult is not available after a few attempts in contacting that person.

The unit for which expenditure reports are collected is the set of eligible individuals constituting a consumer unit, which is defined as (1) all members of a particular housing unit who are related by blood, marriage, adoption, or some other legal arrangement, such as foster children; and (2) a person living alone or sharing a household with others, or living as a roomer in a private home, lodging house, or in permanent living quarters in a hotel or motel, but who is financially independent. In the ongoing survey, students living in university-sponsored housing are also included in the sample as separate CU's.

The Interview Survey collects detailed data on an estimated 60 to 70 percent of total family expenditures. In addition, global estimates, i.e., estimated average expenditures for a 3-month period, are obtained for food and other selected items. These global estimates account for an additional 20 to 25 percent of total expenditures. On the average, it takes approximately 90 to 120 minutes to complete the interview.

In the Diary Survey, detailed data are collected on all expenditures made by consumer units during their participation in the survey. It is estimated that it takes approximately 20 minutes for the interviewer to collect the demographic data and to instruct the respondent on how to keep the diary. It is also estimated that it will take the respondent about 90 to 105 minutes each week to complete the diary.

There is a reinterview program established for the Consumer Expenditure Survey to provide quality control. It provides a means of evaluating individual interviewer performance to determine how well the procedures are being carried out in the field. The reinterview must be conducted by a member of the supervisory staff. A subsample of approximately 6 percent of households in the Interview Survey and 17 percent in the Diary Survey are reinterviewed on an ongoing basis.

All data collected in both surveys are subject to Census and BLS confidentiality requirements which prevent the disclosure of the respondents' identities. All employees have taken an oath to this effect.

Interview Survey

The Interview Survey is designed to collect data on the types of expenditures which respondents can be expected to recall for a period of 3 months or longer. In general, expenses reported in the Interview Survey are either relatively large, such as property, automobiles, or major appliances, or are expenses which occur on a fairly regular basis, such as rent, utility bills, or insurance premiums. Each occupied sample unit is interviewed once per quarter for five consecutive quarters. After the fifth interview, the sample unit is dropped from the survey and replaced by a new consumer unit. For the survey as a whole, 20 percent of the sample is dropped and a new group added each quarter. New families are introduced into the sample on a regular basis as other families complete their participation. This rotating procedure is designed to improve operational efficiency. Another feature of the current survey is that data collected in each quarter are considered independently, so that estimates are not dependent upon a family participating in the survey for a full five quarters.

For the initial interview, information is collected on demographic and family characteristics and on the inventory of major durable goods of each consumer unit. Expenditure information is also collected in this interview, using a 1-month recall, but is used, along with the inventory information, solely for bounding purposes; i.e, to classify the unit for analysis and to prevent duplicate reporting of expenditures in subsequent interviews.

The second through fifth interviews use uniform questionnaires to collect expenditure information in each quarter. Data collected in these questionnaires, which are arranged by major expenditure component (e.g., housing, transportation, medical, education), form the basis of the expenditure estimates derived from the Interview Survey. In addition, information is obtained on the names of establishments (or outlets) from which selected commodities or services are purchased. Wage, salary, and other information on the employment of each CU member is also collected or updated in each of these interviews. The expenditure data are collected via two major types of questions asked. The first type of question asks for the purchase month directly for each reported expenditure. The second type of question asks for a quarterly amount of expenditures. The usage of these two types of questions varies depending on the types of expenditures collected. Approximately 64 percent of the data were collected using the direct monthly method, whereas about 36 percent were collected using the quarterly recall approach.

In the fifth and final interview, an annual supplement is used to obtain a financial profile of the consumer unit. This profile consists of information on the income of the CU as a whole, including unemployment compensation; income from royalties, dividends, and estates; alimony and child support, etc. A 12-month recall period is used to collect income and asset type data.

Diary Survey

The primary objective of the Diary Survey is to obtain expenditure data on small, frequently purchased items which are normally difficult to recall. These items include detailed expenditures for food and beverages, both at home and in eating places; housekeeping supplies and services; nonprescription drugs; and personal care products and services. The Diary Survey is not limited to these types of expenditures, but rather, includes all expenses which the consumer unit incurs during the survey week. Expenses incurred by family members while away from home overnight and for credit and installment plan payments are excluded.

Two separate questionnaires are used to collect Diary data: a Household Characteristics Questionnaire and a Record of Daily Expenses. The Household Characteristics Questionnaire is used to record information pertaining to age, sex, race, marital status, and family composition, as well as information on the work experience and earnings of each CU member. This socioeconomic information is used by BLS to classify the consumer unit for publication of statistical tables and for economic analysis. Data on household characteristics also provide the link in the integration of Diary expenditure data with Interview expenditure data for publishing a full profile of consumer expenditures by demographic characteristics.

The daily expense record is designed as a self-reporting, product-oriented diary on which respondents record a detailed description of all expenses for two consecutive 1-week periods. Data collected each week are considered independently. The diary is divided by day of purchase and by broad classifications of goods and services—a breakdown designed to aid the respondent when recording daily purchases. The items reported are subsequently coded by the Bureau of the Census so that BLS can aggregate individual purchases for representation in the Consumer Price Index and for presentation in statistical tables.

Processing

Due to differences in format and design, Diary and Interview Survey data are processed separately. Diary questionnaires are reviewed for completeness and consistency and are then transmitted to the Census Processing Center in Washington, DC, where computer processing is performed. In addition, missing or invalid data on demographic or work experience are imputed. No imputation is done for missing data on income. The families are assigned weights so that estimates can be derived that represent the total civilian noninstitutional population. Finally, monthly Diary data tapes are transmitted to the Bureau of Labor Statistics.

As the monthly Diary data tapes are received, BLS combines the tapes into separate data bases that form calendar quarters. The data on these quarterly tapes are screened selectively for invalid coding and inconsistent relationships as well as for extreme values that may affect the reasonableness of estimates after the data are aggregated. All errors of coding or extreme value are corrected before further processing.

Selected portions of the Diary data are also adjusted by automated imputation and allocation routines when respondents report insufficient detail to meet publication requirements. These procedures are performed on the data annually. The imputation routines assign qualifying information to data items when there is clear evidence of invalid nonresponse. For example, the qualifiers classify food expenditures by type of processing (i.e., fresh or frozen) and apparel expenditures by age and sex groupings of the members in the consumer units. Allocation routines are a means of transforming reports of nonspecific items into specific ones. For example, when respondents report expenditures for "meat" rather than beef or pork, allocations are performed using proportions derived from specific reports in other completed diaries to distribute the expenditure reported for "meat" to the specific items such as beef or pork.

Census processing of Interview Survey questionnaires proceeds along similar lines. The questionnaires are completed and returned to the regional offices, where codes are applied to identify demographic characteristics, expenditures, income and assets, and other items such as make and model of automobile, and trip destination. In addition, all outlets are coded uniquely by name. Upon completion of the clerical processing, the data are keyed and transmitted to Washington where they pass through a detailed computer pre-edit. Inconsistencies, errors, and identification of missing questionnaires are transmitted back to the regional offices for reconciliation by the field staff through office review or interviewer followup. Corrections are keyed and transmitted to Washington, and again cycled through the computer pre-edit. This continues until errors identified by the pre-edit no longer appear. Once the pre-edit process is completed for a given month, data necessary for bounding are transcribed to the next quarter's questionnaire. The current quarter's questionnaire is sent to a regional processing office for microfilming and storage.

The data then go through a series of complex computer edits and adjustments which include the identification and correction of data irregularities and inconsistencies throughout the questionnaire. Other adjustments convert mortgage and vehicle payments into principal and interest (given associated data on the interest rate and term of the loan), eliminate business and other reimbursed expenses, apply appropriate sales taxes, and derive weights for individual questionnaires. In addition, demographic and work-experience items (except income) are imputed when missing or invalid.

The Bureau of Labor Statistics, upon receipt of the

data from the Bureau of Census, conducts an extensive review to ensure that severe data aberrations are corrected. The review takes place in several stages: A review of counts and means by region; a review of coding of family relationships for inconsistencies; a review of selected extreme values for expenditure and income categories; and a verification of the various data transformations performed by BLS. Cases of questionable data values or relationships are investigated by looking up questionnaires on microfilm. Any errors are corrected prior to release of the data for public use.

Data imputation routines are carried out in the Interview Survey to account for missing or inconsistent entries. The procedures are performed on the data quarterly. The routines, which affect all fields in the data base except income and assets, are intended to improve the estimates derived from the survey. Imputation in the Interview Survey is done at the cell level with cells defined by variables such as income class, family size, region, and so on. The methods used—hot deck, weighting class, and percent distribution—depend on the types of expenditures. In addition, allocation routines are applied to the Interview data in a fashion similar to that for the Diary data.

Sample Design

Selection of households

The Consumer Expenditure Survey is a national probability sample of households designed to represent the total civilian noninstitutional population. The selection of households begins with primary sampling units (PSU's), which consist of counties (or parts thereof), groups of counties, or independent cities. The set of sample PSU's used for the survey is composed of 109 areas, of which 91 urban areas have also been selected by BLS for the Consumer Price Index program. These urban PSU's are classified according to the following four categories: 31 "A" certainty PSU's (i.e., they are self-representing) that are Metropolitan Statistical Areas (MSA's) with nonfarm population greater than 1.2 million; 22 "L" PSU's, which are medium-sized MSA's; 24 "M" PSU's, which are small MSA's; and 14 "R" PSU's, which are urban nonmetropolitan areas. The population break between L and M PSU's is different by region. The breaks are: Northeast—500,000; Midwest—360,000; South—450,000; and West—330,000. Since these PSU's do not represent the entire rural part of the United States, 18 additional PSU's (denoted as "T") are selected to represent the rural nonmetropolitan areas.

The sampling frame (i.e., the list from which housing units are chosen) for this survey is now generated from the 1980 census 100-percent detail file, which is augmented by a sample drawn from new construction permits and coverage improvement techniques to eliminate recognized deficiencies in the census. In addition, the sample for the Diary Survey is doubled during the last 6 weeks of the year to collect expenditures during the peak shopping period of the Christmas and New Year holidays.

The population of interest is the total U.S. civilian population. Within this framework, the eligible population is composed of all civilian noninstitutional persons (for example, those living in houses, condominiums, or apartments) and all people residing in the following group quarters:

> Boarding houses; housing facilities for students and workers; staff units in hospitals and homes for the aged, infirm, or needy; permanent type living quarters in hotels and motels; and mobile home parks. Patients and inmates are eliminated before sampling. The remaining ineligible persons in group quarters and housing units on military reservations are eliminated by later screening. These include: Camps; communes; convents; halfway houses; homes for the aged, infirm, or needy; transient quarters in hotels or motels; and missions.

The Bureau of the Census establishes a sample of 8,180 addresses that are requested to participate annually in the Diary Survey. This results in an effective annual sample size of 6,050 households, since many interviews are not completed due to refusals, vacancies, or the nonexistence of the household address. The actual workload of interviews is spaced over the 52 weeks of the year.

The Interview Survey is a rotating panel survey in which approximately 9,150 addresses are contacted in each of the five calendar quarters. Allowing for bounding interviews, which are not included in the estimates, and for nonresponse (including vacancies), the number of completed interviews per quarter is targeted at 6,760. Each month, one-fifth of the units interviewed are new to the survey. Each panel is interviewed for five consecutive quarters and then dropped from the survey.

Cooperation levels

The response data for the Consumer Expenditure Survey are shown below for the Interview and Diary Surveys. The results are based on 1986 data. For the Interview Survey, the total refers to housing units when a unique housing unit address is interviewed once each quarter for the year.

Response data for 1986 CE Survey

Survey	Housing units designated for the survey	Type B or C nonresponse	Eligible			
			Total	Type A nonresponse	Responded	Response rate (percent)
Interview	39,916	6,970	32,946	4,708	28,238	86
Diary	9,288	1,636	7,652	791	6,861	90

Type B or C nonresponses are housing units that are vacant, nonexistent, or ineligible for interview. Type A nonresponses are housing units which the interviewers were unable to contact or the respondents refused to participate in the survey. These response rates are based on the eligible housing units (i.e., the designated sample less type B and type C nonresponses).

Weighting

Each family included in the Consumer Expenditure Survey represents a given number of families in the U.S. civilian population, which is the universe. The translation of sample families into the universe of families is known as weighting. Several factors are involved in determining the weight for each consumer unit for which a usable report is received. One factor in assigning weights is the inverse of the probability of selection of the housing unit and the adjustment for subsampling in the field. For interviews which cannot be conducted in occupied sample households because of refusals or the fact that no one is home, a complex noninterview adjustment is made. Additional factors include a national-ratio estimate adjustment for age, sex, and race to known civilian noninstitutional population controls and an adjustment based upon CU family composition to determine a weight for the consumer unit. In the case of the Diary, a pre-Christmas seasonal factor is also included in the probability of selection factor.

Beginning with 1984 data, an additional step in the weighting procedure was introduced to correct the inconsistent demographic estimates between the Diary and Interview Surveys. The new step is a ratio estimation procedure using the method of generalized least squares. It is used to narrow the difference between the consumer unit counts of the two surveys for selected published characteristics. While this new step equalizes the number of consumer unit counts of the two surveys, the impact on mean expenditures is small.

Presentation

Information from the ongoing Consumer Expenditure Survey is available in bulletins, reports, analytical papers, and on public-use tapes. The publications may be obtained through the BLS Office of Publications, the Chicago regional office, or from the Government Printing Office. Information on public-use tapes can be obtained from the BLS Division of Consumer Expenditure Surveys.

Publications from the Consumer Expenditures Survey generally include tabulations of average expenditures and income arrayed by family characteristics. Data tabulated for a given year are shown at a relatively aggregated level due to the small sample size of the ongoing survey. As the survey continues and more data become available, however, estimates for several years may be combined to provide greater expenditure detail and additional classifications of families.

Data are currently published for the Interview and Diary Surveys separately; data from the two surveys must be combined to obtain a complete spending picture. Integrated data will be published in the near future.

The public-use tapes contain the actual expenditure and income reports of each family but prevent identification of the family. By eliminating selected geographic detail, the Bureau reduces the possibility that participating families may even be indirectly identified.

Uses and Limitations

The survey data are of value to government and private agencies interested in studying the welfare of particular segments of the population, such as the elderly, low-income families, urban families, and those receiving food stamps. The survey data are used by economic policymakers interested in the effects of policy changes on levels of living among diverse socioeconomic groups. Econometricians find the data useful in constructing economic models. Market researchers find them valuable in analyzing the demand for groups of goods and services. The Department of Commerce uses the survey data as a source of information for revising its benchmark estimates of some of the personal consumption expenditure components of the gross national product.

As in the past, the revision of the Consumer Price Index remains a primary reason for undertaking such an extensive survey. The results of the Consumer Expenditure Survey have been used to select new market baskets of goods and services for the index, to determine the relative importance of components, and to derive new cost weights for the baskets.

Sample surveys are subject to two types of errors, nonsampling and sampling. Nonsampling errors can be attributed to many sources, such as definitional difficulties, differences in the interpretation of questions, inability or unwillingness of the respondent to provide correct information, mistakes in coding or recording the data obtained, and other errors of collection, response, processing, coverage, estimation for missing data, and interviewer variability.

For the Interview Survey, an analysis of time-in-sample and recall effects was done on a macro level using the 1982–83 data. Minimal-to-moderate conditioning effects were found in less than half of the published means. However, the recall-length effects were widespread and substantial among the expenditure classes for which the expenditure month is collected. Research on nonsampling error will continue.

Sampling errors occur because observations are not taken from the entire population. The standard error, which is the accepted measure for sampling error, is an estimate of the difference between the sample data and the data that would have been obtained from a complete census. The methodology employed to calculate the sampling variance is balanced half-sample replication. Standard error tables applicable to published BLS data can be obtained from the BLS Division of Consumer Expenditure Surveys.

Chapter 19. The Consumer Price Index

Part I. The Index in Brief

The Consumer Price Index (CPI) is a measure of the average change in the prices paid by urban consumers for a fixed market basket of goods and services. It is calculated monthly for two population groups, one consisting only of wage earners and clerical workers and the other consisting of all urban families.[1] The wage earner index (CPI-W) is a continuation of the historic index that was introduced well over a half-century ago for use in wage negotiations. As new uses were developed for the CPI in recent years, the need for a broader and more representative index became apparent. The all urban index (CPI-U) introduced in 1978 is representative of the buying habits of about 80 percent of the noninstitutional population of the United States, compared with 32 percent represented in the older index. The methodology for producing the index is the same for both populations and is described in detail in part II of this chapter.

History

The Consumer Price Index was initiated during World War I, when rapid increases in prices, particularly in shipbuilding centers, made such an index essential for calculating cost-of-living adjustments in wages. To provide appropriate weighting patterns for the index, so that it would reflect the relative importance of goods and services purchased by consumers, studies of family expenditures were conducted in 92 industrial centers in 1917–19. Periodic collection of prices was started, and, in 1919, the Bureau of Labor Statistics began publication of separate indexes for 32 cities. Regular publication of a national index, the U.S. city average, began in 1921, and indexes were estimated back to 1913.[2]

Because people's buying habits had changed substantially, a new study was made covering expenditures in the years 1934–36, which provided the basis for a comprehensively revised index introduced in 1940.

During World War II, when many commodities were scarce and goods were rationed, the index weights were adjusted temporarily to reflect these shortages. In 1951, the Bureau again made interim adjustments, based on surveys of consumer expenditures in seven cities between 1947 and 1949, to reflect the most important effects of immediate postwar changes in buying patterns.[3]

The first comprehensive postwar revision of the index was completed in January 1953, using weights from the 1950 expenditure survey.[4] At that time, not only were the weighting factors, list of items, and sources of price data updated (appendix 1), but many improvements in pricing and calculation methods were introduced. Medium-size and small cities were added to the city sample to make the index representative of prices paid by all urban wage-earner and clerical-worker families.

Another revision, completed in 1964, introduced new expenditure weights based on spending patterns in 1960–61 of single persons as well as families, and updated samples of cities, goods and services, and retail stores and service establishments.[5]

The 1978 revision reflected spending patterns based upon the surveys of consumer expenditures conducted in 1972–74. A new and expanded 85-area sample was selected based on the 1970 Census of Population. The Point-of-Purchase Survey was introduced, which eliminated reliance on outdated secondary sources for screening samples of establishments or outlets where prices are collected. A new store-specific approach to the item selection process was also introduced. In addition, it also introduced a second index, the more broadly based CPI for All Urban Consumers (CPI-U), which took into account the buying patterns of professional and salaried workers, part-time workers, the self-employed, the unemployed, and retired people, in addition to wage earners and clerical workers.[6]

[1] The all-urban-consumer population consists of all urban households in Metropolitan Statistical Areas and in urban places of 2,500 inhabitants. Nonfarm families living in rural areas within MSA's are included, but the index excludes rural families and the military and institutional population. The urban wage earner and clerical worker population consists of consumer units with clerical workers, sales workers, craft workers, operatives, service workers, or laborers. More than one-half of the consumer unit's income has to be earned from the above occupations, and at least one of the members must be employed for 37 weeks or more in an eligible occupation.

[2] Collection of food prices back to 1890 had been initiated in 1903. During the course of the 1917–19 expenditure survey, retail prices for other articles were collected in 19 cities for December of each year back to 1914 and in 13 other cities back to December 1917 only. Retail prices of food and wholesale prices of other items were used to estimate price change from 1914 back to 1913.

[3] *Interim Adjustment of Consumers' Price Index*, Bulletin 1039 (Bureau of Labor Statistics, 1951).

[4] *Consumer Prices in the United States, 1953–58*, Bulletin 1256 (Bureau of Labor Statistics, 1959).

[5] *The Consumer Price Index: History and Techniques*, Bulletin 1517 (Bureau of Labor Statistics, 1966).

[6] *The Consumer Price Index: Concepts and Content Over the Years*, Report 517 (Bureau of Labor Statistics, 1978).

In January 1983, the Bureau changed the way in which homeownership costs were measured.[7] A rental equivalence method replaced the asset-price approach to homeownership costs for the CPI-U. In January 1985, the same change was made in the CPI-W. The central purpose of the change was to separate shelter costs from the investment component of homeownership so that the index would reflect only the cost of shelter services provided by owner-occupied homes.

The most recent revision of the CPI, completed in 1987, further improved sampling, data collection, processing, and statistical estimation. This revision stressed techniques that would make the production and calculation of the CPI more efficient, especially with respect to design and allocation of the samples. The updated samples of items, outlets, and areas were based upon data from the Survey of Consumer Expenditures for the years 1982, 1983, and 1984, the 1980 Census of Population, and the ongoing Point-of-Purchase Survey, which, beginning with 1985, reflected the new item and area design. The new technique of rolling in the new area, item, and outlet samples significantly reduced the cost of introducing new samples. In addition, the housing survey was redesigned to represent optimally both owners and renters, which improved the estimation method for shelter costs.

The improvements introduced over the years have reflected not only the Bureau's own experience and research, but also the criticisms and investigations of outsiders. A major study was conducted during World War II by the President's Committee on the Cost of Living.[8] The House Committee on Education and Labor conducted a detailed examination of the index in 1951.[9] A decade later, a study was made by the Price Statistics Review Committee, which was appointed by the National Bureau of Economic Research, at the request of the Office of Statistical Standards of the Bureau of the Budget, to review all Government price statistics.[10] A continuing flow of articles in professional journals and books has also contributed to the assessment of the CPI's quality and of the ways in which it might be improved.[11]

[7] "Changing the Homeownership Component of the Consumer Price Index to Rental Equivalence," *CPI Detailed Report*, January 1983, pp. 7–13.

[8] *Report of The President's Committee on the Cost of Living* (Washington, Office of Economic Stabilization, 1945).

[9] *Consumers' Price Index*, Report of a Special Subcommittee of the Committee on Education and Labor, U.S. Congress, House of Representatives, 82/1, Subcommittee Report No. 2 (Washington, U.S. Government Printing Office, 1951).

[10] *Government Price Statistics*, Hearings before the Subcommittee on Economic Statistics, U.S. Congress, Joint Economic Committee, 871. Part I (Washington, U.S. Government Printing Office, Jan. 24, 1961).

[11] For a list of published papers on the CPI, see Technical References at the end of this chapter.

Concepts

Several key concepts indicate the nature of the Consumer Price Index and the way in which it is calculated.

Prices and living costs

The CPI is based on a sample of prices of food, clothing, shelter and fuels, transportation, medical services, and other goods and services that people buy for day-to-day living. Price change is measured by repricing essentially the same market basket of goods and services at regular intervals and comparing aggregate costs with the costs of the same market basket in a selected base period.

A unifying framework for dealing with practical questions that arise in construction of the CPI is provided by the concept of the cost-of-living (COL) index.[12] As it pertains to the CPI, the COL index for the current month is based on the answer to the following question: "What is the cost, at this month's market prices, of achieving the standard of living actually attained in the base period?" This cost is a hypothetical expenditure—the lowest expenditure level necessary at this month's prices to achieve the base-period's living standard. The ratio of this hypothetical cost to the actual cost of the base-period consumption basket in the base period is the COL index.[13]

The COL index is a measure of price change (it compares current-period and base-period prices). However, the concept is difficult to implement because it holds the standard of living constant, and the living standard must be estimated in some way.

The CPI uses a fixed market basket to hold the base-period living standard constant. The CPI equals the ratio of the cost of the base-period basket at this month's prices to the actual cost of the base-period basket in the base period. The formula used for calculating the CPI is the one known in price index literature as the Laspeyres index. (See part II.) The CPI provides an approximation to a COL index as a measure of consumption costs. It is sometimes said that the CPI's Laspeyres formula provides an "upper bound" on the COL index.

Note that both the CPI and the COL index that were defined above measure changes in expenditures. Neither one measures the change in income required to maintain the base-period living standard. For this reason, neither the COL index nor the CPI are affected by changes in

[12] On the use of a cost-of-living index as a conceptual framework for practical decisionmaking in putting together a price index, see Robert Gillingham, "A Conceptual Framework for the Revised Consumer Price Index," *Proceedings of the Business and Economic Statistics Section*, American Statistical Association, 1974, pp. 46–52.

[13] For more information on the cost-of-living index concept, see Technical References at the end of this chapter.

income taxes, but both will include the effects of changes in sales taxes and other indirect taxes.

For certain purposes, one might want to define price indexes to include, rather than exclude, income taxes. One could develop either a COL index or a Laspeyres index along these lines. Such indexes would provide an answer to a different question from the one for which the present CPI is relevant, and would be appropriate for different uses. For a research measure of a consumption index inclusive of income taxes and Social Security contributions, see Gillingham and Greenlees.[14]

Sampling

Since it is not practical to obtain prices for all consumer transactions in the United States, the CPI is estimated from a set of samples. These samples are designed using statistical procedures to make the CPI representative of the prices paid for all goods and services purchased by consumers in all urban areas of the United States. The samples are:

- A sample of urban areas selected from all U.S. urban areas,
- A sample of consumer units within each selected urban area,
- A sample of outlets from which these consumer units purchased goods and services,
- A sample of specific, unique items—goods and services—purchased by these consumer units,
- A sample of housing units in each urban area for the shelter component of the CPI.

Weights and relative importance

The weight of an item in the CPI is derived from the expenditure on that item as estimated by the Consumer Expenditure Survey. This survey provides data on the average expenditure on selected items, such as white bread, gasoline, and so on, that were purchased by the index population during the survey period. In a fixed-weight index such as the CPI, the implicit quantity of any item used in calculating the index remains the same from month to month.

A related concept is the relative importance of an item. The relative importance shows the share of total expenditure that would occur if quantities consumed were unaffected by changes in relative prices and actually remained constant. Although the implicit quantity weights remain fixed, the relative importance changes over time, reflecting the effect of price changes. Items registering a greater than average price increase (or smaller decrease) become relatively more important. Conversely, items registering a smaller than average price increase (or larger decrease) become relatively less important. Thus, the relative importance of medical care in the index for all urban consumers, which was 6.0 percent in December 1982, was 6.9 percent in December 1986. During the same period, the relative importance of energy fell from 12.4 percent to 8.9 percent. The published data on relative importance are often used to answer such questions as: What was the direct effect on the overall CPI of a particular price change (e.g., gasoline prices) for a particular period? (See appendix 2.)

Owners' equivalent rent

The concept of owners' equivalent rent used to measure homeowner shelter costs was introduced in the CPI-U in January 1983 and in the CPI-W in January 1985. The owners' equivalent rent index measures the change in the cost of renting housing services equivalent to those services provided by owner-occupied housing.

Prior to the introduction of owners' equivalent rent, homeowners' shelter costs in the CPI were represented by five elements: (1) house prices, (2) mortgage interest costs, (3) property taxes, (4) homeowner insurance charges, and (5) maintenance and repair costs. These constitute the major costs associated with purchasing and maintaining the physical asset of a house.

This "asset price" approach to homeowner costs was flawed because it failed to distinguish the investment aspect of owning a home from the consumption aspect. The basic concept of the CPI is as a measure of the average change in the prices paid by consumers for consumption goods and services. Investment purchases, such as stocks and bonds, are conceptually out of the scope of the index and are excluded. A house is not consumed at the time of purchase. It is a long-lived asset (investment), but it also provides the owner with a flow of shelter services over time. Thus, it is the cost of this shelter service provided by the asset that is the conceptually appropriate measurement for the CPI.

To implement the new concept, the old homeownership component was replaced with two items: (1) owners' equivalent rent; and (2) household insurance, which contains those parts of homeowners' insurance that do not insure the structure.

In addition, the previous maintenance and repairs component was made a new component covering both renters' expenses and owners' expenses—exclusive of those estimated to be part of owners' equivalent rent. Also, the weight for household appliances was reduced to remove those expenses in homeowners' cost for appliances included with the house.

[14] Robert F. Gillingham and John Greenlees, "The Impact of Direct Taxes on the Cost of Living," *Journal of Political Economy*, 95(4), August 1987.

Scope and Calculation

Prices for the goods and services used to calculate the index are collected in 91 urban areas throughout the country and from about 21,000 retail and service establishments—supermarkets, department stores, filling stations, hospitals, etc. In addition, data on rents are collected from about 40,000 tenants and 20,000 owner-occupied housing units.

Food, fuels, and a few other items are priced monthly in all 91 locations. Prices of most other goods and services are collected monthly in the five largest urban areas and bimonthly in the remaining areas. All price information is obtained through visits or calls by trained BLS field representatives.

To calculate the index, the price changes for all the various items within each area are averaged together using weights which represent the importance of the items in the spending pattern of the appropriate population group in that area. The U.S. city averages are obtained by combining the local area data. Separate indexes are compiled for: 14 groups cross-classified by region and population size, 4 regions, 4 size classes, and 27 local metropolitan statistical areas.

Movements of the indexes from one month to another are usually expressed as percent changes rather than changes in index points because index point changes are affected by the level of the index in relation to its base period while percent changes are not. The example in the tabulation illustrates the computation of index points and percent changes:

Index point change

CPI	326.0
Less CPI for previous period	318.8
Equals index point change	7.2

Percent change

Index point difference	7.2
Divided by the previous index	318.8
Equals	0.023
Results multiplied by 100	0.023 × 100
Equals percent change	2.3

Percent changes for 3-month and 6-month periods can be expressed as annual rates and are computed according to the standard formula for compound growth rates. These data indicate what the percent change would be if the average rate for the 3-month or 6-month period were maintained for a 12-month period.

Uses

Almost all Americans are affected by the Consumer Price Index because of the many ways that it is used. Three major uses are:

As an economic indicator. As the most widely used measure of inflation, the CPI is an indicator of the effectiveness of government economic policy. The President, Congress, and the Federal Reserve Board use trends in the CPI to aid in formulating fiscal and monetary policies. In addition, business executives, labor leaders, and other private citizens use the index as a guide in making economic decisions.

As a deflator of other economic series. The CPI and its components are used to adjust other economic series for price changes and to translate these series into inflation-free dollars. Examples of series adjusted by the CPI include retail sales, hourly and weekly earnings, and components of the gross national product.

As a means of adjusting income payments. More than 3 million workers are covered by collective bargaining agreements which tie wages to the CPI. The index affects the income of more than 60 million persons as a result of statutory action: 38 million Social Security beneficiaries, over 3 million military and Federal Civil Service retirees and survivors, and about 19 million food stamp recipients. Changes in the CPI also affect the cost of lunches for the 24 million children who eat lunch at school. Some private firms and individuals use the index to keep rents, royalties, alimony, and child support payments in line with changing prices. Finally, since 1985, the CPI has been used to adjust the Federal income tax structure to prevent inflation-induced increases in tax rates.

Analysis and Presentation

CPI data are issued initially in a news release about 3 weeks following the reference month. Summary tables are sent to persons on the mailing list at that time. The *CPI Detailed Report*, available about 3 weeks after the initial release, provides detailed indexes and a monthly analysis of U.S. price movements. The *Monthly Labor Review* also contains much of the CPI data each month and provides semiannual analyses of recent price movements as well as of long-term trends.

Seasonally adjusted data—primarily of use for current economic analysis—are presented in addition to the unadjusted data. The purpose of seasonal adjustment is to remove the estimated effect of changes that normally occur at the same time and in about the same magnitude every year (such as price movements resulting from changing climatic conditions, production cycles, model changeovers, holidays, sales, etc.). Seasonal factors used in computing the seasonally adjusted indexes are derived using the ARIMA option of the X-11 variant of the Census Method II Seasonal Adjustment Program. The seasonal factors are updated annually, and seasonally

adjusted data that have been published earlier are subject to revision for up to 5 years after their original release. (See appendix A for an explanation of BLS seasonal adjustment methods.)

Limitations of the Index

It should be understood that the CPI may not be applicable to all questions about price movements for all population groups. For example, the indexes are designed to represent the average movement of prices for the U.S. urban population and, thus, are not precisely appropriate for use by nonurban residents. Also, the CPI does not provide data separately for the rate of inflation experienced by any particular demographic subgroup of the population, such as the elderly.

In addition, the indexes cannot be used to determine relative living costs. An individual geographic area index measures how much prices have changed in that particular area over a specific time period. It does not show whether prices or living costs are higher or lower in that area relative to another.

A further limitation is that the CPI is not a complete measure of price change. Because the index is estimated from a sample of consumer purchases, the results may deviate slightly from those which would be obtained if all consumer transactions were covered. These estimating or sampling errors are statistical limitations of the index.

A different kind of error in the CPI can occur when a respondent provides BLS field representatives with inaccurate or incomplete information. The Bureau attempts to minimize these errors by obtaining prices by personal observation wherever possible, and by correcting errors immediately upon discovery. The field representatives, technicians, and commodity specialists who collect, process, and analyze the data are trained to watch for deviations in reported prices which might be due to errors. Also, an independent audit staff conducts a systematic evaluation of all CPI collection and processing activities. The goal is to develop long-term quality improvement in all aspects of the index calculation.

A fuller discussion of the varieties and sources of possible error in the index is presented in part III of this chapter, "Precision of Estimates."

Part II. Construction of the Index

The construction of the Consumer Price Index is based on a series of samples and on estimation procedures described below.

Definition of the Index

The CPI is defined as a fixed-quantity price index, that is, a measure of the price change in a fixed market basket of consumption goods and services of constant quantity and quality bought on average by urban consumers, either for all urban consumers (CPI-U) or for urban wage earners and clerical workers (CPI-W). It is a ratio of the costs of purchasing a set of items (i) of constant quality and constant quantity in two different time periods. We denote the index by $I_{t,0}$, where t is the comparison period for which a new index number is to be calculated and 0, the reference period:

$$I_{t,0} = \frac{\sum_i P_{it}\, Q_{ib}}{\sum_i P_{i0}\, Q_{ib}} \times 100.0$$

where:

P_{it} is the price for the i^{th} item in comparison period t
P_{i0} is the price for the i^{th} item in reference period 0
Q_{ib} is the quantity of the i^{th} item consumed in the expenditure base period b.

When the expenditure base (b) and reference period (0) coincide, this becomes the Laspeyres price index formula. For the 1987 revision of the CPI, however, they did not coincide and the formula was modified. The expenditure data, $\Sigma\, P_{ib}\, Q_{ib}$, from the 1982–84 Consumer Expenditure Survey (described later in this chapter) were updated for relative price changes (P_{ip} / P_{ib}) to November or December 1986, the respective pivot periods, p, when they were introduced into the CPI. Expenditure data for index areas priced bimonthly in the odd-numbered months were updated to November 1986. Expenditure data for the index areas priced monthly or bimonthly in the even-numbered months were updated to December 1986. Price relatives from the midpoint (June 1983) of the Consumer Expenditure Survey collection period to November or December 1986 were calculated from the appropriate detailed indexes for the period. The price relatives were applied to the corresponding expenditure data, thereby updating the expenditures to the end of 1986. Continuity with the pre-1987 version of the CPI was maintained in the published version by modifying the above formula to:

$$I_{t,0} = \frac{\sum_i P_{it}\, Q_{ib}}{\sum_i P_{ip}\, Q_{ib}}\ I_{p,1967}$$

where $I_{p,1967}$ is the 1967-based value of the CPI for the pivot month, November or December 1986.

NOTE: The base period for the expenditure weights, 1982–84, should not be confused with the numeric base period for the index, 1967 = 100. A new base period for the index, corresponding to the base period for the expenditure weights (1982–84), will be established effective with the index for January 1988. Such changes in numeric bases are achieved by dividing all indexes in a series by the appropriate average index on the old base for the time period of the new base.

Index Estimation

For sampling and computational purposes, the set of all retail consumer expenditures by the target population for a given index area has been subdivided into 207 classes of similar items called item strata. The item strata are mutually exclusive and exhaustive of all consumer expenditures. They are defined identically for both index populations.

The CPI is computed by a chaining process in which the index for the previous month, $I_{hzt-1,0}$, for each basic area (h) and item stratum (z) is multiplied by an estimate of the relative change in price from the previous month to the current month to provide the current-month index for that area and item stratum:

$$I_{hzt,0} = I_{hzt-1,0} \times R_{hzt,t-1}$$

where $R_{hzt,t-1}$ is an estimate of the one-period price change in the h^{th} basic area for the z^{th} item stratum. Basic area and item stratum indexes are then aggregated using aggregation weights to form desired aggregate area and item indexes, $I_{hzt,0}$:

$$I_{hzt,0} = \frac{\sum_h \sum_z A_{hz} I_{hzt,0}}{A_{HZ}}$$

where A_{hz} is the aggregation weight for the h^{th} basic area and item stratum and A_{HZ} is the aggregation weight for the h^{th} area aggregate and z^{th} item aggregate.

The U.S. city average all items CPI is computed by aggregating all basic component area and item aggregate indexes:

$$I_{t,0} = \frac{\sum_H \sum_z A_{hz} I_{hzt,0}}{A}$$

where A is the aggregation weight for the U.S. city average all items CPI.

Aggregation weights are calculated for a given area and item combination as the expenditures for the pivot period ($P_{ip} Q_{ir}$) divided by the corresponding index in the pivot period, that is,

$$A = P_{ip} Q_{ir} / I_p$$

where p is November or December 1986.

The computation of the index using one-period price relatives based on identical item specifications in adjacent periods allows the requisite flexibility to update the samples of outlets and specifications to reflect an updated distribution of purchases within an item stratum within a local area. The form of the estimator for a one-period price change, $R_{hzt,t-1}$, depends on the procedures used for selecting the samples of outlets and items. When the samples are selected with each unit having a probability proportional to quantity, the estimator of $R_{hzt,t-1}$ is:

$$R_{hzt,t-1} = \frac{\sum_{i \epsilon z} W_{hi} P_{hit}}{\sum_{i \epsilon z} W_{hi} P_{hi,t-1}}$$

This is the ratio of the summation of weighted prices, where the weights (W_{hi}) reflect the probability of selection of the item being priced and a noninterview adjustment. Noninterview adjustment is a statistical procedure designed to adjust for nonresponse. This form of the estimator is used in the rent and owners' equivalent rent item strata.

When the samples of outlets and items are selected with probability proportional to expenditure, the estimator of $R_{hzt,t-1}$ is:

$$R_{hzt,t-1} = \frac{\sum_{i \epsilon z} W_{hi} P_{hi,t} / P_{hia}}{\sum_{i \epsilon z} W_{hi} P_{hi,t-1} / P_{hia}}$$

where P_{hia} is an estimate of the price of the selected item in period a, corresponding to the expenditures used in outlet sampling.

This is the ratio of the summation of weighted price ratios, where the weights reflect the probability of selection of the item being priced and noninterview adjustments. It is used for all commodity and service item strata.

Thus, construction of the CPI is a twofold estimation process. First, the aggregation weights, A, must be estimated. These estimates are derived from the Consumer Expenditure Survey (CE) as explained in the next section. Second, the one-period price changes, $R_{hzt,t-1}$, must be estimated for each pricing period. The methodology for estimating price changes is explained in later sections.

Estimation of expenditure-population weights (aggregation weights)

Within each of the index areas for each item stratum for both the U and W populations, an estimate of expenditure is needed to define and weight the market basket of goods and services for which the index is computed. Each expenditure-population weight is the product of estimates of mean expenditures per consumer unit derived from the 1982–84 CE Survey and estimates of the number of consumer units obtained from a special tabulation of the 1980 census sample detail files.

Calculation of mean expenditures consists of three steps: (1) estimation of preliminary expenditures and their relative importance, (2) estimation of relative importances, using a composite estimation procedure, (3) estimation of final mean expenditures using a raking process on mean expenditures derived from the relative importance data determined in (2). The design criterion for this estimation procedure is to minimize the average mean square error of the relative importance of the aggregation weights for the index areas.

Preliminary mean expenditures and relative importance. Preliminary mean expenditures and their relative importance are calculated for each item stratum and expenditure class, for each population, index area, replicate,[15] and major area by survey source—the CE Interview or Diary Surveys. There were eight major geographic areas (index area aggregates), each consisting of either the self-representing or non-self-representing index areas[16] in a particular Census region. The mean expenditures are estimated using information from the CE Survey. They are the simple weighted averages of the expenditures for the particular item stratum or expenditure class for all consumer units in the population desired. The consumer unit weights are those described in the section on the CE Survey. The relative importance of an item stratum or expenditure cla_s is calculated as the proportion of expenditures that consumer units in a population (U or *W*), index area (or major area), and replicate spend for that item relative to their expenditures on all items.

Composite estimation. Composite estimation is a method used to decrease the mean square error (MSE) of index area, item stratum, and exenditure class (EC) estimators by using data for the corresponding major area. It is implemented separately for data from the Diary and Interview Surveys. The composite estimator of relative importance for a particular index area, item stratum, or expenditure class is a weighted average of the two preliminary relative importance estimators, RI, for the index area and major area.

To calculate the composite estimator, let RI_i and RI_m be, respectively, the relative importance for the particular item stratum (or EC) at the index area and major area. The initial composite estimator, ICRI, is calculated as:

$$ICRI = B_i * RI_m + (1-B_i) * RI_i$$

where:

$$B_i = \frac{\text{Var } RI_i - \text{Cov } RI_i}{\text{ESD } RI_i}$$

where:

- Var RI_i, is the estimated variance of the relative importance for the i^{th} index area,
- Cov RI_i, is the estimated covariance of the relative importance RI_i and RI_m, and
- ESD RI_i, is the estimated expected squared differences of the relative importance RI_i and RI_m.

If $B_i < 0$, then B_i is set equal to 0. If $B_i > 1.0$, then B_i is set equal to 1.0.

[15] A single selection of entry level items and outlets for all item strata assigned to a primary sampling unit is called a replicate.

[16] Self-representing and non-self-representing index areas are defined in the section on sample and publication areas.

The above composite estimation procedure defines a "shrinkage" estimator. A further refinement is employed in defining the final composite estimator, CRI, to limit the shrinkage. Let $SDRI_i$ be the square root of the Var RI_i. The final composite estimator is calculated as:

$$CRI_i = ICRI_i \quad \text{if } ICRI_i - RI_i < K_{m,mg} * SDRI_i$$

$$CRI_i = RI_i - K_{m,mg} * SDRI_i \quad \text{if } RI_i - ICRI_i \geq K_{m,mg} * SDRI_i$$

$$CRI_i = RI_i + K_{m,mg} * SDRI_i \quad \text{if } ICRI_i - RI_i \geq K_{m,mg} * SDRI_i$$

where $K_{m,mg}$ is a limiting factor defined for each major area, m, and major item group, mg. The parameter, $K_{m,mg}$, was determined by testing alternative values on the 1972–73 CE data. The value which maximized the reduction of the MSE and minimized the change for expenditure estimates at the major group level was selected.

Raking. After composite estimation of the relative importance, initial total expenditure estimates, TE, for each item stratum or expenditure class, population, index area, and replicate for the Diary and Interview Surveys were calculated as:

$$TE_{ai} = CRI_{Ai} * ES_A$$

where ES_A is the sum of preliminary mean expenditures across all item strata for index area A.

Similarly, total expenditure estimates were calculated for each item stratum and EC at the major area level. To reestablish data consistency between item strata and EC levels and to reflect the special consumer unit weights, an iterative ratio estimation procedure (raking) was performed. That is, the sum of the expenditures for all item strata within an EC for an index area was forced to equal the total expenditures for the EC in the index area. The sum of the expenditures for a specific item stratum across all index areas in a major area was forced to equal the major area estimate of average expenditures for the item stratum times the special consumer unit weights.

Expenditures from the Diary and Interview Surveys were then integrated. Each item has as its expenditure source either the Diary or Interview Survey. All of the processing activities described above were performed separately by survey. After raking and composite estimation were completed, expenditures from the two surveys were combined to form the set of total expenditures.

The raked, composite estimated expenditures are converted to aggregation weights in a two-step process. First, item strata expenditures were updated from the midpoint of the CE, June 1983, to the pivot (November or December 1986). Each expenditure weight was multiplied by a long-term price change from the CPI for the time interval:

$$E_{hi8612} = E_{hi8306} \cdot \frac{I_{hi8612}}{I_{hi8306}}$$

where:

E_{hi8612} is the updated expenditure for the item strata in the h^{th} area for December 1986,

E_{hi8306} is the raked composite estimated expenditure for the i^{th} item strata in the h^{th} area for June 1983,

I_{hi8612} is the CPI index for the i^{th} item strata for the h^{th} area for December 1986, and

I_{hi8306} is the CPI index for the i^{th} item strata for the h^{th} area for June 1983.

Updated item strata expenditures were summed to arrive at the required updated expenditures for aggregate items and areas. In the second step, the updated expenditure weights were divided by a corresponding index for the pivot period, yielding the aggregation weight:

$$A_{hi} = \frac{E_{hi8612}}{I_{hi8612}}$$

Special expenditure weight procedures. As a result of the 1987 revision, the cost-weight definitions for new and used vehicles and for medical care item strata were changed significantly. In the former CPI, all expenditures for vehicles were valued at the net transaction price—the negotiated price less any trade-in value. In the revised CPI, the treatment of trade-ins and outright sales of used vehicles has been changed. Trade-ins at their market value continue to be netted out of the price of used vehicles. In addition, the market value of trade-ins on new vehicles is netted from used vehicle purchases, rather than new vehicles. Sales of vehicles from one consumer to another are netted against the corresponding purchase because the transaction is really an intrapopulation exchange of wealth; there is no net change in the consumption of used vehicles. In medical care, there is a change in the way health insurance premiums are represented in the cost weight. Health insurance represents only expenditures by consumers for premiums; employers' contributions are not included, just as other medical care expenditures are out-of-pocket payments by consumers. Insurance premiums can be viewed as purchasing two things: (1) the medical care for which benefits are paid, and (2) the services of the insurance carrier in administering the policy. This second element has been labeled retained earnings and refers to operating costs and any profit of the insurance carrier.

In the former CPI, the entire insurance premium was classified as health insurance. However, within health insurance, it was broken into many item strata for pricing—one for each type of benefit paid and one for the retained earnings associated with each type of benefit. The price movement for a health insurance benefit stratum (for example, insurance-paid hospital rooms) was the same as the price movement for the corresponding medical item in the CPI (hospital rooms). The price movement for a retained earnings stratum was the combination of price change for the relevant medical care items and an estimate of changes in retained earnings as a proportion of premiums. In the revised CPI, instead of using the price change for hospital rooms (or any other medical item) for both the hospital room index and the hospital-room-paid-by-insurance index, the expenditures for the two types of hospital payment are combined into a single index. The cost-weight for each medical care item is the combination of direct out-of-pocket expense for the item and indirect out-of-pocket expense for the item paid from consumer-purchased health insurance. The health insurance cost weight is the sum of all retained earnings. While this has no effect on the final index result and is mathematically equivalent to the former procedure, it is believed that the new structure provides a clearer picture of the role of health insurance in the CPI.

Annual and semiannual average index estimation

Annual average CPI values are constructed using 12 successive months of CPI values as:

$$I_{12av} = \sum_{i=1}^{12} I_{i,0} / 12$$

Semiannual average indexes are computed using 6 successive months of CPI values as:

$$I_{6av} = \sum_{i=1}^{6} I_{i,0} / 6$$

where the value of each monthly index is real or imputed, depending on availability.[17] For bimonthly indexes, the intermediate indexes are calculated using a geometric mean of the values in the months adjacent to the one being estimated.

Sampling: Areas, Items, and Outlets

Area sample

Pricing for the CPI is conducted in 94 primary sampling units (PSU's) in 91 geographic areas. (The New York area has three PSU's and the Los Angeles area has two PSU's.) The area design[18] and sampling are summarized as follows: The entire country was divided into 1088 PSU's. A PSU is a county or a group of contiguous counties. The basis of the PSU definition was the geographic areas defined by the Bureau of the Census for

[17] To be published, a semiannual average must have at least two nonimputed index values with sufficient samples. An annual average must have at least four nonimputed index values with sufficient samples.

[18] Cathryn S. Dippo and Curtis A. Jacobs, "Area Sample Redesign for the Consumer Price Index," *Proceedings of the Survey Research Methods Section,* American Statistical Association, August 1983.

the Current Population Survey in 1980 with population estimates from the 1980 census. Each Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA) as defined by the Office of Management and Budget in 1983 is a PSU. BLS grouped the remaining non-MSA counties containing any urban population to form PSU's. Rural areas of the non-MSA counties were excluded. (See appendix 3.)

Ninety-one geographic strata were defined by combining similar PSU's according to the following characteristics, which were found to be highly correlated with price change:

a. Region, population size, MSA *vs.* non-MSA,
b. Mean interest and dividend income per housing unit,
c. Mean wage and salary income per housing unit,
d. Percent of housing units heated by electricity,
e. Percent of housing units heated by fuel oil,
f. Percent black, and
g. Percent retired.

This area design resulted in 31 strata with 1 pricing area per stratum (self-representing PSU's) and 60 non-self-representing strata. (The three New York PSU's and two Los Angeles PSU's are also self-representing.) One sample PSU was selected from each non-self-representing stratum. A controlled selection program was used to insure that the sample areas were distributed geographically across the United States and to increase the overlap between the old area sample and the new area sample.

Although 39 of the 94 PSU's selected are new to the CPI, the new area sample for the CPI is being introduced over a 2-year period. Twenty new PSU's were initiated during 1986 and have been used in CPI index calculations since January 1987. Sixteen of the remaining new PSU's were initiated during 1987, and the final three will be initiated in 1988. Each of the 19 old PSU's will continue to be priced until the new PSU which corresponds to it is initiated and linked into the index.

The new area design defines 37 publication areas, that is, areas for which a CPI is published. Twenty-seven of the self-representing areas were defined as publication areas. Eight additional publication areas were defined by crossing the two city-size classes (non-self-representing MSA areas) by the four Census regions. The non-MSA areas in the Midwest and South were also defined as publication areas. Each of these region-by-size publication areas has 4, 6, or 10 strata. Only two strata were defined in the non-MSA areas in the West and Northwest, which made them ineligible for publication. Indexes are also published for the U.S. total as well as for region and city-size class totals.

Indexes for the U.S. total, the 10 region-by-size class areas, and the 5 largest local areas are published monthly. Indexes for the 10 next largest areas are published bimonthly, and indexes for the smaller local areas are published only as semiannual and annual averages.

The CPI includes the pricing of 134 replicates every 2 months where one replicate is approximately 1,100 price quotes for commodities and services and 390 housing units for shelter. The allocation of the replicates is proportional to the population represented by the PSU, with at least one replicate assigned to each PSU.

Item and outlet samples: Commodities and services other than shelter

Item structure and sampling. The CPI item structure has four levels of classification. The 7 major product groups are composed of 69 expenditure classes (EC's), which in turn are divided into 207 item strata. Within each item stratum, one or more substrata, called entry level items (ELI's), are defined. There are 364 entry level items. (See appendix 4 for a complete list of EC's, item strata, and ELI's.) The ELI's are the ultimate sampling units for items as selected by the BLS national office. They are the level of item definition at which the data collectors begin item sampling within each sample outlet.

To enable the CPI to reflect changes in the marketplace, item and outlet samples are selected each year for 20 percent of the PSU's on a rotating basis. Each year, four regional item universes are tabulated from the two most recent years of Consumer Expenditure Survey data. An independent sample of ELI's is selected for each item stratum for each PSU replicate scheduled for rotation that year from the corresponding regional item universe. Thus, for the complete 5-year cycle, 134 samples of ELI's are selected nationally. Each ELI sample is selected using a systematic sampling procedure, with each ELI within an item stratum assigned a probability of selection proportional to the relative expenditures for the ELI within the item stratum for the CPI-U population within the region. Selection of outlet samples is described in the following section. Linking of the new samples is presented in the section "Item substitution, quality adjustments, and linking."

Item and outlet sample design. Two separate sample designs are employed in the CPI, one for commodities and services, and one for rent and owners' equivalent rent. The methodology employed to determine the commodities and services item and outlet sample design is presented here. Those for the rent and owners' equivalent rent components are described later. For the development of the sample design, all commodities and services item strata were grouped into eight major groups:

Food and beverages	Transportation
Fuels and utilities	Medical care
Household services and furnishings	Entertainment
Apparel and upkeep	Other commodities and services

The objective of the sample design methodology was to determine the number of ELI's to be sampled and the

number of outlets to be selected per PSU replicate by major group. Four major activities were included in the design project. First, a variance function was developed to project the variance of price change as a function of the above variables for the commodity and service components. Second, a cost function was formulated to model the total annual cost of the commodities and services components of the CPI. Third, estimated values for all coefficients of the two functions were developed including estimates of outlet overlap. Fourth, nonlinear programming techniques were used to determine approximately optimal values for the item and outlet sample sizes under varying assumptions of annual price change and cost constraints.

The variance and cost functions for the CPI were modeled for 10 PSU groups:

1. New York City
2. New York, New Jersey suburbs
3. Los Angeles City
4. Los Angeles suburbs
5. Chicago
6. Philadelphia
7. San Francisco, Detroit
8. Large self-representing PSU's
9. Small self-representing PSU's
10. Non-self-representing PSU's

A detailed discussion of the sample allocation methodology is provided in appendix 5.

The solution of the design problem yielded the following number of item strata selections per PSU replicate by major item group:

CPI expenditure categories	*Item strata selections (ELI's)*
Food and beverages	73
Fuel and utilities	12
Household services and furnishings	66
Apparel and upkeep	47
Transportation	34
Medical care	18
Entertainment	27
Other commodities and services	21

The number of outlets selected for each Point-of-Purchase-Survey category (see below) for each major item group by PSU group is as follows:

POPS expenditure categories	*PSU group*									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Food and beverages	6	7	6	6	8	9	9	4	2	6
Fuel and utilities	7	8	4	4	7	8	6	4	2	6
Household services and furnishings	1	1	1	1	1	1	1	1	1	1
Apparel and upkeep	2	2	2	2	2	3	3	2	1	2
Transportation	2	4	3	3	3	4	4	3	1	3
Medical care	3	3	3	3	3	5	3	3	1	4
Entertainment	1	1	1	1	1	1	1	1	1	1
Other commodities and services	1	1	1	1	1	2	1	1	1	1

The PSU groups are as defined earlier. With this allocation, outlets and quotes will be initiated each year under sample rotation. For ongoing pricing, there will be about 25,000 outlets visited each month, with prices collected for 95,000 items.

Outlet and price surveys. BLS field representatives collect prices monthly for food, energy items, rent, owners' equivalent rent, and a small number of other commodity and service item strata in all 94 PSU's. Prices are collected monthly for all commodity and service item strata in the five largest index areas (New York, Los Angeles, Chicago, Philadelphia, and San Francisco). Prices are collected bimonthly for the item strata not cited above in the remaining index areas. A given PSU is assigned to either the even- or odd-numbered months for pricing. Food and other commodities and services, rent, and owners' equivalent rent each have separate pricing surveys, each with its own sample design. Prices for health insurance are obtained from sources outside of BLS. The sample design for each component is described later. Frame development and sampling methodologies for these items are also described later.

Point-of-Purchase Survey. Since 1977, the Bureau of the Census has conducted a Continuing Point-of-Purchase Survey (CPOPS) for BLS, to acquire current data on outlets from which urban households made purchases of defined groups of commodities and services. Data from the survey provide the sampling frame of outlets for food and most commodities and services to be priced in the CPI. CPOPS is the source of the outlet sampling frame for about two-thirds of the CPI items by expenditure weight. (See appendix 6 for a list of CPOPS categories.) Items not covered by the CPOPS include rent, owners' equivalent rent, natural gas, and electricity.

The Point-of-Purchase Survey conducted in 1974 was the source of the outlet sampling frame in the 87 PSU's defined for the 1977 CPI. It was based on the 1970 census. From 1977 to 1984, the Continuing Point-of-Purchase Survey was conducted in approximately one-fifth of these PSU's on a rotating basis, so that the outlet sample for any PSU was never more than 5 years old. Since 1985, the survey has been based on the 1980 census and covers the 94 PSU's defined for the 1987 CPI.

Various methods have been tested to determine the sample of households to be interviewed in the survey. In 1974, a highly clustered sample of households was selected on the assumption that, if families tended to buy in the areas where they live, the outlets given as responses to the survey would also be clustered. In order to increase the expected chance of clustering the outlets, the household clusters were formed (where possible) around central business districts, shopping centers, and other retail centers. These large clusters were called secondary sampling units (SSU's). Within a cluster of tracts, a sample of Census enumeration districts (ED's) was selected, and, within the selected ED's, the sampled households

were dispersed evenly. Five housing units were selected in each ED, and, since the desired sample size per cluster was 40 housing units, about 8 ED's were sampled from each cluster. In areas that issue permits for new construction, construction units were selected from the list of permits issued; in other areas, selection was made from area segments. This sampling approach was used, with minor modifications, in 1977 and 1978.

From 1979 through 1984, unclustered samples of households were selected for the survey. Since 1985, households have been selected on the basis of a noncompact clustering procedure which is modeled after the sample design for the Consumer Expenditure Survey (CE). There are five sample frames: Unit, special place, area, block, and permit. The 1980 Census 100-Percent Edited Detail File is used as the source for all frames, except new construction in permit areas. For this frame, an unclustered sample of units is chosen from the permits issued since January 1980. For the unit, special place, area, and block frames, ED's are selected first. Then, a systematic sample of four or five units from each chosen ED is selected.

The Continuing Point-of-Purchase Survey is conducted annually over a period of 4 to 6 weeks, usually beginning in April, in approximately one-fifth of the PSU's in the CPI. The eligible population for the survey is the same as for the CE Survey: All civilian, noninstitutional persons, including persons residing in boarding houses, housing facilities for students and workers, mobile home parks, permanent-type living quarters in hotels and motels, and staff residing in institutions. The interviews, conducted in selected housing units, consist of two parts. First, the interviewer elicits information on the demographic and socioeconomic characteristics of the household. This information is used to analyze the shopping patterns of various segments of the population. It is also used to determine how many consumer units reside in the housing unit and should be interviewed. A consumer unit (CU) consists of all members of a particular housing unit or other type of living quarters who are related by blood, marriage, adoption, or some other legal arrangement, such as foster children, or who are unrelated but financially dependent upon each other for major living expenses, such as housing or food.

In the second part of the interview, the respondent is asked whether or not the CU purchased categories of goods and services within a specified recall period. Commodities and services are grouped into sampling categories called POPS categories based on entry level items as defined in the CPI classification structure. Some POPS categories consist of only one ELI, while others consist of combinations of ELI's. ELI's are combined into a single POPS category when the commodities or services are generally sold in the same outlets. For example, POPS category 106, Meat and Poultry, consists of eight beef ELI's, six pork ELI's, four ELI's for other meats, and three poultry ELI's. These ELI's are combined because an outlet that sells beef also tends to sell other meats.

Recall periods for POPS categories vary from 1 week to 5 years. The recall period for a specific POPS category is defined to produce a sufficient, but not excessive, number of outlets for sampling purposes. Since consumer units tend to purchase food items, tobacco products, and gasoline frequently throughout the year, a 1- or 2-week recall period is used. In contrast, CU's tend to purchase cars, hard-surface flooring, and funeral services infrequently; therefore, a 5-year recall period is assigned to these categories.

In the 1987 survey design, there are 170 POPS categories. Two different checklists of POPS categories are used by interviewers—each checklist is used in one-half of all sample households in the total nationwide sample. Each checklist consists of a subsample of 147 POPS categories. Most categories are included on both checklists. However, some of the short-recall-period categories are included on only one checklist. Subsampling on two checklists is used to control the expected number of responses received from a household and to minimize respondent burden. The combination of sample size and reference period for a given POPS category is designed to generate 6 to 12, not necessarily unique, outlets reported for a given PSU/POPS category. For each POPS category on the designated checklist, the respondent for a CU is asked whether purchases were made within the stated recall period and, if so, the names and locations of all places of purchase and the expenditure amounts.

From the results of the annual household survey, a new sample of outlets is selected for approximately one-fifth of the PSU's in the CPI. In the year following the survey, BLS initiates these new outlets, selects items for pricing from each, and replaces the former set of items in the CPI from each surveyed city with the new outlets and items.

Outlet sampling procedures. As indicated earlier, item and outlet samples are selected each year for 20 percent of the PSU's on a rotating basis. When a sampled ELI is selected, a specific POPS category is identified for outlet selection. In self-representing PSU's, sample households for the POPS are divided into two or more independent groups by the first-stage order of selection, which defines two or more frames of outlets for outlet selection. The independent groups or replicates are needed for variance estimation. A single selection of ELI's and outlets for all item strata assigned to a PSU is called a replicate. For a given PSU, POPS category and replicate, the total expenditures reported for a given outlet are edited. If a purchase is reported for an outlet but the amount of expenditures is not reported, then, to ensure a chance of selection for the outlet, the mean expenditure for the PSU, replicate, and category is assigned. If an outlet reports large expenditures, then the amount is restricted to 20 percent

of the total expenditure for the PSU, replicate, and category.

Outlet samples are selected independently for each PSU, replicate, and POPS category using a systematic sampling procedure. Each outlet on the frame has a probability of selection proportional to the amount of expenditures reported in the POPS. All ELI's selected in the item sampling process for a given PSU replicate are assigned for pricing in each sample outlet for the corresponding PSU, replicate, and POPS category. When multiple selections of the sample outlet occur, a comparable increase is made in the number of quotes priced for the outlet. The designated sample size for a given POPS category within each major item group for each replicate within a PSU group was presented in the section on item and outlet sample designs. The designated sample size is the number of outlet selections and not the number of unique outlets. It also does not reflect nonresponse, which is discussed in a later section. The number of replicates by PSU group is presented below. There are a total of 134 replicates included in the CPI.

	PSU group	*Number of replicates*
1.	New York City	4
2.	New York, New Jersey suburbs	4
3.	Los Angeles City	4
4.	Los Angeles suburbs	2
5.	Chicago	4
6.	Philadelphia	2
7.	San Francisco, Detroit	4
8.	Large self-representing PSU's	18
9.	Small self-representing PSU's	32
10.	Non-self-representing PSU's	60

Outlet sampling procedures for commodities and services not included in the POPS. Some commodity and service items were excluded from the POPS either because existing sampling frames were adequate or it was apparent that the POPS would not yield an adequate sampling frame. For each component, the sampling frame was either acquired from another source or constructed by BLS. Each of these items has its own sample design. The frames consist of all outlets providing the commodity or service in each sample area. A measure of size was associated with each outlet on the sampling frame. Ideally, this measure of size was the amount of revenue generated by the outlet for the item for the CPI-U population in the sample area. Whenever revenue was not available, an alternative measure of size, such as employment, number of customers, or sales volume, was substituted. All samples were selected using systematic sampling techniques with probability proportional to the measure of size.

The source of the sampling frame, the definition of the sampling unit, the measure of size employed, the final pricing unit, and the number of designated outlets and quotes for each item are presented in appendix 7.

Merge of item and outlet samples. Since the item and outlet samples are selected in separate processes for each PSU replicate, they must be merged before data collection. A concordance was created mapping each ELI to a corresponding Point-of-Purchase category. Each sample ELI is assigned for price collection to the outlet sample selected for the corresponding Point-of-Purchase category. The number of price quotes collected for an ELI in each outlet is equivalent to the number of times the ELI was selected for the PSU replicate in the item sampling process.

The number of price quotes assigned for collection in a sample outlet is determined through the item/outlet sample merge. In the outlet sampling process, an outlet may be selected more than once for a given POPS category, provided the expenditures reported for the outlet are large. The outlet may also be selected for more than one POPS category. If an outlet is selected multiple times for a given POPS category, the same multiple of price quotes will be assigned for collection for each sample ELI matching the category. If an outlet is selected for more than one POPS category, price quotes will be assigned for collection for all sample ELI's matching the categories.

Selection procedures within outlets. For each ELI assigned for price collection in a sample outlet, a BLS field representative selects a specific store item using multistage probability selection techniques. The field representative first identifies all of the items included in the ELI definition and offered for sale by the outlet. Items are grouped by common characteristics, such as brand, style, size, or type of packaging, etc. With the assistance of the respondent for the outlet, probabilities of selection are assigned to each group.

The probabilities of selection are proportional to the sales of the items included in each group. The field representatives may use any of four alternative procedures for determining the proportion of sales. In order of preference, they are:

a. Obtaining the proportions directly from a respondent;
b. Ranking the groups by importance of sales as indicated by the respondent and then obtaining the proportions directly or using preassigned proportions;
c. Using shelf space to estimate the proportions where applicable; and
d. Using equal probability.

After assigning probabilities of selection, the field representative uses a random number table to select a group. All items included in the selected group are identified. Further groups are formed based on the common characteristics of the items. Probabilities are assigned to each group, and a random number table is used for selection. The process is repeated through successive stages until a unique item is identified. The field representative

describes the selected item on a checklist which contains the descriptive characteristics necessary to identify the item and to determine or explain price differences for all items defined within the ELI.

These procedures make possible an objective probability sampling of items throughout the CPI. They also allow broad definitions of ELI's so that the same tight specification need not be priced everywhere. The wide variety of specific items greatly reduces the within-item component of variance, reduces the correlation of price movement between areas, and allows a substantial reduction in the number of quotes required. A second important benefit from the broader ELI's is a significantly higher probability of finding a priceable item within the definition of the ELI within the sample outlet.

This selection process is completed at the initial visit to the outlet. Subsequent visits are made to obtain the price for the selected item either monthly or bimonthly. Data collection is generally done by personal visit, but some pricing is completed by phone.

Item and outlet samples: Shelter

The CPI housing sample is the source of information on price change for the two principal shelter indexes—the residential rent index and the owners' equivalent rent index. The shelter indexes account for approximately 25 percent of the total CPI weight. The housing unit sample is a stratified, systematic, multistage, cluster sample that consists of approximately 40,000 rental units and 20,000 owner units. BLS selected housing units constructed before 1980 with data developed from the 1980 Census of Population and Housing. For housing constructed since 1980, the Bureau of the Census supplies an annual sample of new units from building permits data and from a canvassing of an area sample developed for areas not requiring permits.

Stratification. BLS used two variables, average rent level and tenure (percent renter occupied), to select the stratifying area clusters called segments; these variables correlate with rent change. Using them for sampling stratification serves to make the sample sizes within clusters more consistent, uniform, and homogeneous.

Stratification accomplished two goals. First, stratifying by variables associated with rent change insured sample coverage for important characteristics that correlate with rent. Second, stratification by percent renter occupied produced the clustering and the consistent sample sizes of renter and owner housing units within clusters. It is this geographic clustering that permits the assignment or "matching" of renter-occupied units in the sample to the owner units in the sample. Matching is the mechanism that provides the basis for measuring price change of owner housing that is used in the owners' equivalent rent index.

To meet the stratification goals, BLS stratified at the lowest published Census areas within the 94 CPI PSU's. Before stratifying areas where the Census Bureau provided data by block group and block, BLS defined partial block groups (PBG's). In the few CPI areas where the Census Bureau provided data only by enumeration district (ED), BLS stratified at the ED level. Individual blocks within a block group were established as independent PBG's when they had a high percentage of renters and a large enough number of housing units to stand as an individual cluster. The balance of each original block group was also designated in total as a PBG. Less than 5 percent of the block groups were affected by this process. However, the use of the process cut significantly the cases where large numbers of renters were selected in a single building. The resulting PBG's were generally far more homogeneous in terms of percent renter occupied and structure type than the original block groups.

Strata boundaries were defined, and the PBG's and ED's were sorted into the strata. The two variables, average rent level and tenure (percent renter occupied), defined the strata. Eighteen strata were defined for each PSU, using three rent ranges and six tenure ranges. An important enhancement from previous CPI housing samples was that strata boundaries were defined differently for each PSU to insure that each stratum contained roughly the same number of housing units and allowed for between-PSU differences in rent levels and housing characteristics. BLS sampled PBG/ED's within each stratum, thereby insuring that the survey included housing clusters of all rent and tenure levels. Stratifying by tenure also permitted BLS to vary the sample rate for owners and renters in each cluster to obtain consistent sample sizes by tenure within the clusters.

Sample allocation to PSU's and strata. BLS allocated the sample to minimize a value called Z, which is proportional to the sum of the variance of the rent and owners' equivalent rent indexes. This value is expressed as:

$$Z = \sum_{i=1}^{s} \left[O_i^2 \left(\left(\frac{\sigma_w^2}{o_i} \right) + \left(\frac{L}{r_i} \right) + R_i^2 \left(\frac{L}{r_i} \right) \right) \right]$$

where:

S = number of of strata,
O_i = number of owner units in the i^{th} strata,
R_i = number of renter units in the i^{th} strata,
L = the total unit variance,
σ_w^2 = within cluster variance,
o_i = number of owners allocated to i^{th} strata,
r_i = the number of renters allocated to i^{th} strata.

BLS determined the strata sample sizes, o_i and r_i, subject to the sample size constraints, by finding the values for

o_i and r_i that minimize Z.[19] This produced an optimal sample for the given resource constraints for the two indexes.

BLS determined an initial allocation simultaneously across all strata and PSU's based on a criterion requiring a minimum sample size for each published index. If a publication PSU was not allocated the minimum sample, it was assigned a designated number of units large enough to meet publication standards. This minimum sample was allocated applying the above formula for Z among the strata within the PSU. A single process reallocated the remaining sample to the remaining PSU's.

The budget for the CPI housing survey dictated a sample of 10,000 clusters (called segments) and 100,000 pricings per year for the pre-1980 sample portion of the survey. BLS added 900 more segments to compensate for an expected 9-percent sample loss that results from differences in the Census Bureau and CPI definitions of housing units. In contrast to the Census definition, the CPI excludes public housing, institutional housing, and military housing.

Sample selection within strata. BLS selected sample clusters in each stratum using a systematic probability-proportional-to-size (PPS) sample selection method. Each PBG within a stratum was assigned a measure of size according to the total number of housing units, with controls on the maximum and minimum percent renter occupied. BLS sorted the PBG's geographically and, using the measures of size, allocated the sample of PBG's systematically.

Next, BLS partitioned each selected PBG into a number of clusters, depending on the PBG's size, and selected one at random. When a single Census block contained more than one cluster and one of these was a selected cluster, BLS field representatives defined the individual cluster following strict procedures derived from the sampling plan. For example, suppose that the sample design determined that a segment began 10.1 percent of the way into a block and ended at 23.8 percent into the block. If the block was not too big, the BLS representative would enumerate the entire block and then define the segment. In large blocks, the representative prescreened the blocks and sent the information to the BLS national office, which determined the segment.

A field screening determined the final selection of housing units in the sample. In the first step of this process, called listing, BLS field representatives enumerated in order on listing forms every housing unit or potential housing unit they saw in each segment. The national office had prepared selection sheets that indicated the sequence number of each unit to be screened and its "desired tenure" (whether the unit needed to be owner or renter occupied to pass screening and remain in the survey). With the selection sheets, the field representatives designated on the listing forms the units to be screened and their desired tenure.

Survey statisticians prepared the selection sheets for each segment taking into account each segment's proportion that was renter occupied from the 1980 census to determine how many units to screen, and how many to require of each tenure to yield the optional sample of renter and owner units for the CPI housing survey. The two within-segment sampling rates determined how many renters and owners should be in the final sample. The survey statisticians determined them from the final desired probability of selection for each tenure, the number of renters and owners in each stratum, and the number of selected segments and total segments in each stratum.

Before the field agents contacted survey respondents for the first time, they had already designated the units in each segment into one of four cases:

(1) Screen but initiate only if the unit is renter occupied.
(2) Screen but initiate only if the unit is owner occupied.
(3) Screen and initiate if either owner or renter occupied.
(4) Do not contact for screening or initiation.

During screening, the field representatives contacted an eligible respondent for each housing unit and determined that the unit met the tenure criteria for the survey as well as other criteria such as being a year-round housing unit, built before 1980, that was someone's primary residence.

After they determined the desired tenure, the field representatives contacted an eligible respondent for each unit to be screened and obtained the actual tenure and other eligibility data. Housing units were initiated into the survey only if their actual tenure was the same as the desired tenure, and they met the other eligibility criteria. (Initiation is the process of collecting a first-time interview.) Units that did not pass screening were not initiated; however, they may be recontacted in the future to augment or to rotate the sample.

As planned, only about one-fourth of the units interviewed for screening met the tenure and other eligibility criteria required to pass screening and be initiated into the CPI housing survey. Because renters were allocated according to total units and each cluster was allocated an equal number of renters, most of the units contacted in areas known from the Census Bureau to be mostly owner occupied failed screening. However, this process located the sparse renters in these areas for the survey and added "extra" renter units to the rent sample in owner areas. Although they represent few renters in the renter universe and, consequently, have very low weight in the rent index, they serve as the main source of rental units to match with owner units. It is their movement that primarily drives the owners' equivalent rent index.

[19] For a full derivation of Z, see W. F. Lane and J. P. Sommers, "Improved Measures of Shelter Costs," *Proceedings of the Business and Economic Statistics Section,* American Statistical Association, 1984.

Estimation of Price Change

Commodities and services other than shelter

At the end of each pricing period, the estimate of the one-period (t–1 to t) price change (price relative) is computed for each item stratum and index area. Only price quotes obtained in both the current and previous pricing periods for the same or comparable items are used in the estimate. Where appropriate, prices for food items are converted to a price per ounce before they are used in the estimation of price change. The same quote weights are used both for the current- and previous-period price quotes. The estimate of the one-period price change for the h^{th} index area for the z^{th} item stratum for a given market basket is computed as:

$$R_{hzt,t-1} = \frac{R_{hzt,\,a}}{R_{hzt-1,\,a}} = \frac{\sum_{i \epsilon z} W_{hi} P_{hit} / P_{hia}}{\sum_{i \epsilon z} W_{hi} P_{hit-1} / P_{hia}}$$

where:

P_{hit} is the price of the i^{th} quote in the current pricing period, t, for item stratum z in index area h;

P_{hit-1} is the price of the i^{th} quote in the previous pricing period, t–1, for item stratum z in index area h;

P_{hia} is the estimated price for the i^{th} quote for item stratum z in the time period, a, of the POPS in index area h;

W_{hi} is the quote weight for the i^{th} quote for item stratum z in index area h.

The quote weight, W_{hi}, consists of the product of the following factors: An estimate of the total daily expenditure (E) for the POPS category, for the index area replicate and the CPI-U population; a duplication factor (f) to reflect any special subsampling of outlets or quotes; the percent of sales (α) of the ELI to the total sales of the POPS category in the outlet; the proportion (B) the expenditures for the selected ELI is of the total expenditures for the item stratum in the region (the probability of selection for the ELI); a geographic factor (g) to reflect the difference in coverage for the index area for the pre-1987 area definitions to the 1987 area definitions; and the number of usable quotes (M) for the ELI/PSU replicate within the item stratum:

$$W_{hi} = \alpha Efg/MB$$

NOTE: The geographic factor is 1.000 for all samples selected using the 1987 area definitions. See the section on outlet sampling procedures for an explanation of sample rotation.

Item substitution, quality adjustments, and linking

One of the more difficult conceptual problems faced in compiling a price index is the accurate measurement and treatment of quality change due to constantly changing product specifications and consumption patterns. The concept of the CPI requires measures of the cost of purchasing a fixed market basket of goods and services of constant quality through time. In reality, products frequently disappear, products are replaced with new versions, and new products emerge. Ideally, estimates would be obtained for the dollar value of each quality change resulting from a change in the model priced or a substitution to a new item. This estimate would reflect how much consumers value the quality change. The direct measurement of the value consumers place on quality change when product substitution occurs, of course, is rarely possible. As an approximation, BLS uses several methods to adjust for quality change and to account for the change in item specifications. These methods may be categorized as 1) directly comparable, 2) direct quality adjustment, 3) linking with overlap price, and 4) linking without overlap price. In all cases, it is necessary to estimate a new base-period price in order to use the new item specification in future, if not current, periods.

Directly comparable. If the new and old item specifications are considered directly comparable, i.e., the characteristics that define the new specification are essentially the same as the old item's characteristics, the base-period price for the new specification is set equal to the base-period price for the old specification, and the price comparison between the items is used in the index. It is assumed that no quality difference has occurred.

Direct quality adjustment. This is the most explicit measure for dealing with specification changes. Direct quality adjustments are frequently made for the food, rent, and automobile components of the CPI. The conversion of food prices to price per ounce accounts for some quality adjustment. If the net weight of an item changes, then the method used in recording food prices will take into account this type of change in quality.

Quality adjustments are also made to the cost of rental housing used in the rent and owners' equivalent rent indexes. BLS collects the rent change plus a description of major services and facilities provided by the landlord. If the services and facilities differ between two collection periods when rents are compared, the rent for the current period is adjusted to reflect the differences in services between the time periods. For instance, if the owner no longer provides a certain utility, BLS calculates and adds an estimate of the value of that utility to the current rent in order to have an adjusted rent value. This adjusted rent is the current cost of the same set of services provided for the previous rent payment.

BLS used data from the Department of Energy's Residential Energy Survey to develop formulas to estimate utility usage for various types and sizes of housing, in

various climates, with different types of heating and air-conditioning, hot water, cooking stove, and so on. The prices for the utilities come from the CPI average price program. A similar, although simpler, formula estimates water costs. Research is underway to determine how to quality adjust major changes such as changes in the number of rooms or bathrooms. Currently, when such major changes occur, BLS omits these observations from the calculation in estimating price change.

The most frequently cited example of direct quality adjustment is the annual model changeover for new automobiles. Direct quality adjustments are made for changes in standard features between model years. This estimate is based on all costs incurred in manufacturing plus the established manufacturer and retail markup to the selling price of passenger cars. This producer-cost estimate applies to all new features that are installed as standard equipment, that is, features on all cars in the same or comparable series. Any former optional item that becomes standard has a market price (i.e., the former option price) which is the consumer value of that option for those who bought it. For such items, the value of the quality change is a weighted average of the former option price and the producer cost. For all items that replace or modify some previously existing feature, the estimate is based on the difference in producer cost between the old and the new feature, marked up to retail. In other words, the estimate of total production cost for new items is computed for both the new and the old feature. The difference between these values is used as the estimate of quality change.

Adjustments for quality change in the CPI new car index include structural and engineering changes that affect safety, environment, reliability, performance, durability, economy, carrying capacity, maneuverability, comfort, and convenience. Although antipollution equipment on automobiles does not directly increase the quality of the automobile for the buyer, these devices do improve the quality for consumers in general. Consequently, quality adjustments are made for pollution controls to automobiles on the assumption that, by legislative definition, the cost of installing antipollution devices was no more than the value derived from them.

Quality adjustments of new cars exclude changes in style or appearance, such as chrome trim, unless these features have been offered as options and purchased by customers. Also, new technology sometimes results in better quality at the same or reduced cost. No satisfactory value can usually be developed for such a change. In such cases, it is ignored, and prices are compared directly.

In general, if the new item specification is similar to the previous one but has changed one or more of its component parts, a quality adjustment may be made to establish comparability between their prices. A synthetic previous-period price for the new item ($P^*_{i,t-1}$) is calculated as follows:

$$P^*_{i,t-1} = P_{i,t-1} + QA$$

where:

$P_{i,t-1}$ is the previous-period price of the old specification,

and

QA is the dollar value of the quality change which may be either positive or negative. After the above imputation is made, the base-period price for the new item ($P^*_{i,a}$) is computed as:

$$P^*_{i,a} = \frac{P_{i,a}\, P^*_{i,t-1}}{P_{i,t-1}}$$

where:

$P_{i,a}$ is the base-period price for the previous item.

Linking with overlap price. When a noncomparable substitution occurs and a price is obtained for both the old ($P_{i,t}$) and new ($P^*_{i,t}$) specifications in the same period (overlap pricing), the estimation of the new base-period price is based on the same-period price relationship of the two specifications. The new base-period price ($P^*_{i,a}$) is estimated as follows:

$$P^*_{i,a} = P^*_{i,t}\ (P_{i,a} / P_{i,t})$$

The linking of quotes with overlap prices is done before item relatives are compared. For the current month, the price comparison used in the index is based on the old variety. At the next pricing, the comparison will be made on the new item. The quality difference is assumed to be the difference in the observed prices of the old and new varieties in the current month.

Linking without overlap price. For quotes which are not comparable because of a change in specification (substitution) and no quality adjustment or overlap price can be obtained, the new specification price is not used in the current-period estimate of the relative. Implicitly, this means that the price change for that price quote is assumed to be the same as the average change of those quotes in the same item stratum/index area/pricing cycle.

To execute the link, an estimate of the long-term change for the previous pricing period ($R_{zt-1,a}$) for the item stratum and the current 1-month pricing period relative ($R_{zt,t-1}$) is required. A new base-period price ($P^*_{zi,a}$) for the specification is computed as follows:

$$P^*_{zi,a} = \frac{P_{zi,t}}{R_{zt-1,a}\, R_{zt,t-1}}$$

The value of $R_{zt-1,a}$ is estimated at either the quote level by using the ratio of the previous-period price to the base price or at the item strata level by using the ratio of indexes for the item stratum/index area/cycle, where:

$$R_{zt-1,a} = \frac{I_{z,t-1}}{I_{z,a}}$$

$I_{z,t-1}$ is the index of the previous pricing period for the item stratum/index area/pricing cycle,

$I_{z,a}$ is the base-period index for the CPOPS (or other frame reference),

$R_{zt,t-1}$ is the one-period price change relative for the stratum.

The quality difference between the items in this case is assumed to be the difference between the price of the new variety and the imputed price for the old variety. (See discussion of price imputation in the "Estimation of price change" section above.)

The incidence of substitution by major CPI category during 1983 and 1984 is presented in table 1. The rate of substitution has averaged about 3.9 percent of price occurrences. The highest rates of substitution occur in the apparel and upkeep category and the transportation category. Direct quality adjustments are made most frequently to new vehicles within the transportation category.

Apparel. The pricing of apparel items causes a number of problems for quality adjustment in the CPI. Many apparel items are seasonal and subject to frequent style changes. When new styles replace old ones, many substitutions are deemed to be noncomparable. Adjusting for quality change becomes complicated because information from manufacturers to make direct quality adjustments is not available or difficult to estimate. In addition, overlap prices are not available since the old style has usually been sold out. The only method available is to link the quote.

Linking without an overlap price could cause a bias in the index due to the nature of price setting in retail apparel stores. New items are sold at introductory prices in the beginning of their selling season and then continually have their prices reduced through repeated "sales" until the stock is depleted. Linking quotes would result in no price comparison being made between items at the time of substitution. Price change is imputed from those quotes priced during the period, which include many year-round items and some new varieties that are deemed comparable to the old item. In subsequent months, as price reductions occur, the index will show continuous price declines. The following example illustrates the problem:

	Prices for hypothetical apparel item					
	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*
Old item	$100	$75	$50	—	—	—
New item	—	—	—	$150	$125	$100
Percent change	—	-25	-33	[1]1	-17	-20

[1] Imputed from other apparel items.

In January through March, the old item was priced and showed large declines. In April, the old item is not available and a substitution to a new item occurs. The two are declared noncomparable and there is no overlap price. If the new item is linked into the index, the price change is imputed as the average of all other items in that index area/stratum. Assume this to be 1 percent.

Table 1. Substitutions as a percent of occurrences by major CPI category, 1983 and 1984

Category and year	Total	Directly comparable	Link			Direct quality adjustment
			Total	With overlap	Without overlap	
All:						
1983	3.85	1.56	1.97	0.23	1.74	0.32
1984	3.95	1.70	1.95	.23	1.71	.30
Food and beverages:						
1983	1.81	.52	1.29	.04	1.25	.00
1984	1.93	.52	1.41	.08	1.33	.00
Housing:						
1983	4.25	2.21	1.89	.22	1.67	.15
1984	4.73	2.67	1.93	.21	1.62	.22
Apparel and upkeep:						
1983	17.34	7.15	10.15	2.69	7.46	.03
1984	17.59	7.80	9.70	2.43	7.27	.09
Transportation:						
1983	6.72	3.13	1.41	.06	1.35	2.18
1984	5.80	3.02	1.93	.07	.96	1.74
Medical care:						
1983	2.22	.65	.95	.03	.981	.64
1984	2.19	.80	1.02	.03	.99	.38
Entertainment:						
1983	4.61	1.92	2.51	.23	2.28	.18
1984	6.08	2.85	2.96	.26	2.70	.27
Other goods and services:						
1983	3.30	1.44	1.69	.06	1.64	.17
1984	3.99	1.94	1.64	.08	1.56	.49

Note: Because of special pricing procedures the following items were excluded: Residential rent and owners' equivalent rent within housing; used cars within Transportation; health insurance within Medical Care; and magazines, periodicals, and books within Entertainment.

In May's pricing, the new item shows a decline of 17 percent, and, in June, there is another decline of 20 percent. Thus, the index would show an almost continual downward movement. To overcome this inherent bias, there is a procedural rule used that prohibits an item from going out of the index on sale. When the item is no longer available following a sale price, and a noncomparable substitute is selected, an estimated overlap price is used. This estimated price is the item's last regular (nonsale) price. In the above example, when a noncomparable substitute occurred in April, an artificial price of $100 would be used as an estimated overlap for computing the index so that the March to April change would be 100 percent ($50 to $100), thus bringing the index back to its presale level. This procedure of estimated overlaps prevents a severe downward bias from being introduced into the CPI when items disappear from the index on sale and are replaced by varieties with substantially different quality features. This artificial overlap represents an estimate of the "nonsale" price of the old variety if it were still available. Research is underway to evaluate alternative estimators that may produce better unbiased estimated overlap prices for this situation. Alternative imputation procedures for noncomparable substitutes are also being studied.

Medical care. Another area in which quality adjustment presents particular difficulties is medical care. Not all factors affecting the quality of medical care services can be accounted for in the description of the item being priced. Quite often the respondent does not have knowledge of many price-determining quality factors. For example, hospital room modifications, changes in the nurse-to-patient ratio, or the availability of new equipment are all likely to contribute to determining the price level of the room service priced. Such changes are normally reflected as price movement because BLS either is not aware of the changes or has no method available to deal with the change. Improved technologies and procedures can lead to quality changes that cannot necessarily be measured by BLS. For instance, new advances in the development of porous materials in the manufacturing of prosthetic implants, such as in hip replacement surgery, allow the bone to grow around the prosthesis. This is not the case with the nonporous materials that have been commonly used in hip replacement prosthetic implants. Many doctors view this porous implant as an improvement in the results of hip replacement surgery. In pricing total hip replacement surgery, the quality impact of shifting from a nonporous to a porous implant would not be factored out of the index, as BLS has no methodology to account for the value of the quality difference.

There are, however, certain areas in medical care where the quality difference can be measured and adjustments made for changes in the quality of priced services. For example, the CPI might be pricing a limited visit to a physician's office for treatment of a sore throat, and the physician might have later changed the fee schedule so that a throat culture would be included in the price of the visit, whereas previously it had been separately billed for by a laboratory. The addition of the throat culture would be reflected as a quality change to the previously described service. If a hospital introduces a separate admitting charge that previously was included in the room rate, BLS prorates the admission charge to a per-day basis using an appropriate hospital-provided length-of-stay measure. The prorated admission charge is then added to the room rate priced to reflect the price movement in the index.

Other price adjustments

Bonus merchandise adjustments. Sometimes products are offered with free merchandise included with the purchase of the original item. Such "bonus" items may provide additional satisfaction to consumers, and BLS will, therefore, make adjustments to the purchase price to take into consideration the value of the bonus merchandise. The adjustment made depends on the type of merchandise offered and the perceived value of the bonus to the consumer.

If the bonus merchandise consists of more of the same item, the adjustment is reflected in the unit price of the item. For example, if a manufacturer offers 2 ounces of toothpaste "free with the purchase of the regular 6-ounce tube," then the item's price will be reduced by 25 percent, reflecting the decline in the cost per ounce. When the bonus is removed, the price per ounce will return to its prior level, and a price increase will be recorded. In this instance, the value to the consumer is assumed to be one-third greater.

If the bonus merchandise consists of an item that has some significant value to the consumer, and the item is of a different genre, an adjustment will be made to account for the value of the free item offered when the original item selected for the CPI is priced. For example, when a box of cereal is sold containing a free package of candy, the item's price will be reduced by the unit cost of the candy to the manufacturer. In this instance, the value to the consumer is assumed to be equal to the manufacturer's cost.

When bonus merchandise adjustments occur, base prices are not adjusted since there is no difference in the quantity or quality of the original item being priced.

Utility refunds. Sometimes public utility commissions require that utilities such as telephone, natural gas, or electricity companies make rebates to their customers. These rebates may arise from a number of different causes. For example, a utility may be permitted to use a new rate schedule temporarily until a final determination is made. If the final rates set by the commission are lower than the temporary ones, the difference must be refunded for

consumption during the period. The utility bills priced for the CPI will reflect the full amount of these refunds in the month(s) they are credited to the customers.

Manufacturers' rebate. When product manufacturers offer cash rebates to consumers for purchases of items priced in the CPI, BLS reflects these rebates as price reductions in the index. The amount of the rebate adjustment usually depends on the percentage of purchasers who take advantage of the rebate offer. For example, when auto manufacturers offer a $500 rebate on the purchase of a new car or reduced-rate financing, the price of each car eligible for the rebate is reduced by the proportion of customers who opt for the rebate. If 70 percent of customers choose rebates for a particular model, then the price of each quote for that model in the CPI will be reduced by $350, and the index will reflect the price decline. The reduced interest rates chosen by the remaining customers will be reflected in the auto financing component of the CPI. For mail-in rebate offers, an attempt is made to determine the proportion of customers who take advantage of the rebate, and the reported prices are adjusted accordingly.

Cents-off coupons. Generally, no adjustments are made for coupons presented by customers as price reductions at the time of payment. Research has indicated that less than 10 percent of customers take advantage of these coupons. One exception is when the coupons are attached to the product for immediate redemption at the point of purchase. BLS field representatives are instructed in this latter situation to deduct the amount of the coupon from the price of the item.

Seasonal items

Seasonal items are those commodities and services that are not available year round but are available in a seasonal pattern. Heavyweight coats, tents, and fresh peaches are examples of items that are often available only during certain times of the year. Special procedures are employed when selecting and pricing these types of items to ensure they are appropriately represented in the sample and price changes are correctly included in the calculation of the CPI.

Although seasonal items can exist in any ELI, some ELI's include an especially large percentage of seasonal items and receive special treatment. These seasonal ELI's include most apparel items, fresh fruit, and sports and recreational equipment. The designation of an ELI as seasonal or nonseasonal was made at the regional level, using the four geographic regions in the CPI design. It is not uncommon for some items that are seasonal in the Northeast region, for example, to be sold year round in the South.

After the samples for these seasonal ELI's are selected following the normal sample selection procedure, the number of quotes is doubled to ensure that, despite the seasonal disappearance of a large number of quotes, a large enough residual number of in-season quotes will exist to calculate the index. The quotes in these ELI's are paired; that is, for each original quote that is selected, a second quote in the same ELI and outlet is initiated and priced. In the fresh fruit ELI's, one quote of each pair is designated January–June, and the other quote is designated July–December. In all other seasonal ELI's, one quote of each pair is designated fall/winter, and one quote is designated spring/summer. The fall/winter and spring/summer designations are used for the nonfood quotes because these are the distinctions that are most commonly used by the retailing industry to categorize seasonal merchandise. The seasonal designations are used to help establish the specific items eligible for each quote so that year-round items and items from each season are initiated in their proper proportions.

At initiation and each time an item is priced, the data for in-season months are collected for every specific commodity and service priced in the CPI, including year round items. These data become a part of the item description and are updated if there is a change. An attempt is made to price every item every on-cycle month, even during those months when the item may be out of its indicated season. If the item is available, the price is collected and used in the calculation of the CPI. If the item is unavailable because it is out of season, no further action is taken, and that item is not used in the calculation of the CPI that month. Its price is imputed using standard imputation procedures.

When an item becomes permanently unavailable, the standard procedure is to substitute the most similar item. In the case of a year-round item not in a seasonal ELI, this process takes place as soon as the item is permanently unavailable. However, for items in seasonal ELI's and seasonal items in ELI's that are not designated seasonal, the period during which a substitution can take place is restricted to those months when a full selection of appropriate seasonal merchandise is available.

These special initiation, pricing, and substitution procedures are intended to ensure that an adequate sample of items is available every month, and the correct balance of seasonal and year-round items is maintained. As a result, the estimates of price movement for the ELI's that include seasonal items correctly reflect price changes for the universe of items included in those ELI's.

Special estimation procedures

A number of special estimation procedures are used in compiling price information for selected categories of items in the CPI.

New vehicles. Prices for new cars and trucks selected for inclusion in the CPI pose a special problem since the

manufacturer's suggested retail (sticker) price does not represent the transaction price for most new vehicles. Most automotive dealers offer customers concessions on the sticker price and include certain dealer preparation charges. In some instances where models are in high demand, dealers will even charge an additional markup beyond the sticker price. When pricing new vehicles, BLS field representatives obtain separately the base price and all the options on the selected vehicle. In addition, they obtain from the dealer the average concession and/or markup during the preceding 30 days. This enables BLS to estimate the average price of the vehicle after concessions/markups.

Used cars. The only expenditures on used cars included in the CPI market basket are those for previously owned cars consumers purchased from the business or government sectors and the profit of dealers on the sale of used cars. (See Special expenditure weight issues above.) The used-car sample was selected from types of cars purchased for use by businesses and governments. The sample consists of 1- through 5-year-old models. Average wholesale prices of clean cars sold at used-car auctions are published by the National Automotive Dealers Association. The average of these prices is adjusted for depreciation using the difference in prices between model years for the same model car. The prices used in the index are a 3-month moving average of the average wholesale price adjusted for depreciation.

Natural gas. The energy value of natural gas varies according to the quality of the gas supplied. BLS attempts to price a constant amount of energy consumption for natural gas. When natural gas is sold by volume—e.g., cubic feet—the amount of gas needed to produce a constant amount of energy will vary depending on the heating value of the gas. To ensure that a constant amount of energy is being priced, the amount of gas consumed is adjusted each month based on the current heating value. Thus, through time, a constant amount of energy is priced. The current adjusted consumption is calculated as follows:

Current adjusted consumption = original consumption × (original heat value/current heat value).

Health insurance. Health insurance is not directly priced in the CPI. The price change is imputed from the price movement of the various services that are covered by health insurance and from the change in the ratio of retained earnings to benefits paid by type of health insurance carrier —Blue Cross/Blue Shield or other. (For additional detail, see Special expenditure weight procedures.) Thus, the price change for health insurance, by type of carrier, is estimated each month by the product of two relatives—one for the change in the various assigned medical care items (e.g., physician services, hospital rooms, etc.) and the other for the change in the retained earnings ratio of the carrier.

Automobile finance charges. The price used in the CPI for automobile finance charges represents the amount paid for financing a loan with fixed characteristics such as downpayment percentage, term of the loan, type and model of car, etc. The price change is affected by two items—the interest rate on the loan and the changes in the amount financed due to price movement for new cars. The automobile financing charges index is estimated each month by the product of two relatives, one for changes in interest rates charged on new-car loans and the other for changes in new-car prices.

Quantity discounts. Many items in the CPI are sold both individually and in quantity. When consumers are able to purchase an amount greater than a single unit at a discounted price, the first multiple unit price is reported for use in the CPI. For example, if the 12-ounce can of corn being priced can be purchased at 25 cents for a single can, three cans for 69 cents, or five cans for $1, the price used in the CPI will be the per-ounce price of the three cans.

Unit-priced fruits and vegetables. When pricing fresh fruits and vegetables that are sold on a unit basis, two of the items are weighed to determine an average weight for the item. This helps to reduce the variability in the size that occurs among individual, loose-produce items and is not overly burdensome for the data collection process. For example, if the item being priced is Red Delicious apples and the price is 50 cents, the BLS field staff will report the price of one apple and the weight of two Red Delicious apples taken from the produce rack. In computing the price per ounce, the weight of the two apples is divided by two and the price of an apple is divided by this average weight.

Bottle deposits. BLS collects information on bottle deposits for a variety of nonalcoholic and alcoholic beverages in order to calculate the influence of changes in bottle legislation on price change. Consumers who purchase throwaway containers are considered to be purchasing the product itself and the convenience of throwing the container away. When a local jurisdiction enacts bottle legislation and no longer allows stores to sell throwaway containers, those consumers who were previously purchasing throwaway containers may experience a change in price for the convenience. The price of the same size bottle of product plus its deposit establishes an upper bound of the price change since the consumer could retain the former convenience by now purchasing returnables and simply throwing them away. In similar fashion, information about deposits and the status of bottle legislation

can be used to estimate price change when a bottle bill is repealed. Changes due to bottle bills are shown in the month the legislation is effective.

Sales taxes. Conceptually, the CPI should include all applicable taxes paid by consumers for consumption items. A number of products and services are priced with taxes included since this is the manner in which they are sold. Many items are priced using their shelf prices and with taxes subsequently added during compilation of the CPI. Tax rates for these items are determined from secondary sources based on the tax jurisdiction in which the outlet is located and the entry level item (ELI) in which the item is priced. There are instances where the majority of items within an ELI in a tax jurisdiction are taxable but some items are not. Taxes are applied to all items in that ELI/tax jurisdiction, regardless. In other instances, the majority of items in the ELI are not taxable, but some are. For these cases, no taxes are applied. BLS is currently evaluating the procedure of collecting data on sales taxes for each individual item priced so that sales taxes may be reflected more accurately in the index.

Shelter: Rent and owners' equivalent rent

The rent and owners' equivalent rent indexes measure the change in the cost of shelter for renters and owners, respectively. Price change data for these two indexes come from the CPI housing survey. Each month, BLS field representatives gather information from renter units on the rent for the current month and the previous month and on what services are provided; from owners' units, they obtain an estimated or implicit rent; and from all units, they collect information on characteristics of the sample housing units and respondents.

Rent. BLS estimates the monthly rent price indexes for each market basket using the rent indexes for the previous month and for 6 months earlier and 1-month and 6-month measures of rent change estimated from the CPI shelter survey. The estimate of the 1-month rent change is the sum of the current month's rents—weighted and adjusted for 1 month of aging—divided by the previous month's sum of weighted rents. The estimate of the 6-month rent change is the sum of the current month's rents—weighted and adjusted for 6 months of aging—divided by the sum of weighted rents for the previous 6 months. The current month's rent index is a weighted average of the previous month's rent index moved forward by the estimate of 1-month rent change and the rent index from 6 months earlier advanced by the estimate of 6-month change.

To put this in the form of an equation, let S_1 be the set of rental units interviewed in the shelter survey in time t in a market basket with valid comparable rents in both time t and in time t–1; and let S_6 be the set of units interviewed in t with valid comparable rent values in both time t and time t–6. Vacant units that were previously renter occupied are also included in S_1 and S_6 and have current (t) and previous (t–1) month's rents assigned using a vacancy imputation process. Let the rent for rental unit i in time t be r_{it}, and let a_{it} be a factor that adjusts for the estimated small loss in quality due to the aging it experienced between t–1 and t. The 1-month and 6-month estimate of rent change, $R_{t,t-1}$ and $R_{t,t-6}$, are calculated by:

$$R_{t,t-1} = \frac{\sum_{i \epsilon S_1} (r_{i,t} + a_i r_{i,t-1}) W_{i1}}{\sum_{i \epsilon S_1} r_{i,t-1} W_{i1}} \qquad R_{t,t-6} = \frac{\sum_{i \epsilon S_6} (r_{i,t} + 6a_i r_{i,t-6}) W_{i1}}{\sum_{i \epsilon S_6} r_{i,t-6} W_{i6}}$$

where:

W_i, and W_{i6} are the renter units probabilities of selection adjusted for nonresponse.

Using $R_{t,t-1}$ and $R_{t,t-6}$ and the indexes for the previous month, I_{t-1}, and for the 6 months previous, I_{t-6}, BLS computes two preliminary estimates ($I_{t-1}R_{t,t-1}$ and $I_{t-6}R_{t,t-6}$) of the current month's rent index, I_t, for each market basket. The final rent index for month, t, for each market basket is the weighted average of the two preliminary estimates:

$$I_t = A\,(I_{t-1}\,R_{t,t-1}) + (1-A)\,(I_{t-6}\,R_{t,t-6})$$

where:

$A = 0.65$, the value that simulation studies determined minimizes the mean squared error of the estimate.[20]

Vacancy imputation. Vacant units which were previously renter occupied are used in the calculation of $R_{t,t-1}$ and $R_{t,t-6}$. The vacancy imputation process incorporates several assumptions about the unobserved rents of vacant units. It is assumed that rents tend to change at a different rate for units that become vacant (and are, therefore, in the process of changing tenants) than for other units. The vacancy imputation model assumes that, after an initial lease period, expected rents change at a steady rate until the old tenant moves out of the unit. When there is a change in occupant or a unit becomes vacant, its rent is assumed to "jump" at some rate, referred to as the "jump rate." In markets with generally rising rents, this jump rate is usually greater than the average rate of change for occupied units. BLS estimates the jump rate based on nonvacant sample units in the PSU which have had a change in tenant between t and t–6. Nonvacant units without a tenant change are used to calculate the average continuous rate of change. These

[20] For a derivation of the optimal value of A, see C. L. Kosary, J. P. Sommers, and J. M. Branscome, "Evaluation Alternatives to the Rent Estimator," *Proceedings of the Business and Economic Statistics Section*, American Statistical Association, 1984.

values are used to impute rents for vacant units for periods t and t–1 from their rent in t–6.[21] In general, the imputed rents, $r_{i,t}$ and $r_{i,t-1}$, of the i^{th} vacant rental unit in t and t–1 are:

$$r_{i,t-1} = r_{i,t-6}\, C^5 \text{ and } r_{i,t} = r_{i,t-1}\, J$$

where J is the jump rate for the PSU calculated, and C is the steady rate of change.

The imputation of vacant rents ensures that the unobserved rent change that occurs when a unit becomes vacant will be reflected in the final rent index. The 6-month rent-change estimates will capture these changes once the units become occupied. However, they will be missed in 1-month rent-change estimates without vacancy imputation. Because the final rent index is calculated using both 1- and 6-month change estimates, omission or misstatement of rent estimates for vacant units would lead to BLS missing part of rent changes in the CPI.

Aging adjustment. The aging adjustment accounts for the small loss in quality as housing units age (or depreciate) between interviews. The aging adjustment factors, a_i, can be thought of as $1/(1-d)$ where d is the monthly rate of physical depreciation. BLS computes factors for each housing unit with regression-based formulas. The formulas account for the age of the unit and a number of structural characteristics.[22] The aging adjustment procedure was introduced into the CPI in 1988.

The rent figures collected in the housing survey are the amounts the tenants pay their landlords plus any rent reductions tenants receive for performing services for the landlord (sometimes called "rent as pay") plus any subsidy payment (such as Section 8 payments) paid to the landlord. If the rent is lower than prevailing market rents because the tenant is related to the landlord, the unit is not used in the calculation. Reductions for any other reasons are not considered part of the rent.

The collected rents are "contract" rents; they are the payment for all services the landlord provides in exchange for the rent. For example, if the landlord provides electricity, it is part of the contract rent. The CPI item expenditure weights also include the full contract rent payment.

Quality adjustment. Quality adjustments made to the cost of rental housing are used in the rent and owners' equivalent rent indexes. BLS collects the rent charged plus a description of major services and facilities provided by the landlord. If the services and facilities differ between two collection periods when rents are compared, the rent for the current period is adjusted to reflect the differences in services between the time periods. For instance, if the owner no longer provides a certain utility, BLS calculates an estimate of the value of that utility and adds it to the current rent in order to have an adjusted rent value. This adjusted rent is the current cost of the same set of services provided for the previous rent.

To make quality adjustments in costs of utilities and water, BLS uses data from the Department of Energy's Residential Energy Survey to develop formulas to estimate utility usage for various types and sizes of housing, in various climates, with different types of heating and air-conditioning, hot water, cooking stoves, and so on. Prices for utilities come from the CPI average price program. A similar, simpler formula is used to estimate water costs. Research is underway to determine how to adjust for major quality changes in housing such as in the number of rooms or bathrooms. Currently, when such major changes occur, BLS omits these observations from the calculation for estimation of price change.

Owners' equivalent rent. BLS estimates the owners' equivalent rent index[23] by estimating the owners' implicit rent, m_j, for each owner unit, j, in the sample. In contrast to the contract rent concept used in the rent index, the implicit rent is a "pure rent"; that is, it excludes payments for extra services such as utilities and furniture. Once the implicit rents are estimated, the calculation of the owners' equivalent rent index essentially follows that of the rent index.

The initial value derived for time t for $m_{j,t}$ is an estimate of the rent the owner-occupied housing units in the housing survey would bring if they were rented. The estimate is based on the answer to the question, "If this house or apartment were a rental unit, how much do you think it would rent for monthly, including maintenance but without utilities and furniture?" For owner-occupied units whose owners are unable to estimate their unit's implicit rent, BLS uses an imputation procedure that assigns the implicit rent from a similar unit to any that have missing values.

To get subsequent values of implicit rent each month, BLS assigns a set of renters, Q_j, to each owner unit, j. This assignment is done on the basis of location within the PSU, structure type, and structural characteristics. BLS first tries to match owners with renters that fit for all variables. For those owners for whom a matching set of renters is not obtained at the first stage, BLS relaxes the

[21] For more information on vacancy imputation, see J. P. Sommers and J. D. Rivers, "Vacancy Imputation Methology for Rents in the CPI," *Proceedings of the Business and Economic Statistics Section*, American Statistical Association, 1983.

[22] For further information, see William C. Randolph, "Housing Depreciation and Aging Bias in the Consumer Price Index," BLS Working Paper 166, April 1987.

[23] Substantial changes in the method of measuring price change of owner-occupied housing were introduced with the index for January 1983 (January 1985 for the CPI-W). For information on the change and the old method, see "Changing the Homeownership Component of the Consumer Price Index to Rental Equivalence," *CPI Detailed Report*, January 1983.

constraints one at a time until a satisfactory set of renters is found for all the owners. In general, a single renter may be assigned to sets for estimating no more than three owner equivalents. When several renters, say n_j, are assigned to owner j, this counts as only $1/n_j$ toward each renter's maximum of three owners. However, renters are only checked against their maximum after a round of matching, so it is possible for a renter to move more than three owner equivalents if the renter is matched to more than three during one round. The sample selection process, which sampled renters in owner areas at a very high rate, facilitated the matching of renters to owners. (See the section on Item and outlet samples for shelter.) BLS estimates the pure rent, Pi, for all the rental units in Q_j. This pure rent estimate, P_i, is r_i minus an estimate of the value of any utilities or furniture the landlord provides.

Q_{j1} is the subset of the renters in Q_j that have valid comparable rents in both t and t-1. Q_{j6} is the subset with valid rents in both t and t-6. Vacant, previously renter-occupied housing units are eligible for Q_{j1} and Q_{j6}. The implicit rent, m_{jt}, for owner j in time t is estimated from the implicit rent for t-6 and the average change in the pure rent of the units in Q_{j6}:

$$m_{j,t} = m_{j,t-6} \sum_{i \epsilon Q_{j6}} \left(\frac{P_{i,t}}{P_{i,t-6}} + 6a_i \right) / n_{j6}$$

where $p_{i,t}$ is the i^{th} rental unit's pure rent, a_i is the aging adjustment factor, and n_{j6} is the number of rental units in Q_{j6}.

The 1-month previous implicit rent is the current month's implicit rent moved back 1 month with the pure rents in Q_{j1}:

$$m_{j,t-1} = m_{jt} \sum_{i \epsilon Q_{j1}} \left(\frac{P_{i,t-1}}{P_{i,t} + a_i P_{i,t-1}} \right) / n_{j1}$$

Once BLS obtains estimates of current, 1-month-ago, and 6-months-ago implicit rent for all owners, it proceeds to estimate the owners' equivalent rent index for the current month. The process is similar to that used for the rent index. There is no problem here with missing price change for vacant units or aging since the calculation of implicit rent already adjusts for these considerations.

BLS makes 1-month and 6-month estimates of change in the owners' shelter cost for each market basket as follows: Let S_1 be the set of owner units with implicit rents in both time t and times t-1 and S_6 with implicit rents in t and t-6. Note that owner units may not be in S_1 or S_6 if their sets Q_{j1} or Q_{j6} are empty. The 1-month and 6-month estimates of price change for owner units in each market basket are:

$$R_{i,t-1} = \frac{\sum_{j \epsilon S_1} m_{jt} \, w_{j1}}{\sum_{i \epsilon S_1} m_{j,t-1} \, w_{j1}} \qquad R_{i,t-6} = \frac{\sum_{i \epsilon S_6} m_{jt} \, w_{j6}}{\sum_{i \epsilon S_6} m_{j,t-6} \, w_{j6}}$$

where the w_{j1}'s and w_{j6}'s are the owner units' probability of selection adjusted for nonresponse.

As in the rent index, two preliminary estimates of the current month's price index for each market basket ($I_{t-1} \, R_{t,t1}$ and $I_{t-6} \, R_{t,t-6}$) are averaged together to get the final estimate I_t:

$$I_t = A \, (I_{t-1} \, R_{t,t-1}) + (1-A) \, (I_{t-6} R_{t,t-6})$$

Again, A = 0.65 is the value that minimizes the mean squared error.

Average Prices

Average prices are estimated from CPI data for selected food items, gasoline, utility (piped) gas, electricity, and fuel oil. Average prices for each food item for a specified unit of size (i.e., pound, gallon, etc.) are published monthly for the U.S. average and for four regions—Northeast, Midwest, South, and West. The regional definitions are those of the Bureau of the Census.

Average prices for gasoline, utility (piped) gas, electricity, and fuel oil are published monthly for the U.S. average, 4 regions, 14 region/population size-class cross-classifications, and the 15 largest index areas. For utility (piped) gas, average prices per therm, per 40 therms, and per 100 therms are published. For electricity, average prices per kWh and per 500 kWh are published. For fuel oil and gasoline, the average price per gallon is published. Average prices for all types of gasoline, leaded regular, unleaded regular, and unleaded premium are published.

Price quotes for 40 therms and 100 therms of utility gas and for 500 kWh of electricity are collected in sample outlets for use in the average price programs only. Since they are for prespecified consumption amounts, they are not used in the CPI. All other price quotes used for average price estimation are regular CPI data.

With the exception of the 40 therms, 100 therms, and 500 kWh price quotes, all prices are converted to a price-per-normalized quantity. For example, prices for gallons, quarts, or pints of milk are converted to prices per ounce. All prices are then used to estimate a price for a defined fixed quantity. That is, a price per ounce of milk is estimated and multiplied by 64 to yield a price per half gallon, the published quantity.

The average price for collection period, t, is estimated as:

$$\bar{P}_t = \frac{\sum_i W_{it} \, P_{it} / P_{ia}}{\sum_i W_{it} / P_{ia}}$$

where W_{it} is the quote weight as defined in the estimation of price change modified to reflect the number of quotes (M′) usable for average price estimation for the ELI/PSU/replicate. (Imputed prices are used in estimating average prices.)

In the equation, W_{it} is an expenditure weight. Dividing the expenditure weight by the price, P_{ia}, for a given quote yields an implicit estimate of quantity. Thus, the average price is, conceptually, a weighted average of prices where the weights are quantity amounts.

Part III. Precision of Estimates

An important advantage of probability sampling methods is that a measure of the sampling error can be computed directly from the sample data. The CPI sample design accommodates error estimation by making two or more selections (replicates) of items and outlets within an index area. Therefore, two or more samples of quotes in each self-representing PSU and one in each non-self-representing PSU are available. Given this structure, which reflects all stages of the sample design, variance estimation techniques using replicated samples are employed.

Different methods of variance estimation were used for the CPI during the period 1978–86 than are used in the current CPI. The sampling of areas, outlets, and items for the CPI for both periods follows replicated sample designs. The 1982–84 CE Survey also employs a replicated sample design. However, the 1972–73 CE Survey, which provided the expenditure weights for the 1978–86 CPI, did not use a replicated sample design. To reflect the contribution to the variance from the CE during both time periods, separate methods of total variance estimation are employed. Both methods are described below.

1978–86 CPI Variance Estimation

The method used to estimate CPI variances depends upon the statistical independence of the estimated indexes for individual market baskets. The independence is violated somewhat by the fact that, for the 1978–86 time period, a replicate of ELI's was used in more than one PSU within a region. However, since the selection of specific items to be priced involved considerable subsampling of the ELI's within outlets, the local area indexes may be regarded as statistically independent for variance estimation. For each index area, two independent estimates of the index were constructed using the replicates specified in the design. This required calculation of price relatives by replicate for each item stratum for each time period, application of the replicate relatives to the previous-period replicate index for a particular item stratum, and aggregation across item strata to the index area replicate level.

Squared differences of these indexes (properly scaled) provide conditional estimates of the variance of the area index. These variance estimates are conditional on the values of the base expenditures estimated from the 1972–73 CE Survey. Unconditional estimates of index variances, including the expenditure weight component of error, are derived analytically. These area index variances are the building blocks upon which the variance of regional and national indexes are based. The variance estimates may be for the index for all items or for a subset of items.

Price relatives were computed for each item stratum for each index area of the CPI. Variance estimation required that price relatives also be computed for each item stratum for each index area and replicate. The methodology for computing the price relatives was the same for the full index area as for the replicates. All replicate computations were for the CPI-U population with sales and excise taxes included.

For commodities and services, each price quote was sampled independently by index area replicate. For the shelter survey, for each self-representing PSU, each rental unit was assigned to replicate A or replicate B. For non-self-representing index areas, the index PSU determined the replicate for a given rental unit.

For relative computation for rent and owners' equivalent rent, artificial replicate cost weights for each index area replicate were constructed to provide a basis for weighting the 1-month and 6-month relatives together. Let:

$r^{(i)}_{ht}$ denote the corresponding 1-month replicate (i) relative

$A^{(i)}_{ht}$ denote the i^{th} replicate cost weight for index area h at month t

$r^{(i)}_{ht-6}$ denote the corresponding 6-month replicate (i) relative

Then $A^{(i)}_{ht}$ is computed by:

$$A^{(i)}_{ht} = 0.65\, A^{(i)}_{ht-1}\, r^{(i)}_{ht} + 0.35\, A^{(i)}_{ht-6}\, r_{ht-6}$$

The final shelter relatives, $R^{(i)}_{ht}$, are computed by:

$$R^{(i)}_{ht} = A^{(i)}_{ht} / A^{(i)}_{ht-1}$$

The CPI before 1987 was computed by a chaining process in which an estimate of expenditure for the previous month in each item stratum was multiplied by the price relative to provide an estimate of the current month's expenditure for the item stratum. The item stratum expenditure values, called cost weights and denoted by C_{zt}, were then aggregated and compared to the total expenditure in the reference period. Thus, for a single item stratum index the sequence of computations would be:

$$C_{zt} = C_{zt-1}\, R_{zt,t-1}$$

and

$$I_{zt,0} = \frac{C_{zt}}{C_{z0}} \times 100.0$$

Replicate indexes for variance estimation were similarly constructed. A data base of replicate cost weights was created, maintained, and updated monthly with corresponding replicate relatives. Each replicate index was computed as the ratio of the updated replicate cost weight divided by the replicate cost weight in the reference period:

$$I^{(i)}_{zt,0} = \frac{C^{(i)}_{zt}}{C^{(i)}_{z0}} \times 100.0$$

Estimates of the variance of the index, conditional on the reference period cost weights, for all items or a subset of items at the national, regional, or area level, were calculated as follows:

Let the quantity $U_{ht,0}$ be a relative importance computed as a ratio as follows:

a. The numerator is the sum of the total cost weights over the item strata and pricing cycles being considered for index area h at time t;
b. The denominator is the summation of all base-period cost weights for the item strata and index areas being considered.

The corresponding quantities based on the replicate cost weights for each index area replicate (instead of the total cost weights) are denoted, respectively:

$$U^{(A)}_{ht,0} \quad \text{or} \quad U^{(B)}_{ht,0}$$

A variance formula for the index $I_{t,0}$ is the sum over all index areas, h, being considered:

$$\sigma^2(I_{t,0}) = \sum_h \frac{100^2}{2}\left[(U^{(A)}_{ht,0} - U_{ht,0})^2 + (U^{(B)}_{ht,0} - U_{ht,0})^2\right]$$

The price change for period t relative to a period m months earlier is denoted by:

$$I_{t,t-m} = I_{t,0} / I_{t-m,0}$$

In order to compute the estimate of the variance of $I_{t,t-m}$, the covariance of the numerator and denominator must be estimated. The estimated covariance of $I_{t,0}$ and $I_{t-m,0}$ is the sum over all index areas h being considered:

$$\text{Cov}(I_{t,0}, I_{t-m,0}) = \sum_h \frac{100^2}{2}\left[(U^{(A)}_{ht,0} - U_{ht,0})(U^{(A)}_{ht-m,0} - U_{ht-m,0}) + (U^{(B)}_{ht,0} - U_{ht,0})(U^{(B)}_{ht-m,0} - U_{ht-m,0})\right]$$

One variance estimator of $I_{t,t-m}$ is estimated by the Taylor series approximation:

$$\sigma^2(I_{t,t-m}) = \frac{1}{(I_{t-m,0})^2}\left[\sigma^2(I_{t,0}) + (I_{t,t-m})^2\,\sigma^2(I_{t-m,0}) - 2\,I_{t,t-m}\,\text{Cov}(I_{t,0}, I_{t-m,0})\right]$$

The foregoing discussion has treated two replicates. The method can be extended for those index areas with four and six replicates.

Unconditional estimates of the total variance of the index or of price change for all items or a subset of items at the national, regional, or area level are calculated as follows. Let the value, C_{iat}, be the cost weight at time t for item or item aggregate i, for area or area aggregate a. The index for time t can be denoted by:

$$I_{iat} = I_{iap} \times \frac{C_{iat}}{C_{iap}}$$

where p denotes the pivot month. The pivot month is the month for which a revised index series is linked to the corresponding unrevised index series. for the 1978–86 CPI, the pivot month can generally be assumed to be December 1977.

The price change from period t–m to t can be expressed as:

$$PC_{iat,t-m} = 100\left[(I_{iat} / I_{iat-m}) - 1\right]$$

Let Var C_{iat} and Var C_{iat-m} be the estimated variances of the cost weights at times t and t–m, respectively. Let Cov (C_{iat}, C_{iat-m}) be the estimated total covariance of the expenditure weights for t and t–m. The total variance of the index for period t is:

$$\text{Var}(I_{iat}) = \left[\frac{I_{iap}}{C_{iap}}\right]^2\left[\text{Var}(C_{iat}) + \left(\frac{C_{iat}}{C_{iap}}\right)^2 \text{Var}(C_{iap}) - 2\,\frac{C_{iat}}{C_{iap}}\,\text{Cov}(C_{iap}, C_{iat})\right]$$

The total variance of price change from period t–m to t is:

$$\text{Var}(PC_{iat,t-m}) = \left[\frac{100}{C_{iat-m}}\right]^2\left[\text{Var}(C_{iat}) + \left(\frac{C_{iat}}{C_{iat-m}}\right)^2 \text{Var}(C_{iat-m}) - 2\,\frac{C_{iat}}{C_{iat-m}}\,\text{Cov}(C_{iat}, C_{iat-m})\right]$$

In order to estimate the cost-weight variances and covariances in the above expressions, estimates of two more conditional covariances of the index must be given. The conditional covariance of the index between items j and j′ in item aggregate i, aggregate area a, and time t is estimated by:

$$\text{Cov}(I_{jat}, I_{j'at}) = 1/2\left[(I_{jaAt} - I_{jaft}) \cdot (I_{j'aAt} - I_{j'aft}) + (I_{jaBt} - I_{jaft}) \cdot (I_{j'aBt} - I_{j'aft})\right]$$

Here, I_{jaft} represents the full sample index for the item stratum, aggregate area, and time t and I_{jaAt} and I_{jaBt} represent the indexes for the corresponding replicates.

Similarly, the conditional mixed covariance of the index between times t and t–m, and item strata j and j′ in aggregate area a is estimated by:

$$\text{Cov}(I_{jat}, I_{j'at-m}) = 1/2\left[(I_{jaAt} - I_{jaft}) \cdot (I_{j'aAt-m} - I_{j'aft-m}) + (I_{jaBt} - I_{jaft}) \cdot (I_{j'aBt-m} - I_{j'aft-m})\right]$$

Given these index variance and covariance estimators, the cost-weight variances and covariances in the expressions for unconditional variance above can be estimated in the following way:

An estimate of the cost-weight variance for item aggregate i, area aggregate a, and time t is given by:

$$\text{Var } C_{iat} = (C_{iap} / I_{iap})^2 \cdot \text{Var } I_{iat}$$
$$+ \sum_{h \epsilon a} \sum_{j \epsilon i} (1/I_{jhp})^2 [(I_{jht})^2 - \text{Var } I_{jht}] \cdot \text{Var}_E C_{jhp}$$
$$+ \sum_{h \epsilon a} \sum_{j \epsilon i} \sum_{j' \neq j} (1/(I_{jhp} \cdot I_{j'hp}) [I_{jht} \cdot I_{j'ht} - \text{Cov } (I_{jht}, I_{j'ht})]$$
$$\cdot \text{Cov}_E (C_{jhp}, C_{j'hp})$$

where:

$\text{Var}_E C_{iap}$ is the variance of the cost-weight for item aggregate i, area aggregate a at pivot month p,

$\text{Cov}_E (C_{jhp}, C_{jhp})$ is the covariance between the cost-weights for item strata j and j′ in item aggregate i and index area h in pivot month p,

I_{iat} and I_{iap} are estimates of the index at times t and the pivot month p, respectively,

$\text{Var } I_{iat}$ is the conditional variance of the index at time t, and

$\text{Cov } (I_{jat}, I_{j'at})$ is the conditional covariance of the index between item strata j and j′ in item aggregate i, as previously defined above.

Summations indicated above are over all index areas in area aggregate a, and over item strata in item aggregate i.

Estimates of the components of the conditional variance of the index have been given above. The remaining quantities in the above expression are estimated as follows:

An estimate of the variance of the pivot month cost-weight, C_{jhp}, is given by:

$$\text{Var}_E C_{jhp} = (F_{jh})^2 \cdot \text{Var } C_{jh,\,72\text{-}73}$$

Here, F_{jh} is the factor used to update the base-period cost-weight to the pivot month p, and

$\text{Var}_E C_{jh,72\text{-}73}$ is the variance of the base-period cost-weight, which is estimated by:

$$\text{Var}_E C_{jh,72\text{-}73} = 1/2 [(C_{jh,A,72\text{-}73} - C_{jhf,72\text{-}73})^2 + (C_{jh,B,72\text{-}73} - C_{jhf,72\text{-}73})^2]$$

Here, $C_{jhf,72\text{-}73}$ denotes the full sample estimate of the cost-weight for the base-period 1972–1973, and $C_{jh,A,72\text{-}73}$ and $C_{jh,B,72\text{-}73}$ denote the corresponding replicate cost-weights.

An estimate of the pivot month cost-weight covariance between item strata j and j′ is computed in a similar manner:

$$\text{Cov}_E (C_{jhp}, C_{j'hp}) = F_{jh} \cdot F_{j'h} [\text{Cov}_E (C_{jh,72\text{-}73}, C_{j'h,72\text{-}73})]$$

where F_{jh} and $F_{j'h}$ are defined as above and the base-period covariance term is estimated by:

$$\text{Cov}_E (C_{jh,72\text{-}73}, C_{j'h,72\text{-}73}) =$$
$$1/2 [(C_{jh,A,72\text{-}73} - C_{jhf,72\text{-}73}) \cdot (C_{j'h,A,72\text{-}73} - C_{j'hf,72\text{-}73})$$
$$+ (C_{jh,B,72\text{-}73} - C_{jhf,72\text{-}73}) \cdot (C_{j'h,B,72\text{-}73} - C_{j'hf,72\text{-}73})]$$

An estimate of the covariance of the cost-weights between times t and t–m is given by:

$$\text{Cov } (C_{iat}, C_{iat-m}) = (C_{iap} / I_{iap})^2 \cdot \text{Cov } (I_{iat}, I_{iat-m})$$
$$+ \sum_{h \epsilon a} \sum_{j \epsilon i} (1/I_{ihp})^2 [(I_{jht} \cdot I_{jht-m} - \text{Cov } (I_{jht}, I_{jht-m})] \cdot \text{Var}_E C_{jhp}$$
$$+ \sum_{h \epsilon a} \sum_{j \epsilon i} \sum_{j' \neq j} (1/(I_{jhp} \cdot I_{j'hp}) [I_{jht} \cdot I_{j'ht-m} - \text{Cov } (I_{jht}, I_{j'ht-m})]$$
$$\cdot \text{Cov}_E (C_{jhp}, C_{j'hp})$$

Estimating Variances of the Index and of Price Change, Starting in 1987

Variance estimates for the index and price change are being computed by different methods starting in 1987. The most important difference between these estimators and those previously described is that they directly incorporate the contribution to the variance from the expenditure weights (the aggregation weights) in the computation of the unconditional variance of the index or price change. Variance estimators previously described measured the conditional variance of the index or price change given the expenditure weights, and then measured the unconditional variance using a two-step estimation process involving first estimating the unconditional variances of the expenditure weights, and then incorporating the variance of the expenditure weights into a final estimate of the unconditional variance of the index or price change.

As in the past, all computations will be based on the CPI-U population with sales and excise taxes included. Expenditure weights used in computation of the index are derived from the 1982–84 Consumer Expenditure Survey.

The variance estimators given here depend on the aggregation structure of the index which supports the construction of indexes for higher levels of aggregation such as item groups, regions, and the Nation from those for basic item strata and index areas. The estimators also depend on the replicate structure of the index sample. Use of replicates provides a means of measuring the overall variation of the index from those computed over subsets of the sample. The full sample for each index area comprises two or more replicate panels, of which half are designated "odd" and half, "even."

Variance estimates for the index

To estimate the unconditional variance of an index, consider the index for a particular item aggregate I, geographic area aggregate M, for month t expressed as:

$$IX(I,M,t) = IX(I,M,p) \cdot WI(I,M,t) / WI(I,M,p)$$

Here, p denotes the pivot month (December 1986). The pivot index, IX(I,M,p), which in many cases will be 100, acts as a normalization constant. The weighted index or cost weight, WI(I,M,t) is the sum over all index areas in

the aggregate area M of the product of individual index area aggregation weights multiplied by the corresponding index. For example, for the full sample for month t and index area m, the weighted index for item aggregate I is given by:

$$WI(I,m,f,t) = AW(I,m,f) \cdot IX(I,m,f,t)$$

where AW(I,m,f) and IX(I,m,f,t) are respectively the full sample aggregation weight and month t index for the item aggregate and index area. Similarly, for any sample replicate r, for month t, and index area m, the weighted index for item aggregate I is given by:

$$WI(I,m,r,t) = AW(I,m,r) \cdot IX(I,m,r,t)$$

where AW(I,m,r) and IX(I,m,r,t) are respectively the corresponding aggregation weight and index for replicate r. Separate aggregation weights and indexes are computed and maintained for each sample replicate.

If the variances of WI(I,M,t) and WI(I,M,p) and their covariances are known, then the variance of IX(I,M,t) can be estimated by a Taylor series linear approximation. Components of these variances can be estimated in the following way:

Consider the weighted index $WI(I,M,t) = \sum_{m \epsilon M} WI(I,m,t)$

where WI(I,m,t) is the weighted index for index area m in aggregate area M.

Then:

$$Var(WI(I,M,t)) = \sigma^2_{WI}(I,M,t)$$

$$= \sum_{m \epsilon M} \sigma^2_{WI}(I,m,t) + \sum_{m \epsilon M} \sum_{m' \neq m} Cov_A(I,m',m,t)$$

where $\sigma^2_{WI}(I,m\ t)$ is the variance of the index area level weighted index and $Cov_A(I,m',m,t)$ is the between-index-area covariance for the index month t.

The variance of the index area level weighted index is estimated by:

$$\sigma^2_{WI}(I,m,t) = 1/2\ [(WI(I,m,odd,t) - WI(I,m,f,t))^2 + (WI(I,m,even,t) - WI(I,m,f,t))^2]$$

Here, WI(I,m,odd,t) and WI(I,m,even,t) are weighted indexes for odd and even replicates, respectively, defined by:

$$WI(I,m,odd,t) = 2/NR(m) \sum_{r\ odd} AW(I,m,r,t) \cdot IX(I,m,r,t),$$

and

$$WI(I,m,even,t) = 2/NR(m) \sum_{r\ even} AW(I,m,r,t) \cdot IX(I,m,r,t)$$

and NR(m) denotes the total number of replicates for index area m.

Each index area is in 1 of 4 Census regions. Each region can further be divided into two major areas, one composed of the self-representing (A) index areas and one composed of the non-self-representing (non-A) index areas. Hence there are eight major areas in the Nation. For aggregate areas larger than one index area, estimates of between-index-area covariances for each ordered pair m and m′ of different index areas in the same major area are given by:

$$Cov_A(I,m',m,t) = 1/2\ \{ [(WI(I,m',odd,t) - WI(I,m',f,t)) \cdot (WI(I,m,odd,t) - WI(I,m,f,t)) + (WI(I,m',even,t) - WI(I,m',f,t)) \cdot (WI(I,m,even,t) - WI(I,m,f,t))]\}$$

Between-index-area covariances for the pivot month p are computed similarly.

The estimator of the covariance between WI(I,M,t) and WI(I,M,p) has two components. The first comprises the sum across all index areas in the aggregate area of the within-index-area time covariance between the weighted indexes for month t and month p:

$$Cov_T(I,M,p,t) = \sum_{m \epsilon M} Cov_T(I,m,p,t) =$$

$$\sum_{m \epsilon M} 1/2\ \{[(WI(I,m,odd,p) - WI(I,m,f,p)) \cdot (WI(I,m,odd,t) - WI(I,m,f,t))] + [(WI(I,m,even,p) - WI(I,m,f,p)) \cdot (WI(I,m,even,t) - WI(I,m,f,t))]\}.$$

The second component comprises the sum across pairs of index areas m and m′ in the aggregate area of the mixed covariances between the weighted index for index area m′, in pivot month p, and that for index area m, in month t. It is given by:

$$Cov_M(I,M,p,t) = \sum_{m \epsilon M} \sum_{m' \neq m} Cov_M(I,m',m,p,t) =$$

$$\sum_{m \epsilon M} \sum_{m' \neq m} 1/2\ \{[(WI(I,m',odd,p) - WI(I,m',f,p)) \cdot (WI(I,m,odd,t) - WI(I,m,f,t))] + [(WI(I,m',even,p) - WI(I,m',f,p)) \cdot (WI(I,m,even,t) - WI(I,m,f,t))]\}$$

Hence, the covariance between WI(I,M,t) and WI(I,M,p) is given by:

$$Cov_{WI}(I,M,p,t) = Cov_T(I,M,p,t) + Cov_M(I,M,p,t)$$

An estimate of the unconditional variance of IX(I,M,t) is then:

$$\sigma^2_{IX}(I,M,t) = IX(I,M,p)^2 \cdot [1/WI(I,M,p)]^2 \cdot [\sigma^2_{WI}(I,M,t) + (WI(I,M,t)/WI(I,M,p))^2 \cdot \sigma^2_{WI}(I,M,p) - 2\ (WI(I,M,t)/WI(I,M,p)) \cdot Cov_{WI}(I,M,p,t)]$$

The formula for the estimated bias of the index is:

$$Bias_{IX}(I,M,t) = IX(I,M,p) \cdot \{WI(I,M,t) \cdot \sigma^2_{WI}(I,M,p) / (WI(I,M,p))^3 - Cov_{WI}(I,M,p,t) / (WI(I,M,P))^2\}$$

The mean squared error of the index is then estimated by:

$$MSE_{IX}(I,M,t) = \sigma^2_{IX}(I,M,t) + (Bias_{IX}(I,M,t))^2$$

Variance estimates for price change

The estimated price change, PC(I,M,t′t), from month t′ to month t for item aggregate I and area aggregate M is computed by:

$$PC(I,M,t',t) = (100 \cdot WI(I,M,t) / WI(I,M,t')) - 100$$

Thus, price change is also a simple function of the ratio of weighted indexes for two time periods. The formula for the estimated variance of price change is given by:

$$\sigma^2_{PC}(I,M,t',t) = (100/WI(I,M,t'))^2 \cdot [\sigma^2_{WI}(I,M,t) + (WI(I,M,t) / WI(I,M,t'))^2 \cdot \sigma^2_{WI}(I,M,t') - 2 \cdot (WI(I,M,t) / WI(I,M,t')) \cdot Cov_{WI}(I,M,t',t)]$$

The formula for the estimated bias of price change is:

$$Bias_{PC}(I,M,t',t) = 100 \cdot \{WI(I,M,t) \cdot \sigma^2_{WI}(I,M,t') / (WI(I,M,t'))^3 - Cov_{WI}(I,M,t',t) / (WI(I,M,t'))^2\}$$

The mean squared error of price change is then estimated by:

$$MSE_{PC}(I,M,t',t) = \sigma^2_{PC}(I,M,t',t) + (Bias_{PC}(I,M,t',t))^2$$

Nonsampling Error

CPI estimates are subject to nonsampling error as well as sampling error. Surveys involve many operations that must be performed in order to produce the final results. All of these are potential sources of nonsampling error. The errors arise from the survey process regardless of whether the data are collected from the entire universe or from a sample of the population. The most general categories of nonsampling error are coverage error, nonresponse error, response error, processing error, and estimation error.

Coverage error in an estimate results from the omission of part of the target population (undercoverage) or the inclusion of units from outside of the target population (overcoverage). Coverage errors would result from the omission of cities, households, outlets, and items that are part of the target populations from the relevant sampling frames or the double counting or inclusion in the frames of such sample units when they should not be. A potential source of coverage error is the timelag between the Point of-Purchase Survey and the initiation of price collection for commodities and services at resampled outlets. Because of the timelag, the products offered by the outlet at the time pricing is initiated may not exactly coincide with the set from which the POPS respondents were purchasing.

Nonresponse error results when data are not collected for some sampled units because of the failure to interview households or outlets. This can occur when selected households and outlets cannot be contacted or refuse to participate in the survey. Nonresponse rates at initiation for the CPI commodities and services and housing surveys are shown in tables 2 and 5. This nonresponse could bias the CPI if the rate of price change at the lost survey units differed from the rate of price change at the survey units successfully initiated. Nonresponse rates during monthly pricing for the CPI commodities and services and housing surveys are shown in tables 3 and 6.

Response error results from the collection and use in estimation of incorrect, inconsistent, or incomplete data. Response error may arise because of the collection of data from inappropriate respondents, respondent memory or recall errors, deliberate distortion of responses, interviewer effects, misrecording of responses, pricing of wrong items, misunderstanding or misapplication of data collection procedures, or misunderstanding of the survey needs and/or lack of cooperation from respondents. BLS is currently developing a reinterview methodology for investigation of various kinds of response variance in the CPI. Response variance can be measured through a reinterview conducted under conditions identical to those of the original interview. Work in the area of response biases has not yet been developed for the CPI. The pricing methodology in the commodities and services component of the CPI allows the previous period's price to be available at the time of collection. This dependent-pricing methodology is believed to reduce response variance for measuring change, but may cause response bias and lag.

Processing error arises from incorrect editing, coding, and data transfer. Survey data are converted into machine-readable form by two independent key entry operators, and discrepancies are resolved by a third person. Processing errors can be introduced by an incorrect resolution or by an identical miskeying of an element by two operators. Errors can also result from software problems in the computer processing which cause correctly keyed data to be lost. Computer screening and professional review of the data provide checks on processing accuracy. Occasional studies of these processing errors in the CPI have shown them to be extremely small.

Estimation error results when the survey process does not accurately measure what is intended. Such errors may be conceptual or procedural in nature, arising from a misunderstanding of the underlying survey measurement concepts or a misapplication of rules and procedures. A source of estimation error due to conceptual problems was the treatment of housing before 1983, which failed to distinguish between the consumption and investment aspects of homeownership. Prior to implementation of the change to the owners' equivalent rent, an experimental

measure using rental equivalence diverged considerably from the official CPI.[24]

Substitutions and adjustments for quality change in the items priced for the CPI are possible sources of estimation error due to procedural difficulties. Ideally, CPI data collection forms and procedures would yield all information necessary to determine or explain price and quality differences for all items defined within an ELI. Since such perfect information is not available, BLS economists supplement directly collected data with secondary data. Estimation error will result if the BLS adjustment process, which necessarily has a significant judgment component and may have key data unavailable, is misapplied, or if it consistently overestimates or underestimates quality change for particular kinds of items. While individual problems arising from substitution in estimating quality change have been identified, the evidence to date is that on average there is no systematic bias from this process. Cases where price change is overestimated are about as frequent as those where it is underestimated.

An example of potential estimation error, which is similar to the issue of quality change in commodities and services, is the effect of the aging of housing units. Until 1988, BLS did not adjust for the slow depreciation of houses and apartments over time. Current BLS research indicates that annual changes for the residential rent and owners' equivalent rent indexes would have been 0.2 to 0.3 percent larger if some type of aging adjustment had been included.

The total effect of nonsampling error on the accuracy of CPI estimates varies depending on the type of data collected, the methods of collection, the data processing routines, and the nature and complexity of the estimation processes. The cumulative effect of nonsampling error can be much greater than the effect of sampling error. A long-term goal of BLS is the publication of a full error profile for the CPI.

Response rates: Commodities and services

Response rates at initiation of commodities and services components were calculated as follows: Approximately one-fifth of the PSU's are initiated each year. The sample initiated in 1986 is presented here. Although it is somewhat atypical in size-class distribution because the areas are primarily non-self-representing, the magnitude of response is similar to previous years' results.

Approximately 70 percent of the data is collected for pricing by personal visit and the remainder is collected by telephone.

[24] See Robert Gillingham and Walter Lane, "Changing the Treatment of Shelter Costs for Homeowners in the Consumer Price Index," *Statistical Reporter*, December 1981.

Table 2. Response rates at initiation for CPI commodities and services in the outlet survey, 1986

Type of interview	Number of outlets	Number of quotes
Total designated outlets or quotes	6,563	27,512
Total outlets or quotes interviewed	5,823	24,118
At least one quote obtained	5,329	22,428
Unable to price during pricing period	274	1,131
Refusal	138	500
Out of season	19	59
Total outlets or quotes not interviewed	740	1,352
No items available for ELI pricing	352	770
Out of business	124	542
Out of scope	36	115
Unable to locate	136	342
Outside pricing area	83	248
Outlet moved	9	25
Percent of interviewed outlets or quotes responding	92.6	93.0
Percent noninterview of total	11.3	12.3

Response rates at pricing of commodities and services were calculated from data shown in table 3.

Table 3. Number of outlets and quotes for pricing for CPI commodities and services by outlet response classification

Response classification	Outlets		Quotes	
	April 1987	May 1987	April 1987	May 1987
Total			98,126	100,240
Total outlets or quotes sent to the field	23,104	23,159	96,111	97,652
Reporting one quote available	21,998	21,970	92,810	93,859
Temporarily unavailable	841	822	2,889	3,298
Outlet refusal	15	23	23	48
Quotes not available	69	57	140	107
Outlet out of season	24	36	47	65
Outlet out of business	49	56	151	194
Unable to locate outlets	13	11	18	23
Out of area	8	16	44	19
Moved	5	2	7	3
Out of scope	5	6	7	11
Total out of scope	226	308	202	275
Quotes not sent to field			2,014	2,588

For outlets reporting in April or May 1987, not all quotes received are eligible for estimation. Of the 92,810 and 93,859 quotes returned with a price, 87,822 and 89,342 quotes are of the same version and are likely to be used in index estimation. Quotes requiring initiation, reinitiation, and deletion are not used in the index, and quotes involving some form of substitution may be used in estimation. Of the 92,810 and 93,859 quotes priced, 11,582 and 12,746 quotes are deemed not comparable and not used in index estimation. Thus the number of quotes used in index estimation, 81,227 and 81,113, respectively, account for 84.5 percent and 83.1 percent of the quotes sent to the field.

Table 4. Number of quotes for commodities and services pricing by quote response classification

Response classification	April 1987	May 1987
Number of outlets reporting one quote available	21,998	21,970
Number of quotes returned with price	92,810	93,859
Quotes reporting:		
Same version	87,822	89,342
Reinitiation	28	25
Deletion of quote from outlet	173	145
Change in version (substitution):		
Without overlap	2,129	1,968
With overlap	472	358
Data collected:		
For previous period	20	40
For previous and current period	47	11
Initiation	2,119	1,970

Response rates: Housing

From the beginning of the survey through the collection period ended June 30, 1987, BLS obtained the following results in listing, screening, and initiation of units. Approximately 485,000 units were listed in 10,000 segments, of which 264,300 units were chosen to be screened. This was approximately 18,000 screenings above the 246,000 projected from the 1980 census data. However, the extra units were expected because of the inability to distinguish post-1980 housing during listing. These numbers can be seen in table 5.

After each panel had passed through two initiation periods, 88.5 percent of the screening had been completed. As of October 1987, the sample contained 18,041 owners and 29,933 renters. The forecast final sample size of units built before 1980 was about 20,800 owners and 35,400 renters. (See table 5.)

For the period January through June 1987, the 40,133 units which had passed screening were sent for repricing collection. Of these, BLS contacted and obtained potentially usable responses from 34,005 (84.7 percent); 4,009 (10.0 percent) could not be contacted; and 446 (1.1 percent) were either temporarily or permanently out of the scope of the survey.

Of the 34,005 units which provided information, 1,431 (4.2 percent) were not used in estimation because they were deemed not comparable. The mode of collection used in pricing the housing survey units is a combination of telephone and personal visit; 53.2 percent were collected by telephone, 44.7 percent were collected by personal visit, and 2.1 percent did not report the collection mode.

Table 5. Initiation results after two screening attempts, January-June 1987

Item	Total initiation results	
Expected	246,000	
Actual	264,300	
Remaining	30,400	
Percent complete	88.5	
	Initiation results for owners and renters	
	Owners	Renters
Expected	20,366	39,200
Forecast	20,842	35,442
Current	18,040	29,933

Table 6. Pricing results for January-June 1987

Item	Number	Percent
Total contacted	35,678	88.9
Information obtained	34,005	84.7
Could not provide information	833	2.1
Refusal	840	2.1
Total not contacted	4,455	11.1
Not contacted	4009	10.0
Out of scope	449	1.1
Total number of units	40,133	100

The following table provides a distribution of all contacted units by their usability in estimation by the mode of collection. Some units were contacted at the place of residence. For renter units, about one-third of the responses were obtained from the managers of the apartments.

Table 7. Usability of information for contacted units by type of contact

Type of contact	Total	Personal visit	Telephone	Not reported
Total	35,678	15,948	18,982	748
Occupied usable	30,359	13,093	16,843	423
Vacant usable	2,215	1,536	519	160
Occupied unusable	1,431	542	810	79
Refusal	840	416	379	45
Could not provide information	833	361	431	41

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CPI Appendix 1. Chronology of changes in the Consumer Price Index, 1890 to date

Date	Survey providing expenditure weight		Base period	Census providing population weights	Number of areas included	Family composition	Earnings of chief earner	Source and amount of family income	Length of employment	Economic level, length of residence, nativity, and race	Title(s)
	Group weights	Item weights									
1890[1] ...	None	1901	Varied	None	Varied	Two or more persons.	Salaried worker earning $1,200 or less during year. No limitation on wage earners.	No limitation.	No limitation.	No limitation.	
1919	1917–19	1917–19	1913								
Feb. 1921					[2]32	Minimum of husband, wife, and 1 child who was not a boarder or lodger. No boarders nor more than 3 lodgers present.	Salaried worker earning $2,000 or less. No limitation on wage earners.	At least 75 percent from principal earner or others who contributed all earnings to family fund.		No slum or charity families; white only; in area entire year and in the United States 5 years or more; no non-English speaking families.	Cost of living.
Sept. ... 1935				[3]Average 1920–30							
Dec. .... 1935[4]			1923–25								
Aug. .... 1940[5]	1934–36	[6]1934–36	1935–39	1930	[7]33	Two or more persons. Not more than 2 boarders or lodgers, or guests for more than 26 guest-weeks.	At least $300. Salaried worker earning less than $2,000 during year or less than $200 during any month. No upper limitation on wage earners.	At least $500. Less than one-fourth from interest, dividends, royalties, speculative gains, rents, gifts, or income in kind. No rent in payment of services. Less than 3 months' free rent. No subsidiary clerical worker earning $2,000 or over.	At least 1,008 hours spread over 36 weeks.	No relief families, either on direct or work relief; white only, except where black population was significant part of total; in area 9 months or more.	Indexes of the cost of living of wage earners and lower-salaried workers in large cities.
May .... 1941[8]					34						
July 1943				[9]1940							
Sept. ... 1945											Consumer's Price Index for Moderate Income Families in Large Cities.
Jan. .... 1951[10]	1947–49	[11]1934–36		1950		Two or more persons.	No limitation. (Family income not in excess of $10,000.)	Family income under $10,000 after taxes in the survey year. No minimum income limit, except that families with no income from wages or salaries were excluded.	Family head must have been employed at least 26 weeks.	No exclusion for receipt of relief as such, but only families with wage or salary earnings included. No length of residence, nativity, or racial limitations.	

See footnotes at end of table.

CPI Appendix 1. Chronology of changes in the Consumer Price Index, 1890 to date—Continued

Date	Survey providing expenditure weight		Base period	Census providing population weights	Number of areas included	Family composition	Earnings of chief earner	Source and amount of family income	Length of employment	Economic level, length of residence, nativity, and race	Title(s)
	Group weights	Item weights									
Jan. 1953[12]	[13]1950	[13]1950	[14]1947–49		46				No specific requirement, but major portion of income of family head must be from employment as wage earner or salaried clerical worker.	Short title. Consumer Price Index Complete name: Index of Change in Prices of Goods and Services Purchased by City Wage-Earner and Clerical-Worker Families to Maintain Their Level of Living.	
Jan. 1962			[15]1957–59								
Jan. 1964[16]	[17]1960–61	[17]1960–61		1960	50	Families of 2 or more persons and single workers; at least 1 full-time wage earner.	No limitation.	More than half of combined family income from wage-earner or clerical-worker occupation.	A minimum of 37 weeks for at least 1 family member.	No restriction on other than the wage-earner and clerical-worker definition.	Consumer Price Index for Urban Wage Earners and Clerical Workers.
Jan. 1966[18]					56						
Jan. 1971[19]			1967								
Jan. 1978[20]	[21]1972–73	[21]1972–73		1970	85	Same as above for earner and clerical-worker index. No limitation for urban consumer index.		Same as above for wage-earner and clerical-worker index. No limitation for urban-consumer index.	Same as above for wage-earner and clerical-worker index. No employment required for urban-consumer index.	Same as above for wage-earner and clerical-worker index. No limitation for urban-consumer index.[22]	1) Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). 2) Consumer Price Index for All Urban Consumers (CPI-U).
Jan. 1987[23]	[24]1982–84	[24]1982–84		1980	91	Similar to above except that students residing in college-regulated housing are treated as separate family units.					
Jan. 1988			[25]1982–84								

[1] Food price index only

[2] For 19 cities, data were available back to December 1914 and for 13 cities, back to 1917. For the United States, data were available back to the 1913 annual average.

[3] Indexes between 1918–29 were recomputed retroactively with population weights based on the average of the 1920 and 1930 censuses.

[4] Index published in December 1935 for July 15, 1935; indexes were also calculated on the 1913=100 base.

[5] Indexes between 1925–29 were recomputed retroactively with group weights based on the average of 1917–19 and 1934–36, indexes between March 15, 1930, and March 15, 1940, were recomputed retroactively using 1934–36 group weights.

[6] During World War II, weights were adjusted to account for rationing and shortages.

[7] 51–56 cities included in the food index.

[8] Index published in May 1941 for March 14, 1941. Food indexes were based on 51 cities.

[9] 1940 census data were supplemented by ration book registration data.

[10] Index published in March 1951 for January 1951.

[11] Indexes between January 1950 and January 1951 were revised retroactively for all items and group indexes. Indexes for rent and all items were corrected for the new unit bias from 1940. Old series also published through 1952.

[12] Item weights were revised for only the 7 cities for which 1947–49 expenditure data were available. Index published in February for January 1953. Linked to old series as of December 1952. Old series also published for a 6-month overlap period.

[13] Data were adjusted to 1952 for weight derivation.

[14] Indexes were also calculated on the base of 1935–39=100 through December 1957.

[15] Index published in February for January 1962. Indexes were also calculated on bases of 1947–49=100 and 1939=100.

[16] Index published March 3 for January 1964. Linked to old series as of December 1963. Old series also published for a 6-month overlap period.

[17] Data were adjusted to December 1963 for weight derivation.

[18] Index published in February for January 1966. Linked to old series as of December 1965.

[19] Index published in February for January 1971. Indexes were also calculated on the 1957–59=100 base.

[20] Index published in February for January 1978. Linked to old series as of December 1977. Old series also published for a 6-month overlap period.

[21] Data were adjusted to December 1977 for weight deriviation.

[22] Coverage was expanded to include wage earners and clerical workers in the entire nonfarm parts of the metropolitan areas in addition to those living within the urbanized areas of the metropolitan areas and urban places of 2,500 or more inhabitants.

[23] Index published in February for January 1987, linked to old series as of December 1986. Old series also published for a 6-month overlap period.

[24] Data were adjusted to December 1986 for weight derivation.

[25] Index published in February for January 1988. Indexes also calculated on the 1967=100 base.

CPI Appendix 2. Relative importance of all components in the Consumer Price Indexes: U.S. city average, December 1986

(Percent of all items)

Item and group	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)
All items	100.000	100.000
Food and beverages	17.758	19.652
Food	16.190	17.972
Food at home	9.952	11.263
Cereals and bakery products	1.354	1.539
Cereal and cereal products	.428	.494
Flour and prepared flour mixes	.076	.090
Cereal	.251	.287
Rice, pasta, and cornmeal	.101	.117
Bakery products	.926	1.045
White bread	.221	.272
Fresh other bread, biscuits, rolls, and muffins	.206	.215
Cookies, fresh cakes, and cupcakes	.235	.278
Other bakery products	.265	.282
Meats, poultry, fish, and eggs	3.135	3.668
Meats, poultry, and fish	2.948	3.448
Meats	2.085	2.504
Beef and veal	1.011	1.210
Ground beef other than canned	.373	.463
Chuck roast	.085	.098
Round roast	.053	.059
Round steak	.086	.112
Sirloin steak	.078	.097
Other beef and veal	.335	.380
Pork	.654	.796
Bacon	.116	.137
Chops	.155	.192
Ham	.158	.192
Other pork, including sausage	.226	.274
Other meats	.420	.498
Poultry	.490	.546
Fresh whole chicken	.164	.194
Fresh and frozen chicken parts	.235	.256
Other poultry	.091	.096
Fish and seafood	.373	.398
Canned fish and seafood	.081	.089
Fresh and frozen fish and seafood	.292	.309
Eggs	.187	.220
Dairy products	1.261	1.394
Fresh milk and cream	.625	.729
Fresh whole milk	.365	.452
Other fresh milk and cream	.260	.277
Processed dairy products	.636	.665
Cheese	.348	.359
Ice cream and related products	.166	.179
Other dairy products, including butter	.122	.127
Fruits and vegetables	1.654	1.748
Fresh fruits and vegetables	1.017	1.070
Fresh fruits	.516	.538
Apples	.102	.111
Bananas	.059	.063
Oranges, including tangerines	.072	.087
Other fresh fruits	.283	.278
Fresh vegetables	.501	.532
Potatoes	.087	.097
Lettuce	.059	.063
Tomatoes	0.084	0.097
Other fresh vegetables	.272	.275
Processed fruits and vegetables	.637	.678
Processed fruits	.365	.367
Frozen juices and frozen fruit	.283	.289
Canned and dried fruits	.082	.078
Processed vegetables	.273	.311
Frozen vegetables	.093	.102
Other processed vegetables	.179	.209
Other food at home	2.548	2.913
Sugar and sweets	.358	.402
Sugar and artificial sweeteners	.094	.116
Sweets, including candy	.265	.286
Fats and oils	.265	.303
Nonalcoholic beverages	.889	1.026
Carbonated drinks	.445	.546
Coffee	.290	.306
Other noncarbonated drinks	.153	.174
Other prepared food	1.035	1.182
Canned and packaged soup	.083	.091
Frozen prepared food	.186	.206
Snacks	.216	.245
Seasonings, condiments, and spices	.269	.304
Miscellaneous prepared food, including baby food	.281	.336
Food away from home	6.238	6.709
Lunch	2.188	2.478
Dinner	2.683	2.763
Other meals and snacks	1.044	1.236
Unpriced items	.323	.232
Alcoholic beverages	1.568	1.680
Alcoholic beverages at home	.870	.953
Beer and ale	.448	.560
Distilled spirits	.228	.216
Wine at home	.194	.176
Alcoholic beverages away from home	.698	.727
Housing	42.791	40.318
Shelter	27.691	25.433
Renters' costs	7.957	8.174
Rent, residential	6.058	6.922
Other renters' costs	1.899	1.253
Lodging while out of town	1.670	1.101
Lodging while at school	.193	.122
Tenants' insurance	.036	.030
Homeowners' costs	19.512	17.049
Owners' equivalent rent	19.100	16.700
Household insurance	.412	.348
Maintenance and repairs	.222	.210
Maintenance and repair services	.133	.112
Maintenance and repair commodities	.089	.099
Materials, supplies, and equipment for home repairs	.040	.044
Other maintenance and repair commodities	.049	.055
Fuels and other utilities	7.908	8.123
Fuels	4.456	4.563
Fuel oil and other household fuel commodities	.394	.360
Fuel oil	.265	.227
Other household fuel commodities	.128	.133

See footnotes at end of table.

CPI Appendix 2. Relative importance of all components in the Consumer Price Indexes: U.S. city average, December 1986—Continued

(Percent of all items)

Item and group	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)
Gas (piped) and electricity	4.062	4.202
Electricity	2.742	2.811
Utility (piped) gas	1.320	1.391
Other utilities and public services	3.452	3.560
Telephone services	2.210	2.230
Local charges	1.335	1.353
Interstate toll calls	.500	.497
Intrastate toll calls	.374	.379
Water and sewerage maintenance	.661	.688
Cable television	.424	.487
Refuse collection	.157	.156
Household furnishings and operation	7.193	6.762
Housefurnishings	4.432	4.344
Textile housefurnishings	.425	.397
Furniture and bedding	1.301	1.270
Bedroom furniture	.427	.472
Sofas	.258	.253
Living room chairs and tables	.210	.201
Other furniture	.405	.345
Appliances, including electronic equipment	1.310	1.361
Television and sound equipment	.720	.785
Television	.254	.289
Other video equipment	.177	.182
Sound equipment	.290	.314
Unpriced items	.000	.000
Major household appliances	.393	.430
Refrigerators and home freezers	.114	.124
Laundry equipment	.123	.142
Stoves, ovens, dishwashers, and air-conditioners	.157	.165
Information processing equipment	.196	.146
Other housefurnishings	1.396	1.316
Floor and window coverings, infants', laundry, cleaning, and outdoor equipment	.193	.161
Clocks, lamps, and decor items	.266	.216
Tableware, serving pieces, and nonelectric kitchenware	.240	.214
Lawn equipment, power tools, and other hardware	.238	.289
Sewing, floor cleaning, small kitchen, and portable heating appliances	.186	.195
Indoor plants and fresh cut flowers	.174	.152
Unpriced items	.099	.089
Housekeeping supplies	1.212	1.244
Laundry and cleaning products, including soap	.422	.485
Household paper products and stationery supplies	.395	.389
Other household, lawn, and garden supplies	.396	.370
Housekeeping services	1.549	1.174
Postage	.255	.247
Appliance and furniture repair	.188	.147
Gardening and other household services	.394	.225
Babysitting	.270	.347
Domestic services	.266	.076
Care of invalids, elderly, and convalescents	.056	.038
Unpriced items	.121	.094
Apparel and upkeep	6.309	6.333
Apparel commodities	5.743	5.805
Apparel commodities less footwear	4.898	4.875
Men's and boys'	1.543	1.540
Men's	1.243	1.170
Suits, sport coats, coats, and jackets	.362	.278
Furnishings and special clothing	.306	.291
Shirts	.310	.308
Dungarees, jeans, and trousers	.249	.271
Unpriced items	.017	.021
Boys'	.300	.370
Women's and girls'	2.600	2.550
Women's	2.219	2.113
Coats and jackets	.207	.170
Dresses	.370	.369
Separates and sportswear	1.071	1.056
Underwear, nightwear, hosiery, and accessories	.374	.376
Suits	.164	.112
Unpriced items	.033	.030
Girls'	.381	.438
Infants' and toddlers'	.236	.303
Other apparel commodities	.520	.482
Sewing materials, notions, and luggage	.098	.087
Watches and jewelry	.421	.395
Watches	.093	.088
Jewelry	.328	.307
Footwear	.845	.929
Men's	.270	.315
Boys' and girls'	.173	.223
Women's	.402	.391
Apparel services	.565	.528
Laundry and dry cleaning other than coin operated	.294	.225
Other apparel services	.271	.303
Transportation	17.172	19.018
Private	15.684	17.874
New vehicles	5.591	5.434
New cars	4.537	4.035
New trucks	.971	1.250
New motorcycles	.083	.149
Used cars	1.259	2.253
Motor fuel	2.897	3.552
Automobile maintenance and repair	1.543	1.611
Body work	.158	.163
Automobile drive train, brake, miscellaneous mechanical repair	.442	.480
Maintenance and servicing	.520	.497
Power plant repair	.399	.449
Unpriced items	.023	.021
Other private transportation	4.396	5.026
Other private transportation commodities	.769	.972
Motor oil, coolant, and other products	.066	.085
Automobile parts and equipment	.703	.888
Tires	.347	.412
Other parts and equipment	.356	.475
Other private transportation services	3.627	4.053
Automobile insurance	2.135	2.413
Automobile finance charges	.775	.969
Automobile fees	.716	.671

See footnotes at end of table.

CPI Appendix 2. Relative importance of all components in the Consumer Price Indexes: U.S. city average, December 1986—Continued

(Percent of all items)

Item and group	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)
Automobile registration, licensing, and inspection fees	0.337	0.367
Other automobile-related fees	.354	.288
Unpriced items	.025	.017
Public transportation	1.488	1.144
Airline fares	.948	.595
Other intercity transportation	.163	.112
Intracity public transportation	.365	.427
Unpriced items	.012	.010
Medical care	5.749	4.868
Medical care commodities	1.086	.893
Prescription drugs[1]	.702	.561
Nonprescription drugs and medical supplies	.384	.332
Internal and respiratory over-the-counter drugs	.248	.249
Nonprescription medical equipment and supplies	.136	.083
Medical care services	4.663	3.975
Professional medical services	2.926	2.476
Physicians' services[2]	1.554	1.319
Dental services[3]	.866	.773
Eye care[4]	.343	.286
Services by other medical professionals[5]	.164	.099
Hospital and related services	1.516	1.335
Hospital rooms[6]	.608	.580
Other inpatient hospital services[7]	.567	.487
Outpatient services[8]	.337	.265
Unpriced items	.004	.003
Health insurance[9]	.221	.163
Entertainment	4.385	4.067
Entertainment commodities	2.116	2.210
Reading materials	.692	.603
Newspapers	.330	.304
Magazines, periodicals, and books	.362	.299
Unpriced items	.000	.000
Sporting goods and equipment	.478	.587
Sport vehicles, including bicycles	.221	.343
Other sporting goods	.258	.244
Toys, hobbies, and other entertainment	.945	1.020
Toys, hobbies, and music equipment	.437	.479
Photographic supplies and equipment	.132	.117
Pet supplies and expense	.365	.408
Unpriced items	.011	.015
Entertainment services	2.270	1.857
Club memberships	.386	.209
Fees for participant sports, excluding club memberships	.339	.302
Admissions	.636	.545
Fees for lessons or instructions	.214	.152
Other entertainment services	.674	.637
Unpriced items	.021	.013
Other goods and services	5.836	5.743
Tobacco and smoking products	1.246	1.640
Personal care	1.231	1.184
Toilet goods and personal care appliances	.661	.678
Other toilet goods and small personal care applianced, including hair and dental products	0.381	0.415
Cosmetics, bath and nail preparations, manicure and eye makeup implements	.280	.263
Personal care services	.570	.506
Beauty parlor services for females	.453	.399
Haircuts and other barber shop services for males	.116	.107
Unpriced items	.000	.000
Personal and educational expenses	3.359	2.919
School books and supplies	.217	.187
School books and supplies for colleges	.150	.120
Elementary and high school books and supplies	.055	.056
Unpriced items	.011	.012
Personal and educational services	3.142	2.732
Tuition and other school fees	1.971	1.674
College tuition	1.107	.820
Elementary and high school tuition	.345	.276
Day care and nursery school	.319	.388
Tuition for technical, business, and other schools	.121	.121
Unpriced items	.080	.069
Personal expenses	1.171	1.058
Legal service fees	.432	.375
Funeral expenses	.305	.251
Personal financial services	.341	.343
Unpriced items	.093	.089
Commodity and service group		
All items	100.000	100.000
Commodities	45.468	49.323
Food and beverages	17.758	19.652
Commodities less food and beverages	27.710	29.671
Nondurables less food and beverages	15.584	16.464
Apparel commodities	5.743	5.805
Nondurables less food, beverages, and apparel	9.840	10.660
Durables	12.126	13.207
Services	54.532	50.677
Rent of shelter	27.020	24.845
Rent of residential	6.058	6.922
Household services less rent of shelter	9.644	9.426
Transportation services	6.658	6.808
Medical care services	4.663	3.975
Other services	6.547	5.624
Special indexes		
All items less food	83.810	82.028
All items less shelter	72.309	74.567
All items less homeowners' costs	80.488	82.951
All items less medical care	94.251	95.132
Commodities less food	29.278	31.351
Nondurables less food	17.152	18.144
Nondurables less food and apparel	11.408	12.340
Nondurables	33.342	36.116
Services less rent of shelter	27.512	25.832

See footnotes at end of table.

CPI Appendix 2. Relative importance of all components in the Consumer Price Indexes: U.S. city average, December 1986—Continued

(Percent of all items)

Item and group	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Item and group	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)
Services less medical care	49.869	46.703	Housekeeping and home maintenance services	1.682	1.286
Domestically produced farm food	8.632	9.776			
Selected beef cuts	.694	.851	Energy	7.352	8.114
Motor fuel, motor oil, coolant, and other products	2.963	3.636	All items less energy	92.648	91.886
Utilities and public transportation	9.002	8.906	All items less food and energy	76.458	73.914
			Commodities less food and energy	25.988	27.439
			Energy commodities	3.290	3.912
			Services less energy	50.471	46.475

[1] Benefits provided by consumer-paid health insurance constitute 5.9 percent of the relative importance for the U-population and 6.3 percent for the W population.

[2] Benefits provided by consumer-paid health insurance constitute 30.8 percent of the relative importance for the U-population and 30.8 percent for the W population.

[3] Benefits provided by consumer-paid health insurance constitute 8.7 percent of the relative importance for the U-population and 8.7 percent for the W population.

[4] Benefits provided by consumer-paid health insurance constitute 0.7 percent of the relative importance for the U-population and 0.7 percent for the W population.

[5] Benefits provided by consumer-paid health insurance constitute 24.7 percent of the relative importance for the U-population and 29.3 percent for the W population.

[6] Benefits provided by consumer-paid health insurance constitute 61.0 percent of the relative importance for the U-population and 54.4 percent for the W population.

[7] Benefits provided by consumer-paid health insurance constitute 62.6 percent of the relative importance for the U-population and 62.8 percent for the W population.

[8] Benefits provided by consumer-paid health insurance constitute 57.0 percent of the relative importance for the U-population and 53.4 percent for the W population.

[9] Only health insurance premiums paid by the consumer are included in the CPI. The health insurance relative importance includes only that portion of the premium that is retained by the insurance carrier for administrative cost and profit, 9.7 percent of the total premiums for the U population and 10.6 percent for the W population. The portions of the premium that are paid as benefits have been assigned to the relevant medical care categories.

NOTE: Dash indicates that data are not available.

CPI Appendix 3. Sample areas, population weights, and pricing cycles

PSU	Sample areas and counties	Percent of index population	Pricing cycle	
			Odd months	Even months
	Northeast Region			
	New York—Northern New Jersey—Long Island, NY-NJ-CT, CMSA:			
A109	New York City ..... Bronx, Kings, New York, Queens, Richmond	4.115	X	X
A110	New York—Connecticut suburbs	2.375	X	X
	New York portion: Wassau, Orange, Putnam, Rockland, Suffolk, Westchester			
	Conneticut portion: Fairfield, Litchfield (part), New Haven (part)			
A111	New Jersey suburbs ..... Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union	2.762	X	X
A102	Philadelphia—Wilmington—Trenton, PA-DE-NJ-MD, CMSA	2.920	X	X
	Pennsylvania portion: Bucks, Chester, Delaware, Montgomery, Philadelphia			
	New Jersey portion: Burlington, Camden, Cumberland, Gloucester, Mercer, Salem			
	Delaware portion: New Castle			
	Maryland portion: Cecil			
A103	Boston—Lawrence—Salem, MA-NH, CMSA	2.141	X	
	Massachusetts portion: Bristol (part), Essex, Middlesex (part), Norfolk (part), Plymouth (part), Suffolk, Worcester (part)			
	New Hampshire portion: Hillsborough (part), Rockingham			
A104	Pittsburgh—Beaver Valley, PA, CMSA ..... Allegheny, Beaver, Fayette, Washington, Westmoreland	1.276		X
A105	Buffalo—Niagara Falls, NY, CMSA ..... Erie, Niagara, New York	.653		X
L102	Hartford—New Britain—Middletown, CT, CMSA .. Hartford (part), Litchfield (part), Middlesex (part), New London (part), Tolland (part)	.991	X	
L104	Syracuse, NY, MSA ..... Madison, Onondaga	0.767	X	
L106	Springfield, MA, MSA ..... Hampden (part), Hampshire (part)	.847		X
L108	Scranton—Wilkes-Barre, PA, MSA ..... Columbia, Lackawanna, Luzerne, Wyoming	.974		X
M102	Williamsport, PA, MSA .... Lycoming	.824	X	
M104	Lancaster, PA, MSA ..... Lancaster	.746	X	
M106	Johnstown, PA, MSA ..... Cambria, Somerset	.756		X
M108	Poughkeepsie, NY, MSA ... Dutchess	.771		X
R102	St. Lawrence Co, NY ..... Urban parts of: St. Lawrence	.545	X	
R104	Augusta, ME ..... Urban parts of: Kennebec, Lincoln	.535		X
	Midwest Region			
A207	Chicago—Gary—Lake County, IL-IN-WI, CMSA ..	4.039	X	X
	Illinois portion: Cook, Du Page, Grundy, Kane, Kendall, Lake, Mchenry, Will			
	Indiana portion: Lake, Porter			
	Wisconsin portion: Kenosha			
A208	Detroit—Ann Arbor, MI, CMSA ..... Lapeer, Livingston, Macomb, Oakland, St. Clair, Washtenaw, Wayne	2.363		X
A209	St. Louis—East St. Louis, MO-IL, CMSA	1.201	X	
	Missouri portion: Franklin, Jefferson, St. Charles, St. Louis, St. Louis City			
	Illinois portion: Clinton, Jersey, Madison, Monroe, St. Clair			
A210	Cleveland—Akron—Lorain, OH, CMSA ..... Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	1.478	X	
A211	Minneapolis—St. Paul, MN-WI, MSA	1.155	X	
	Minnesota portion: Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Washington, Wright			
	Wisconsin portion: St. Croix			

CPI Appendix 3. Sample areas, population weights, and pricing cycles—Continued

PSU	Sample areas and counties	Percent of index population	Pricing cycle	
			Odd months	Even months
A212	Milwaukee, WI, PMSA ..... Milwaukee, Ozaukee, Washington, Waukesha	0.740		X
A213	Cincinnati—Hamilton, OH-KY-IN, CMSA ..... Ohio portion: Butler, Clermont, Hamilton, Warren Kentucky portion: Boone, Campbell, Kenton Indiana portion: Dearborn	.855	X	
A214	Kansas City, MO—Kansas City, KS, CMSA ..... Missouri portion: Cass, Clay, Jackson, Lafayette, Platte, Ray Kansas portion: Johnson, Leavenworth, Miami, Wyandotte	.754		X
A215	Columbus, OH, MSA ..... Delaware, Fairfield, Franklin, Licking, Madison, Pickaway, Union	.677		X
L210	Flint, MI, MSA ..... Genesee	.709		X
L212	Dayton—Springfield, OH, MSA ..... Clark, Greene, Miami, Montgomery	.871		X
L214	Youngstown—Warren, OH, MSA ..... Mahoning, Trumbull	.769	X	
L216	Indianapolis, IN, MSA ..... Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan, Shelby	.840	X	
M210	Steubenville—Weirton, OH-WV, MSA ..... Ohio portion: Jefferson West Virginia portion: Brooke, Hancock	.794		X
M212	Racine, WI, PMSA ..... Racine	.792	X	
M214	Waterloo—Cedar Falls, IA, MSA ..... Black Hawk, Bremer	.839		X
M216	Lawrence, KS, MSA ..... Douglas	1.004	X	
M218	Terre Haute, IN, MSA ..... Clay, Vigo	.838		X
M220	Elkhart—Goshen, IN, MSA Elkhart	.809	X	
R206	Grand Island, NE ..... Urban parts of: Hall, Hamilton, Howard, Merrick	779	X	
R208	Kennett, MO ..... Urban parts of: Dunklin, Pemiscot	0.739		X
R210	Mexico, MO ..... Urban parts of: Audrain, Lincoln, Pike, Ralls	.801	X	
R212	Ft. Dodge, IA ..... Urban parts of: Calhoun, Hamilton, Webster	.761		X
	South Region			
A315	Washington, DC-MD-VA, MSA District of Columbia portion: Washington Maryland portion: Calvert, Charles, Frederick, Montgomery, Prince Georges Virginia portion: Arlington, Fairfax, Loudoun, Prince William, Stafford, Alexandria City, Fairfax City, Falls Church City, Manassas City, Manassas Park City	1.766	X	
A316	Dallas—Fort Worth, TX, CMSA ..... Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant	1.556		X
A317	Baltimore, MD, MSA ..... Anne Arundel, Baltimore, Carroll, Harford, Howard, Queen Annes, Baltimore City	1.124	X	
A318	Houston—Galveston—Brazoria, TX, CMSA ..... Brazoria, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller	1.621		X
A319	Atlanta, GA, MSA ..... Barrow, Butts, Cherokee, Clayton, Cobb, Coweta, De Kalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Newton, Paulding, Rockdale, Spalding, Walton	1.118		X
A320	Miami—Fort Lauderdale, FL, CMSA ..... Broward, Dade	1.526	X	
A321	Tampa—St. Petersburg—Clearwater, FL, MSA ..... Hernando, Willsborough, Pasco, Pinellas	.953		X

CPI Appendix 3. Sample areas, population weights, and pricing cycles—Continued

PSU	Sample areas and counties	Percent of index popul ation	Pricing cycle	
			Odd months	Even months
A322	New Orleans, LA, MSA ... Jefferson, Orleans, St. Bernard, St. Charles, St. John The Baptist, St. Tammany	0.639	X	
L318	Richmond, VA, MSA ..... Charles City, Chesterfield, Goochland, Hanover, Henrico, New Kent, Powhatan, Richmond City	.792		X
L320	Jacksonville, FL, MSA .... Clay, Duval, Nassau, St. Johns	.812		X
L322	Charlotte—Gastonia—Rock Hill, WC-SC, MSA ..... North Carolina portion: Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan, Union South Carolina portion: York	.800	X	
L324	Tulsa, OK, MSA ..... Creek, Osage, Rogers, Tulsa, Wagoner	.836	X	
L326	Raleigh—Durham, NC, MSA Durham, Franklin, Orange, Wake	.897		X
L328	Norfolk—Virginia Beach—Newport News, VA, MSA Gloucester, James City, York, Chesapeake City, Hampton City, Newport News City, Norfolk City, Poquoson City, Portsmouth City, Suffolk City, Virginia Beach City, Williamsburg City	.761		X
L330	Washville, TN, MSA ..... Cheatham, Davidson, Dickson, Robertson, Rutherford, Sumner, Williamson, Wilson	.909	X	
L332	El Paso, TX, MSA ..... El Paso	.664	X	
L334	Birmingham, AL, MSA .... Blount, Jefferson, St. Clair, Shelby, Walker	.747	X	
L336	Orlando, FL, MSA ..... Orange, Osceola, Seminole	.720		X
M322	Corpus Christi, TX, MSA .. Nueces, San Patricio	.817	X	
M324	Pine Bluff, AR, MSA ..... Jefferson	.774		X
M326	Fort Smith, AR-OK, MSA .. Arkansas portion: Crawford, Sebastian	.811	X	
M328	Brownsville—Harlingen, TX, MSA ..... Cameron	.612	X	
M330	Albany, GA, MSA ..... Dougherty, Lee	0.793		X
M332	Florence, SC, MSA ..... Florence	.826		X
M334	Gainesville, FL, MSA ..... Alachua, Bradford	.785	X	
M336	Huntsville, AL, MSA ..... Madison	.788		X
M338	Beaumont—Port Arthur, TX, MSA ..... Hardin, Jefferson, Orange	.778		X
M340	Ocala, FL, MSA ..... Marion	.897	X	
R314	Cleveland, TN ..... Urban parts of: Bradley, Polk	.654		X
R316	Hammond, LA ..... Urban parts of: East Feliciana, St. Helena, Tangipahoa	.693	X	
R318	Raeford, NC ..... Urban parts of: Woke, Scotland	.680	X	
R320	Pontotoc, MS ..... Urban parts of: Benton, Pontotoc, Tippah, Union	.688	X	
R322	Halifax, NC ..... Urban parts of: Halifax	.627		X
R324	Central KY ..... Urban parts of: Breathitt, Estill, Garrard, Jackson, Lee, Madison, Montgomery, Owsley, Powell, Rockcastle	.631		X
	West Region			
	Los Angeles—Anaheim—Riverside, CA, CMSA:			
A419	Los Angeles City ..... Los Angeles	4.189	X	X
A420	Greater Los Angeles ..... Orange, Riverside, San Bernardino, Ventura	2.102	X	X
A422	San Francisco—Oakland—San Jose, CA, CMSA ..... Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma	3.156	X	X
A423	Seattle—Tacoma, WA, CMSA King, Pierce, Snohomish	1.193		X
A424	San Diego, CA, MSA ..... San Diego	.987	X	

CPI Appendix 3. Sample areas, population weights, and pricing cycles—Continued

PSU	Sample areas and counties	Percent of index population	Pricing cycle	
			Odd months	Even months
A425	Portland—Vancouver, OR-WA, CMSA ..... Oregon portion: Clackamas, Multnomah, Washington, Yamhill Washington portion: Clark	0.744	X	
A426	Honolulu, HI, MSA ..... Honolulu	.320		X
A427	Anchorage, AK, MSA ..... Anchorage Borough	.086		X
A429	Phoenix, AZ, MSA ..... Maricopa	.816	X	
A433	Denver—Boulder, CO, CMSA Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson	.929		X
L438	Sacramento, CA, MSA .... El Dorado, Placer, Sacramento, Yolo	.814	X	
L440	Salt Lake City—Ogden, UT MSA ..... Davis, Salt Lake, Weber	0.619		X
L442	Tucson, AZ, MSA ..... Pima	.521	X	
L444	Fresno, CA, MSA ..... Fresno	.513		X
M442	Redding, CA, MSA ..... Shasta	.642	X	
M444	Colorado Springs, CO, MSA El Paso	.581	X	
M446	Yakima, WA, MSA ..... Yakima	.654		X
M448	Provo—Orem, UT, MSA ... Utah	.647		X
R426	Alamogordo, NM ..... Urban parts of: Otero	.892		X
R428	Yuma, AZ	893	X	

CPI Appendix 4. Expenditure classes, item strata, and entry level items

EC 01 Cereals and cereal products
0101 Flour and prepared flour mixes
01011 Flour

01012 Prepared flour mixes

0102 Cereal
01021 Cereal

0103 Rice, pasta, and cornmeal
01031 Rice

01032 Macaroni, similar products, and cornmeal

EC 02 Bakery products
0201 White bread
02011 White bread

0202 Other breads, rolls, biscuits, and muffins
02021 Bread other than white

02022 Rolls, biscuits, muffins (excluding frozen)

0204 Cakes, cupcakes, and cookies
02041 Cakes and cupcakes (excluding frozen)

02042 Cookies

0206 Other bakery products
02061 Crackers

02062 Bread and cracker products

02063 Sweetrolls, coffee cake, and doughnuts (excluding frozen)

02064 Frozen bakery products and frozen/refrigerated doughs and batters

02065 Pies, tarts, turnovers (excluding frozen)

EC 03 Beef and veal
0301 Ground beef
03011 Ground beef

0302 Chuck roast
03021 Chuck roast

0303 Round roast
03031 Round roast

0304 Other steak, roast, and other beef
03041 Other roasts (excluding chuck and round)

03042 Other steak (excluding round and sirloin)

03043 Other beef

0305 Round steak
03051 Round steak

0306 Sirloin steak
03061 Sirloin steak

EC 04 Pork
0401 Bacon
04011 Bacon

0402 Pork chops
04021 Pork chops

0403 Ham
04031 Ham (excluding canned)

04032 Canned ham

0404 Other pork, including sausage
04041 Pork roasts, picnics, other pork

04042 Pork sausage

EC 05 Other meats
0501 Lunchmeat, lamb, organ meats, and game

05011 Frankfurters

05012 Bologna, liverwurst, salami

05013 Other lunchmeats (excluding bologna, liverwurst, salami)

05014 Lamb, organ meats, and game

EC 06 Poultry
0601 Fresh whole chicken
06011 Fresh whole chicken

0602 Fresh or frozen chicken parts
06021 Fresh or frozen chicken parts

0603 Other poultry
06031 Other poultry

EC 07 Fish and seafood
0701 Canned fish and seafood
07011 Canned fish or seafood

0702 Fresh or frozen fish and seafood
07021 Shellfish (excluding canned)

07022 Fish (excluding canned)

EC 08 Eggs
0801 Eggs
08011 Eggs

EC 09 Fresh milk and cream
0901 Fresh whole milk
09011 Fresh whole milk

0902 Other fresh milk and cream
09021 Other fresh milk and cream

EC 10 Processed dairy products
1001 Butter and other dairy products (excluding cheese, ice cream)
10011 Butter

10012 Other dairy products

1002 Cheese
10021 Cheese

1004 Ice cream and related products
10041 Ice cream and related products

EC 11 Fresh fruits
1101 Apples
11011 Apples

1102 Bananas
11021 Bananas

1103 Oranges
11031 Oranges

1104 Other fresh fruits
11041 Other fresh fruits

EC 12 Fresh vegetables
1201 Potatoes
12011 Potatoes

1202 Lettuce
12021 Lettuce

1203 Tomatoes
12031 Tomatoes

1204 Other fresh vegetables
12041 Other fresh vegetables

EC 13 Processed fruits
1301 Fruit juices and frozen fruits
13011 Frozen orange juice

13012 Other frozen fruits and fruit juices

13013 Fresh, canned/or bottled fruit juices

1303 Canned and dried fruits
13031 Canned and dried fruits

EC 14 Processed vegetables
1401 Frozen vegetables
14011 Frozen vegetables

1402 Canned and other processed vegetables
14021 Canned beans other than lima beans

14022 Canned cut corn

14023 Other processed vegetables

EC 15 Sugar and sweets
1501 Candy and other sweets
15011 Candy and chewing gum

15012 Other sweets (excluding candy and gum)

1502 Sugar and artificial sweeteners
15021 Sugar and artificial sweeteners

EC 16 Fats and oils
1601 Fats and oils
16011 Margarine

16012 Other fats and oils

16013 Nondairy cream substitutes

16014 Peanut butter

EC 17 Nonalcoholic beverages
1701 Carbonated drinks
17011 Cola drinks

17012 Carbonated drinks other than cola

1703 Coffee
17031 Roasted coffee

17032 Instant and freeze dried coffee

1705 Other noncarbonated drinks
17051 Noncarbonated fruit-flavored drinks

17052 Tea

17053 Other noncarbonated drinks

EC 18 Other prepared foods
1801 Canned and packaged soup
18011 Canned and packaged soup

1802 Frozen prepared foods
18021 Frozen prepared meals

18022 Frozen prepared foods other than meals

1803 Snacks
18031 Potato chips and other snacks

18032 Nuts

1804 Spices, seasonings, condiments, sauces
18041 Salt and other seasonings and spices

18042 Olives, pickles, relishes

18043 Sauces and gravies

18044 Other condiments (excluding olives, pickles, relishes)

1806 Other prepared food
18061 Canned or packaged salads and desserts

18062 Baby food

18063 Other canned or packaged prepared foods

EC 19 Food away from home
1901 Lunch
19011 Lunch

1902 Dinner
19021 Dinner

CPI Appendix 4. Expenditure classes, item strata, and entry level items—Continued

1903 Other meals and snacks
19031 Snacks and nonalcoholic beverages
19032 Breakfast or brunch

1909 Unpriced board and catered affairs
19090 Unpriced items

EC 20 Alcoholic beverages
2001 Beer, ale, and other alcoholic malt beverages at home
20011 Beer, ale, and other alcoholic malt beverages at home

2002 Distilled spirits at home
20021 Whiskey at home

20022 Distilled spirits at home (excluding whiskey)

2003 Wine at home
20031 Wine at home

2005 Alcoholic beverages away from home
20051 Beer, ale, and other alcoholic malt beverages away from home

20052 Wine away from home

20053 Distilled spirits away from home

EC 21 Pure rent-renter occupied
2101 Rent of dwelling
21011 Rent of dwelling

2102 Lodging while out of town
21021 Lodging while out of town

2103 Lodging while at school
21031 Housing at school, excluding board

EC 22 Rental equivalence and household insurance
2201 Owners' equivalent rent
22011 Owners' equivalent rent

2202 Household insurance
22021 Household insurance

EC 23 Maintenance and repair services
2301 Property maintenance and repair services
23011 Inside home maintenance and repair services

23012 Repair/replacement of hard surface flooring

23013 Replacement of installed wall-to-wall carpet

23014 Repair of disposal, built-in dishwasher, range hood

EC 24 Maintenance and repair commodities
2401 Materials, supplies, equipment for home repairs
24011 Paint, wallpaper and supplies

24012 Tools and equipment for painting

24013 Lumber, paneling, wall and ceiling tile; awnings, glass

24014 Blacktop and masonry materials

24015 Plumbing supplies and equipment

24016 Electrical supplies, heating and cooling equipment

2404 Other property maintenance commodities
24041 Miscellaneous supplies and equipment

24042 Hard surface floor covering

24043 Landscaping items

EC 25 Fuel oil and other fuels
2501 Fuel oil
25011 Fuel oil

2502 Other fuels
25021 Bottled or tank gas

25022 Coal

25023 Other fuels

EC 26 Gas (piped) and electricity
2601 Electricity
26011 Electricity

2602 Utility natural gas service
26021 Utility natural gas service

EC 27 Other utilities and public services
2701 Telephone services, local charges
27011 Telephone services, local charges

2702 Water and sewerage maintenance
27021 Residential water and sewer service

2703 Community antenna and cable television
27031 Community antenna or cable TV

2704 Garbage and trash collection
27041 Garbage and trash collection

2705 Interstate telephone services
27051 Interstate telephone services

2706 Intrastate telephone services
27061 Intrastate telephone services

EC 28 Textile housefurnishings
2801 Linens, curtains, drapes, sewing materials
28011 Bathroom linens

28012 Bedroom linens

28013 Kitchen and dining room linens

28014 Curtains and drapes

28015 Slipcovers and decorative pillows

28016 Sewing materials for household items

EC 29 Furniture and bedding
2901 Bedroom furniture
29011 Mattress and springs

29012 Bedroom furniture other than mattress/and springs

2902 Sofas
29021 Sofas

2903 Living room chairs and tables
29031 Living room chairs

29032 Living room tables

2904 Other furniture
29041 Kitchen and dining room furniture

29042 Infants' furniture

29043 Outdoor furniture

29044 Occasional furniture

EC 30 Household appliances
3001 Refrigerators and home freezers
30011 Refrigerators and home freezers

3002 Laundry equipment
30021 Washers

30022 Dryers

3003 Stoves, ovens, portable dishwashers, window air-conditioners

30031 Stoves and ovens (excluding microwave ovens)

30032 Microwave ovens

30033 Portable dishwashers

30034 Window air-conditioners

EC 31 Television and sound equipment
3101 Television sets
31011 Television sets

3102 Video cassette recorders, disc players, and tapes
31021 Video cassette recorders, disc players, cameras, and accessories

31022 Video cassettes and discs, blank and prerecorded

31023 Video game hardware, software and accessories

3103 Audio components, radios, recordings, and other audio equipment
31031 Radios, phonographs, and tape recorders/players

31032 Components and other sound equipment

31033 Records and tapes, prerecorded and blank

3109 Unpriced accessories for electronic equipment
31090 Unpriced items

EC 32 Other household equipment and furnishings
3201 Floor/window coverings, outdoor/infant/laundry/cleaning equipment
32011 Floor coverings

32012 Window coverings

32013 Infants' equipment

32014 Laundry and cleaning equipment

32015 Outdoor equipment

3202 Clocks, lamps, and decorator items
32021 Clocks

32022 Lamps and lighting fixtures

32023 Household decorative items

3203 Tableware, serving pieces, nonelectric kitchenware
32031 Plastic dinnerware

32032 China and other dinnerware

32033 Flatware

32034 Glassware

32035 Silver serving pieces

32036 Serving pieces other than silver or glass

32037 Nonelectric cookingware

32038 Tableware and nonelectric kitchenware

3204 Lawn and garden equipment, tools, hardware
32041 Lawn and garden equipment

32042 Power tools

32043 Other hardware

32044 Nonpowered handtools

CPI Appendix 4. Expenditure classes, item strata, and entry level items—Continued

3205 Small kitchen appliances, sewing machines, portable heating/cooling equipment
32051 Floor cleaning equipment and sewing machines

32052 Portable heating/cooling equipment, small electric kitchen appliances

3206 Indoor plants and fresh cut flowers
32061 Indoor plants and fresh cut flowers

3209 Unpriced household equipment parts, small furnishings
32090 Unpriced items

EC 33 Housekeeping supplies
3301 Laundry and cleaning products
33011 Soaps and detergents

33012 Other laundry and cleaning products

3303 Household paper products, including stationery
33031 Cleansing and toilet tissue, paper towels, napkins

33032 Stationery, stationery supplies, gift wrap

3305 Other household products, lawn and garden supplies
33051 Miscellaneous household products

33052 Lawn and garden supplies

EC 34 Housekeeping services
3401 Postage
34011 Postage

3402 Babysitting
34021 Babysitting services

3403 Domestic service
34031 Domestic services

3404 Other household services
34041 Gardening and lawncare services

34042 Water softening service

34043 Moving, storage, freight expense

34044 Household laundry and drycleaning, excluding coin operated

34045 Coin-operated household laundry and drycleaning

3406 Appliance and furniture repair
34061 Repair of television, radio, and sound equipment

34062 Repair of household appliances

34063 Reupholstery of furniture

3407 Care of invalids, elderly, and convalescents in the home
34071 Care of invalids, elderly, and convalescents in the home

3409 Unpriced rent/repair of household equipment, sound equipment
34090 Unpriced items

34091 Unpriced items

EC 35 Tenants' insurance
3501 Tenants' insurance
35011 Tenants' insurance

EC 36 Men's apparel

3601 Men's suits, coats, sportcoats, jackets
36011 Men's suits

36012 Men's sport coats and tailored jackets

36013 Men's coats and jackets

3603 Men's furnishings
36031 Men's underwear and hosiery

36032 Men's nightwear

36033 Men's accessories

36034 Men's sweaters

36035 Men's active sportswear

3604 Men's shirts
36041 Men's shirts

3605 Men's pants and shorts
36051 Men's pants and shorts

3609 Unpriced men's uniforms and other clothing
36090 Unpriced items

EC 37 Boys' apparel
3701 Boys' apparel
37011 Boys' coats and jackets

37012 Boys' sweaters

37013 Boys' shirts

37014 Boys' underwear, nightwear, and hosiery

37015 Boys' accessories

37016 Boys' suits, sport coats, and pants

37017 Boys' active sportswear

3709 Unpriced boys' uniforms and other clothing
37090 Unpriced items

EC 38 Women's apparel
3801 Women's coats and jackets
38011 Women's coats and jackets

3802 Women's dresses
38021 Women's dresses

3803 Women's separates, sportswear
38031 Women's tops

38032 Women's skirts

38033 Women's pants and shorts

38034 Women's active sportswear

3804 Women's underwear, nightwear, accessories
38041 Women's nightwear

38042 Women's underwear

38043 Women's hosiery

38044 Women's accessories

3805 Women's suits
38051 Women's suits

3809 Unpriced women's uniforms and other clothing
38090 Unpriced items

EC 39 Girls' apparel
3901 Girls' apparel
39011 Girls' coats and jackets

39012 Girls' dresses and suits

39013 Girls' tops

39014 Girls' skirts and pants

39015 Girls' active sportswear

39016 Girls' underwear and nightwear

39017 Girls' hosiery and accessories

3909 Unpriced girls' uniforms and other clothing
39090 Unpriced items

EC 40 Footwear
4001 Men's footwear
40011 Men's footwear

4002 Boys' and girls' footwear
40021 Boys' footwear

40022 Girls' footwear

4003 Women's footwear
40031 Women's footwear

EC 41 Infants' and toddlers' apparel
4101 Infants' and toddlers' apparel
41011 Infants' and toddlers' outerwear

41012 Infants' and toddlers' play and dresswear

41013 Infants' and toddlers' underwear

41014 Infants' and toddlers' sleepwear

4109 Unpriced infants' accessories and other clothing
41090 Unpriced items

EC 42 Sewing materials and luggage
4201 Sewing materials, notions, luggage
42011 Fabric for making clothes

42012 Sewing notions and patterns

42013 Luggage

EC 43 Jewelry
4301 Watches
43011 Watches

4302 Jewelry
43021 Jewelry

EC 44 Apparel services
4401 Other apparel services
44011 Shoe repair and other shoe services

44012 Coin-operated apparel laundry and drycleaning

44013 Alterations and repairs

44014 Clothing rental

44015 Watch and jewelry repair

4402 Apparel laundry and drycleaning, excluding coin operated
44021 Apparel laundry and drycleaning, excluding coin operated

EC 45 New vehicles
4501 New cars
45011 New cars

4502 New trucks
45021 New trucks

4503 New motorcycles
45031 New motorcycles

EC 46 Used vehicles
4601 Used cars
46011 Used cars

4609 Unpriced other used motor vehicles
46090 Unpriced items

EC 47 Motor fuel, motor oil, coolant, and fluids
4701 Motor fuel
47011 Motor fuels

4702 Motor oil, coolant, and other fluids

CPI Appendix 4. Expenditure classes, item strata, and entry level items—Continued

47021 Motor oil

47022 Coolant, brake fluid, transmission fluid, additives

EC 48 Automobile parts and equipment
4801 Tires
48011 Tires

4802 Vehicle parts and equipment other than tires
48021 Vehicle parts and equipment other than tires

EC 49 Automobile maintenance and repair
4901 Automotive body work
49011 Automotive body work

4902 Automotive drive-train, front end repair
49021 Automotive drive-train repair

49022 Automotive brake work

49023 Repair to steering, front end, cooling system, and air-conditioning

4903 Automotive maintenance and servicing
49031 Automotive maintenance and servicing

4904 Automotive power plant repair
49041 Automotive power plant repair

4909 Unpriced automotive repair service policy
49090 Unpriced items

EC 50 Automobile insurance
5001 Automobile insurance
50011 Automobile insurance

EC 51 Vehicle finance charges
5101 Automobile finance charges
51011 Automobile finance charges

5109 Unpriced other vehicle finance charges
51090 Unpriced items

EC 52 Vehicle rental, registration, and inspection
5201 State and local automobile registration, license, inspection
52011 State automobile registration

52012 Local automobile registration

52013 Driver's license

52014 Vehicle inspection

5205 Other automobile-related fees
52051 Automobile rental

52052 Truck rental

52053 Parking fees

52054 Vehicle tolls

52055 Automobile towing charges

52056 Other vehicle rentals

5209 Unpriced docking and landing fees
52090 Unpriced items

EC 53 Public transportation
5301 Airline fare
53011 Airline fare

5302 Other intercity transportation
53021 Intercity bus fare

53022 Intercity train fare

53023 Ship fares

5303 Intracity transportation
53031 Intracity mass transit

53032 Taxi fare

53033 Car and van pools

5309 Unpriced school bus
53090 Unpriced items

EC 54 Prescription drugs and medical supplies
5401 Prescription drugs and medical supplies
54011 Prescription drugs and medical supplies

EC 55 Nonprescription drugs and medical supplies
5502 Internal and respiratory over-the-counter drugs
55021 Internal and respiratory over-the-counter drugs

5503 Nonprescription medical equipment and supplies
55031 Topicals and dressings

55032 Medical equipment for general use

55033 Supportive and convalescent medical equipment

55034 Hearing aids

5509 Unpriced drugs
55090 Unpriced items

EC 56 Professional services
5601 Physicians' services
56011 Physicians' services

5602 Dental services
56021 Dental services

5603 Eyeglasses and eye care
56031 Eyeglasses and eye care

5604 Services by other medical professionals
56041 Services by other medical professionals

EC 57 Hospital and other medical care services
5701 Hospital room, in-patient
57011 Hospital room, in-patient

5702 Other in-patient services
57021 Hospital in-patient services other than room

57022 Nursing and convalescent home care

5703 Hospital out-patient services
57031 Hospital out-patient services

5709 Unpriced rent or repair of medical equipment
57090 Unpriced items

EC 58 Health insurance
5811 Commercial health insurance retained earnings-prescription drugs
58111 Commercial health insurance retained earnings-prescription drugs

5812 Commercial health insurance retained earnings-physicians' services
58121 Commercial health insurance retained earnings-physicians' services

5813 Commercial health insurance retained earnings-dental services
58131 Commercial health insurance retained earnings-dental services

5814 Commercial health insurance retained earnings-eye care services
58141 Commercial health insurance retained earnings-eye care services

5815 Commercial health insurance retained earnings-other professional services
58151 Commercial health insurance retained earnings-other professional services

5816 Commercial health insurance retained earnings-hospital room
58161 Commercial health insurance retained earnings-hospital room

5817 Commercial health insurance retained earnings-other in-patient hospital services
58171 Commercial health insurance retained earnings-other in-patient hospital services

5818 Commercial health insurance retained earnings-out-patient hosp services
58181 Commercial health insurance retained earnings-out-patient hosp services

58211 Blue Cross/Blue Shield retained earnings-prescription drugs

5822Blue Cross/Blue Shield retained earnings-physicians' services
58221 Blue Cross/Blue Shield retained earnings-physicians' services

5823 Blue Cross/Blue Shield retained earnings-dental services
58231 Blue Cross/Blue Shield retained earnings-dental services

5824 Blue Cross/Blue Shield retained earnings-eye care services
58241 Blue Cross/Blue Shield retained earnings-eye care services

5825 Blue Cross/Blue Shield retained earnings-other professionals' services
58251 Blue Cross/Blue Shield retained earnings-other professionals' services

5826 Blue Cross/Blue Shield retained earnings-hospital room
58261 Blue Cross/Blue Shield retained earnings-hospital room

5827 Blue Cross/Blue Shield retained earnings-other in-patient hospital services
58271 Blue Cross/Blue Shield retained earnings-other in-patient hospital services

5828 Blue Cross/Blue Shield retained earnings-out-patient hospital services
58281 Blue Cross/Blue Shield retained earnings-out-patient hospital services

5831HMO retained earnings-prescription drugs
583117 HMO retained earnings-prescription drugs

5832 HMO retained earnings-physicians' services
58321 HMO retained earnings-physicians' services

5833 HMO retained earnings-dental services
58331 HMO retained earnings-dental services

5834 HMO retained earnings-eyecare services
58341 HMO retained earnings-eyecare services

5835 HMO retained earnings-other professionals' services
58351 HMO retained earnings-other professionals' services

5836 HMO retained earnings-hospital room
58361 HMO retained earnings-hospital room

5837 HMO retained earnings-other in-patient hospital services
58371 HMO retained earnings-other in-patient hospital services

5838 HMO retained earnings-out-patient hospital services
58381 HMO retained earnings-out-patient hospital services

CPI Appendix 4. Expenditure classes, item strata, and entry level items—Continued

5841 Other health insurance retained earnings-prescription drugs
58411 Other health insurance retained earnings-prescription drugs

5842 Other health insurance retained earnings-physicians' services
58421 Other health insurance retained earnings-physicians' services

5843 Other health insurance retained earnings-dental services
58431 Other health insurance retained earnings-dental services

5844 Other health insurance retained earnings-eyecare services
58441 Other health insurance retained earnings-eyecare services

5845 Other health insurance retained earnings-other professionals' services
58451 Other health insurance retained earnings-other professionals' services

5846 Other health insurance retained earnings-hospital room
58461 Other health insurance retained earnings-hospital room

5847 Other health insurance retained earnings-other in-patient hospital services
58471 Other health insurance retained earnings-other in-patient hospital services

5848 Other health insurance retained earnings-out-patient hospital services
58481 Other health insurance retained earnings-out-patient hospital services

EC 59 Reading materials
5901 Newspapers
59011 Newspapers

5902 Magazines, periodicals, and books
59021 Magazines

59022 Books purchased through book clubs

59023 Books not purchased through book clubs

5909 Unpriced newsletters
59090 Unpriced items

EC 60 Sporting goods and equipment
6001 Sports vehicles, including bicycles
60011 Outboard motors and powered sports vehicles

60012 Unpowered boats and trailers

60013 Bicycles

6002 Sports equipment
60021 Indoor, warm weather, and winter sports equipment

60022 Hunting, fishing, and camping equipment

EC 61 Toys, hobbies, and other entertainment commodities
6101 Toys, hobbies, and music equipment
61011 Toys, games, and hobbies

61012 Playground equipment

61013 Music instruments and accessories

6102 Photographic supplies and equipment
61021 Film

61022 Photographic and darkroom supplies

61023 Photographic equipment

6103 Pets and pet products
61031 Pet food

61032 Purchase of pets, pet supplies, accessories

6109 Unpriced souvenirs, fireworks, optic goods
61090 Unpriced items

EC 62 Entertainment services
6201 Club membership dues and fees
62011 Club membership dues and fees

6202 Fees for participant sports
62021 Fees for participant sports

6203 Admissions
62031 Admission to movies, theaters, and concerts

62032 Admission to sporting events

6204 Fees for lessons or instructions
62041 Fees for lessons or instructions

6205 Photographers, film processing, pet services
62051 Photographer fees

62052 Film processing

62053 Pet services

62054 Veterinarian services

62055 Other entertainment services

6209 Unpriced rental of recreational vehicles
62090 Unpriced items

EC 63 Tobacco products
6301 Tobacco and smoking supplies
63011 Cigarettes

63012 Tobacco products other than cigarettes

63013 Smoking accessories

6309 Unpriced smoking products
63090 Unpriced items

EC 64 Toilet goods and personal care appliances
6401 Hair, dental, shaving, miscellaneous personal care products
64011 Products for the hair

64012 Nonelectric articles for the hair

64013 Woman's hair pieces and wigs

64014 Dental products, nonelectric dental articles

64015 Shaving products, nonelectric shaving articles

64016 Deodorant/suntan preparations, sanitary/footcare products

64017 Electric personal care appliances

6403 Cosmetics/bath/nail preparations and implements
64031 Cosmetics, bath/nail/make-up preparations and implements

EC 65 Personal care services
6501 Beauty parlor services for females
65011 Beauty parlor services for females

6502 Haircuts and other barber shop services for males

65021 Haircuts and other barber shop services for males

6509 Unpriced repair of personal care appliances
65090 Unpriced items

EC 66 School books and supplies
6601 School books and supplies for college
66011 College textbooks

6602 Reference books and elementary and high school books
66021 Elementary and high school books and supplies

66022 Encyclopedias and other sets of reference books

6609 Unpriced miscellaneous school purchases
66090 Unpriced items

EC 67 Daycare, tuition, and other school fees
6701 College tuition and fees
67011 College tuition and fixed fees

6702 Elementary and high school tuition and fees
67021 Elementary and high school tuition and fixed fees

6703 Child daycare, nursery school
67031 Daycare and nursery school

6704 Other tuition and fees
67041 Technical and business school tuition and fixed fees

6709 Unpriced miscellaneous school items, rentals and other services
67090 Unpriced items

EC 68 Legal, financial, and funeral services
6801 Legal fees
68011 Legal fees

6802 Banking and accounting expenses
68021 Safe deposit box rental

68022 Checking accounts and special check services

68023 Tax return preparation and other accounting fees

6803 Cemetery lots and funeral expenses
68031 Funeral expenses

68032 Cemetery lots and crypts

6809 Unpriced miscellaneous personal services
68090 Unpriced items

EC 69 Information processing equipment
6901 Information processing equipment
69011 Personal computers and peripheral equipment

69012 Computer software and accessories

69013 Telephone, peripheral equipment, and accessories

69014 Calculators, adding machines, and typewriters

69015 Other information processing equipment

EC 72 Utility average prices
7260 Utility natural gas, 40 therms
72601 Utility natural gas, 40 therms

7261 Utility natural gas, 100 therms
72611 Utility natural gas, 100 therms

7262 Electricity, 500 kilowatt hours
72621 Electricity, 500 kilowatt hours

CPI Appendix 5. Sample Allocation Methodology for Commodities and Services

Introduction

The objective of the item-outlet sample design for the commodities and services component of the CPI revision was to determine the sample resource allocation by PSU, replicate, item stratum, and POPS category which minimizes the sampling variance of the CPI at the U.S. level, while at the same time meeting certain budgetary constraints on total expenditures and total travel expenditures.

Certain simplifying assumptions were made to render this problem manageable. First, all item strata were divided into eight major groups:

Food and beverages	Transportation
Fuel and utilities	Medical care
Household furnishings	Entertainment
Apparel and upkeep	Other commodities and services

Second, all sample PSU's were divided into 10 groups. Further, it was decided that the number of item selections in each major group would remain the same across all PSU's, and that the number of outlet selections per POPS category would remain the same within a PSU-major group. This reduced the design problem to one in 88 variables, $\{M_{ij}\}$ and $\{K_j\}$, $i=1,\ldots,10$, $j=1,\ldots,8$, where M_{ij} represents the designated outlet sample size per POPS category for PSU group i and major group j, and K_j represents the designated item sample size for major group j.

Sampling variance and cost functions were developed in terms of these design variables.

The sampling variance function

The variance function for the CPI revision was modeled for index areas, i.e., geographic areas defined by PSU's or groups of PSU's. Each self-representing PSU constitutes a single index area. Non-self-representing PSU's were grouped into 12 index areas, each composed of 2 to 10 PSU's. It was assumed that the total variance of price change for major commodity group j within index area k can be expressed as the sum of four components:

$$\sigma^2_{j,k} = \sigma^2_{p,j,k} + \sigma^2_{e,j,k} + \sigma^2_{o,j,k} + \sigma^2_{r,j,k}$$

where:

- $\sigma^2_{p,j,k}$ is the component of variance due to the sampling of PSU's,
- $\sigma^2_{e,j,k}$ is the component of variance due to the sampling of ELI's within item strata,
- $\sigma^2_{o,j,k}$ is the component of variance due to the sampling of outlets, and
- $\sigma^2_{r,j,k}$ is the residual component of variance.

Similarly, it was assumed that the variance of price change of a sample unit (i.e., a single quote) within a major group j can be given by:

$$\sigma^2_{\text{unit, j}} = \sigma^2_{p,\text{unit,j}} + \sigma^2_{e,\text{unit,j}} + \sigma^2_{o,\text{unit,j}} + \sigma^2_{r,\text{unit,j}}$$

where:

- $\sigma^2_{p,\text{unit,j}}$ is the component of unit variance due to the sampling of PSU's,
- $\sigma^2_{e,\text{unit,j}}$ is the component of unit variance due to the sampling of ELI's within item strata,
- $\sigma^2_{o,\text{unit,j}}$ is the component of unit variance due to the sampling of outlets, and
- $\sigma^2_{r,\text{unit,j}}$ is the residual component of unit variance.

Given these assumptions, it follows that each component of $\sigma^2_{j,k}$ can be expressed in terms of its corresponding unit variance components:

$$\sigma^2_{p,j,k} = \sigma^2_{p,\text{unit,j}}/N'_k$$

where:

N'_k is the number of non-self-representing PSU's in the index area (Note: $\sigma^2_{p,j,k}$ is 0 for self-representing PSU's);

$$\sigma^2_{e,j,k} = (\sigma^2_{e,\text{unit,j}}/N_k \cdot H_k \cdot K_j) \cdot \text{fpc}_j \cdot NC_j$$

where:

- N_k is the number of PSU's,
- H_k is the number of replicates per PSU in the index area,
- $\text{fpc}_j = (1-K_j/TI_j)$ is a finite population correction factor,
- TI_j is the number of ELI's in the major group,
- NC_j is the percent of the strata in the major group which are noncertainty strata, i.e., containing more than one ELI;

$$\sigma^2_{o,j,k} = \sigma^2_{o,\text{unit,j}}/(N_k \cdot H_k \cdot M'_{j,k} \cdot P_j)$$

where:

- $M'_{j,k}$ is the number of unique inscope outlets selected per PSU-replicate per POPS category,
- P_j is the number of POPS categories in the major group, and

$$\sigma^2_{r,j,k} = \sigma^2_{r,\text{unit,j}}/(N_k \cdot H_k \cdot M_{j,k} \cdot K_j \cdot P_j)$$

This gives the sampling variance of the national commodities and services index as:

$$\sigma^2_{\text{TOTAL}} = \sum_j (\text{relimp}_j)^2 \sum_k (w_k)^2 \sigma^2_{j,k}$$

where:

- w_k is the population weight of index area k,
- relimp_j is the relative importance of major group j.

The relative importance of an item stratum or major group is obtained from the Consumer Expenditure Survey and is the percentage of total expenditures on all items which are expenditures on items in the stratum or major group. In this application, the relative importance data used were index area averages.

The cost function

The total annual cost of the commodities and services components of the CPI revision includes costs of initiation data collection, processing and review, personal visit and telephone pricing, and pricing processing and review. The costs of initiation of data collection, processing, and review were developed as either outlet- or quote-related costs. For PSU group i and major group j, outlet-related costs for initiation are:

$$CI_O(M_{ij},K_j) = .2\, N_i \cdot H_i \cdot (C_{O,j} + C_{T,j}) \cdot (a_{ij} M_{ij}^2 + b_{ij} M_{ij} + c_{ij}) \cdot P_j$$

and quote-related costs for initiation are:

$$CI_Q(M_{ij}, K_j) = .2\, N_i \cdot H_i \cdot (C_{Q,j} + C'_{Q,j}) \cdot M_{ij} \cdot K_j \cdot NR_j$$

where:

N_i is the number of PSU's in PSU group i,

H_i is the number of replicates per PSU in PSU group i,

$C_{O,j}$ is the initiation cost per outlet for major group j,

$C_{T,j}$ is the travel cost at initiation per outlet for major group j,

$(a_{ij} M_{ij}^2 + b_{ij} M_{ij} + c_{ij})$ is a quadratic overlap function used to predict the number of unique sample outlets, accounting for the overlap of elements in the outlet sample within and between major groups for a PSU-replicate,

P_j is the number of POPS categories in major group j,

$C_{Q,j}$ is the initiation cost per quote for major group j,

$C'_{Q,j}$ is the initiation processing cost per quote for major group j,

NR_j is the outlet in-scope rate for major group j.

The 0.2 factor in the above cost formulas accounts for the rotation or reinitiation of the outlet sample in one-fifth of the sample PSU's each year. Note that the expected number of quotes per PSU-replicate-major group is estimated by the product of the number of designated outlets and the number of item strata hits, $M_{ij} \cdot K_j$.

The costs of ongoing price data collection, processing, and review were also developed as either outlet- or quote-related costs. For PSU group i and major group j, outlet-related costs for ongoing pricing are:

$$CP_O(M_{i,j}, K_j) = MB_{i,j} \cdot N_i \cdot H_i \cdot NR_j \cdot (a_{ij} M_{ij}^2 + b_{ij} M_{ij} + c_{ij}) \cdot P_j \cdot [(C_{PV,O,j} + C_{PV,T,j}) \cdot (1-R_{T,O,j}) + C_{T,O,j} \cdot R_{T,O,j}]$$

and quote-related costs for ongoing pricing are:

$$CP_Q(M_{ij}, K_j) = MB_{ij} \cdot N_i \cdot H_i \cdot M_{ij} \cdot K_j \cdot [C_{PV,Q,j}(1-R_{T,Q,j}) + C_{T,Q,j} R_{T,Q,j} + C_{P,Q}]$$

where:

$C_{PV,O,j}$ is the cost for a personal visit for pricing per outlet for major group j,

$C_{PV,T,j}$ is the travel cost for a personal visit for pricing per outlet for major group j,

$R_{T,O,j}$ is the proportion of outlets priced by telephone for major group j,

$C_{T,O,j}$ is the cost for telephone collection per outlet for major group j;

MB_{ij} is a factor to adjust for the monthly/bimonthly mix of outlets and quotes by PSU and major product group,

$C_{PV,Q,j}$ is the per quote cost for a personal visit for pricing,

$R_{T,Q,j}$ is the proportion of telephone collected quotes for major group j,

$C_{T,Q,j}$ is the per quote cost for telephone collection for major group j, and

$C_{P,Q}$ is the per quote cost for processing repricing data.

The total cost function associated with data collection and processing for the commodities and services index, summed over all major groups and PSU groups, is then given by:

$$TCOST = \sum_{i,j} CI_O(M_{ij}, K_j) + CI_Q(M_{ij}, K_j) + CP_O(M_{ij}, K_j) + CP_Q(M_{ij}, K_j)$$

The total travel cost function depends only on the expected number of unique outlets in the sample and is a subtotal of the above, namely:

$$TRCOST = \sum_{i,j} N_i \cdot H_i \cdot P_j \{.2C_{T,j}(a_{ij} M_{ij}^2 + b_{ij} M_{ij} + c_{ij}) + MB_{ij} NR_j (a_{ij} M_{ij}^2 + b_{ij} M_{ij} + c_{ij}) \cdot C_{PV,T,j}(1-R_{T,O,j})\}$$

Note that the variance and total cost functions are nonlinear in the sample design variables $\{M_{ij}\}$ and $\{K_j\}$. The total travel cost function, however, is linear in the variables $\{M_{ij}\}$ and does not depend on the $\{K_j\}$.

Thus the sample design problem can be expressed as:

$$\begin{array}{lll} \text{minimize} & \sigma^2_{TOTAL} & \\ \{M_{ij}\},\{K_j\} & \text{integer} & \\ \text{subject to} & TCOST \leqslant TCLIM, & \\ & TRCOST \leqslant TRAVLIM, & \\ & M_{ij} \geqslant 1, & i=1,\ldots,10, \\ & & j=1,\ldots,8, \\ & K_j \geqslant STRATA_j, & j=1,\ldots,8, \\ & K_j \leqslant TI_j, & j=1,\ldots,8. \end{array}$$

Here, TCLIM and TRAVLIM are the design parameters representing total expenditure and total travel expenditure ceilings, respectively, and $STRATA_j$ and TI_j are the design parameters denoting the number of item strata and total number of ELI's, respectively, in the j^{th} major group.

Model coefficients

Estimates of components of the cost function were developed from agency administrative records and directly collected studies of travel time and within-outlet

time. Response rates for each major group were developed from past initiation and pricing experience. Overlap functions, used to project the number of unique outlets, were developed by modeling the number of unique outlets obtained in simulations of the sampling procedures for each PSU type. Since outlet samples are selected independently for each point-of-purchase category, an individual outlet may be selected for more than one category. For example, a grocery store could be selected for both bakery products and dairy products. The number of unique outlets yielded by the sampling process is needed to project outlet-related costs.

Estimates of the components of the variance function were developed as follows. The total variance of price change for 2- and 6-month changes was computed by major group and for all items less housing using CPI data for January 1980 through December 1982. Components of the variance of price change for each major group were estimated using a three-way analysis of variance technique. The total unit variance and unit components of variance were computed by dividing the total variance and components of variance by the sample sizes employed for the respective indexes for each time period. The component unit variances and the total unit variance computed as the sum of the components were ratio-adjusted to the total unit variance computed directly from the CPI data to assure data consistency. Finally, generalized unit variance functions were obtained by modeling observations of the unit variance of price change as a function of price change by major group. The total unit variance of price change used in the solution of the sample design problem was generated from the generalized unit variance functions.

Intraclass correlations for each major group were obtained from models of the component unit relative variances. Relative variances were computed for the PSU, outlet, and ELI components by dividing the corresponding unit variances by the squared price change. Components of relative variance were then modeled as functions of price change with the functional form:

$$Y = b1\ X^{b2}$$

where:

Y = the PSU, ELI, or outlet relative variance and
X = price change.

Intraclass correlations were then calculated by dividing the components of relative variance by their sum for each price change of interest. Final estimates of components of relative variance for a given time change and inflation rate were then obtained by multiplying modeled unit relvariances and their corresponding modeled estimates of intraclass correlations.

The solution

A sequential unconstrained minimization technique,[1] implemented in the nonlinear programming code Symbolic Factorable SUMT[2] was used to solve the design problem. Solution values of the sets $\{M_{ij}\}$ and $\{K_j\}$ were computed for various values of TCLIM and TRAVLIM and for modeled estimates of components of variance computed for various annual inflation rates and time periods. For each major group j, K_j was bounded below by the number of item strata in the major group and above by the number of ELI's in the major group. For the food and beverages group, a lower constraint of 73 item strata selections was imposed in order to support average food prices.

Unit variance and intraclass correlation estimates used were for a 6-month price change at a 10-percent annual rate. Design solutions were also found using model estimates for 2-month price changes at both 8-percent and 10-percent annual rates. Only minor differences were observed between the problem solutions found with variance estimates for the 6-month price change at 8-percent and 10-percent annual rates. The problem solution found for a 6-month price change at a 10-percent annual rate was selected as the final sample design because the estimates of unit variances and intraclass correlations for some major groups were slightly less stable at the 8-percent annual rate. Solutions using estimates for 2-month price changes were not used since some major groups have little or no price change in a short period.

[1] A. V. Fiacco and G. P. McCormick, *Nonlinear Programming: Sequential Unconstrained Minimization Techniques* (New York, Wiley, 1968).

[2] A. Ghaemi and G. P. McCormick, "Factorable SUMT: What Is It? How is It Used?" Technical Paper Serial T-402 (Washington, DC. The George Washington University, Institute for Management Science and Engineering, 1979).

CPI Appendix 6. POPS Categories

001 Prescription drugs

54011 Prescription drugs and medical supplies

002 Over-the-counter drugs, medicines, and medical supplies

55021 Internal and respiratory over-the-counter drugs
55031 Topicals and dressings
55032 Medical equipment for general use
55033 Supportive and convalescent medical equipment
55034 Hearing aids

003 Personal care services for female

65011 Beauty parlor services for females

004 Women's hosiery

38043 Women's hosiery

005 Personal care services for males

65021 Haircuts and other barber shop services for males

006 Laundry and drycleaning, not coin operated

34044 Household laundry and drycleaning, excluding coin operated
44021 Apparel laundry and drycleaning, excluding coin operated

007 Laundry and drycleaning, self-service

34045 Coin-operated household laundry and drycleaning
44012 Coin-operated apparel laundry and drycleaning

008 Stationery, greeting cards, gift wrap, wrap accessories

33032 Stationery, stationery supplies, gift wrap

009 Admissions to movies, theaters, concerts: combined season and single (367)

62031 Admission to movies, theaters, and concerts

010 Fees for participant sports

62021 Fees for participant sports

011 Wine for home use

20031 Wine at home

012 Whiskey and other liquors for home use

20021 Whiskey at home
20022 Distilled spirits at home (excluding whiskey)

013 Beer and ale for home use

20011 Beer, ale, and other alcoholic malt beverages at home

014 Alcoholic beverages purchased in restaurants and bars

20051 Beer, ale, and other alcoholic malt beverages away from home
20052 Wine away from home
20053 Distilled spirits away from home

015 Toys, games, hobbies, tricycles, and battery-powered riders

61011 Toys, games, and hobbies

016 Eye examination, eye care, glasses, contact lenses

56031 Eyeglasses and eye care

017 Medical/surgical care by general practitioners and specialists

56011 Physicians' services

018 Women's accessories

38044 Women's accessories

019 Women's sleepwear

38041 Women's nightwear

020 Men's accessories

36033 Men's accessories

021 Men's trousers

36051 Men's pants and shorts

022 Records, tapes, needles

31033 Records and tapes, prerecorded and blank

023 Repair of TV, radio, other sound equipment

34061 Repair of television, radio, and sound equipment

024 Household linens

28011 Bathroom linens
28012 Bedroom linens
28013 Kitchen and dining room linens

025 Dinnerware, glassware, flatware, and serving pieces

32031 Plastic dinnerware
32032 China and other dinnerware
32033 Flatware
32034 Glassware
32035 Silver serving pieces
32036 Serving pieces other than silver or glass

026 Indoor/outdoor plants and garden supplies

24043 Landscaping items
32061 Indoor plants and fresh cut flowers
33052 Lawn and garden supplies

027 Men's suits

36011 Men's suits

028 Men's sportcoats and tailored jackets

36012 Men's sport coats and tailored jackets

029 Men's overcoats, topcoats, raincoats, jackets

36013 Men's coats and jackets

030 Women's suits, including pantsuits

38051 Women's suits

031 Women's dresses

38021 Women's dresses

032 Women's coats, jackets, raincoats

38011 Women's coats and jackets

034 Women's active sportswear and playwear

38034 Women's active sportswear

035 Boys' clothing and accessories

37011 Boys' coats and jackets
37012 Boys' sweaters
37013 Boys' shirts
37014 Boys' underwear, nightwear, and hosiery
37015 Boys' accessories
37016 Boys' suits, sport coats, and pants
37017 Boys' active sportswear

036 Boys' footwear

40021 Boys' footwear

037 Girls' clothing and accessories

39011 Girls' coats and jackets
39012 Girls' dresses and suits
39013 Girls' tops
39014 Girls' skirts and pants
39015 Girls' active sportswear
39016 Girls' underwear and nightwear
39017 Girls' hosiery and accessories

038 Girls' footwear

40022 Girls' footwear

039 Infants' and toddlers' clothing and accessories

41011 Infants' and toddlers' outerwear
41012 Infants' and toddlers' play and dresswear
41013 Infants' and toddlers' underwear
41014 Infants' and toddlers' sleepwear

041 Shoe repair and other shoe services

44011 Shoe repair and other shoe services

042 Repair of household appliances, except radio, TV, sound equipment

23014 Repair of disposal, built-in dishwasher, range hood
34062 Repair of household appliances

043 Major household appliances

30011 Refrigerators and home freezers
30021 Washers
30022 Dryers
30031 Stoves and ovens excluding microwave ovens
30032 Microwave ovens
30033 Portable dishwashers
30034 Window air-conditioners
32051 Floor cleaning equipment and sewing machines
69015 Other information processing equipment

044 Small electric appliances for kitchen, personal care, etc.

32052 Portable cool/heat equipment, small electric kitchen appliances
64017 Electric personal care appliances

045 Soft surface floor covering

23013 Replacement of installed wall-to-wall carpet
32011 Floor coverings

046 Window and furniture coverings, upholstery, decorative pillows

28014 Curtains and drapes
28015 Slipcovers and decorative pillows
32012 Window coverings
34063 Reupholstery of furniture

047 Automotive body repair

49011 Automotive body work

048 Inside repair, replacement, installation, and maintenance of property

CPI Appendix 6. POPS Categories—Continued

23011 Inside home maintenance and repair services

049 Radios, tape recorders/players, and phonographs

31021 Video cassette recorders, disc players, cameras, and accessories
31031 Radios phonographs, and tape recorders/players
31032 Components and other sound equipment

051 Photographic equipment

61023 Photographic equipment

052 Lamps and lighting fixtures

32022 Lamps and lighting fixtures

053 Pictures, mirrors, clocks, and other home decorations

32021 Clocks
32023 Household decorative items

054 Household furniture

29011 Mattress and springs
29012 Bedroom furniture other than mattress and springs
29021 Sofas
29031 Living room chairs
29032 Living room tables
29041 Kitchen and dining room furniture
29044 Occasional furniture

055 TV and TV combinations

31011 Television sets

056 Lawn mowing and other yard equipment

32041 Lawn and garden equipment

057 Men's sweaters and vests

36034 Men's sweaters

058 Moving expenses, including freight and storage

34043 Moving, storage, freight expense

059 Hospital care

57011 Hospital room, in-patient
57021 Hospital, in-patient services other than room
57031 Hospital out-patient services

060 New cars

45011 New cars

062 Office equipment for home use such as typewriters, etc.

69014 Calculators, adding machines, and typewriters

063 Men's active sportswear and playwear

36035 Men's active sportswear

064 Power tools

32042 Power tools

065 Bicycles, bicycle parts and accessories, and bicycle repair

60013 Bicycles

066 Playground equipment

61012 Playground equipment

067 Sports equipment, including unpowered sports vehicles

60012 Unpowered boats and trailers
60021 Indoor, warm weather, and winter sports equipment
60022 Hunting, fishing, and camping equipment

068 Musical instruments and accessories, including sheet music

61013 Music instruments and accessories

069 Infants' furniture and equipment

29042 Infants' furniture
32013 Infants' equipment

070 Patio, porch, other outdoor furniture and equipment

29043 Outdoor furniture
32015 Outdoor equipment

072 Hard surface flooring and floor covering

23012 Repair/replacement of hard surface flooring
24042 Hard surface floor covering

073 Used cars

46011 Used cars

076 Nonelectric cookware, kitchen utensils, laundry and cleaning equipment, closet-storage items

32014 Laundry and cleaning equipment
32037 Nonelectric cookingware
32038 Tableware and nonelectric kitchenware

077 Automotive repair to engine and related equipment

49021 Automotive drive train repair
49041 Automotive power plant repair

078 Miscellaneous automotive repair, maintenance, servicing

49022 Automotive brake work
49023 Repair to steering, front end, cooling system, and air-conditioning
49031 Automotive maintenance and servicing
52055 Automobile towing charges

079 Automotive parts, accessories, and products, excluding tires

47021 Motor oil
47022 Coolant, brake fluid, transmission fluid, additives
48021 Vehicle parts and equipment other than tires

080 Luggage

42013 Luggage

081 Wigs and hairpieces for females

64013 Women's hair pieces and wigs

082 Fish and seafood

07011 Canned fish or seafood
07021 Shellfish (excluding canned)
07022 Fish (excluding canned)

083 Processed fruits and vegetables

13011 Frozen orange juice
13012 Other frozen fruits and fruit juices
13013 Fresh, canned, or bottled fruit juices
13031 Canned and dried fruits
14011 Frozen vegetables
14021 Canned beans other than lima beans
14022 Canned cut corn
14023 Other processed vegetables

084 Fats, oils, peanut butter, salad dressings, dairy product substitutes

16011 Margarine
16012 Other fats and oils
16013 Nondairy cream substitutes
16014 Peanut butter

085 Sugar and other sweets, for home use

15011 Candy and chewing gun
15012 Other sweets (excluding candy and gum)
15021 Sugar and artificial sweeteners

086 Coffee, tea, fruit flavored drinks, other noncarbonated beverages

17031 Roasted coffee
17032 Instant and freeze dried coffee
17051 Noncarbonated fruit flavored drinks
17052 Tea
17053 Other noncarbonated drinks

087 Apparel and accessory alteration, repair, and rental

44013 Alterations and repairs
44014 Clothing rental

088 Watches, jewelry, and repair
43011 Watches
43021 Jewelry
44015 Watch and jewelry repair

090 Tickets to sporting events: combined season and single tickets (366)

62032 Admissions to sporting events

101 Gasoline and other vehicle fuels

47011 Motor fuels

102 Tobacco products

63011 Cigarettes
63012 Tobacco products other than cigarettes

103 Personal care items

64011 Products for the hair
64012 Nonelectric articles for the hair
64014 Dental products, nonelectric dental articles
64015 Shaving products, nonelectric shaving articles
64016 Deodorant/suntan preparations, sanitary/footcare products
64031 Cosmetics, bath/nail/makeup preparations and implements

104 Cleaning and laundry products, paper supplies, other household supplies

33011 Soaps and detergents
33012 Other laundry and cleaning products
33031 Cleansing and toilet tissue, paper towels, napkins
33051 Miscellaneous household products

105 Bakery products

02011 White bread
02021 Bread other than white
02022 Rolls, biscuits, muffins (excluding frozen)
02041 Cakes and cupcakes (excluding frozen)
02042 Cookies
02061 Crackers
02062 Bread and cracker products
02063 Sweetrolls, coffee cake and doughnuts (excluding frozen)

CPI Appendix 6. POPS Categories—Continued

02064 Frozen bakery products and frozen/refrigerated doughs and batters
02065 Pies, tarts, turnovers (excluding frozen)

106 Meats and poultry

03011 Ground beef
03021 Chuck roast
03031 Round roast
03041 Other roasts (excluding chuck and round)
03042 Other steak (excluding round and sirloin)
03043 Other beef
03051 Round steak
03061 Sirloin steak
04011 Bacon
04021 Pork chops
04031 Ham (excluding canned)
04032 Canned ham
04041 Pork roasts, picnics, other pork
04042 Pork sausage
05011 Frankfurters
05012 Bologna, liverwurst, salami
05013 Other lunchmeats (excluding bologna, liverwurst, salami)
05014 Lamb, organ meats, and game
06011 Fresh whole chicken
06021 Fresh or frozen chicken parts
06031 Other poultry

107 Dairy products, including eggs

08011 Eggs
09011 Fresh whole milk
09021 Other fresh milk and cream
10011 Butter
10012 Other dairy products
10021 Cheese
10041 Ice cream and related products

108 Fresh fruits and vegetables

11011 Apples
11021 Bananas
11031 Oranges
11041 Other fresh fruits
12011 Potatoes
12021 Lettuce
12031 Tomatoes
12041 Other fresh vegetables

109 Carbonated beverages for home use

17011 Cola drinks
17012 Carbonated drinks other than cola

110 Miscellaneous prepared foods, cereals, condiments, and seasonings

01011 Flour
01012 Prepared flour mixes
01021 Cereal
01031 Rice
01032 Macaroni, similar products, and cornmeal
18011 Canned and packaged soup
18021 Frozen prepared meals
18022 Frozen prepared foods other than meals
18031 Potato chips and other snacks
18032 Nuts
18041 Salt and other seasonings and spices
18042 Olives, pickles, relishes
18043 Other condiments (excluding olives, pickles, relishes)
18044 Sauces and gravies
18061 Canned or packaged salads and desserts
18062 Baby food
18063 Other canned or packaged prepared foods

111 Meals in restaurants, cafeterias, carryouts, drive-ins

19011 Lunch
19021 Dinner
19032 Breakfast or brunch

112 Snacks and beverages away from home

19031 Snacks and nonalcoholic beverages

113 Pet food.

61031 Pet food

114 Footwear for men

40011 Men's footwear

115 Shirts for men

36041 Men's shirts

117 Socks, underwear, sleepwear, and bathrobes for men

36031 Men's underwear and hosiery
36032 Men's nightwear

118 Footwear for women

40031 Women's footwear

120 Separates and coordinates for women

38031 Women's tops
38032 Women's skirts
38033 Women's pants and shorts

122 Underwear for women

38042 Women's underwear

123 Sewing materials and notions

28016 Sewing materials for household items
42011 Fabric for making clothes
42012 Sewing notions and patterns

124 Dental care

56021 Dental services

126 Film and film processing

61021 Film
62052 Film processing

127 Materials and supplies for major home repairs

24013 Lumber, paneling, wall and ceiling tile, awnings, glass
24014 Blacktop and masonry materials

128 Automobile tires

48011 Tires

129 Hardware items, handtools, and other materials for minor home repairs

24011 Paint, wallpaper and supplies
24012 Tools and equipment for painting
24015 Plumbing supplies and equipment
24016 Electrical supplies, heating and cooling equipment
24041 Miscellaneous supplies and equipment
32043 Other hardware
32044 Nonpowered handtools

131 Pet services

62053 Pet services

132 Veterinarian services

62054 Veterinarian services

133 Personal income tax preparation fees and other accounting fees

68023 Tax return preparation and other accounting fees

134 Business and technical schools

67041 Technical and business school tuition and fixed fees

137 Local telephone service

27011 Telephone services, local charges

140 Other vehicle rentals

52056 Other vehicle rentals

141 Passenger ship carriers

53023 Ship fares

142 Van and carpools used for commuting

53033 Car and van pools

144 Water softening service

34042 Water softening service

146 Elementary and high school books and supplies

66021 Elementary and high school books and supplies

301 Automobile insurance

50011 Automobile insurance

302 Pipes, lighters, lighter fuel, and other smoking accessories

63013 Smoking accessories

303 College tuition and fixed fees

67011 College tuition and fixed fees

304 Housing at school (excluding board)

21031 Housing at school (excluding board)

305 Electricity

26011 Electricity

307 Homeowners' and tenants' insurance

35011 Tenants' insurance

308 Utility natural gas service

26021 Utility natural gas service

309 Rental of miscellaneous equipment

62055 Other entertainment services

310 Fuel oil, kerosene, bottled or tank gas, coal, and wood

25011 Fuel oil
25021 Bottled or tank gas
25022 Coal
25023 Other fuels

311 Electronic equipment for nonbusiness use in the home

31023 Video game hardware, software, and accessories
69011 Personal computers and peripheral equipment
69012 Computer software and accessories

312 Telephones and accessories

69013 Telephone peripheral equipment, and accessories

CPI Appendix 6. POPS Categories—Continued

313 Long-distance telephone service
- 27051 Interstate telephone services
- 27061 Intrastate telephone services

314 Finance charges for automobiles and other vehicles
- 51011 Automobile finance charges

315 State vehicle registration
- 52011 State automobile registration

316 Local automobile registration (not State)
- 52012 Local automobile registration

318 Driver's license
- 52013 Driver's license

319 Vehicle inspection
- 52014 Vehicle inspection

321 Automobile rental
- 52051 Automobile rental

322 Truck and van rental
- 52052 Truck rental

323 Automobile parking
- 52053 Parking fees

324 Vehicle tolls
- 52054 Vehicle tolls

326 Airline fares
- 53011 Airline fares

327 Intercity bus fares
- 53021 Intercity bus fares

328 Intracity mass transit
- 53031 Intracity mass transit

330 College textbooks
- 66011 College textbooks

331 Elementary and high school tuition and fixed fees
- 67021 Elementary and high school tuition and fixed fees

333 Legal services, excluding closing costs for purchase of real estate
- 68011 Legal fees

334 Bank services
- 68021 Safe deposit box rental
- 68022 Checking accounts and special check services

336 Funeral services
- 68031 Funeral expenses

337 Water and sewer maintenance
- 27021 Residential water and sewer service

338 Taxicabs
- 53032 Taxi fares

339 Community antenna and cable TV
- 27031 Community antenna or cable TV

341 Garbage and trash collection
- 27041 Garbage and trash collection

342 Lodging away from home
- 21021 Lodging while out of town

344 Cemetery lots and crypts
- 68032 Cemetery lots and crypts

346 Services by practitioners other than physicians
- 56041 Services by other medical professionals

347 Postage
- 34011 Postage

348 Babysitting services
- 34021 Babysitting services

349 Child daycare services and nursery school
- 67031 Daycare and nursery school

350 Video cassettes, tapes, and discs
- 31022 Video cassettes and discs, blank and prerecorded

351 Flashbulbs/cubes, darkroom supplies, and other photographic supplies
- 61022 Photographic and darkroom supplies

352 New motorcycles
- 45031 New motorcycles

354 Nursing and convalescent home care
- 57022 Nursing and convalescent home care

355 Books purchased through book clubs and sets of reference books
- 59022 Books purchased through book clubs
- 66022 Encyclopedias and other sets of reference books

356 Powered sports vehicles, such as boats, dunebuggies, golf carts, snowmobiles
- 60011 Outboard motors and powered sports vehicles

357 Purchase of pets, pet accessories, and pet supplies (excluding food)
- 61032 Purchase of pets, pet supplies, accessories

360 New trucks and vans
- 45021 New trucks

361 Newspapers: combined single copies and subscriptions (377)
- 59011 Newspapers

362 Magazines: combined single copies and subscriptions (378)
- 59021 Magazines

363 Domestic household services
- 34031 Domestic services
- 34071 Care of invalids, elderly, and convalescents in the home

364 Garden or lawn services
- 34041 Gardening and lawncare services

365 Membership dues and fees
- 62011 Club membership dues and fees

368 Lessons or instructions in golf, swimming, piano, dancing, crafts, hobbies
- 62041 Fees for lessons or instructions

371 Intercity train fares
- 53022 Intercity train fares

375 Individual books not purchased through clubs
- 59023 Books not purchased through book clubs

376 Photographers
- 62051 Photographer fees

CPI Appendix 7. Non-POPS Sample Designs

For each non-POPS entry level item (electricity, for example), the following information is given below:

1. Source of the universe data
2. Sampling unit for outlets
3. Measure of size
4. Desired final pricing unit
5. Number of designated outlets and designated quotes.

21031 Housing while at school

1. Schools reported for college tuition in the Point-of-Purchase Survey.
2. Schools reported for college tuition in each CPI sample area.
3. Expenditures reported for college tuition.
4. Specific housing fee for the college.
5. Outlets, 136; quotes, 136.

26011 Electricity

1. a. Department of Energy publication: *Typical Electric Bills–January 1, 1984.*
   b. Department of Energy publication: *Financial Statistics of Selected Electric Utilities, 1982.*
   c. *American Public Power Association 1986 Directory.*
   d. Consumer Expenditure Survey (CE).
2. Electric utility companies serving each of the 91 CPI sample areas or electric utility companies reported in the CE Survey.
3. Annual revenue from sales of electricity to residents of the respective sample areas or expenditures reported for electricity in the CE Survey.
4. Specific type of service for a specific number of kilowatt hours.
5. Outlets, 604; quotes, 1,208.

26021 Utility natural gas

1. a. *Brown's Directory of North American and International Gas Companies.*
   b. Consumer Expenditure (CE) Survey.
2. Gas (or electricity and gas) companies serving each of the 91 CPI sample areas or gas utility companies reported in the CE Survey.
3. Annual revenue from sales of natural gas to residents of the respective sample areas or expenditures reported for natural gas in the CE Survey.
4. Specific type of service and specific number of cubic feet or therms of gas.
5. Outlets, 260; quotes, 1,040.

27011 Local telephone charges

1. *Telephony's Directory and Buyers Guide.*
2. Companies providing local telephone service in each CPI sample area.
3. Number of residential customers.
4. Specific service such as main station costs, additional message units, extension costs, etc.
5. Outlets, 660; quotes, 660.

34011 Postage

1. The distribution of household mail by type of postal service, by postal zone as determined by the *Household Mailstream Study, Final Report*, prepared for the U.S. Postal Service.
2. U.S. Postal Service.
3. Postal revenue for each type of service and postal zone.
4. Specific postal service and postal zones traveled.
5. Outlets, 140; quotes 140.

34021 Babysitting

1. Federal mimimum wage.
2. State mimimum wage.
3. Outlets, 7; quotes 250.

35011/50011 Insurance—auto and tenants

1. Data file of insurance companies obtained from A.M. Best Data Center.
2. Insurance companies serving the States in which the CPI sample areas are located.
3. Total revenue for noncommercial policies by type of insurance.
4. Specific policy within the sample area.
5. Auto: Outlets, 342; quotes, 486.
   Tenants: Outlets, 388; quotes, 388.

46011 Used cars

1. *1985/86 Survey and analysis of Business Car Policies and Costs,* published by Rungheimer International.
2. Selection of used car prices in *The Official Used Car Trade-In Guide*, Published by National Automobile Dealers Association.

3. Total sales of used cars from the business and government sectors to the consumer sector.
4. Specific used cars equiped with specific options.
5. Outlets, 348; quotes 348.

52011/52013/52014 State vehicle registration, driver's license, and State vehicle inspection

1. *Digest of Motor Laws.*
2. State motor vehicle departments in each CPI sample area.
3. Revenue generated by the fees.
4. Specific class/vehicle registration, type of license, or inspection service.
5. State vehicle registration: outlets, 88; quotes, 88.
   Driver's license: Outlets, 8; quotes, 8.
   State vehicle inspection: Outlets, 8; quotes, 8.

52054 Tolls

1. a. *Toll Facilities in the U.S.,* the Federal Highway Administration.
   b. *Highway Statistics 1982,* the Federal Highway Administration.
2. All toll facilities in the United States.
3. Total toll revenue for each toll facility.
4. Specific toll fee for a specified use of the facility.
5. Outlets, 53; quotes, 53.

53011 Airline fares

1. Civil Aeronautics Board data file consisting of a 10-percent sample of all passenger itineraries originating in the United States.
2. All airlines providing service from the 91 CPI sample areas.
3. Number of nonbusiness passengers per airline, per trip itinerary, per fare class.
4. A specific trip itinerary and fare class for the selected airline.
5. Outlets, 348; quotes, 348.

53021 Intercity bus

1. *Russell's Official National Motor Coach Guide.*
2. Bus companies serving each of the 91 CPI sample areas.
3. Number of trips per week.
4. Specific trip (origin and destination) and class of service.
5. Outlets, 140; quotes, 140.

53022 Intercity train

1. Data file of intercity train trips provided by Amtrak and the Alaskan Railroad.
2. Amtrak and the Alaskan railroad.
3. Number of tickets sold.
4. Specific trip and class.
5. Outlets, 2; quotes 64.

Appendix A. Seasonal Adjustment Methodology at BLS

An economic time series may be affected by regular intrayearly (seasonal) movements which result from climatic conditions, model changeovers, vacation practices, holidays, and similar factors. Often such effects are large enough to mask the short-term, underlying movements of the series. If the effect of such intrayearly repetitive movements can be isolated and removed, the evaluation of a series may be made more perceptive.

Seasonal movements are found in almost all economic time series. They may be regular, yet they do show variation from year to year and are subject to changes in pattern over time. Because these intrayearly patterns are combined with the underlying growth or decline and cyclical movements of the series (trend-cycle) and also random irregularities, it is difficult to estimate the pattern with exactness.

More than a half-century ago, attempts were made to isolate seasonal factors from time series. Some early methods depended upon smoothing curves by using personal judgment. Other formal approaches were periodogram analysis, regression analysis, and correlation analysis. Because these methods involved a large amount of work, relatively little application of seasonal factor adjustment procedures was carried out.

In the mid-1950's, new electronic equipment made more elaborate approaches feasible in seasonal factor methods as well as in other areas. Using a computer, the Bureau of the Census developed seasonal factors based on a ratio-to-moving-average approach. This was a major forward step, as it made possible the uniform application of a method to a large number of series at a relatively low cost.[1] Subsequent improvements in methods and in computer technology have led to more refined procedures which are both faster and cheaper than the original technique.

The Bureau of Labor Statistics began work on seasonal factor methods in 1959. Prior to that time, when additional data became available and seasonal factors were generated from the lengthened series, the new factors sometimes differed markedly from the corresponding factors based on the shorter series. This difference could affect any portion of the series. It was difficult to accept a process by which the addition of recent information could affect significantly the seasonal factors for periods as much as 15 years earlier, especially since this meant that factors could never become final. The first BLS method, introduced in 1960, had two goals: First, to stabilize the seasonal factors for the earlier part of the series; second, to minimize the revisions in the factors for the recent period.

Since 1960, the Bureau has made numerous changes and improvements in its techniques and in methods of applying them. Thus far, all the changes have been made within the scope of the ratio-to-moving-average or difference-from-moving-average types of approaches. The BLS 1960 method, entitled "The BLS Seasonal Factor Method," was further refined, with the final version being introduced in 1966. It was in continuous use for many Bureau series (especially employment series based on the establishment data) until 1980. In 1967, the Bureau of the Census introduced "The X-11 Variant of the Census Method II Seasonal Adjustment Program," better known as simply X-11. The X-11 provided some useful analytical measures along with many more options than the BLS method. Taking advantage of the X-11's additional flexibility, BLS began making increasing use of the X-11 method in the early 1970's, especially for seasonal adjustment of the labor force data based on the household survey. Later in the 1970's, Statistics Canada, the Canadian national statistical agency, developed an extension of the X-11 called "The X-11 ARIMA Seasonal Adjustment Method." The X-11 ARIMA provided the option of using ARIMA (Autoregressive Integrated Moving Average) modeling and forecasting techniques to extrapolate some extra data at the end of a time series to be seasonally adjusted. The extrapolated data help to alleviate the effects of the inherent limitations of the moving average techniques at the ends of series. After extensive testing and research showed that use of X-11 ARIMA would help to further minimize revisions in factors for recent periods, BLS began using the X-11 ARIMA procedure in 1980 for most of its official seasonal adjustment.

The standard practice at BLS for current seasonal adjustment of data as it is initially released is to use projected seasonal factors which are published ahead of time. The time series are generally run through the seasonal adjustment program once a year to provide the projected

[1] Julius Shiskin, *Electronic Computers and Business Indicators,* Occasional Paper No. 57 (New York, National Bureau of Economic Research, 1957).

factors for the ensuing months and the revised seasonally adjusted data for the recent history of the series, usually the last 5 or 6 years. It has generally been unnecessary to revise any further back in time because the programs which have been used have all accomplished the objective of stabilizing the factors for the earlier part of the series, and any further revisions would produce only trivial changes. For the projected factors, the factors for the last complete year of actual data were selected when the X-11 or the BLS method programs were used. With the X-11 ARIMA procedure, the projected year-ahead factors produced by the program are normally used. For the labor force data since 1980, only the first 6 months of factors projected from the annual run are used—a special midyear run of the program is done, with up-to-date data included—to project the factors for the remaining 6 months of the year.

The alternative to the use of projected factors is concurrent adjustment, where all data are run through the seasonal adjustment program each month, and the current observation participates in the calculation of the current factor. Of course, the concurrent approach precludes the prior publication of factors and requires substantially more staff and computer resources to run, monitor, and evaluate the seasonal adjustment process. However, recent research has shown potentially significant technical advantages in the area of minimization of factor revisions that are possible with concurrent adjustment. If future findings suggest the desirability of a change to a concurrent procedure or to some other type of methodology, such a change will be seriously considered in consultation with the Government's working group on statistics.

In applying any method of seasonal adjustment, the user should be aware that the result of combining series which have been adjusted separately will usually be a little different from the direct adjustment of the combined series. For example, the quotient of seasonally adjusted unemployment divided by seasonally adjusted labor force will not be quite the same as when the unemployment rate is adjusted directly. Similarly, the sum of seasonally adjusted unemployment and seasonally adjusted employment will not quite match the directly adjusted labor force. Separate adjustment of components and summing of them to the total usually provides series that are easier to analyze; it is also generally preferable in cases where the relative weights among components with greatly different seasonal factors may shift radically. For other series, however, it may be better to adjust the total directly if high irregularity among some of the components makes a good adjustment of all components difficult.

Finally, it is worth noting that the availability of a fast, efficient procedure for making seasonal adjustment computations can easily lead to the processing of large numbers of series without allotting enough time to review the results. No standard procedure can take the place of careful review and evaluation by a skilled analyst. A review of all results is strongly recommended. And it should also be remembered that, whenever one applies seasonal factors and analyzes seasonally adjusted data, seasonal adjustment is a process which estimates a set of not directly observable components (seasonal, trend-cycle, irregular) from the observed series and is, therefore, subject to error. Because of the complex nature of methods such as X-11 ARIMA, the precise statistical properties of these errors are not yet known.

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Appendix B. Industrial Classification

BLS and other Federal and State agencies follow as closely as possible a single system to define and classify industries in the U.S. economy. The Office of Management and Budget, in the Executive Office of the President, publishes the *Standard Industrial Classification Manual* (SIC) based on principles set forth by a technical group made up of Government and industry experts. The Bureau of Labor Statistics participated in the initial development of the classification and continues to work with the Office of Management and Budget and other agencies in seeking to improve it. The manual is revised periodically to reflect the economy's changing industrial composition and organization.

Three basic principles were followed in developing the SIC: (1) the classification should conform to the existing structure of American industry; (2) each establishment is to be classified according to its primary activity; and (3) to be recognized as an industry, the group of establishments constituting the proposed classification must be statistically significant in the number of persons employed, the volume of business done, and other measures of economic activity.

As there are thousands of products and activities, the SIC provides for grouping these into categories, both narrow and broad, to enhance the value of industrial statistics for users interested in different levels of detail. In the 1972 edition of the SIC manual, the broadest grouping divides the economy into 11 divisions: Agriculture, forestry, and fishing; mining; construction; manufacturing; transportation, communications, electric, gas, and sanitary services; wholesale trade; retail trade; finance, insurance, and real estate; services; public administration; and nonclassifiable establishments. At the 2-digit level, all products and services are combined into 84 "major groups." Thus, in the manufacturing division, establishments engaged in manufacturing machinery, apparatus, and supplies for the generation, storage, transmission, transformation, and use of electrical energy are combined into Major Group 36—Electrical and electronic machinery, equipment, and supplies.

The 3-digit level provides several hundred categories. In the electrical machinery major group, the SIC provides eight groups of industries: Electric transmission and distribution equipment; Electrical industrial apparatus; Household appliances; Electric lighting and wiring equipment; Radio and television receiving equipment, except communication types; Communication equipment; Electronic components and accessories; and Miscellaneous electrical machinery, equipment, and supplies.

Thousands of products and activities are distinguished at the 4-digit level. For example, in Group 367, nine industries are defined: Radio and television receiving type electron tubes, except cathode ray; Cathode ray television picture tubes; Transmitting, industrial, and special purpose electron tubes; Semiconductors and related devices; Electronic capacitors; Resistors, for electronic applications; Electronic coils, transformers, and other inductors; Connectors, for electronic applications; and Electronic components, not elsewhere classified.

The Bureau classifies reports from survey respondents, usually based on an establishment concept, according to their primary product or activity. The SIC is used in the same way by the agencies supplying the Bureau with universe lists and benchmark data. Hence, a high degree of orderliness and consistency is attained, which benefits not only the users of all BLS establishment statistics, but also the users of all Government figures.

An establishment is defined as an economic unit, generally at a single physical location, where business is conducted or where services or industrial operations are performed (for example: A factory, mill, store, hotel, movie theater, mine, etc.).

Where separate economic activities are performed at a single physical location (such as construction activities operated out of the same location as a lumber yard), each activity should be treated as a separate establishment wherever (1) no one industry description in the classification includes such combined activities; (2) the employment in each such economic activity is significant; and (3) reports can be prepared on the number of employees, their wages and salaries, sales or receipts, and other establishment type data.

For activities such as construction and similar physically dispersed operations, establishments are represented by those relatively permanent main or branch offices, terminals, stations, etc., which are either (1) directly responsible for supervising such activities, or (2) the base from which personnel operate to carry out these activities. Hence, the individual sites, projects, fields, networks, lines, or systems of such dispersed activities are not ordinarily considered to be establishments.

An establishment is not necessarily identical with an

enterprise or company, which may consist of one or more establishments. Also, it is to be distinguished from subunits, departments, or divisions. Supplemental interpretations of the definition of an establishment are included in the industry descriptions of the Standard Industrial Classification where appropriate.

Beginning with the 1972 SIC manual, the classification system was changed so that all establishments primarily engaged in the same kind of economic activity are now classified in the same 4-digit industry, regardless of the type of ownership. Hence, their owners may include such diverse organizations as corporations, partnerships, individual proprietors, government agencies, joint ventures, etc.

After a lengthy review process, the manual was revised again in 1987 to reflect the technological changes that had occurred in the economy as well as some institutional changes such as the deregulation of the transportation (airlines and trucking) and banking industries. Also included in the manual revision were additional industry breakouts for the services sector of the economy, which has experienced significant expansion during the past 10–15 years.

Although the 1987 manual revision was effective January 1, 1987, implementation will begin in 1988. The Bureau's current plans are for the Employment and Wages program (the ES–202 program) to be converted to the 1987 SIC manual with the submittal of the first quarter 1988 ES–202 report. That quarter's report will be submitted on both classification systems to measure the employment shifts caused by the change in the classification system. The ES–202 program was selected to be the first to be revised since data from this program are used as the sampling frame for many of the Bureau's directly collected surveys as well as many of the Federal/State cooperative surveys. In addition, employment data from this program are used to establish industry employment benchmarks for the Current Employment Statistics program and as a key element in the estimation component of other Bureau programs. Other BLS data series will be converted to the 1987 classification system at a later date.

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Appendix C. Geographic Classification

The geographic detail for which BLS publishes data varies with the scope and size of the surveys it undertakes. In addition to national summaries, the Bureau publishes data for four regions; individual States, the District of Columbia, and outlying areas (Puerto Rico, Guam, and the Virgin Islands); Metropolitan Statistical Areas (MSA's); Labor Market Areas (LMA's); individual cities; and other area designations developed to meet specific survey objectives. (See table C-1.)

BLS regions

For survey estimates and indexes (including estimates of the civilian labor force and unemployment, Area Wage Surveys,[1] Employment Cost Index, productivity surveys, and the Consumer Price Index), BLS generally uses a four-region classification system[2] as follows:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont;

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin;

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia;

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

Data for the Industry Wage Surveys are published for nine regions.[3]

[1] Alaska and Hawaii are not covered in the Area Wage Surveys.

[2] This classification is the same as the four regions used by the Bureau of the Census.

[3] *New England:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; *Middle Atlantic:* New Jersey, New York, Pennsylvania; *Border States:* Delaware, District of Columbia, Kentucky, Maryland, Virginia, West Virginia; *Southeast:* Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee; *Southwest:* Arkansas, Louisiana, Oklahoma, Texas; *Great Lakes:* Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin; *Middle West:* Iowa, Kansas, Missouri, Nebraska, North Dakota, South Dakota; *Mountain:* Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Wyoming; *Pacific*: Alaska, California, Hawaii, Nevada, Oregon, Washington.

Metropolitan Statistical Areas

Metropolitan Statistical Areas are designated by the Office of Management and Budget through the Federal Committee on Standard Metropolitan Statistical Areas. BLS is represented on this committee along with other organizations.[4]

The Office of Management and Budget has changed the official title, "Standard Metropolitan Statistical Area," to "Metropolitan Statistical Area."

The general concept of a metropolitan statistical area is one of a large population nucleus together with adjacent communities which have a high degree of economic and social integration with that nucleus.

Metropolitan statistical areas are relatively "free-standing" and not closely associated with other metropolitan statistical areas. These areas are typically surrounded by nonmetropolitan counties. Areas qualifying for recognition as metropolitan statistical areas have either a city with a population of at least 50,000 *or* a Bureau of the Census urbanized area of at least 50,000 *and* a total metropolitan statistical area population of at least 100,000.

Each metropolitan statistical area has one or more central counties, containing the area's main population concentration. A metropolitan statistical area may also include outlying counties which have close economic and social relationships with the central counties. Such counties must have a specified level of commuting to the central counties and must meet certain standards regarding metropolitan character, such as population density. In New England, metropolitan statistical areas are composed of cities and towns, rather than whole counties. Under specified conditions, two adjacent areas may be consolidated or combined into a single metropolitan statistical area.

Each metropolitan statistical area has at least one central city. The titles of metropolitan statistical areas include up to three central city names, as well as the name of each State into which the metropolitan statistical area extends.

[4] The other organizations include the Employment and Training Administration of the Department of Labor, the Department of Housing and Urban Development, the Bureau of the Census, the Federal Reserve Board, the Department of Agriculture, and the Department of Transportation. The committee is chaired by a representative of the Office of Management and Budget.

Each metropolitan statistical area is categorized in one of the following levels based on total population:

Level A – Metropolitan Statistical Areas of 1 million or more.
Level B – Metropolitan Statistical Areas of 250,000 to 1 million.
Level C – Metropolitan Statistical Areas of 100,000 to 250,000.
Level D – Metropolitan Statistical Areas of less than 100,000.

Areas assigned to Levels B, C, or D are designated as *metropolitan statistical areas.* In areas with over 1 million population (Level A), *primary metropolitan statistical areas* may be identified. These areas consist of a large urbanized county, or cluster of counties, that demonstrates very strong internal economic and social links, in addition to close ties to neighboring areas. When primary metropolitan statistical areas are defined, the large area of which they are components is designated a *consolidated metropolitan statistical area.*[5]

[5] *Federal Register,* Vol. 45, No. 2, Jan. 3, 1980, pp. 956–63.

Labor market areas

A labor market area (LMA) is defined by the Bureau of Labor Statistics as a geographic area consisting of a central community and contiguous areas which are economically integrated into that community. Within a labor market area, workers generally can change jobs without relocating. BLS defines LMA's in terms of entire counties, except in New England where cities and towns are used. LMA's are categorized as either "major," which is usually coterminous with a metropolitan statistical area, or as "small." A "small" labor market area is defined as a county or group of counties with a central community of at least 5,000 population and which meets commuting requirements. Generally, LMA's do not cross State boundaries. Counties which are not included in labor market areas are designated as "estimating areas." (In New England, estimating areas are made up of cities or towns, or groups of cities or towns.)

More detailed information on the definitions and the geographic boundaries of labor market and estimating areas will be available in the Bureau of Labor Statistics forthcoming publication, *Directory of Labor Market Areas.*

Table C-1. Geographic areas currently used in selected BLS programs

Program and major publication	Nation	Region	State	MSA	Labor Market Area	Other areas[1]	Cities
Labor Force Statistics							
Labor Force, Employment, and Unemployment:							
Employment and Earnings	x						
Nonagricultural Employment, Hours, and Earnings:							
Employment and Earnings	x		x	x	x	x	
Local Area Unemployment Statistics:							
Employment and Earnings			x	x	x	x	x
Geographic Profile of Employment and Unemployment	x	(2)	x	x		x	x
Occupational Employment:							
Occupational Employment in Manufacturing	x		x				
Occupational Employment in Selected Nonmanufacturing Industries	x		x				
Employment and Wages:							
Employment and Wages	x		x				
Prices and Living Conditions							
Consumer Expenditures and Income:							
Consumer Expenditure Survey	x	(2)		x			
International Prices:							
U.S. Import Price Indexes; U.S. Export Price Indexes	x						
Consumer Prices:							
CPI Detailed Report	x	(2)		x		x	
Producer Prices:							
Producer Price Indexes	x						
Wages and Industrial Relations							
Survey of Professional, Administrative, Technical, and Clerical Pay:							
The National Survey of Professional, Administrative, Technical, and Clerical Pay	x						
Area Wage Surveys:							
Area Wage Surveys	x	(2)		x			
Industry Wage Surveys:							
Industry Wage Surveys	x	(3)	x	x			
Employee Benefits Survey:							
Employee Benefits Survey	x						
Employment Cost Index:							
Current Wage Developments	x	(2)					
Productivity and Technology							
Productivity Research:							
Productivity and Costs	x						
Multifactor Productivity Measures	x						
Industry Productivity and Technology Studies:							
Productivity Measures for Selected Industries	x						
Foreign Labor Statistics:							
International Comparisons of Manufacturing and Labor Force Trends						x	
Occupational Safety and Health							
Occupational Safety and Health Statistics:							
Occupational Injuries and Illnesses	x		x				

[1] Defined according to survey objectives.

[2] Four-region classification designated in "BLS regions."

[3] Nine-region classification designated in footnote 3 of text.

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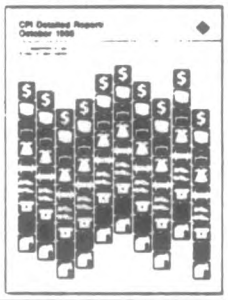
BLS Periodicals

BLS periodicals provide timely information on employment, occupations, wages, and prices.

Monthly Labor Review
the oldest and most authoritative Government research journal in economics and social sciences. Regular features include current labor statistics and developments in industrial relations.
$16 a year

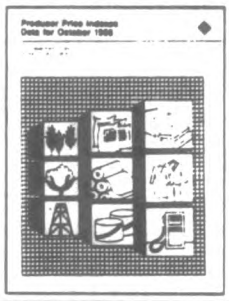
Current Wage Developments
reports monthly on specific wage and benefit changes from collective bargaining agreements. Includes data on strikes or lockouts, major agreements expiring, and compensation changes.
$12 a year

Occupational Outlook Quarterly
helps students and guidance counselors learn about new occupations, training opportunities, salary trends, and career counseling programs. Written in nontechnical language and illustrated in color.
$5 a year



CPI Detailed Report
is the most comprehensive report on monthly consumer price indexes and rates of change.
$16 a year

Employment and Earnings
gives current monthly employment and earnings statistics for the Nation as a whole, for States and for more than 200 areas. Included are household and establishment data seasonally and not seasonally adjusted. Includes annual supplement.
$22 a year



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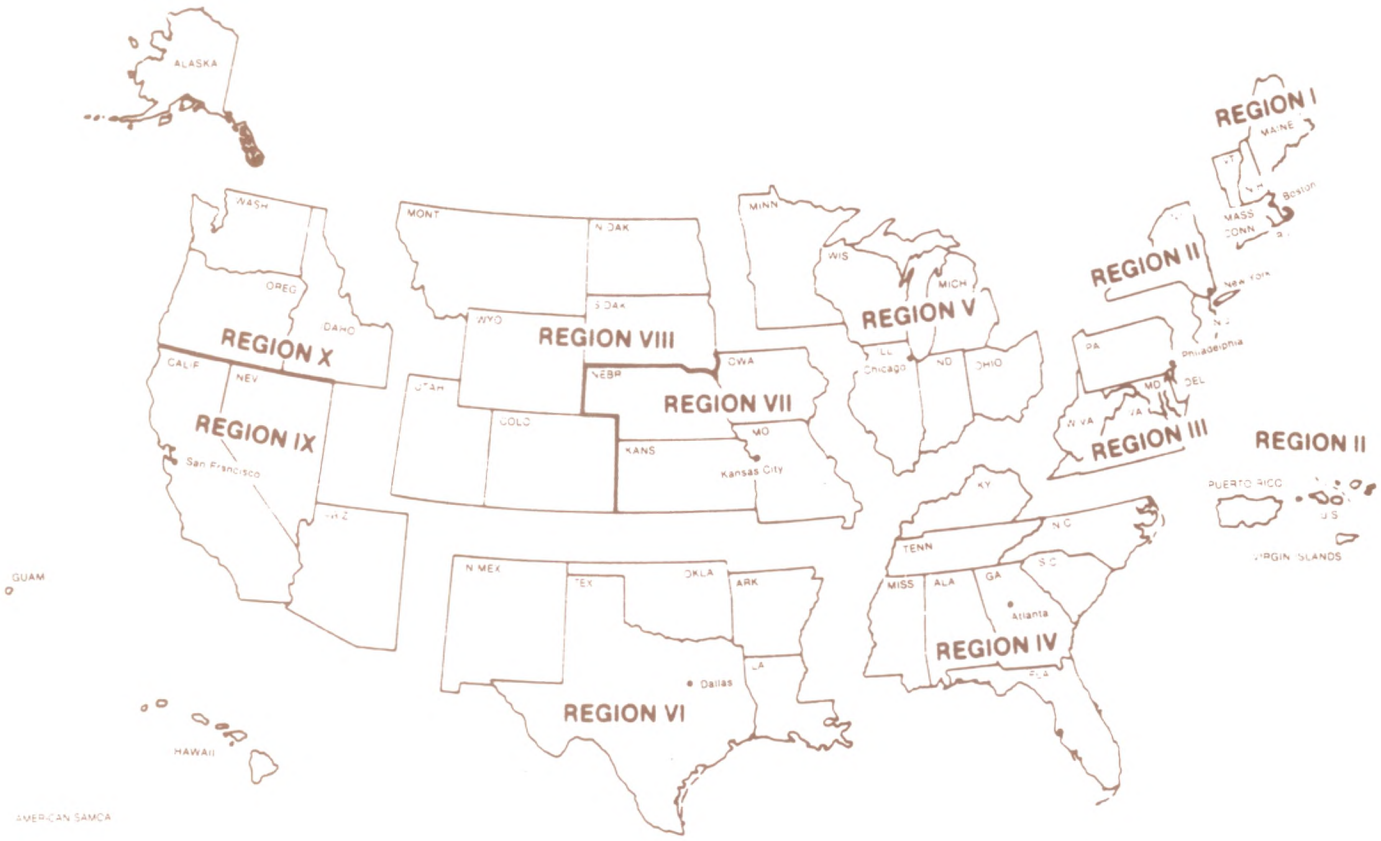

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