BLS Handbook of Methods

Volume I

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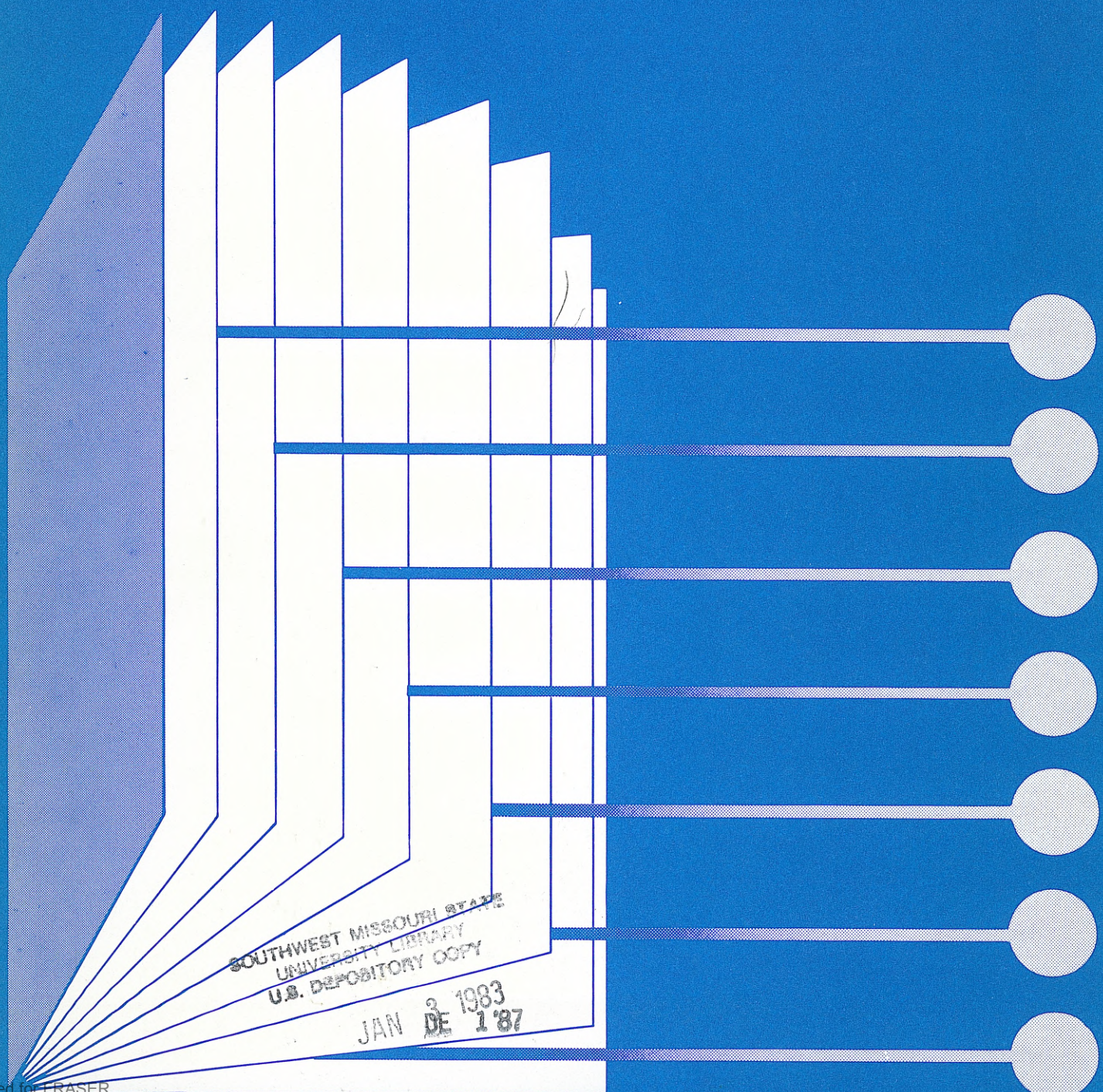

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Volume I

U.S. Department of Labor
Raymond J. Donovan, Secretary

Bureau of Labor Statistics
Janet L. Norwood, Commissioner

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Preface

The *BLS Handbook of Methods* presents in two volumes detailed explanations of how the Bureau of Labor Statistics obtains and prepares the economic data it publishes. Volume I contains this information for all BLS programs except the Consumer Price Index. Volume II contains information for the CPI.

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.

Contents

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 96 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 instruct them in the proper 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 professional analysts, trained to search out the implications of survey findings for the welfare of workers and to present them as cogently and as promptly as possible in written and oral form. How successfully this can be accomplished depends greatly upon the competence of the analysts and their supporting personnel.

In BLS, analytical and statistical work is performed by economists, statisticians, and mathematical statisticians with the aid of an experienced corps of programmers, systems analysts, and other professionals. For analytical work, economists at even the lowest grade level must meet requirements roughly equivalent to a college major in economics. There are comparable requirements for other professionals. Great efforts are made to hire the best qualified persons available.

The Bureau provides training needed for on-the-job skills, as background to special assignments, to keep professionals abreast of changes in their fields, and to aid higher level and executive professionals in obtaining the best results from their staffs. In training staff, a special effort is made to impart detailed knowledge of the techniques used in collecting and compiling the statistics, so that maximum application of the data to current problems can be made without a risk of exceeding the limits of their significance.

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, and academic organizations and from members of the public. Over the years, the advice the Commissioner of Labor Statistics has received on policy and technical

matters from responsible parties, relating to the collection and analysis of Bureau statistics, has been very helpful. Of course, decisions on statistical policy have always been the final responsibility of the Commissioner.

In order to keep in touch with the current and anticipated needs of business and labor groups and to seek advice on technical problems, the Commissioner established 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 competence. 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 of Labor Statistics 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. The council provides general direction to the advisory activities of trade union research directors in relation to the Bureau.

The Bureau often seeks the advice of professional economists, statisticians, social scientists, educators, and others, either in their individual capacities or as members of professional organizations. This is most likely to occur when a conceptual or theoretical question arises which is considered fundamental to the work of the Bureau in a specialized field, and where professional acceptance of the Bureau's work in that field may be reinforced by the findings of an independent analyst.

Voluntary reporting and confidentiality

Voluntary reporting and the preserving of the confidential nature of reported data are important characteristics of BLS programs. Over the course of almost 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 response has been remarkable in its generosity. In no small measure, the cooperation received is due to the great care taken to avoid identifying the firm or the person supplying the information. The fact that Bureau employees pledge themselves to protect these data is less important than that they have a deep understanding of the adverse long-run consequences of even a single lapse. They are aware of the greater worth, in terms of pure statistical validity, of the information provided voluntarily compared with that supplied under legal sanctions. The only inducement employed 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.

Another assurance given respondents is that their reports will be used for statistical purposes only. Attempts to "break" this policy, by organizations or individuals who wanted access to the data and were willing to go to the courts to secure it, have been successfully resisted.[1] A similar problem occurs when an administrative agency of government seeks court action to compel a company to release its file copy of information provided in confidence to a statistical agency.[2]

While it cannot be proved that these policies result in more reliable statistics, Bureau Commissioners and their staffs over the years have been convinced from experience that it is so. It is notable that some other Federal agencies (especially the Bureau of the Census), well equipped with authority to compel the submittal of certain reports, rarely if ever invoke this power. Rather, they also choose to rely on persuasion. The Bureau of Labor Statistics, while its functions as a statistical agency are prescribed by law,[3] has always relied upon voluntary cooperation of respondents in collecting information.

[1] For example, see *Norwegian Nitrogen Company v. United States,* 288 U.S. 294; *United States v. Kohler,* 13 Fed. Rules Serv. 33.333 (E.D., Pa., 1949); *Hawes v. Walsh,* 277 Fed. 569, the Court of Appeals for the District of Columbia. In all of these cases, the courts sustained the policy of protecting the confidentiality of information given voluntarily and in confidence to an agency of the Federal Government.

[2] See Supreme Court of the United States, *St. Regis Paper Company, Petitioner, v. United States,* No. 47, October term, 1961.

[3] Excerpts from 29 U.S.C. 1, acts of June 27, 1884, ch. 127, 23 Stat. 60; June 13, 1888, ch. 389, 1, 25 Stat. 182; Feb. 14, 1903, ch. 552, 4, 32 Stat. 826; Mar. 18, 1904, ch. 716, 33 Stat. 136; Mar. 4, 1913, ch. 141, 3, 37 Stat. 737.

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 on his actual activity within a designated time period; i.e., was he 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 continued 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 Armed Forces (obtained monthly from the Department of Defense) are added to the CPS estimates to derive estimates of the "total labor force" and the "total 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 60,000 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 were seeking other jobs. 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. Also included as unemployed are those who did not work at all during the survey week, were available for work, and (a) were waiting to be called back to a job from which they had been laid off, or (b) were waiting to report to a new wage or salary job scheduled to start within 30 days.

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 total labor force, in addition, includes members of the Armed Forces stationed either in the United States or abroad.

Unemployment rate. The unemployment rate 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 their 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 overall unemployment rate.

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 national sample is located in 629 areas comprising 1,148 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 60,000 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 120,000 individuals 16 years and over.

The description of the sampling design and selection that follows is based on the procedures used in the redesign following the 1970 Census of Population. The present sampled households used each month, updated by information on new construction, are derived from this design. The survey is expected to be redesigned, based on the 1980 census, by January 1985, and these plans are described briefly in the last section of this chapter.

Selection of sample areas. The entire area of the United States consisting of 3,146 counties and independent cities is divided into 1,931 primary sampling units (PSU's). With some minor exceptions, a PSU consists of a county or a number of contiguous counties. Each of the 238 Standard Metropolitan Statistical Areas (SMSA's)[1] in existence at the time of the 1970 census constituted a separate PSU. Outside SMSA's, counties normally are combined, except where the geographic area of the single county is excessive. By combining counties to form PSU's, greater heterogeneity is accomplished. Moreover, another important consideration is to have the PSU sufficiently compact in area so that, with a small sample spread throughout, it can be efficiently canvassed without undue travel cost. A typical primary sampling unit, for example, includes urban and rural residents of both high and low economic levels and encompasses, to the extent feasible, diverse occupations and industries.

The PSU's are grouped into strata. Among these PSU's, the largest SMSA's and a small number of the other areas which are not SMSA's are separate strata representing themselves. In general, however, a stratum consists of a set of PSU's as much alike as possible in various characteristics such as geography, population density, rate of growth in the 1960-70 decade, proportion of blacks and other minorities, principal industry, number of farms, and so on. Except for the self-representing PSU's, each of which is a complete stratum, the strata are established so that their sizes in terms of 1970 population are approximately equal. Where a PSU is a stratum by itself, it automatically falls in the sample. The rest of the 629 sample PSU's are selected from the remaining strata in a random manner in such a way that their probability of selection is proportionate to their 1970 population. For example, within a stratum, the chance that a PSU with a population of 50,000 would be selected for the sample is twice that for a unit having a population of 25,000.

Selection of sample households. The sample design calls for a sampling ratio which depends on the predetermined total sample size. At present, the sampling ratio is roughly 1 household for every 1,500 households in each stratum. The sampling ratio is modified slightly each month, as the size of the sample is held relatively constant despite the overall growth of the population. The sampling ratio used within each sample PSU depends on the proportion that the population of the sample area was of the stratum population at the time of the 1970 census. In a sample area which was one-tenth of the stratum, the within-PSU sampling ratio that results is 1 in 150, thereby achieving the desired ratio of 1 in 1,500 for the stratum.

With each of the 629 sample PSU's, the number of households to be enumerated each month is determined by the application of the within-PSU sampling ratio rather than through the assignment of a fixed quota. This procedure makes it possible to reflect, on a current basis, population changes within the sample area. Consequently, the sample as a whole properly reflects the changing distribution of the population and

[1] See appendix C.

avoids the distortion which would result from the application of fixed quotas of households or persons based on the population at an earlier date.

Within each designated PSU, several stages of sampling may be used in selecting the units to be enumerated. The first step is the selection of a sample of census enumeration districts (ED's), which are administrative units used in the 1970 census and contain, on the average, about 300 households. These are selected systematically from a geographically arranged listing so that the sample ED's are spread over the entire PSU. The probability of selection of any one ED is proportionate to its 1970 population.

The next step is to select a cluster of approximately four households to be enumerated within each designated ED. This selection is made wherever possible from the list of addresses for the ED compiled during the 1970 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 as geographically contiguous addresses as possible.

This 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. A special procedure is also followed to include units in the sample that had been missed in the census. 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; the probability of selection is proportionate to the estimated size of the segment. 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.

Rotation of sample. Part of the sample is changed each month. For each sample, eight systematic subsamples (rotation groups) of 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.

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 household head. 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 60 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 work-

ing 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 interviewers on the CPS 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 kept under control and errors or deficiencies are brought directly to their attention.

Estimating Methods

The CPS estimation procedure involves weighting the data from each sample person. The basic weight, which is the inverse of the probability of the person being in the sample, is a rough measure of the number of actual persons that the sample person represents. The basic weights are then adjusted for noninterview, 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 unavailablility of the respondent for other reasons. This adjustment is made separately by combinations of sample areas within each State and the District of Columbia, and within these, for six groups—two race categories (white, and black and other) within three residence categories. For sample areas which are SMSA's, these residence categories are the central cities, and the urban and the rural balance of the SMSA's. For other sample areas, the residence categories are urban, rural nonfarm, and rural farm. 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 629 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 procedure is performed at two geographic levels: First, by the four Census regions (Northeast, North Central, South, and West), and second, for each of the 46 States which contain nonsample areas. The procedure corrects for the differences that existed at the time of the 1970 census between the distribution by race and residence of the population in the sample areas and the known race-residence distribution in the portions of the census region or State represented by these areas. The regional adjustment is performed by metropolitan-nonmetropolitan residence and race, while the State adjustment is done by urban-rural status and race.

b. Second-stage ratio estimate. The sample proportions in the categories described below are adjusted to the distribution of independent current estimates of the population in the same categories. The second-stage ratio estimate is performed in order to increase the reliability of the estimates and is carried out in two 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 for the State. The second step of the adjustment is applied to all sample persons and is a weighting to nationwide independent population estimates within 68 age-sex-race groups. The entire second-stage ratio estimation procedure is iterated six times, each time beginning at the weights developed the previous time. This iteration ensures that the sample estimates both of State population and of the national age-sex-race categories will be virtually equal to the independent population estimates.

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.

Prior to January 1982, the independent national controls used for the age-sex-race groups in the final step of the second stage ratio adjustment were obtained from the "inflation-deflation" method. This procedure inflated the most recent census counts to include the estimated net census undercount 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 were then "deflated" to census level to reflect the pattern of net undercount in the most recent census by age, sex, and race. The actual percent change over time in the population in any age group was preserved. Introduced into the CPS estimation procedure in January 1982, the independent population controls are computed by carrying forward the April 1, 1980, total population (including Armed Forces overseas) by age, race, and sex, taking account of the subsequent aging of the population, fertility, mortality, and net immigration.

The CPS sample returns (taking into account the weights determined after the first stage of ratio estimates) are, in effect, used to determine only the percent distribution within a given age-race-sex group by employment status and other characteristics. In developing absolute numbers, these percentage distributions are multiplied by the independent population estimate for the appropriate age-race-sex group.

Composite estimate. The last step in the preparation of estimates makes use of a composite estimate. In this procedure, a weighted average of two estimates is obtained for the current month for any particular item. The first estimate is the result of the two stages of ratio estimates described above. The second estimate consists of the composite estimate for the preceding month to which has been added an estimate of the change in each item between the preceding month and the present month, based upon that part of the sample which is common to both months (75 percent). Although the weights for the two components of such a composite estimate do not necessarily have to be equal, in this instance the weights used for combining these two estimates are each one-half. Equal weights in this case satisfy the condition that for virtually all items there will be some gain in reliability over the estimation procedure after the first two stages of ratio estimates.

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 considerd 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 ob-

tain information on their skills and past work experience.

Each month, a significant amount of basic information about the labor force is analyzed and published in *Employment and Earnings.* The detailed tables in this report 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 broken down by a variety of characteristics. Approximately 250 of the most important estimates from the CPS are presented each month on a seasonally adjusted basis.[2]

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. Suveys have been made periodically on subjects such as job mobility, job tenure, job-search activities of the unemployed, and the intensity of the job search.

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.* Reprints of the articles, together with technical notes and additional tables have been published as *Special Labor Force Reports.*

[2] 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, February 1980.

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. The CPS is designed to produce reliable monthly national estimates. A sample which could produce monthly estimates for all States as reliable as those now published for the Nation would have to be about as large as the present national sample in each State. Subnational data derived from the CPS are published monthly for 10 large States and annually for all States, 30 large SMSA's, 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 tem-

porary 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 in 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.

Planned Changes for the CPS

Several changes are scheduled to be made in the design and content of the CPS in the near future. These will result primarily from a planned redesign of the CPS sample based on information collected in the 1980 decennial census.

Redesign of the CPS sample

Since the inception of the CPS in 1940, it has been the practice to update and revise the sample after each decennial census. At the same time, improvements in sampling methodology or survey procedures are introduced.

As 1980 census data become available, several revisions in the sample design and survey procedures will be introduced into the CPS. Consistent with procedures following past censuses, new sample areas for the CPS will be introduced which, for the most part, will remain in the CPS sample until it is redesigned after the 1990 census. In the redesign, currently underway, the sampling frame is also being changed. Heretofore, the CPS has been designed as a national sample, with its goal to provide 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 was selectively expanded on several occasions in recent years to improve its ability to provide State and local labor force estimates. Even with these efforts, it is still difficult for the CPS to provide very reliable subnational data except in large States and metropolitan areas. Therefore, in an effort to provide more accurate and reliable subnational estimates, the survey is expected to be designed as 51 separate samples for each of the States and the District of Columbia. At the same time, the redesign is expected to improve the statistical reliability of the national estimates. As of mid-1982, the plan envisioned that the new samples will be introduced into the CPS on a flow basis during July-December 1984 and will be fully in place in January 1985. A detailed description of the procedures used to select the new

samples and any other changes in sampling procedures will be available at that time.

Content changes

In addition to the sample redesign, two changes are scheduled to be introduced into the CPS in early 1983. The first is that U.S.-based Armed Forces will be included in the *official* national labor force estimates. As indicated earlier in the section on concepts, present labor force statistics encompass only the civilian noninstitutional population. Data on members of the Armed Forces stationed either in the United States or abroad are reported separately and are not included in the employment totals or in the civilian labor force base used to calculate the unemployment rate. The Armed Forces, however, are added to the civilian labor force to arrive at the measure known as the total labor force. This change was recommended by the National Commission on Employment and Unemployment Statistics in their final report, *Counting the Labor Force.*

The other scheduled change will be the introduction of a revised occupational and industry classification system into the labor force data. The new occupational classification system, which was used in the 1980 census and is based on the Standard Occupational Classification system issued in 1977 and revised in 1980, represents the most substantial revision in occupational classification since 1940. Occupational data for 1982 based on both the old and new systems are to be made available to help users make the transition to the new system. Only minor changes are planned in the industry classification system.

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 Reinterview Program, January 1961 through December 1966," *Technical Paper No. 19,* 1968.

A summary of procedures and results of the CPS reinterview program.

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 the affect the national employment statistics.

U.S. Department of Labor, Bureau of Labor Statistics, and U.S. Department of Commerce, Bureau of the Census. *Concepts and Methods Used in Labor Force Statistics Derived from the Current Population Survey,* BLS Report 463 and Current Population Reports, Series P-23, No. 62, 1976.

A concise description of the methodology used in obtaining labor force information from sample households. Labor force concepts and definitions are set forth. The adequacy of labor force data and quality controls are discussed, and major improvements in the CPS are listed chronologically.

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. *How the Government Measures Unemployment,* Report 505, 1977.

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

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.

Bureau of Labor Statistics. *Using the Current Population Survey as a Longitudinal Data Base,* Report 608, 1980.

A discussion of the potential and problems in using CPS labor force data for purposes of longitudinal analysis.

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 ○

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)

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?

20B. INTERVIEWER CHECK ITEM

49+ ○ *(Skip to item 23)*

1–34 ○ *(Go to 20C)*

35–48 ○ *(Go to 20D)*

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; otherwise, skip to 23.)

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 . . . getting wages or salary for any of the time off LAST WEEK?

Yes . . . . . ○
No . . . . . ○
Self-employed ○

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		OCCUPATION	
A	○	N	○
B	○	P	○
C	○	Q	○
D	○	R	○
E	○	S	○
F	○	T	○
G	○	U	○
H	○	V	○
J	○	W	○
K	○	X	○
L	○	Y	○
Ref. M	○	Ref. Z	○

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., CETA, union or prof. register, etc.)* . . . . . ○

22B. Why did . . . start looking for work? Was it because . . . lost or quit a job at that time *(pause)* **or was there some other reason?**

- Lost job . . . . . ○
- Quit job . . . . . ○
- Left school . . . . . ○
- Wanted temporary work ○
- Other *(Specify in notes)* . ○

22C. 1) How many weeks has . . . been looking for work?

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. Is there any reason why . . . could not take a job LAST WEEK?

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

No ○

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 . . . . . ○
- Nev. 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 civilian 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, or 8 *(End questions)*

○ 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 . . . ○ *(Go to 24B)*
- 3 up to 4 years ago . . . ○
- 4 up to 5 years ago . . . ○
- 5 or more years ago . . ○ *(Skip to 24C)*
- Never worked . . . . . ○

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, end questions.)

25. INTERVIEWER CHECK ITEM *(Rotation number)*

First digit of SEGMENT number is:

○ 2, 3, 4, 6, 7, or 8 *(End questions)*

○ 1 or 5 *(Go to 25A)*

25A. How many hours per week does . . . USUALLY work at this job?

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

(Ask 25D)

25D. How much does . . . USUALLY earn per week at this job BEFORE deductions? Include any overtime pay, commissions, or tips usually received.

$

(End questions)

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? *(For example: types, keeps account books, files, sells cars, operates printing press, finishes concrete.)*

23E. Was this person

- An employee of 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 *(or farm)* . . SE ○
- Working WITHOUT PAY in fam. bus. or farm . . . . . WP ○
- NEVER WORKED . . . . . NEV ○

(End questions)

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 ○ *(End questions)*

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 1981, this sample included approximately 166,000 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 hourly earnings, average weekly hours, and average weekly overtime hours. 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 1981, 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. In the collection of data on employment, payrolls, and hours, BLS usually requests separate reports by establishment.

However, when a company has more than one establishment engaged in the same activity in a geographic area, these establishments may be covered by a combined report.

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 shedule 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 the service industries), 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.")

Gross payrolls include pay before deductions for social security, unemployment insurance, group insurance, withholding tax, 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.

Gross 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. Gross 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 gross average weekly earnings by means of the Bureau's Consumer Price Index, indicates 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 gross 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 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.)

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. 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 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. 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. UI data on private elementary and secondary school employment are augmented by data from the National Catholic Welfare Association for the number of members of religious orders who teach in such schools. Employment figures for religious organizations are obtained from data provided by the National Council of Churches and surveys of churches 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 smaller establishments. Many

[1] For a more detailed description of the benchmarks, see Carol M. Utter and John B. Farrell, "BLS Establishment Estimates Revised to March 1980 Benchmarks," *Employment and Earnings,* July 1981, pp. 7-13.

industries in the trade and service 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

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. (See earlier sections on benchmarks.)
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.

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 mulitplied 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 under "Estimating Procedures—Hours and earnings."

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 16 months after the benchmark month (usually March). For example, the revised estimates based on the March 1980 benchmarks were released in August 1981. The revision period extended from April 1979 through July 1981.

To determine the appropriate revisons, 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. National nonagricultural payroll employment estimates, by industry division, as a percent of the benchmark for 1978, 1979, and 1980

Industry division	1978	1979	1980
Total	99.3	99.5	100.1
Mining	98.1	99.8	100.6
Construction	98.4	103.2	101.5
Manufacturing	99.4	99.6	100.3
Transportation and public utilities	99.1	100.3	100.3
Wholesale and retail trade	99.6	99.4	100.8
Finance, insurance, and real estate	99.0	99.9	99.9
Services	98.8	99.5	99.1
Government	100.0	98.1	99.5

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 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. If preliminary estimates were attempted using the full stratification pattern, there would be a number of cells with no sample reported. 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, North Central, 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.

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

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

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 ($\bar{X}_p$) 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 ($\bar{X}_p$) when applying the numerical factors.

The results of the formula may be modified if the difference between $\bar{X}_p$ 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 gross 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 gross average weekly hours.

Gross average weekly earnings in 1977 dollars. Gross 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 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 172 unpublished seasonally adjusted employment series (2-digit nonmanufacturing industries and 3-digit manufacturing industries) covering all nonagricultural payroll employment in the private sector.[2]

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.[3]

The seasonally adjusted series for 2-digit industry categories in manufacturing and for divisions in nonmanufacturing 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

At the national level, the program produces more than 2,600 separate published series each month. Tables 2, 3, and 4 provide a summary of the national detail which is published currently. 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 by type and industry division.

In addition to the series published on a current monthly basis, a single figure for employment in March of each year (based on benchmark data) is published for a number of industries for which monthly estimates do not currently meet established standards for publication. In 1981, following revision to the 1980 benchmark, data for 279 such industries were published.

In September 1981, employment, hours, and earnings statistics were available for the Nation as a whole and for all 50 States, the District of Columbia, Puerto Rico, the Virgin Islands, and 263 areas.[4] Approximately 10,000 employment series and about 11,000 hours and earnings series (for 214 areas) are published for these States and areas by the State agencies. The employment series usually cover total nonagricultural employment,

[2] For a detailed discussion of these indexes, see "Introduction of Diffusion Indexes," in the December 1974 issue of *Employment and Earnings.*

[3] See appendix A of this bulletin for a description of the seasonal adjustment method.

[4] Puerto Rico and Virgin Islands data are not used in making national estimates.

Table 2. Number of industries for which "primary" national series are published under the BLS Current Employment Statistics program—employment, hours, and earnings, September 1981

Industry division	All employees	Production workers[1]	Women workers	Hours and earnings[2]	Average weekly overtime hours
Total	512	453	440	454	323
Goods producing	1	1	1	–	–
Mining	13	11	9	11	–
Construction	15	15	15	15	–
Manufacturing	324	323	270	323	323
Service producing	1	–	1	–	–
Private service producing	1	1	1	–	–
Transportation and public utilities	24	16	22	19	–
Trade	54	52	54	52	–
Finance, insurance, and real estate	19	10	19	10	–
Services	35	23	34	23	–
Government	23	–	12	–	–
Total private	1	1	1	1	–
Total nonagricultural	1	–	1	–	–

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

[2] Average hourly earnings, average weekly hours, and average weekly earnings.

Table 3. Number of national industries for which special series are published under the Current Employment Statistics program—employment, hours, and earnings, September 1981

Industry division	Index of aggregate weekly worker hours	Index of aggregate weekly payrolls	Gross average weekly earnings (1977 dollars)	Average hourly earnings (excluding overtime)	Hourly earnings index
Total private	1	1	1	–	1
Goods producing	1	1	–	–	–
Mining	1	1	1	–	1
Construction	1	1	1	–	1
Manufacturing	23	23	1	23	1
Service producing	1	1	–	–	–
Transportation and public utilities	1	1	1	–	1
Trade	3	3	1	–	1
Finance, insurance, and real estate	1	1	1	–	1
Services	1	1	1	–	1

Table 4. Number of seasonally adjusted national series published under the Current Employment Statistics program—employment, hours, and earnings, September 1981

Industry division	Seasonally adjusted series							
	All employees	Women workers	Production workers	Average weekly earnings	Average hourly earnings	Average weekly hours	Worker hour index	Average overtime hours
Total nonagricultural	1	1	–	–	–	–	–	–
Total private	1	1	1	1	1	1	1	–
Goods producing	1	1	1	–	–	–	1	–
Mining	1	1	1	–	–	–	1	–
Construction	1	1	1	–	1	–	1	–
Manufacturing	23	23	23	–	1	22	23	3
Service producing	1	1	1	–	–	–	1	–
Transportation and public utilities	1	1	1	–	1	–	1	–
Trade	3	3	3	–	1	3	3	–
Finance, insurance, and real estate	1	1	1	–	–	–	1	–
Services	1	1	1	–	1	1	1	–
Government	3	3	–	–	–	–	–	–

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 a news release which contains preliminary national estimates of nonagricultural employment, average weekly hours, and gross 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 preceding years.

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;* data are shown for each series for the most recent 13 months.

Following each benchmark revision, a historical volume, *Employment and Earnings, United States* (or a supplement), is published. This provides monthly data and annual averages from the beginning date of each series, in a few instances as far back as 1909 (the supplements contain revised data for recent years). A companion volume, *Employment and Earnings, States and Areas,* provides historical data (annual averages) on all employees and on production-worker hours and earnings published by the State agencies for States and areas from the beginning of these series, in some instances as far back as 1939. This volume (or a supplement with revised data for recent years) is published annually. Detailed industry data are available each month in releases published by the cooperating State agencies.

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.

To facilitate the use of its data, BLS has made them available to the public in machine-readable form. More than 2,800 national CES time series are available, as well as over 24,000 State and area series. Employment data for 250 areas and hours and earnings data for 210 areas are included.

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 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 Technical Note in *Employment and Earnings.*

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Bureau of Labor Statistics and the Employment and Training Administration 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
Approval expires 1/31/84

Return promptly each month in the enclosed envelope which requires no postage.

BLS Codes			Location of Establishment(s) Covered in this Report			
State	Report Number	Industry	Number of Establishments	City	County	State

Return to:

SAMPLE COPY

(Change name and mailing address if incorrect—include Zip code.)

Before entering data see explanations on reverse side.

Year and Month	Pay Period: Which includes the 12th of the month. From—	Pay Period: Which includes the 12th of the month. Through	No. of days paid for including holidays and vacations for the majority of nonsupervisory employees. During the entire pay period	No. of days paid for including holidays and vacations for the majority of nonsupervisory employees. During the 7 day period which includes the 12th	Number of Paid Employees: All persons who worked during or received pay for any part of the pay period. Both sexes	Number of Paid Employees: All persons who worked during or received pay for any part of the pay period. Women only	Nonsupervisory Employees: The number of nonsupervisory employees who worked during or received pay for any part of the period reported, the pay earned (before deductions but excluding commissions), and hours paid for. Include pay and hours for overtime, sick leave, holidays, and vacations. Number of nonsupervisory employees	Total nonsupervisory employee payroll (excluding commissions reported in col. 9A) (omit cents)	Total nonsupervisory employee hours (omit fractions)	Commissions of nonsupervisory employees: Amount of commissions (omit cents)	Period in which earned From—	Period in which earned Through
	Both dates inclusive										*Both dates inclusive*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(9A)	(9B)	(9C)
1981 Dec.								$		$		
1982 Jan.												
Feb.												
Mar.												
Apr.												
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Nov.												
Dec.												

	Do Not Use (Office Use Only) P.R. (9X)	H. (10X)	Expl. Code (11)	L/P Code (12)	Your Comments on Changes in Employment, Payroll, or Wage Rates—Enter below the main factors responsible for significant month-to-month changes in employment, average hours worked, average hourly earnings, etc. Examples are: *More business, temporary summer help, wage rate increase, overtime, strike, fire, weather.* For any general wage rate changes (not individual changes for length of service, merit, or promotion), note the amount of increase or decrease (as + 2%, — 5 ¢), the effective date of the change, and the approximate number of nonsupervisory employees affected.
1981 Dec.	$				
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June					
July					
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BLS 790 E (Rev. June 1981)

Additional Space for Comments Provided on Reverse.

Explanations for Entering Data on Reverse Side

Columns 2 and 3. Pay Period Dates—Enter the beginning and ending dates of your pay period which includes the 12th of the month.

Columns 4 and 5. Pay Period—Number of Days—Enter in **column 4**, for the entire pay period reported, the number of days on which the majority of production and related workers performed work plus the number of holidays and vacation days during the period for which the majority were paid. When the period is longer than a week, enter in **column 5** the number of such reported days worked or paid for during the 7-consecutive day period which includes the 12th of the month and falls entirely within the period reported in **columns 2 and 3.**

Column 6. Number of Paid Employees—Both Sexes—Enter the total number of persons on the payroll(s) covered by this report who worked full- or part-time or received pay for any part of the period reported. Include salaried officers of corporations and executives and their staffs, but ***exclude*** proprietors, members of unincorporated firms, and unpaid family workers. Include persons on vacations and sick leave who received pay directly from your firm for the period reported, but ***exclude*** persons on leave without company pay the entire period and pensioners and members of the Armed Forces carried on the rolls but not working during the period reported.

Column 7. Number of Paid Employees—Women Only—Report the number of women employees included in **column 6.**

Column 8. Number of Production and Related Workers—Enter the number of production and related 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 reported. Include persons on vacations or on sick leave when paid directly by your firm.

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

The term "production and related workers" excludes employees engaged in the following activities: Executive, purchasing, finance, accounting, legal, personnel, cafeterias, medical, professional, and technical activities, sales, sales-delivery (e.g., delivery and route workers), advertising, credit, collection, and in installation and servicing of own products, routine office function, factory supervision (above the working supervisors' level); and force account construction employees on your payroll engaged in construction of major additions or alterations to the plant who are utilized as a separate work force. (Employees in the above activities should be excluded from **column 8** but included in **column 6, Number of Paid Employees.**)

Column 9. Payroll—Enter amount of pay earned during the pay period by the production and related workers reported in **column 8.** Payrolls should be reported before deductions for old-age and unemployment insurance, group insurance, withholding tax, bonds, and union dues. Include pay for overtime and for holidays, vacations, and sick leave paid directly by your firm to employees for the pay period reported.

Exclude bonuses (unless earned and paid regularly each pay period), or other pay not earned in pay period reported (e.g., retroactive pay), and value of free rent, fuel, meals, or other payment in kind.

Column 10. Total Hours—Enter the sum of (1) hours worked (including overtime hours) during the pay period by the production and related workers reported in **column 8**, (2) hours paid for stand-by or reporting time, and (3) equivalent hours for which employees received pay directly from the employer for holidays, vacations, sick leave, or other leave paid to these workers. Do not convert overtime or other premium paid hours to straight-time equivalent hours.

Column 10Y. Overtime Hours—Enter the number of hours included in **column 10**, for which premiums were paid because the hours were in excess of the number of hours of either the straight-time workday or workweek. Include Saturday and Sunday hours (or 6th and 7th day hours) only if overtime premiums were paid. Holiday hours worked by employees should be included only if payment for these hours is at more than the straight-time rate. Exclude hours for which only shift differential, hazard, incentive, or other similar types of premiums were paid. If none, enter "0" in **column 10Y.**

Comments	
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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, for each State, and for 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.

Between 1971 and 1981, three survey cycles, on average, were conducted alternately for manufacturing; nonmanufacturing; and trade, transportation, communications, utilities, and government services industries. In addition to the regularly scheduled surveys, which follow a 3-year cycle, surveys were conducted for education services in 1978 and hospitals in 1980. Currently, 48 State agencies (including the District of Columbia) 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; and 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 detailed description of this system.)

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

Occupational classification

The OES classification system is a combination of two widely used systems. Titles and descriptions of occupations used for data collection are derived primarily from the *Dictionary of Occupational Titles,* third and fourth editions published in 1965 and 1977, respectively, by the Department of Labor's United States Employment Service. The *1970 Census of Population,* published by the Department of Commerce, Bureau of the Census, is the other major source for occupational classification. The census is made up of about 400 categories reflecting broad occupational coverage without definitions. The *Dictionary of Occupational Titles,* on the other hand, is a more detailed classification system with about 12,000

definitions of occupations and is organized to meet the operating needs of the public employment service. These two systems, plus information compiled from industry officials and other sources, contributed to the OES occupational classification system.

This system allows for the constant state of change that occupational terminology and classification undergo. This flexibility permits integration of the insight gained from each successive round of OES surveys. In 1983, the OES occupational classification system will be revised to provide compatibility with the 1980 *Standard Occupational Classification System* published by the Department of Commerce.

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 1,700 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 occupation 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 of the month, which is standard for all Federal agencies collecting employment data.

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 survey years

1971, 1977, 1978, 1979, and 1980. 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 use 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.

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Bureau of Labor Statistics. *Occupational Employment in Selected Nonmanufacturing Industries*, Bulletin 2088, 1981.

Presents occupational employment data collected in 1978 for the mining; construction; finance, insurance, and real estate; and services industries.

Bureau of Labor Statistics. *Occupational Employment in Transportation, Communications, Utilities, and Trade,* Bulletin 2116, 1982.

Presents occupational employment data collected in 1979 for the transportation, communications, utilities, and wholesale and retail trade industries.

U.S. Department of Labor, Employment and Training Administration. *Dictionary of Occupational Titles*, fourth edition, 1977.

Comprehensive descriptions of 12,099 jobs coded by work requirements and duties performed.

Chapter 4. Measurement of Unemployment in States and Local Areas

Background

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.

Unemployment estimates have been developed for Labor Market Areas (LMA's) for over 35 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 the 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. 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 5,000 geographic areas which include all States, LMA's, and counties and cities with 50,000 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 reentered 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. For some subgroups, special factors, based on relationships derived from historical data, are used to adjust the State covered rate.

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. A person on an unpaid absence is excluded from the payroll estimate in the Handbook method but is considered employed in the CPS. Also, 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 comprise each State. In the 10 largest States (and 2 large areas mentioned above), CPS data are used directly on a monthly basis. In the 40 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:

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

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 were developed on the basis of employment relationships which existed at the time of the 1970 Decennial Census, which will be updated when 1980 census data become available. 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 40 States or the CPS estimate for the 10 largest States—to produce the final adjusted LMA estimates:

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

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, three alternative methods are

used to disaggregate the LMA estimates to the subarea level.

The population-claims method is the perferred 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.

If the necessary UI claims data are not available, but decennial census data on subarea employment and unemployment are available, then the census-share method is used. This method disaggregates Handbook employment and unemployment based on their 1970 census shares in total LMA employment and unemployment.

Finally, if both claims data and decennial census employment and unemployment are lacking, the population share method is used. This method distributes the LMA estimate to its subareas using shares computed from the latest available population data prepared by the Bureau of the Census.

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 Comprehensive Employment and Training Act (CETA), Public Works and Economic Development Act (PWEDA), the Urban Development Action Grant Program, and Labor Surplus Area designation. Under CETA, unemployment data are used with other data to determine the amount of funds to be allocated; in the case of PWEDA, the Urban Development Action Grant Program, and Labor Surplus Area designation, 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 40 States and monthly for 10 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.

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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 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 until 1980, when quarterly issues were resumed.

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.[3]

UI coverage is broad and basically comparable from State to State. In 1981, UI and UCFE covered 90,641,808 workers, or 90.3 percent of civilian employment. Covered workers received $1,483 billion in pay or 95.7 percent of the wage and salary component of personal income. The principal exclusions from coverage are members of the Armed Forces, railroad employees, and most domestic workers, agricultural employees, and some employees of small nonprofit organizations. Also excluded are the self-employed and unpaid family members.

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 separate, distinct, and significant activities, having separate records, and classifiable in separate industrial codes. Each activity unit is then properly reported as a separate establishment.

Reporting units

A reporting unit is the economic unit for which the employer submits a contribution report or identifies

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

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

[3] The coverage given is, in all cases, the minimum required by Federal law. State legislation often provides coverage for additional categories of workers.

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 installations. 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.[4] 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. 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.[5]

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. Depending on the method used by the Federal agency in preparing its quarterly summary balance (cash or accrual basis), the gross amount of payrolls is either paid or payable.

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

[4] The Department of Defense is an exception. The employment count in installations of the Department of Defense covers all persons employed on the last workday of the month plus all intermittent employees during the month. Intermittent workers are occasional workers who were employed at any time during the month.

[5] 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.

assessment for Unemployment Insurance funds and, therefore, their taxable wages and contributions are not reported.

In mid-1982, approximately half the States required that employers pay UI taxes on the first $6,000 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-1982 also, about half the States allowed employers to obtain lower tax rates by making voluntary contributions to the unemployment tax fund. A small number of States also require contributions from employees. Such contributions are included without separate identification.

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.) 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. (See table.) Statewide 4-digit classifying for nonmanufacturing 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.

Industrial classification of employment and wage data, 1938–81

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 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	
1979-81	20	143	452							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	
1979-81	64	277	553							X

[1] January-March quarter only.

[2] Not coded on a mandatory basis.

Collection methods

Approximately 4.5 million reporting units in the nonagricultural private sector submit quarterly reports to State agencies, with data on monthly employment, quarterly total and taxable wages, and contributions. In addition, the 53 State agencies receive reports from about 33,000 reporting units of the Federal Government for their civilian employees under the UCFE program in each State; they also receive reports covering nearly 99 percent of State and 96 percent of local government employees, and about 40 percent of all farm workers.

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. The States have the option of either submitting two tapes—(1) statewide by 4-digit industry and (2) county by 2-digit industry—or one tape, 4-digit industry by county. Most States provide the latter.

BLS, in turn, further summarizes these data at county, State, and national levels, by industry and by size of reporting unit, and publishes the summaries in the quarterly and annual *Employment and Wages* publication.

The individual States, which have a wide range of uses for these data, usually publish their own ES-202 reports.

Comparison of the ES-202 Program with Other Series

A number of statistical data series, in addition to the ES-202 program, produce employment and wage data comparable in some respects to those obtained by ES-202. These series all have certain applications, strengths, and shortcomings. The ES-202 program, because of its broad universe coverage, continuity, and currency, is one of the most useful.

Economic Census and County Business Patterns

The Bureau of the Census conducts a census of most industries every 5 years. These data, along with the annual Company Organization Survey for multiunits and data from the Internal Revenue Service and Social Security Administration for single units, 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 uses a finer establishment breakdown than the ES-202 reporting concept, so that numbers of units and employment per unit may differ. 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.

In addition, the census reports exclude public sector employees (except in the *Census of Government*). Some censuses (but not *County Business Patterns*) include self-employed persons in the retail trade, construction, and service industries, who are not covered by UI. The censuses also impute employment data, while ES-202 adheres to reported figures. 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 177,000 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, 790 uses several other sources, including the Bureau of the Census' *County Business Patterns* for certain salespersons and agents, the Interstate Commerce Commission data for railroad workers, the U.S. Department of Education and the National Catholic Welfare Association data for private elementary and secondary schools, and the National Council of Churches data and State surveys for religious organizations.

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 the 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 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 60,000 households chosen to represent the entire civilian noninstitutional population and labor force. 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.

Presentation

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

For the first quarter of each year, the publication includes distributions of employment and wages by size of reporting unit for each major industry division within each State and by industry for the United States as a whole. These data are distributed in nine employment-size categories.

To preserve the anonymity of establishments, BLS withholds publication of data for any county, State, or national 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, unpublished data, such as county level data and 3-digit industry data by State are available upon request. Depending on the request, the data may be provided, for a nominal fee, on microfiche or magnetic tape.

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 firm.

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, Occupational Employment Statistics, 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, the ES-202 report is one of the best sources of detailed employment and wage statistics used by business and public and private research organizations.

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Chapter 6. Consumer Expenditures and Income

Consumer expenditure surveys are specialized family living 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 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). (See Volume II.) 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, once again included both urban and rural families, provided the basis for revising the CPI, 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.

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 remainder of this chapter describes the new continuing survey that extends 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 will thereby be 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 kinds of families.

Like the 1972-73 survey, the ongoing survey consists of two separate surveys, each with a different data collection technique and sample. There is an Interview Panel Survey in which 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. In addition, there is a Diary (or recordkeeping) Survey completed at home by the respondent family for two consecutive 1-week periods.

The unit for which expenditure reports are collected is the set of eligible individuals comprising a consumer unit, which is defined as (1) all members of a particular housing unit who are related by blood, marriage, adop-

tion, 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. In the Diary Survey, detailed data are collected on all expenditures made by consumer units during their participation in the survey. All data collected in both surveys are subject to Census and BLS confidentiality requirements, which prevent the disclosure of respondents' identities.

Interview Survey

The Interview Panel 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. 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 respective 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 in certain of these interviews. 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.

Information on occupational expenses and on changes in assets and liabilities is also collected. This information, along with the demographic information collected in the first interview, links the Interview Survey expenditure data to that of the Diary Survey for publication in an integrated format. 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; hence, the rotating nature of the survey.

The rotation of Interview Survey families into and out of the sample is a new feature of the survey which results from its being continuous. 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 new 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 for a full five quarters in the survey.

Diary Survey

The primary objective of the Diary Survey is to obtain reliable 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. Household characteristic data 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. 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 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. Completed diary questionnaires are manually reviewed for completeness and consistency and are then transmitted to the Census Processing Center in Washington, D.C., where further computer processing is performed. In addition, missing or invalid demographic or work-experience data (except income) are imputed. The families are assigned weights so that estimates can be derived that represent the total 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 coding or extreme value errors are corrected before further processing is performed on the quarterly data bases.

Selected portions of the diary data are also affected by automated imputation and allocation routines when respondents report insufficient detail to meet publication requirements. 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 and apparel expenditures by age and sex groupings. 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.

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 preedit. 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 preedit. This continues until errors identified by the preedit no longer appear. Once a panel month's preedit is complete, 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 the 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 family relationship coding inconsistencies; a review of selected extreme values (both high and low) 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 routines, which affect all fields in the data base except income and assets, are intended to improve the estimates derived from the survey. 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 101 areas, of which 85 urban areas have been previously defined and selected by BLS for the Consumer Price Index program. These urban PSU's are classified according to the following four categories: "A" PSU's, which comprise 27 certainty areas (i.e., they are self-representing) that are primarily Standard Metropolitan Statistical

Areas (SMSA's); "B" PSU's, which comprise 20 SMSA's with a total 1970 population of over 400,000; "C" PSU's comprising 22 SMSA's with a total 1970 population of 400,000 or less; and "D" PSU's, comprising 16 urban places in all areas outside of SMSA's. These 16 urban PSU's were supplemented with 16 additional "E" PSU's, representing the rural population, in the original design. However, as of the fourth quarter of 1981, the rural portion was eliminated due to budget constraints imposed on the Bureau.

The sampling frame (i.e., the list from which housing units are chosen) for this survey is generated from the 1970 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 that census. In addition, the sampling frame for the Diary Survey was augmented during the time prior to the Christmas and New Year's holidays to account for expenditure increases and differences during the period.

The Bureau of the Census establishes an address sample of 6,800 households that are requested to participate annually in the Diary Survey. This results in an effective annual sample size of 4,800, 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. As to the Interview Survey, approximately 8,400 addresses are contacted in each of the five calendar quarters. Allowing for bounding interviews, which are not included in estimates, and for nonresponse (including vacancies), the number of completed interviews per quarter is targeted at 4,800. Each month, one-fifth of the units interviewed are new to the survey. This panel—and all others—is interviewed for five consecutive quarters and then dropped from the survey. This rotation of panels, used by the Bureau of the Census in several other continuing surveys, has the advantage of operational efficiency.

Weighting

Each family included in the CES represents a given number of families in the U.S. population, which is considered as 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 a final adjustment based upon CU family composition. In the case of the Diary, a pre-Christmas seasonal factor is also used in the estimation of weights.

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, regional offices, or from the Government Printing Office. Information on public use tapes can be obtained from the BLS Division of Living Conditions Studies.

Publications from the consumer expenditures surveys 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.

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 eliminates the possibility that participating families may even be indirectly identified.

Uses and Limitations

As in the past, the revision of the Consumer Price Index remains a primary reason for undertaking such an extensive survey. The results of consumer expenditure surveys have been used to select new market baskets of goods and services for the index, to determine the relative importance of the items selected, and to derive new cost weights for the baskets.

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 aged, low-income families, urban families, and those receiving food stamps. The Internal Revenue Service has used the data as the basis for revising the average State sales tax tables which taxpayers may use in filing Federal income tax returns. 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.

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 recording or coding the data obtained, and other errors of collection, response, processing, coverage, estimation for missing data, and interviewer variability.

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. Standard error tables applicable to published BLS data can be obtained from the BLS Division of Living Conditions Studies.

Chapter 7. Producer Prices

Part I. Traditional Methodology

Background

The Producer Price Index (PPI), formerly known as the Wholesale Price Index, is one of the oldest continuous statistical series published by the Bureau of Labor Statistics, as well as one of the oldest in 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 in 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.

The most comprehensive overhaul of PPI methodology ever planned has been underway since the late 1970's in what is called the Producer Price Index Revision (PPIR). By the mid-1980's, all indexes in the Producer Price Index will be calculated under this new methodology. By January 1982, nearly one-third of the total value of domestic mining and manufacturing production was being sampled to produce indexes calculated with PPIR methodology. Commodity indexes long established in the PPI are being continued under the new methodology, and all newly introduced indexes for products and industries are being estimated according to PPIR methods. As of January 1982, approximately 3,450 commodities were included in the overall PPI program, and the Bureau was receiving about 18,000 price quotations per month. This data base will be expanded at 6-month intervals until all 493 mining and manufacturing industries are covered by approximately 90,000 price quotations and 6,000 published product indexes each month.

Part I of this chapter describes the traditional Producer Price Index methodology, much of which is currently being phased out. It includes a brief section on the Industry Price Index methodology, which shares the weaknesses of the traditional PPI methodology. Part II describes the methodology of the Producer Price Index Revision, including a discussion of some of the problems with traditional PPI methodology which the PPIR is designed to correct. Some of the principles and practices which have guided the traditional PPI program will, however, continue to be observed even after the transition to the PPIR is complete.

Description of Survey

Concepts

The Wholesale Price Index was established as a measure of price changes for goods sold in primary markets in the United States, "wholesale" referring to sales in large quantities rather than prices received by wholesalers, jobbers, or distributors. In the wake of some semantic confusion, the name Producer Price Index was adopted in 1978 to emphasize that the index measures changes in selling prices received by producers from whoever makes the first commercial purchase.

From its inception, the All Commodities Index was considered a general purpose index designed to measure changes in the general price level in other than retail markets. From the beginning of the index, however, attention was directed to some specific needs of users, and indexes for individual commodities and for major commodity groups were published. As early as 1903, two special group indexes by stage of processing—raw commodities and manufactured commodities—were published to meet the needs of students of price statistics.

Although most price quotations reported to the Bureau are the selling prices of selected manufacturers or producers, some prices are those quoted on organized exchanges (spot prices) or at central markets. Prices for

[1] Senate Committee on Finance, *Wholesale Prices, Wages, and Transportation,* Senate Report No. 1394, "The Aldrich Report," Part I, 52d Congress, 2d sess., Mar. 3, 1893; and U.S. Department of Labor, *Course of Wholesale Prices, 1890-1901,* Bulletin No. 39, March 1902, pp. 205-09.

imported commodities are those received by importers—the first commercial transaction involving the commodity in the United States. Since the index is intended to measure "pure" price change, that is, not influenced by changes in quality, quantity, shipping terms, product mix, etc., commodities included in the index have been defined by precise specifications which incorporate their principal price-determining characteristics.[2] So far as possible, prices are f.o.b. (free on board) production point and have referred to sales for immediate delivery. Prices applicable to long-run contracts have been historically excluded, except where contract prices have dominated the market. "Futures" prices are not included.

Universe

The PPI universe consists of all commodities sold in commercial transactions in primary markets of the United States, commodities produced in the United States as well as those imported for sale. The universe covers manufactured and processed goods and the output of industries classified as manufacturing, agriculture, forestry, fishing, mining, gas and electricity, public utilities, and goods competitive with those made in the producing sector, such as waste and scrap materials. All systematic production is represented, but individually priced items, such as works of art, are excluded. Also excluded are goods transferred between establishments owned by the same company (interplant or intracompany transfers). Goods sold at retail by producer-owned retail establishments are excluded because they conceptually belong to a retail (customers') universe, rather than to primary market transactions.

Civilian goods normally purchased by the Government are in the universe, but military goods are not. Government sales of some commodities (e.g., electric power) are included if they can be considered competitive with free market sales.

Prices

To the extent possible, the prices used in constructing the index are those that apply to the first significant commercial transaction in the United States. Transactions for the same item at later stages of distribution are not included. However, as raw materials are transformed into semifinished and finished goods, the resulting products are represented.

With some exceptions, the prices refer to one particular day of each month. In most cases, the pricing date is Tuesday of the week containing the 13th day; but for some commodities (farm products, particularly) a day other than Tuesday is used because it is considered more representative. Indexes for natural gas, most refined petroleum products, and some industrial chemicals are based on data from the entire month and, therefore, are lagged 1 month in the indexes. A gasoline index for November, for example, would reflect price changes that occurred in October.

The Bureau attempts to base the PPI on actual transaction prices. Companies are requested to report prices less all discounts, allowances, rebates, free deals, etc., so that the resulting net price is the actual selling price of the commodity for the specified basis of quotation. BLS periodically emphasizes to reporters the need to take into account all discounts and allowances. List, or book, prices are used if transaction prices are unobtainable. Some of these list prices are, of course, true transaction prices. List prices have been used for only about 20 percent of traditional PPI's. Rebates and other forms of price concessions granted by producers to their distributors reduce the proceeds received by producers and, therefore, are reflected as decreases in the PPI, even though such rebates are intended to be passed through to the ultimate buyer. Conversely, terminations of rebate programs are considered price increases in the PPI.

Prices are generally f.o.b. production or central marketing point to avoid reflection of changes in transportation costs. Delivered prices are included only when the customary practice of the industry is to quote on this basis and the Bureau can not obtain a price at the production point. In such cases, adjustments for changes in transportation costs are made whenever possible. Subsidies to producers and excise taxes are excluded since they are not considered part of the market price; however, import duties are included as part of the selling price of imported goods.

Although the same commodity usually is priced month after month, it is necessary to provide a means for bridging over changes in detailed specifications (or descriptions of items priced) so that only real price change will be measured. An adjustment is particularly important when new commodities are introduced. Even when specifications of existing commodities are changed, care is exercised to insure that only price changes influence the index. A new price series resulting from a physical change in an article or a change in its selling terms is substituted for the earlier series either by direct comparison or by linking. The objective of the linking procedure is to ensure that the index will reflect only those changes due to actual price difference. Each time a change in the item priced occurs, the Bureau appraises its significance to ascertain whether an actual price change occurred. If the specification change is minor and does not involve price-making factors, the substitution is effected by direct comparison, and any reported price change between the old and the new specification

[2] An example of a commodity specification for steel strip is: "Strip, cold-rolled, carbon steel, coils, No. 4 temper, No. 2 finish, No. 3 edge, base chemistry, 6" x 0.050", in quantities of 10,000 to 19,999 lbs.; mill to user, f.o.b. mill, per 100 lbs."

is reflected in the index. If the change is major and involves price-making factors, the substitution is made by linking, and any price change associated with a quality change is not permitted to affect the index level.[3]

When differences are major, an attempt is made to obtain data from the reporters on the cost of the change and to adjust the price index accordingly. This is particularly important in the case of some durable goods, such as automobiles, which have periodic model changes. Also, price increases which result from the addition of features that formerly sold at extra cost are not reflected in the index. Conversely, price changes attributable to deletion of equipment which was formerly standard are not treated as decreases.

The problem of devising adequate quality adjustment techniques for changes in commodities has been particularly troublesome for complex capital equipment, where new machinery frequently incorporates a new generation of technological advance without corresponding increases in costs. Any inability to reflect technical progress embodied in new products imparts an upward bias of unknown magnitude to PPI data. (Part II further describes this problem and the Bureau's response.)

Prices for specific commodities reported by individual companies are generally averaged using an unweighted mean. If five companies report prices for a product, each company's price counts one-fifth towards the computation of the composite price, even though the firms may be of widely different sizes. Reporting companies are weighted equally in most cases. Month-to-month price change should be computed from matched-company data. In order that a change in the company-reporter sample itself does not affect the measure of price change, the change for any month to the succeeding month is calculated from identical-company data. A new report affects the index no earlier than the second month after introduction.

Linking is also used for: (1) The addition to or deletion of commodities or groups of commodities from the total index; (2) the addition to or deletion of a company report from the sample of companies priced; or (3) occasionally, a change in the price source. Whenever a new commodity is added to an existing commodity grouping, linking of the new item to any one of the existing items is not pertinent. Instead, the weights of the entire group are redistributed to include the new items, and the link is made at the group level instead of at the commodity level. A similar procedure is used to handle items that are dropped from the index without direct replacement.

In the event production of a specified commodity is discontinued by a reporter, or its importance is reduced, the Bureau collects price data for a similar or a replacement item. Prices are obtained for the new and the discontinued series for an overlap period. When production cost data are unavailable, the index is extended by linking, and the difference, if any, between the new item price and the original item price is taken as a measure of the quality difference between the two items.

Classification

Producer Price Indexes can be organized in a number of ways, such as by commodity or stage of processing. The commodity classification organizes products by similarity of end use or material composition. The stage-of-processing (SOP) classification organizes products by degree of fabrication (i.e., finished goods, intermediate goods, and crude materials) and by class of buyer (i.e., final demand or not).

The commodity classification structure of the PPI is unique and does not match any standard classification such as the Standard Industrial Classification (SIC), the Standard Commodity Classification, 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. Since 1952, 15 major commodity groupings have comprised the All Commodities Index; 2 major commodity groupings have been combined to form the Farm Products and Processed Foods and Feeds Index, and the other 13 have been grouped into the Industrial Commodities Index. Each major commodity grouping includes (in descending order of aggregation) subgroups, product classes, subproduct classes, and individual items.

Stage-of-processing (SOP) indexes regroup commodities priced in the PPI at the subproduct class level according to: (1) The amount of processing, manufacturing, or assembling they undergo before entering commercial markets; and (2) the class of buyer. A single subproduct class may appear in several different SOP categories. For example, 31 percent of the value-weight of the index for citrus fruits has been assigned to the index for crude foodstuffs and feedstuffs to represent the proportion of sales to food processors; most of the remaining 69 percent has been assigned to the index for finished consumer foods. The value-weights are the same as those for the PPI subproduct classes. The alloca-

[3] The following simplified example illustrates the principle of linking: The September price for a certain machine was $2,347.50. In October, a new model of the machine was introduced, priced at $2,562.60. The new model was considered essentially comparable with the old, except that it had a more powerful motor and larger tires. These were valued at $186.20 more than the value of those used on the former model. For linking, the September price of the new model was estimated at $2,533.70 ($2,347.50 September price of former model plus $186.20 increase in value of motor and tires). The price comparison between September and October was based on the estimated September price of $2,533.70 and the reported October price of $2,562.60. Thus, a 1.1-percent increase was reflected in the October index, but the price change due to quality improvement (more powerful motor and larger tires) was not reflected. Actual linking procedures used in PPI calculations vary somewhat from those employed in this example.

tions among various SOP categories are currently based on input-output studies for 1972 conducted by the Bureau of Economic Analysis, U.S. Department of Commerce.

Finished goods are commodities that will not undergo further processing and are ready for sale to the ultimate (final demand) user, either an individual consumer or a business firm. Capital equipment (formerly called producer finished goods) includes commodities such as motor trucks, farm equipment, and machine tools. Finished consumer goods include foods and other types of goods purchased by retailers and eventually used by consumers. Finished consumer foods include unprocessed foods such as eggs and fresh vegetables, as well as processed foods such as bakery products and meats. Other finished consumer goods include durables such as automobiles, household furniture, and jewelry, and nondurables such as apparel and gasoline.

Intermediate materials, supplies, and components include commodities that have been processed but require further processing before they become finished goods. Examples of such semifinished goods include flour, cotton yarns, and steel mill products. Commodities that are physically complete but which are purchased by firms as auxiliary products are also considered intermediate goods. Examples would include residual fuel, paper boxes, and motor vehicle parts. The proportion of gasoline sold to businesses for their trucks or auto fleets would also be classified as part of the intermediate goods index since such sales are not considered part of final demand.

Crude materials for further processing include products entering the market for the first time which have not been manufactured or fabricated but which will be processed before becoming finished goods; scrap materials are also included. Crude foodstuffs and feedstuffs include items such as grains and livestock. Crude nonfood materials include raw cotton, crude petroleum, natural gas, hides and skins, and iron and steel scrap.

As we shall see in more detail in Part II, stage-of-processing indexes are more useful than commodity grouping indexes for analysis of general price trends. Aggregated commodity indexes sometimes produce exaggerated or misleading signals of price changes by multiple counting of the same price movement through various stages of processing.

In addition to stage-of-processing and commodity grouping indexes, indexes are available by durability of product and for a number of special commodity groupings, such as construction materials and copper and copper products. Durability-of-product allocations of individual commodities are based upon the Bureau of the Census definition that products with an expected lifetime of less than 3 years are classified as nondurable, and products with a longer life expectancy are considered durable goods. Special grouping indexes rearrange PPI data into different combinations of price series, so that the appropriate prices and weights are those of the PPI. Although most PPI's are based on a national sample because most products are produced for a national market, regional indexes are published for a few series, notably the major refined petroleum products, electric power, and coal. Industry price indexes are described later in this chapter.

Data Sources and Collection Methods

Prices

Reporting of price data by companies through mail questionnaires is voluntary and confidential. Most prices are collected each month; for a few commodities which change prices infrequently, however, a shuttle questionnaire is mailed quarterly. While price data are generally obtained directly from producing companies, trade publications are sometimes used when they are accepted as reliable by the Bureau and the industry; the Bureau has been phasing out this practice as much as possible, however. For fish and most agricultural products, the Bureau uses prices collected and published by other Government agencies.

Price reporting is initiated, whenever possible, by a visit by a Bureau representative to the prospective respondent. A detailed report describing all of the pricemaking characteristics of the commodity is prepared for each new price series. This commodity price information form becomes a part of the permanent record for the series. After the initial collection of prices, monthly information is collected by mail on a shuttle schedule (BLS 473, shown at the end of this chapter).

Sampling

Traditional PPI's are based on nonstatistical, judgment samples of commodities, of specifications (descriptions), and of reporters. Until PPIR sampling techniques became standard, the sample of commodities was chosen after a review of the data of the industrial censuses and other statistics on the value of transactions. Generally, the commodities chosen were those with the largest shipment values. New items were not added until they became established in the market.

Samples of specifications and of reporters were selected after consultation with trade associations or other industry representatives and with staffs of other Government agencies. Individual commodity specifications were selected on the basis of net dollar sales. That is, the volume seller of the industry (not of the company) was preferred. The specification described not only the physical characteristics but also the most common quality, grade, level of distribution, and market.

However, terms of sales (discounts, etc.) were based on the company's own most common practice. For some commodities, prices were quoted by producers and sellers in terms of a single specification taken as standard; all other prices were quoted as differentials from the standard, as for some farm products such as wheat and cotton. When no standard commodity basis existed, the specification to be priced was selected with the help of industry experts.

The number of reporters was determined, to some extent, by the variation of price movements among them and the degree of price leadership. Whenever possible, a minimum of three companies was obtained to report on each item so that data for specified commodities could be published without disclosure of information supplied by individual companies. For commodities with more than one major production area and a definite regional pattern, a larger sample was selected. Among these commodities are electric power; refined petroleum products; waste materials; bituminous coal; and building materials such as brick, cement, and stone.

Estimating Procedures

Weights

The PPI weights represent the total net selling value of commodities produced, processed, or imported in this country and flowing into primary markets. The values are f.o.b. production point, exclusive of excise taxes. The value of interplant transfers, military products, and goods sold at retail directly from producing establishments also is excluded. Thus, the definition of the weights conforms to the universe definition.

Price data for individual commodities are combined into indexes for various groupings by weights based on the total value of commodity shipments. The major sources of shipment-value data include: Bureau of the Census—*Census of Manufactures* and *Census of Mineral Industries*; Bureau of Mines—*Minerals Yearbook* and other publications; U.S. Department of Agriculture—*Agricultural Statistics* and other publications; and Bureau of Fisheries—*Fisheries of the United States* and other publications. In additon, other sources of data, such as trade associations, have been used.

Each commodity price series is considered representative of a class of prices and is assigned its own weight (the shipment value of the commodity) plus the weights of other related commodities not directly priced but whose prices are known or assumed to move similarly. The assignment of price movements for priced commodities to those for which quotations are not obtained is referred to as imputation. For some commodities, such as ships and some kinds of custom-made machinery, it is not possible to obtain direct measures of price movements. The weights for such items are assigned to other commodities or groups of commodities for which prices are available. Usually, this imputation is made to priced commodities that have a similar manufacturing process, on the assumption of similar price movements.

PPI weights are revised when data from the quinquennial industrial censuses, as well as sufficient budgetary resources, become available. Beginning in 1976, weights have been based on the 1972 industrial censuses. Indexes for 1947 through 1954 were based primarily on the 1947 censuses. In the January 1955 index, adjustments were made to align the major group weight totals with 1952-53 average shipment values as reported in the *Surveys of Manufactures*. Weights based on the 1954 census shipment values were introduced in January 1958. From 1961 through 1966, weights were based on 1958 census values, and from 1967 through 1975, they were based on 1963 census values.

The Bureau publishes the relative importance of each item in the PPI, rather than the actual values used as weights. The relative importance of an item represents its basic value weight used in the index, including imputations, multiplied by the relative of price change from the weight date to a later date; the result is expressed as a percent of the total for all commodities or for some index grouping. Data showing the relative importance of commodity subproduct classes with respect to the three major stage-of-processing groupings are also available.

BLS calculates and releases relative importance data each December. Except when entirely new weights are introduced from the latest industrial censuses, relative importance data usually change from December to December primarily because of relative price movements. Thus, a commodity whose price rises faster than the All Commodities Index from one December to the next will automatically have a higher relative importance; a commodity whose price falls or rises less than the All Commodities Index will show a smaller relative importance. Relative importance data, however, are not used as fixed inputs by the Bureau to calculate indexes for a whole year before the next set of relative importance figures is calculated. Theoretically, the Bureau could calculate and publish a new set of relative importance data every month. Relative importance data for any given grouping also change when its components are subjected to a sample change.

Index calculation

In concept, the PPI 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

Q_a represents the quantity shipped during the weight-base period.

An alternative formula more closely approximates the actual computation procedure:

$$I_i = [(\Sigma Q_a P_o(P_i/P_o))/\Sigma Q_a P_o] \times 100$$

In this form, the index is a weighted average of price relatives for each item (P_i/P_o). The expression (Q_aP_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. Each value weight includes not only the value of items priced but also the values of unpriced items whose price movements are assumed to behave similarly. When new weights are introduced, the index with new weights is linked to the index constructed with earlier weights. The weight adjustment itself, therefore, affects only the later calculations of average price change. 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

The monthly PPI is published first in a news release, usually issued in the second week of the month following the reference month. The release includes a narrative on the most significant commodity price movements within the major stage-of-processing groups, as well as tables showing indexes and percent changes, both seasonally adjusted and unadjusted, for all SOP groups and for selected commodity groupings within these SOP groups. Even though the release shows indexes for only a limited number of series, all Producer Price Indexes are available and officially considered published on the day of the monthly news release.

The monthly detailed report, *Producer Prices and Price Indexes,* is printed a few weeks after the news release. It includes every publishable, not seasonally adjusted index within the PPI complex, including industry-oriented indexes from the PPI Revision program, as well as some seasonally adjusted data. Prices for some individual commodities calculated by the traditional methodology are also published. An annual supplement provides all publishable, not seasonally adjusted indexes for the preceding calendar year, as well as tables of relative importance data as of December of that year. Tables of historical price indexes for any series are available without charge on request; the Bureau does not maintain tables of historical dollar prices. Computer tapes and microfiche sets of PPI data are available at cost from the Bureau. Articles by Bureau staff analyzing the economic background for recent patterns in PPI and CPI data appear in the *Monthly Labor Review.*

Seasonally adjusted data. Producer Price Indexes at a variety of levels of aggregation may be seasonally adjusted if statistical tests show there is a stable pattern of seasonal price changes. A few of these seasonally adjusted indexes, as well as a larger number of monthly or quarterly seasonally adjusted percent changes, are printed in the news release and detailed report. Official analyses of the PPI customarily are based on seasonally adjusted data, although unadjusted data are used when tests show an absence of stable seasonality. Seasonal adjustment factors are recalculated early each year. BLS uses the Bureau of the Census' X-11 seasonal adjustment method to compute these seasonal factors.

For analyzing general price trends in the economy, seasonally adjusted data usually are preferred because they eliminate the effect of changes that normally occur at about the same time and in about the same magnitude every year—such as price movements resulting from normal weather patterns, regular production and marketing cycles, and model changeovers. For this reason, seasonally adjusted data reveal more clearly the underlying cyclical trends. The unadjusted data are of primary interest to users who need information which can be related to the actual dollar values of transactions. Unadjusted data generally are used in escalating sales and purchase contracts, for example.

Revised data. All PPI's are subject to revision 4 months after original publication to reflect late reports and corrections by respondents. The news release and detailed report print routinely revised data from the fourth preceding month, as well as the current month's indexes. Seasonally adjusted indexes for the preceding 5 years are also subject to revision early each year to reflect the previous year's impact on seasonal price patterns. Other revisions may be made infrequently, as when all stage-of-processing indexes from January 1976 through December 1980 were revised in early 1981 to reflect 1972 input-output relationships instead of the 1967 relationships on which the indexes had been based. Other, infrequent revisions, including any corrections, are also announced in the news release and detailed report.

Uses and Limitations

Producer Price Indexes are used for many purposes. The Finished Goods Price Index, the major focus of the Bureau's news releases and economic analyses of the PPI

since 1978, is one of the most widely cited indicators of inflation in the overall economy. Fluctuations in this index often presage changes in the Consumer Price Index and the gross national product deflator, two other widely followed measures of general inflation. Changes in the Intermediate Goods Price Index frequently signal similar changes to come in the Finished Goods Price Index. 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. The state-of-processing structure thus facilitates economic analysis of inflation transmission and Government stabilization policies. PPI data are also used in analyzing Government policies directed at specific industries, such as energy and steel.

Private business firms use PPI data to assist their operations in forecasting, market analysis, comparison of costs paid for material inputs or prices received for outputs with national averages, and so forth. One of the most important uses of PPI data in recent years has been in long-term sales and purchase contracts. In a 1976 survey of PPI data users, about half of the respondents who used the PPI for escalation revealed that purchase contracts worth nearly $100 billion were being escalated with one or more Producer Price Indexes; the other half declined to specify the dollar amounts.[4] There is reason to believe that the total then and today in the entire economy is substantially higher than this amount.

Some PPI data, such as indexes for various kinds of capital equipment, are used by the U.S. Department of Commerce to help calculate the gross national product deflator and many of its component deflators. PPI data have also been used to deflate values expressed in current dollars to constant-dollar values for such time series as inventories, sales, shipments, and capital equipment replacement costs, for the total economy and for industries and firms. PPI data are frequently used in LIFO (last-in, first-out) inventory accounting systems by firms wishing to avoid "paper profits" which might appear with a FIFO (first-in, first-out) system.

The Finished Goods Price Index can be used to measure changes in the purchasing power of the dollar in primary (but not retail) markets. This index, the Consumer Price Index, and the U.S. Department of Agriculture's index of prices received by farmers all show relative changes from a base period; however, comparisons among the levels of these indexes should not be interpreted as a measure of the actual margins between farm prices and manufacturing, or between primary and retail markets.

The limitations of Producer Price Indexes calculated by the traditional methodology are explained in detail in Part II.

[4] Bureau of Labor Statistics, *The BLS Industrial Price Program: A Survey of Users,* Report 509, 1977; and *Escalation and Producer Price Indexes: A Guide for Contracting Parties,* Report 570, 1979.

Industry and Product Class Price Indexes

An industry price index is a composite index consisting of price series that follow the general economic pattern of a particular industry. It includes products, sometimes of dissimilar types, grouped by industry of origin. Thus, it differs from the traditional PPI commodity indexes. An industry price index for a given industry represents price indexes for a sample of the products produced by that industry, averaged together according to the value of production of each sample product within the industry.

Industry price indexes use weights of gross shipments of products "made in the industry" for the deflation of industry shipments. The product class indexes (used for deflating Census product classes) are a set of output price indexes of industry shipments classified by industry, but weighted by shipments of the product produced anywhere in the economy.

The Standard Industrial Classification (SIC) system, as revised in 1972, is used to define the scope of the industry price index universe. Related products or services are grouped together and assigned a 2-, 3-, or 4-digit industry code according to the level of detail. Industry price indexes are limited in scope to the value of primary and secondary shipments. Total product shipments are used (including interplant transfers), which inherently include shipments to all customers and the value of exported products.

The SIC provides the basis for the classification scheme used in constructing industry price indexes. Within this framework, individual products are given a 7-digit code by the Bureau of the Census. The product indexes are then aggregated to 5-digit product classes. Using these product-class indexes, 4-digit industry indexes are obtained using made-in-the-industry weights.

The Industry Price Index program has always depended entirely upon price data primarily collected for the PPI. Expansion of data for the industry price index depended on the expansion of the PPI. This expansion was generally directed at those industries considered to be most significant, based on such standards as value of shipments, total employment, market importance, etc. Under these general criteria, particular commodities, specifications, and respondents were selected judgmentally for the PPI and industry price indexes on the basis of volume, market share, and price leadership.

Since January 1976, weights for the output indexes are the 1972 value of shipments. Values include those for interplant transfers, goods processed and consumed in the same establishment, and goods sold for export; values of imported commodities are not included. The difference in the scope of the weights, as compared with PPI commodity indexes, stems from the objective in this

system to match price data with the scope of domestic industry production.

The principal advantage of these price indexes has been their industry orientation, an orientation shared by many other economic time series. It has been easier and more appropriate to use industry price indexes, rather than PPI commodity indexes, in conjunction with data on wages, productivity, employment and other series that are expressed in terms of the SIC and Census product class extensions. At the same time, these industry price indexes share the weaknesses of PPI commodity indexes calculated with traditional methodology. Because indexes from the PPIR program have the advantages of industry price indexes without the corresponding limitations, the Bureau is no longer trying to expand the industry price index system as such. Instead, the Bureau is phasing out this system by eliminating publication of those industry indexes which have been absorbed into the PPIR system.[5]

[5] For a more extended treatment of the traditional industry price index methodology, see ch. 15 of the 1976 edition of the *Handbook of Methods,* pp. 123-26.

Part II. Methodology of the Producer Price Index Revision

In 1978, BLS began publication of the first, pilot group of indexes from the Producer Price Index Revision program. This revision is the first comprehensive overhaul of the entire theory, methods, and procedures used by BLS to construct indexes measuring price changes in nonretail markets.

Differences Between PPI and PPIR

Scientific (probability) sampling techniques are being used instead of judgment sampling to select reporting companies, products, and the price-determining transaction terms. Companies of all sizes (not just larger ones) are being asked to supply prices, and transactions involving all kinds of output (not just volume-selling items) are being priced each month. As a result, statistical measures of index error and precision will become available for the first time.

Coverage is being systematically expanded to include all 493 SIC industries in the mining and manufacturing sectors; thousands of commodity indexes will thus become available for the first time. Before the PPIR began, indexes representing only about half of the total value of mining and manufacturing output were incorporated into the traditional PPI commodity system. Expanded coverage lessens the importance of imputations of unpriced goods.

Indexes from the PPIR are industry oriented instead of commodity oriented. The entire output of each industry is sampled, including primary and secondary production and miscellaneous receipts. Traditional PPI commodity indexes have been based on prices received by producers without regard to the industry classification of these producers. When data from more mining and manufacturing industries are established with the PPIR, additional "wherever-made" indexes will be constructed for each product, regardless of the industry of origin. In the meantime, PPIR indexes for products made in the designated industries are being published.

PPIR indexes are classified according to the SIC and, therefore, are compatible with other industry-oriented economic data, such as on employment, wages, and productivity.

Imports are not priced for the PPIR, which is intended to measure changes in the prices of the output of *domestic* industries. Conversely, the share of domestic industry's output which is exported will be a part of the PPIR. The traditional PPI system, aimed at measuring changes in prices received in the first commercial transaction in this country, included imports and excluded exports. The BLS International Price Program has assumed responsibility for collecting and publishing data on import price changes. These data will eventually be incorporated into the wherever-made product index system.

Specifications for commodities priced for the PPIR follow Bureau of the Census definitions and are considerably broader than most of the highly detailed and narrow specifications for traditional PPI commodity indexes. Because companies in the PPIR are reporting prices for a broader range of commodity and transaction-term specifications within a given commodity index, it is usually not possible to publish meaningful average prices for individual commodities in the PPIR, as has been more frequently possible with the traditional PPI. However, after the product sample is specified, a detailed specification for each price report is followed through time. PPIR indexes are usually calculated by constructing an index for each reporting company's price and then averaging these company indexes to derive the commodity index, rather than by taking an average price directly from individual company prices. In addition, averages of company price indexes in the PPIR are usually weighted by the company's relative size, a departure from the traditional PPI practice of giving equal weight to each reporter.

Indexes calculated with PPIR methodology emphasize *actual transaction prices at time of shipment* to

minimize the use of list prices and order prices, which occasionally have been used in traditional PPI commodity and industry price indexes.

PPIR product indexes

Industries included in the PPIR may be represented by up to three kinds of product indexes. Every industry has primary product indexes to show changes in prices received by establishments classified in the industry for products made primarily, but not exclusively, within that industry. The industry under which an establishment is classified is determined by the Census coding of those products which account for the largest share of its total value of shipments. In addition, some industries may have secondary product indexes to show changes in prices received by establishments classified in the industry for products primary to some other industry. Finally, some industries have miscellaneous receipts indexes to show price changes in other sources of revenue received by establishments within the industry which are not derived from the sale of products. Because of the distinction between primary and secondary products, an index for a product made in one industry may differ from the index for the same product made in another industry.

Corresponding PPIR and PPI indexes

Some 7-digit Census products included in the PPIR correspond to 8-digit commodities published in the traditional PPI commodity system. In this case, movements in the traditional PPI's are governed by movements of their counterparts in the PPIR. Although most such traditional PPI commodity indexes continue to be published on their own original base period, the corresponding indexes in the PPIR are published on a base of the month of their introduction. Therefore, monthly percent changes for corresponding items will be identical even when their respective index levels differ.

The aggregation of traditional PPI commodity indexes into commodity grouping indexes continues to follow the traditional methodology; similarly, stage-of-processing price indexes are still calculated from commodity grouping indexes. However, an entirely new structure will eventually replace the traditional commodity structure as the principal vehicle for releasing and analyzing price changes at the primary market level. One planned refinement is the split of the stage-of-processing index for intermediate materials into one for primary processing and one for intermediate processing. This change should enhance the analysis of the transmission of price changes through the economy.

Economics of Producer Price Measurement

The structure of the traditional PPI has not corresponded to any meaningful economic construct; it has been formulated in a rather *ad hoc* fashion without any reference to a theoretical model. An appropriate model—that of a fixed-input output price index[6]—derived from the theory of the firm has now been developed and is being used in the PPIR program.

Indexes based upon a fixed-input output price model avoid one of the chief defects in the current aggregate commodity indexes—multiple counting of price changes. The All Commodities Index, as well as indexes for major commodity groups, is calculated from price changes of commodities at many stages of processing. Each price change is weighted by its *total* gross value of shipments in the base year. Suppose, as a simplified example, that the price of cotton were to rise sharply. If this price increase were passed through by producers to cotton yarn, then to gray cotton fabric, then to finished cotton fabric, and finally to shirts, the price increase in the raw material would have been included five times in the All Commodities Index and four times in both the Industrials category and the Textiles and apparel major group. So long as prices for all items at all stages of processing are changing at about the same rate, this multiple counting produces no major distortion. But if there is more rapid inflation in the prices for raw materials, this multiple counting can produce aggregate rates of price change that are misleading. More detailed indexes which cover only a single stage of processing are free of this defect.

The existing stage-of-processing indexes provide a better basis for the analysis of price change than the traditional major commodity grouping indexes, although some SOP indexes also suffer from some multiple counting. The Finished Goods Price Index and the Crude Materials Price Index are both rather strictly defined and are, therefore, largely free of multiple counting problems. The Intermediate Materials Price Index, however, is a residual category which still includes several different stages within it—three such stages in the shirt example.

The theoretically ideal output price index would allow firms to adjust their outputs in response to relative price changes. However, it is not feasible to collect and use such changing output data in calculating PPI movements. Instead, the PPI is a *fixed-weighted*, or Laspeyres, index that approximates the theoretically

[6] Robert B. Archibald, "On the Theory of Industrial Price Measurement: Output Price Indexes," *Annals of Economic and Social Measurement,* Winter 1977, pp. 57-72; and Franklin M. Fisher and Karl Schell, *The Economic Theory of Price Indexes* (New York, 1972).

ideal index. Both the theoretical economic index and the Laspeyres index measure the change in revenue from a base period as the result of a change in prices. In the economic index, the firm (or other entity) is allowed to adjust its output in response to these price changes to *maximize* its profit. As a result, it will have revenue at least as large as (and possibly larger than) if it were constrained to maintained relative proportions among its outputs as in the Laspeyres index. The Laspeyres index is the *lower bound* of the true economic output price index.

Net output

In an industry output price index, items are only selected for pricing to the extent that they are actually sold outside the industry. This is called a net output approach to price measurement. In the shirt example, an output price index for the cotton weaving mill industry would contain only the outputs of the industry—in this case, gray cotton fabric. An index for the combined textile and apparel industry would reflect price changes only for shirts; none of the other items actually leaves the industry. Such fabric as *does* leave the industry, for example, for home use, would be included in this latter index, but any fabric used within the industry would be excluded.

In constructing an output price index for a firm, someone could sit at the plant gate and count the amount and price of each item shipped. Because an industry is a set of establishments making similar products, an output price index could be constructed for the industry by placing a fence around all the establishments, and counting and pricing every transaction that passed through that fence. Transactions among establishments inside the fence would not be measured. Thus, for constructing an industry output price index, weights would be used that reflect the new output of each product, that is, total shipments of that product by establishments in the industry to buyers outside the industry. In the construction of an output price index for an aggregate industry composed of several smaller industries, the shipments among the component industries would be excluded, and only those shipments outside the aggregate would be included in the index.

Construction of net output weights for the PPIR indexes is more complex than the use of gross shipment weights in the traditional PPI commodity structure. In addition to the value of shipments data currently used which have been supplied by the *Census of Manufactures,* BLS uses the value of materials consumed (also from the Census), data on detailed industry flows from the input-output table constructed by the Bureau of Economic Analysis, and other detailed industry data to construct appropriate net output weights.

In preparing industry output price indexes, all sources of revenue must be priced. In addition to primary production in an industry (the production associated with the definition of that industry), secondary production and miscellaneous receipts are also priced. Thus, refrigerators made in a home laundry equipment establishment are part of the home laundry equipment output price index. Prices received for the sale of scrap, contract work, or property leasing are also included.

Technological change

The theoretical model for a fixed-input output price index assumes no technological change. However, production technology does change, and new and improved products are frequently introduced into the marketplace. As a result, it is often impossible to obtain prices for identical items over long periods of time. In addition, at any given time, BLS is usually most interested in price changes of output that is in some sense representative of current production. For most purposes, information on price change during the 1980's in outputs stemming from the technology of the 1940's is not very useful.

Three procedures are being used to deal with these problems. One is a periodic substitution of the set of particular commodities to be priced and the weight each is to represent in the index. (In this context, a commodity is defined as a class of similar goods or services at about the same level of detail as represented by the *Census of Manufactures* 7-digit product code or the PPI 8-digit commodity code.) Second is a periodic update of the sample of companies that report prices to BLS. Once the comprehensive PPI revision methodology has been extended to encompass all industries in the mining and manufacturing sectors, BLS will revise company and item samples in one-fifth of the industries each year.

Finally, since individual items are frequently replaced by new models, a replacement procedure is needed to reflect a dynamic economy. This replacement procedure is one of the most difficult methodological challenges in price index construction. The process—usually called quality adjustment—seeks to solve the following type of problem: If a firm stops producing a model A-1 hydraulic crane which has a 30-ton lifting capacity and replaces it with a model A-2 with a 32-ton lifting capacity for which the company charges $5,000 more, how much of that price increase represents the value of the extra 2 tons of lifting capacity, and how much represents "pure price increase"? The current methodology for evaluating this change in specification would be to value it at the cost of the change to the producer. There has been a substantial body of economic literature dealing with this problem,[7] and the Bureau

[7] Jack E. Triplett, "The Measurement of Inflation: A Survey of Research on the Accuracy of Price Indexes," in Paul H. Earl, *Analysis of Inflation* (Lexington, Mass., 1975).

has been among those conducting research to improve quality adjustment procedures.[8]

A system of price indexes

The output price index which has been described here is the major organizing element for the work of the PPIR program. It is the long-run objective to produce output price indexes for every industry in the private economy. The first stage, now well underway, is to include all production of both goods and services in the mining and manufacturing sectors. The next phase will cover the output of agriculture and contract construction. Finally, some work has already begun on calculating service-sector price indexes. Price indexes for railroad freight, telephone services, and postal services are already being published, and developmental work is proceeding on indexes for the life insurance industry. Development of service industry indexes will be slow, but the goal is eventually to cover this entire sector.

The overall relationships among these indexes as will as with other derivative indexes can best be understood in an input-output framework. Figure 1 is a schematic input-output table. Along the left side are arrayed the industries producing goods and services in the economy, including imports. Along the top are the consuming elements in the economy—both intermediate demand (industry purchases of materials and services) and final demand (composed of personal consumption expenditures, gross private domestic investment, net exports, and government purchases).

Each cell of figure 1 represents the value of sales from the producing industry to the consuming element. For example, cell A contains the value of sales from manufacturing industry 2 to mining industry 1; cell L represents the value of sales from manufacturing industry 2 to personal consumption expenditures.

An output price index for manufacturing industry 2 will cover all of the transactions in cells A through O, except cell E, which represents the value of sales *within* the industry. The Standard Industrial Classification is used to classify each producing and consuming industry. As noted earlier, the PPI revision covering mining and manufacturing will produce output price indexes for each 4-digit SIC industry in those two sectors, a total of 493. Each industry is being measured by its own survey, and industry indexes are being published as they become available. As of January 1982, output price indexes were being published for 114 industries, accounting for about one-third of the total value of the output of the mining and manufacturing sectors.

Various aggregate output price indexes can be formulated. Output price indexes for aggregate 3- and 2-digit SIC industries can be constructed which price all transactions originating in the industry, except those transactions within the aggregate industry. For example, an output price index of the combination of manufacturing industries 1 and 2 would exclude transactions in cells D, E, S, and AA. Similarly, aggregate output price indexes can be constructed for mining, for manufacturing, and for the two sectors combined. When all agriculture, construction, and service industries are completed, it will be possible to construct an aggregate output price index for all production in the U.S. economy. The currently published Finished Goods Price Index roughly corresponds in concept to an index for items originating in the mining, manufacturing, and agricultural sectors.

An input-output table also allows the inputs to an industry to be identified. Pricing the transactions in cells P through Z (E excluded) allows the construction of an input price index for manufacturing industry 2 covering its materials and purchased services. An index of *material* input prices could be constructed from cells P through W and the goods portion of Z.

Fundamental to constructing both input and output price indexes are the detailed commodity indexes of items made in or consumed by an industry. A given

[8] Jack E. Triplett and Richard J. McDonald, "Assessing the Quality Error in Output Measures: The Case of Refrigerators," *Review of Income and Wealth,* June 1977.

Figure 1. Schematic input-output table

Producing industry	Consuming industry											Final demand			
	Mining			Manufacturing					Agriculture, forestry, fisheries	Construction	Service sector	Personal consumption expenditures	Gross private investment	Exports	Government purchases
	1	2	3	1	2	3	4	5							
Mining—1					P										
—2					Q										
—3					R										
Manufacturing—1				AA	S										
—2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
—3					T										
—4					U										
—5					V										
Agriculture					W										
Construction					X										
Services					Y										
Imports					Z										

commodity may be produced as a primary product in one industry and as a secondary product in several different industries. The combination of indexes for the same commodity, irrespective of its source, will give detailed commodity indexes. About 6,000 of these wherever-made indexes eventually will be available for mined and manufactured commodities.

Finally, data from the PPIR program can be arranged to form new stage-of-processing indexes, with an industry rather than a commodity basis.[9] The first step in developing new SOP indexes is to rearrange the input-output table so as to minimize the amount of "backflows"—transactions in which the buyer is in an earlier stage of processing than the seller. Ideally, once the table is rearranged, industries would sell only to other industries to the right of them on the table. In practice, some backflows will remain. The existence of these backflows does not reduce the quality of the resulting price indexes but makes analysis a little more involved. Once the 4-digit industries are rearranged, they can be grouped into summary SOP industries. Figure 2 illustrates how that might be done.

Just as was done for the SIC classification approach, an output price index for the finished goods sector could be constructed from transactions in cells A through J. The shaded cells represent within-industry sales. A materials input price index for finished goods industries can be constructed from transactions in cells K, M, N, and O. Other input and output price indexes could be constructed for each stage of processing. Each of these stages could also be divided into other categories of interest, such as food, nonfood, fuels, consumer goods, and capital equipment.

The existing PPI stage-of-processing indexes are commodity-based, not industry-based, and, therefore, differ from those described here. The *existing* Finished Goods Price Index corresponds approximately to transactions in figure 2 in cells R through Z, AA through CC, G through J, and DD through GG. There is currently no input price index for the finished goods sector. It is implicitly assumed that intermediate materials are the input, but there are difficulties with that assumption: (1) The intermediate materials price index, as presently calculated, has substantial multiple counting because it includes sales within the intermediate stage; and (2) inputs to the final production sector may also come from other sources.

Type of price

Clearly, when BLS prices the output of a production unit, the price needed is that which the producer actually received for selling the item—the transaction price. This is not a change from the traditional PPI program (with one exception to be noted later). As in the traditional PPI, the desired price for the PPIR reflects all applicable discounts, extras, and surcharges. The price is f.o.b. the seller's freight dock and excludes all direct excise taxes and transportation charges. There is increased emphasis on pricing all the different types of transactions in which a particular item may be sold: Items may be sold "off the shelf," by a single delivery contract, or by a multiple delivery contract. It is important to price all these types of sales *at the time of shipment.* The time of pricing is very critical, especially because of the increasing use of escalator clauses that adjust the final price in long-term sales and purchase contracts.

One major area in the traditional PPI in which clear

[9] Joel Popkin, "Integration of a System of Price and Quantity Statistics with Data on Related Variables," *Review of Income and Wealth,* March 1978; "An Integrated Model of Final and Intermediate Demand by Stage of Process: A Progress Report," *Proceedings of the American Economic Association,* February 1977; and "Consumer and Wholesale Prices in a Model of Price Behavior by Stage of Processing," *Review of Economics and Statistics,* November 1974.

Figure 2. Idealized stage of processing input-output table

Producing industry	Consuming industry							Final demand			
	Services to business	Crude materials	Primary processing	Intermediate processing	Finished goods	Other service	Construction	Personal consumption expenditures	Gross private investment	Exports	Government purchases
Imports					K			DD	EE	FF	GG
Services to business					L			HH			
Crude materials					M			R	S	T	U
Primary processing					N			V	W	X	Y
Intermediate processing					O			Z	AA	BB	CC
Finished goods	A	B	C	D		E	F	G	H	I	J
Other services					P			II			
Construction					Q			JJ			

shipment prices are not obtained is machinery, where prices reported for major equipment sales are, for the most part, order prices for later delivery. While these usually represent prices at which orders are actually received, they do not necessarily represent the price at which the shipment finally occurs, since the order may not be filled or the final price may be escalated. For measuring current price change, for deflating production or inventories, and for constructing models of price change, shipment (transaction) prices are required.

In some industries, the list price and the transaction price are the same. The same physical item may be sold by its producer at different prices, depending on the circumstances of the transaction. Long-term contracts have different prices from spot sales; large orders, different from small; preferred customers, different from occasional. All of the conditions of the sale must be identified and priced through time, a procedure consistent with the theory of the index in that the technologies of production and distribution will change if order sizes or leadtimes in production are changed. The index assumes constant technology. One method used by others to obtain transaction prices is the average realized price, or unit value procedure, in which the total revenue for an item is divided by the total number sold. However, data are frequently not available for a unique item, but rather for an entire class. For example, a unit value index for nails might decline as production shifted to smaller, cheaper sizes, even though the price for each individual size rose. If this problem is overcome by the use of sufficiently detailed data, there is still a "customer mix" problem: If the proportion of sales to large customers were to rise, the average price across all customers might fall, even if the price to each customer rose. For these reasons, the Bureau tries to avoid resorting to the average realized price approach.

Another suggested procedure is to obtain transaction prices from the buyers. Buyers' prices have been tested by Stigler and Kindahl and have been used by BLS in some series.[10] While buyers' prices may continue to be used in special cases, they are not usually the best approach. In the first place, buyers surveyed may report prices paid at a different stage of distribution, with changes in taxes, transportation, insurance, and distributor markups being mixed with the price change. In addition, the prices reported by a buyer may be from different manufacturers over time, reflecting the buyer's minimization of input costs. This violates the index assumptions of fixed production technology and maximization of production revenue. If the buyers who buy directly from the manufacturer are identified and surveyed, and if they report on prices from the same manufacturer, these problems conceivably could be overcome. However, the Bureau's operational costs would be very high. There is no universe list of the buyers of an industry's output from which a sample can be drawn. Except in those few instances where the sellers of a product outnumber the buyers, it is considerably more expensive to obtain the same precision from a buyers' price index as from a sellers' price index.

[10] George J. Stigler and James K. Kindahl, *The Behavior of Industrial Prices* (New York, National Bureau of Economic Research, 1970).

Sample Design

In order to produce the described indexes with a reasonably small expenditure of money, it is necessary to price only a small number of the transactions through which an industry sells its output. In the traditional PPI, this procedure of selecting items to be priced was "purposive." Major product areas were selected for pricing, and representative products were selected within these areas. Usually, the largest producers were selected to report on these products, with some smaller ones sometimes added. Each company was then asked to report on the volume-selling variety of that product. This procedure resulted in an index heavily composed of volume sellers by major producers.

The industrial price revision is aimed at systematically producing output price indexes and detailed product indexes for each of the 493 4-digit SIC industries in mining and manufacturing. Each industry has an individually designed sample. The first step in selecting the sample is to construct a list of establishments in the industry. The primary source for this list is the data of the Unemployment Insurance System, since almost every employer is, by law, a member. Supplementary information is obtained from multiple, publicly available lists.

An establishment is a production entity in a single location. Two establishments may occupy the same or adjacent space if they are separable by physical identification or recordkeeping, or both. Establishments are the units for which production and employment data are collected. However, establishments are frequently not the proper unit for the collection of price data. As discussed earlier, the model for an output price index assumes a profit-maximizing production unit. An establishment may be one of several owned by a single company engaged in similar production. This group, or cluster, of establishments often constitutes a profit center in the company; in such a case, profits are maximized over the cluster as a whole. The outputs of the establishments are undifferentiated and are priced homogeneously. The second step in sampling consists of clustering establishments into price-forming units that conform as closely as possible to the theoretical concept of the firm. The major deviation from this concept is that establishments in a real-world profit center may be classified in different industries. To meet the need for

industry indexes, the members of a price-forming unit cluster must all belong to the same industry.

Once a list of price-forming units in an industry is constructed, it is stratified by variables that are 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 and input costs. Some industries are characterized by geographically independent markets, which should be strata. Other characteristics may also lead to strata, such as the presence of cooperatives in the industry. Within each stratum, units are usually ordered by geography or size, or both, to ensure a proportionate distribution of the sample. The more successful the identification of the proper strata, the lower is the sampling error of the estimated indexes.

The next 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, they will be assigned a greater proportion of the sample than their value would require. As a further step to reduce the sampling error of the estimate, each price-forming unit is selected systematically with a probability proportionate to its size. The proper measure of size would be the total revenue of the unit; however, because that information is not contained in available universe lists, employment is used as a proxy. As an overall proxy for revenue, employment is rather poor. However, it is usually necessary to use it only within strata within industries; as a result, the production technologies should be relatively homogeneous, and the proxy fit should be fairly good.

Once an establishment or cluster of establishments is selected for pricing, a BLS field economist visits the reporting unit to select a few transactions to be priced through time from among all activities which produce revenue. To avoid bias and to permit estimates of the precision of the indexes, a probability technique called disaggregation is used.[11] This multistage 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 the subsequent stage until unique items or unique types of other receipts are identified.

Even after a unique item is selected, it may be necessary to disaggregate further. If the same 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, or whether it is a spot or contract sale—must also be selected on a probability basis. This method for identification of terms of sale serves two important functions: It ensures that the same type of transaction is priced through time, and it eliminates any bias in the selection of the terms.

There are a number of practical problems that must also be dealt with in the execution of this survey. One is company cooperation, which remains completely voluntary, as it has always been in the traditional PPI program. Companies that cooperate with the program agree to one interview and disaggregation process which averages about 2 hours. They also agree to supply prices for the items selected every month (BLS 473P, shown at the end of this chapter). In general, companies asked to supply prices for the PPIR program have been quite cooperative, with only about 20 percent of these firms declining to participate. The most serious effect of noncooperation is to increase the bias in the indexes. In addition, not all cooperating companies have been as timely and as accurate in their price reports as the firms participating in the traditional PPI program. Because of this and the fact that publication criteria in the PPIR are often more difficult to meet than in the traditional program, a higher proportion of indexes may not be publishable in any given month.

Sometimes the data required for the index are not available for the sample unit (cluster or establishment) but only for some larger aggregation, such as a company division. If the larger aggregation (called a reporting unit) is classified totally within the industry being sampled, the report can be made from it, with some adjustments to the probability of selection. However, if the reporting unit includes establishments classified in other industries, some adjustments can be made, but some nonsampling error will remain. Because individual establishments must report value-of-shipment data for the *Census of Manufactures,* at least the value-of-shipment data required for proper weighting of the index could be obtained for each sample unit.

After the items and terms of sale have been selected, the reporter supplies to BLS each month the transaction price for that item and its terms of sale effective for the Tuesday of the week including the 13th. These data are combined with data from other reporters in the same industry to produce the Laspeyres fixed-weight industry output price index, as well as commodity price indexes and stage-of-processing price indexes.

The reporter also supplies descriptions of any changes that may occur in the physical specification or terms of sale that are available. Such information is used to evaluate these changes so that comparisons are made only between comparable items and transaction terms. Incremental model changes to essentially the same item can readily be made in this manner; radical changes in a reporter's production may require that some of the

[11] BLS successfully developed and used this technique in its revision of the Consumer Price Index.

items reported be reselected if whole categories of items are no longer produced.

As is the case with the traditional Producer Price Indexes, the new price indexes are being released monthly, approximately 4 weeks after the pricing date. They provide a much more comprehensive and accurate picture of industrial price changes than has ever before been available.

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BLS 473
(Rev. Jan. 1974)

Form Approved
O.M.B. No. 44R0194

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics
Washington, D.C. 20212

INFORMATION FOR THE WHOLESALE PRICE INDEX

ALL REPORTS WILL BE HELD IN CONFIDENCE

Dear Sir:

The price data which you provide is used in computing the Wholesale Price Index which is the officially accepted indicator of primary market price movements. The index is widely used by industry and government.

These voluntary reports, submitted by you and other businessmen, are the major source of information used in preparing this index. The information you provide is strictly confidential and open to inspection only to sworn employees of the Bureau of Labor Statistics.

Please use the enclosed envelope, which requires no postage, for returning this schedule. Your continued cooperation is greatly appreciated.

COMMISSIONER OF LABOR STATISTICS

IMPORTANT INSTRUCTIONS

In the boxes provided on the other side, please be sure to indicate all changes in
COMMODITY DESCRIPTION, BASIS OF QUOTATION, DISCOUNTS, ALLOWANCES, AND TAXES
that may have occurred since your last report.
Your cooperation in keeping all information current
is a great aid in computing a reliable, accurate Wholesale Price Index.

Remarks _____

INFORMATION FOR THE WHOLESALE PRICE INDEX

Code No.

1. COMMODITY DESCRIPTION *(Please indicate all changes.)* →

CHANGES

Give date, nature, and estimated value of change

2. BASIS OF QUOTATION *(Please indicate all changes.)* →

Date and nature of change

Unit

Class of seller and customer

Size of order

Shipping terms

Other *(Specify)*

3. DISCOUNTS, ALLOWANCES, AND TAXES Indicate all discounts, allowances, and taxes applicable to above basis of quotation. This information is needed to arrive at the ACTUAL SELLING PRICE. *(Please indicate all changes.)* →

Date and nature of change

		YES	NO
Quantity discount	Have any indicated discounts been deducted from the reported price?		
Trade discount			
Cash discount			
Seasonal discount			
Other discount			
Other charges	Have any of these been included?		
Excise taxes			

4. PRICE INFORMATION For the commodity described in item 1, please enter below the current price for the date indicated, on the basis quoted in item 2.

Price as of Sept. 9, 1975

PRICING DATE	PRICE	DATE OF PRICE CHANGE *(If any)*	PRICING DATE	PRICE	DATE OF PRICE CHANGE *(If any)*
Oct. 14, 1975			Apr. 13, 1976		
Nov. 11, 1975			May 11, 1976		
Dec. 9, 1975			June 15, 1976		
Jan. 13, 1976			July 13, 1976		
Feb. 10, 1976			Aug. 10, 1976		
Mar. 9, 1976			Sept. 14, 1976		

PERMANENT OFFICE RECORD

KINDLY RETURN THIS FORM PROMPTLY

Information for the Producer Price Indexes

U.S. Department of Labor
Bureau of Labor Statistics
600 E Street, N.W. Code 47
Washington, D.C. 20212

GENERAL INSTRUCTIONS: ***This form will be read by an optical scanner.*** It is important that you read both sections and follow the instructions carefully. The reverse of this form provides additional instructions. If you have any questions, please call collect at

SECTION I

The information in Section I was provided by your company. Please determine if it is currently applicable or requires changes. If any changes are necessary, please cross out the incorrect portions and write the new information in the closest open area which is either below or to the right of the change.

Product and Transaction Description: ***If you make any changes in this description,*** please also indicate the date that this change became effective and the estimated value of the change (change in production cost plus standard mark-up).

Previous Price Information: These are the prices that you have supplied in previous months. If the price is blank for any of the dates listed, then please enter one if it is available. Also, in the space provided, correct any incorrect prices that are shown.

The PRICE was	this DATE	CORRECTIONS	The PRICE was	this DATE	CORRECTIONS
$	on		$	on	
$	on		$	on	
$	on		$	on	

Net transaction prices are the most desirable types of prices.

The type of price that you now report is

If this is incorrect, or if you change to a different type of price, please indicate the current type of price.

IMPORTANT!
Please Answer BOTH Questions
Black Pen/Pencil Is Preferred

1. Have you made any changes or entries anywhere in Section I? Yes ☐ No ☐

2. Did the price change between and ? Yes ☐ No ☐

SECTION II

Complete Section II ONLY IF you answered YES to Question 2.

For BLS Use Only

Current Price Information:
If there was a shipment between and please report the price for the ***last*** shipment during that period.
If there was ***not*** a shipment, please estimate the price that you would have charged on

Please enter the price below writing the numbers like this➡ 1 2 3 4 5 6 7 8 9 0 . ***Use black pen/pencil only. Do not type.***

Dollars Cents

$ BB,BBB,BBB.BBB Per

Is this a **closeout** price on a product which is being phased out? _____

PLEASE RETURN THIS FORM WITHIN 5 BUSINESS DAYS EVEN IF THERE ARE NO CHANGES.

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
Approval expires 12/31/83

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 this form. Your continued cooperation is greatly appreciated.

Commissioner of Labor Statistics

Instructions for completing this form:

SECTION I

The information on the reverse side of this form in Section I 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.

Product and Transaction Description

If either the Product Description or the Transaction Terms, or both, no longer apply, a substitute product or substitute transaction terms should be selected by you. **Product substitution** should only occur when the product previously reported is no longer available because it is being or has been permanently discontinued. The substitute product should be as similar as possible in materials and production technology to the current product, and should be expected to remain in production for some time. The substitute transaction terms should likewise be as similar as possible to the discontinued transaction terms.

Report these changes where necessary in the space provided in Section I, and provide current price information in Section II.

Adjustments to Price

Following is a list of the more common adjustments to price. The specific adjustments on the reverse side of this 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 Question 1, which refers to Section I. Mark 'X' in either the ***Yes*** or the ***No*** box depending on whether you have ***('YES')*** or have not ***('NO')*** made any changes or entries within Section I.

For Question 2, mark 'X' in either the ***Yes*** or the ***No*** box depending on whether the shipment price of the product described in Section I changed ***('YES')*** between the two dates listed or whether the shipment price did not change ***('NO')*** during this time period.

If the answer to Question 2 is ***NO***, the form has been completed and is ready for mailing. If the answer to Question 2 is ***YES***, please continue to Section II.

SECTION II

The preferred price is a **net transaction price** of an actual shipment made during the pricing period and as near to the pricing date as possible. The price should reflect all deductions and additions to the price, including competitive price reductions that reflect current market conditions.

Please complete and return within 5 business days all of the 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 this form or its completion may be resolved by calling the Bureau of Labor Statistics, Division of Industrial Prices and Price Indexes, Washington, D.C.; call collect by using the telephone number at the top of the reverse side of this form.

BLS 473P (Rev. Sept. 1981)

Chapter 8. International Price Indexes

Background

The International Price Program (IPP) provides indexes of prices for U.S. exports and imports. The program grew out of a longstanding need for accurate measures of price changes in the foreign trade sector of the U.S. economy. In the period immediately following World War II, BLS began to develop export and import price indexes. The program was terminated in 1948 due to budget reductions and lay dormant until 1967 when BLS began research on the feasibility of reintroducing export and import price indexes.[1] This research resulted in funds being allocated for the program in FY 1970.

Export price indexes were first published in 1971 and import price indexes in 1973. Data were collected annually for June of each year until 1974 when collection and publication began on a quarterly basis. Coverage as of June 1982 accounted for 71 percent of the value of exports and 96 percent of the value of imports. Plans are to extend coverage to all exports and imports of nonmilitary products by late 1983.

Description of Survey

Concepts

The export and import price indexes being developed cover transactions in nonmilitary goods between the United States and the rest of the world. The export price index provides a measure of price change for U.S. products sold to other countries. The import price index provides a measure of price change for goods purchased from other countries by U.S. residents.

In addition to general indexes of prices for U.S. exports and imports, indexes are also published for detailed product categories of exports and imports. These categories are defined by the 4-digit level of detail of the Standard Industrial Trade Classification System (SITC). The calculation of U.S. export and import price indexes by SITC category facilitates the comparison of U.S. price trends and sector production with the export and import price trends of other countries. Indexes are not prepared for SITC categories with small values of trade.

Product universe

The product universe of the export price indexes consists of all products sold by U.S. residents to foreign buyers. ("Residents" refers to the national income account definition; it includes corporations, businesses, and individuals but does not require either U.S. ownership or U.S. citizenship.) The product universe of the import price index covers all products purchased from abroad by U.S. residents. The universe in the case of each of these indexes 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.).

Military goods are not priced in the indexes except to the extent that some products may be purchased on the open market for military use; e.g., automobiles, clothing, nonspecialized hardware, fuel, etc. A few items (works of art, ships, etc.) are not included because of the difficulty of obtaining time series for comparable products in their categories.

Prices

Prices are collected according to the specification method. To the extent possible, they refer to prices at the U.S. border for exports and at both the foreign border and the U.S. border for imports. For nearly all products, the prices refer to transactions completed during the first 2 weeks of the third month of each calendar quarter. If a firm had no transactions in a product during the 2-week period, prices for a transaction up to 2 weeks earlier or later may be used.

Respondents 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 price for which the product was bought or sold. During the quarterly repricing process, respondents are reminded of this requirement through a combination of personal visits, telelphone calls, correspondence, and special enclosures with the reporting forms.

[1] 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.

For the export price indexes, the preferred pricing basis is f.a.s. (free alongside ship) U.S. port of exportation. When firms report export prices f.o.b. (free on board), production point information is collected which enables 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. For finished manufactures, respondents frequently report export prices on an f.o.b. *factory basis.* As a result, many of the export price indexes are published on this basis pending conversion to an f.a.s. basis.

For imports, two prices are collected. The first is the import price f.o.b. at the foreign port of exportation. This is consistent with the basis for valuation of imports in the national accounts. The second is the import price c.i.f. (cost, insurance, and freight) at the U.S. port of importation. 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. The import duty on the product, if any, is collected as a separate piece of information.

Since a price index depends on the same items being priced from period to period, it is necessary to recognize when a product's specifications or terms of transaction have been modified. The specifications collected for each product include detailed descriptions of the physical and functional characteristics of the product. The terms of transaction include information on the number of units bought or sold, discounts, credit terms, packaging, class of buyer or seller, etc.

When there are changes in either the specifications or terms of transaction of a product, the dollar value of each change is deleted from the total price change in order to obtain the "pure" change. Once this value is determined, a linking procedure is employed which allows for the continued repricing of the item.[2]

Average prices are not published or calculated because even within the narrowest category of products, i.e., 7-digit level of detail, products vary among respondents.

Classification

Published indexes are described by the nomenclature of Revision 2 of the SITC system of the United Nations.[3] The SITC is made up of 10 sections at the 1-digit level, 63 divisions at the 2-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.

However, when prices are collected, the products are classified by the basic product classification systems for recording U.S. foreign trade: For exports—the 7-digit Schedule B classification system of the U.S. Department of Commerce;[4] for imports—the 7-digit *Tariff Schedule of the United States Annotated (TSUSA).*[5] Concordance schemes are used for classifying Schedule B or TSUSA categories into the SITC.[6] By maintaining the detailed 7-digit product classification, it is possible to prepare indexes for analytical purposes for groupings other than those afforded by the SITC; e.g., SIC and end-use.

Data Sources and Calculation Methods

Prices

Price data are collected quarterly by mail questionnaire and reporting is voluntary and confidential. In nearly all cases, price data are collected directly from the exporter or importer, although in a few cases, prices are obtained from brokers. Price reporting by firms is initiated by a visit from a Bureau representative, at which 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. No index is published in such a way as to reveal the name, price, or price behavior of any respondent. In all published indexes, the number of respondents is greater than the minimum of three established for this purpose.

Information initially provided by a firm usually contains data for the current and previous quarter. Subsequent current prices are collected quarterly by mail. Telephone contact is maintained each quarter with the person at the firm who is responsible for providing the price information. In addition, respondents are revisited periodically in order to review reporting practices and requirements and to reselect products for which prices are reported. Frequently during these revisits, some products are dropped from further reporting and new items are added.

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 repeatedly priced over time. The survey design is responsive to both cost and reporter burden constraints. The cost constraints impose limits on the number of distinct estab-

[2] The linking procedure is similar to that used for the Producer Price Index. (See chapter 7.)

[3] United Nations Statistical Office, *Standard International Trade Classification, Revised,* Statistical Papers, Series M, No. 34/Rev. 2 (New York, United Nations, 1975).

[4] U.S. Bureau of the Census, *Statistical Classification of Domestic and Foreign Commodities Exported From the United States, Schedule B,* Jan. 1, 1978, edition and revisions.

[5] U.S. International Trade Commission, *Tariff Schedule of the United States Annotated,* 1980.

[6] U.S. Bureau of the Census, *U.S. Foreign Trade Statistics Classifications and Cross Classifications,* 1980.

lishments that are 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 Declarations (SED's) and, in the case of imports, the Consumption Entry and Warehouse Withdrawal Documents. These documents contain brief product descriptions, 7-digit product classification codes, value, quantity (where required), date, origin or destination, company name and address, and, in the case of importers, a company identification code.

The import frame, obtained from the Customs Bureau, contains a record of every import transaction. The availability of a coded company identifier on these records makes it possible to incorporate frequency of trade (consistency) into the import design. Companies are designated as either consistent or inconsistent importers of particular products. This information is used in each stage of sampling with the result being an increased yield of useable prices.

The export frame is drawn by the Bureau of the Census according to a sample design provided by BLS. In contrast to imports, this frame is a sample of the total universe. The selection of SED's is done in each publishable stratum with probabilities proportionate to size (PPS), using the dollar value of any line or lines on the SED within that stratum as a measure of size for the SED's chance of selection. Once selected, all lines on that SED are in the sample. Because the SED's do not contain a company identifier, the name and address of each exporter chosen in the initial sample is obtained manually.[7] Once chosen, these exporter names and addresses are linked to the SED line information resulting in the export frame utilized by IPP.

The sample design for both imports and exports consists of three stages. The first stage selects establishments. The second stage selects Entry Level Items (ELI's—commodity classes within a publishable stratum). The third stage is the selection of specific items in the ELI. The system is identical for both imports and exports unless otherwise noted.

The first step is to generate the measure of size (max-prob) for an establishment as follows. The dollar value (weighted dollar value in exports) on each document is aggregated to company-ELI, company-publishable 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 than implicitly stratified by max-prob strata and a systematic 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 appealing since it is product category indexes which are being produced.

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 control respondent burden, it is then necessary to select a second-stage sample of ELI's within each company. The first step 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 prob 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 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.[8] The process continues through successive subdivisions of each selected subclass until an identifiable item that can be priced over time is obtained.

At this time, most published indexes are composed of products selected prior to the implementation of this probability method. The judgmental criteria that were previously in place required that items selected in each company be repriceable and that their price movement be representative of the respondent's other products in the same ELI. As maintenance samples are conducted on a 4-year timetable, the number of these judgmentally selected products will decrease. Therefore, by 1986, all published indexes will be constructed using probability selected products.

Estimating Procedures

Formula

The export and import price indexes are weighted indexes of the Laspeyres type. Price relatives are assigned

[7] Of necessity, the frame used in sampling is a subset of the total universe of export transactions.

[8] This "proportion of trade" estimate is provided by the respondent.

equal importance within each weight category and are than aggregated to the SITC index level.

$$I_{x,t} = \frac{\sum_j \sum_i \left[\frac{P_i^t}{P_i^o} \right] \frac{w_j}{n_j}}{\sum_j w_j}$$

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_j	=	number of price relatives within j
t	=	time
w_j	=	share of 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

Weights

The values assigned to each weight category are based on trade value figures compiled by the Bureau of the Census.[9] In the case of the export price index, price relatives in each 7-digit Schedule B category are weighted by the dollar value of exports in that category during the base period. For the import price index, price relatives are weighted by the dollar value of imports in each 7-digit TSUSA category during the base period. For both indexes, the weight period is 1980.

Each value weight for a 7-digit category covers unpriced items as well as the priced items which have been selected in that category for estimating indexes. Not all 7-digit categories are included in each SITC group for which an index is published. Instead, a sample of 7-digit categories represents all of the 7-digit categories within the index group. When new 7-digit categories, i.e. weights, are introduced into an index, the index, including the new categories, is linked to the earlier index. As the judgmentally selected items in establishments are replaced by probability selected items through sample rotation, the weight system will be altered to the appropriate sampling weights.

[9] The value data for 7-digit categories are compiled by the Bureau of the Census using Shipper's Export Declarations and Import 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 of each year.

Imports: *U.S. Imports for Consumption and General Imports, Report* FT-246, annual.

Analysis and Presentation

The export and import price indexes are published quarterly in BLS news releases 5 weeks after the reference month. The indexes, which are not seasonally adjusted, are published by SITC categories and are also shown in terms of percent change. The reference period is 1977 = 100, where possible. In numerous cases, however, price data do not extend back to 1977, and these indexes use a more recent reference period. For calculation purposes, as noted above, the weight base remains 1980. Following the calculation, indexes are set equal to 100 in the reference period.

In addition to the export and import price indexes, a quarterly report is prepared that updates BLS Bulletin 2046, *Comparisons of U.S., German, and Japanese Export Indexes.* This bulletin presents index comparisons between the United States and the Federal Republic of Germany, and the United States and Japan. These data are useful in measuring the U.S. export price movement of a given commodity area in comparison to the price movement of competitive products exported from Germany and Japan. The methodology is explained in detail in the bulletin and is accompanied by 34 reference tables of U.S.–Germany comparisons, and 26 reference tables of U.S.–Japan comparisons.

The trend of prices of U.S. and other industrial countries' exports to OPEC is analyzed in BLS Bulletin 1969, *Estimating Price Trends of Industrial Countries' Exports to OPEC.* These are compared with OPEC crude oil prices. The recently released U.S. import price index for crude oil is discussed in "Import Price Indexes for Crude Petroleum," *Monthly Labor Review*, November 1982.

Uses

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 in 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 real exports and imports in the aggregate and for product groups. They 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.

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Chapter 9. Occupational Pay and Supplementary Benefits

Background

For many decades the Bureau of Labor Statistics has conducted studies of wages by occupation and industry, based upon employer records. The Bureau's first such study, growing out of a study by the U.S. Senate in 1891, resulted in a wage rate record extending back continuously to 1860. 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. 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, 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, the Bureau developed new types of 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 metropolitan areas. This survey program was firmly established and temporarily expanded for use in the wage stablization 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 combined.

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, the surveys described form an integrated program of occupational wage surveys based upon a common set of administrative forms, a single manual of procedures, and common concepts and definitions. Employer cooperation in surveys is on a voluntary basis. Confidential individual establishment data compiled by the Bureau's field representatives are grouped in published reports in a manner that will avoid possible disclosure of an establishment's rates. In all surveys, establishments are classified by industry as defined in the 1972 edition of 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. Standard Metropolitan Statistical Area definitions are employed in all programs.[2]

Industry Wage Surveys provide data for occupations selected to represent a range of activities performed by workers. Consideration is given to prevalence in the industry, definiteness and clarity of duties, and importance as reference points in collective bargaining.

In addition to collecting straight-time first-shift rates (or hours and earnings for incentive workers) for individuals in the selected occupations, surveys in most industries also establish the wage frequency distribution for broad employment groups, such as production and related workers or nonsupervisory workers.

Weekly work schedules; shift operations and differentials; paid holiday and vacation practices; and health, insurance, and pension plans are included in the information collected, along with other items applicable to a particular industry. The studies also provide estimates of labor-management agreement coverage, proportions employed under incentive pay plans, and the extent to which establishments provide a single rate or a range of rates for individual job categories.

[1] See appendix B.
[2] See appendix C.

are directed to the Scope and Method of Survey appendix in 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, excluding premium pay for overtime and for work on weekends, holidays, and late shifts, for individual workers. For workers paid under piecework or other types of production incentive pay plans, an earned rate is computed by dividing straight-time earnings for a time period by corresponding hours worked. For all workers, production bonuses, commissions, and cost-of-living bonuses are counted as earnings. In general, bonuses that depend on factors other than the output of the individual worker or group of workers are excluded; examples of such nonproduction payments are safety, attendance, year-end or Christmas bonuses, and cash distributions under profit-sharing plans.

Unless stated otherwise, rates do not include tips or allowances for the value of meals, room, uniform, etc. The earnings figures, thus, represent cash wages (prior to deductions for social security, 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 his regular straight-time salary.

Occupations are defined in advance of the survey. Because of the emphasis on comparability of occupational content, 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.[3]

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.

In applying these job descriptions, the Bureau's field representatives exclude working supervisors, apprentices, learners, beginners, trainees, handicapped workers, part-time or temporary workers, and probationary workers unless provision for their inclusion is specifically stated.

Tabulations of paid holidays, paid vacations, and health, insurance, and pension plans are based on the assumption that plans are applicable to all 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 insurance and pension plans are limited to plans for which at least a part of the cost is borne by the employer. Informal provisions are excluded.

Survey Methods

Planning. 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 importantly supplement comments and suggestions received from the regional offices at the conclusion of 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 salary survey of professional, administrative, technical, and clerical jobs. The needs of major users are a prime consideration in designing the multipurpose occupational studies.

The minimum establishment size included in a survey is set at a point where the possible contribution of the

[3] An example of a job description:
MACHINIST, MAINTENANCE
Produces replacement parts and new parts in making repairs of metal parts of mechanical equipment operated in an establishment. Work involves *most of the following:* Interpreting written instructions and specifications; planning and laying out of work; using a variety of machinists's 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.

[4] 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.

Forty manufacturing and 25 nonmanufacturing industries, accounting for about 27 million employees, are surveyed. A majority are studied on a 5-year cycle, but a number of comparatively low-wage industries are on a 3-year cycle. Most surveys are at the 4-digit SIC level of detail.

Nearly all of the manufacturing, utilities, and mining industries are studied on a nationwide basis, and estimates are provided also for regions and major areas of concentration. Surveys in trade, finance, and service industries usually are limited to a number of metropolitan areas. Nationwide surveys generally develop separate estimates by size of establishment, size of community, labor-management agreement coverage, and type of product or plant group.

Area Wage Surveys annually provide data 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, skilled maintenance trades, and other nonproduction manual 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 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—with a minimum of 100 applying to manufacturing; transportation, communication, and other public utilities; and to retail trade in the 13 largest areas.

In addition to the all-industry 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 two areas. There were 70 Standard Metropolitan Statistical Areas in this survey program as of 1981, selected to represent all metropolitan areas of the United States, excluding Alaska and Hawaii. In 31 of the larger areas, wage data are presented separately for establishments that have 500 workers or more.

Data on weekly work schedules; paid holiday and vacation practices; and health, insurance, and pension plans are recorded separately for nonsupervisory office workers and production and related workers (nonoffice). Data on minimum entrance rates for inexperienced office workers are collected in all industries. While the wage data are collected annually, these items are studied every 3 years.

Cross-industry area wage surveys have also been conducted annually since 1967 at the request of the Employment Standards Administration for use in administering the Service Contract Act of 1965. Survey scope and method are the same as for the Bureau's regular surveys, but a more limited number of occupations and related benefits are studied and data are published only for all industries combined.

In addition to the cross-industry surveys, special industry studies are conducted for the Employment Standards Administration. These studies provide information on hourly earnings for moving and storage, refuse hauling, laundry and drycleaning, and food service jobs. For both the cross-industry surveys and special industry studies, data on incidence of paid holidays; vacation practices; and health, insurance, and pension plans are provided every 3 years.

The National Survey of Professional, Administrative, Technical, and Clerical Pay provides a fund of broadly based information on salary levels and distributions in private employment. Approximately 100 occupation work levels were studied in 1981 selected from the following fields: Accounting, legal services, personnel management, engineering and chemistry, purchasing, photography, drafting, computer processing, and clerical. Definitions for these occupations provide for classification of employees according to appropriate work levels (or classes). Although reflecting duties and responsibilities in industry, the definitions were designed to be translatable to specific pay grades of Federal white-collar employees. This survey, thereby, provides information in a form suitable for use in comparing the pay of salaried employees in the Federal civil service with pay in private industry.

Monthly and annual average salaries are reported for all occupations. Data relate to the standard salaries that were paid for standard work schedules; i.e., to the straight-time salary corresponding to the employee's normal work schedule, excluding overtime hours. Nationwide salary distributions and averages are presented for men and women combined. Averages also are presented for establishments employing 2,500 workers or more.

Industry divisions included are: (1) Mining; (2) construction; (3) manufacturing; (4) transportation, communication, electric, gas, and sanitary services; (5) wholesale trade; (6) retail trade; (7) finance, insurance, and real estate; and (8) selected services.

Limited to the Nation's metropolitan areas during 1960-64, the annual survey was expanded in 1965 to include nonmetropolitan counties. The minimum establishment size included in the survey is 50, 100, or 250, depending on the industry. The minimum establishment size has been adjusted at various times since 1961 in response to the specifications of the President's Pay Agent. Since the survey scope is subject to change, users

excluded establishments 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 job definitions.

Considerations in timing of industry surveys include date of expiration of major labor-management agreements, deferred wage adjustments, seasonality of production, and interests of users. Wherever possible, area wage surveys are timed to follow major wage settlements as well as to meet the needs of government agencies engaged in wage administration as required by law.

The types of occupations studied and the criteria used in their selection are identified in the description 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 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 schedule, overtime premiums, paid holidays and vacations, insurance and pension plans, union contract coverage, and other items applicable to the establishment. The second (BLS 2753G) is used in recording occupation, sex, method of wage payment, hours (where needed), and pay rate or earnings for each worker studied. Supplementary forms are used to meet particular needs.

Collection. Bureau field representatives collect data by visits to each of the sample establishments. Job functions and factors in the establishment are carefully compared with those included in the Bureau job definitions. The job matching may involve review of records such as pay structure plans and organizational charts, company position descriptions, interviews with appropriate officials, and, on occasion, observation of jobs within plants. 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, when needed) from payroll or other records and data on the selected employer practices and supplementary benefits from company officials, company booklets, and labor-management agreements.

Area wage surveys in all areas involve visits every third 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 responding to the mail or telephone request and to those reporting unusual changes from previous-year data.

The work of field representatives is checked for quality of reporting and accuracy in job matching. Revisits are made by supervisory and senior representatives. 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," 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 regulatory government agencies (primarily State unemployment insurance agencies). These are supplemented by data from directories, trade associations, labor unions, and other sources.

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: Textile mills, for instance, are classified by whether they spin only, weave only, or do both. Such stratification is important if the occupational structure of the various industry segements differs widely.

The sample for each industry-area group is a probability sample, each establishment having 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 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 where the standard deviation of the

characteristic being estimated is assumed to be proportional to the average employment in the stratum. 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 estimates of 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 of stratification are region, type of industrial activity as measured by percent of manufacturing employment, and major industries. Each area is selected with its probability of selection proportionate to its nonagricultural employment. The largest 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. Supplementary 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 and 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 rate 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 cell or 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			
Establishment	*Weight*	*Actual employment in occupation*	*Average hourly earnings*	*Estimate of total in stratum*	
				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.

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 totals to regional and/or national estimates. 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. This procedure provides the ratio of nonagricultural employment in the stratum to that in the sample area (one in the case of the large self-representing areas). Summing all such estimated stratum totals yields the earnings and employment totals for the regional and the national estimates.

Analysis and Presentation

Where an industry survey is designed to yield estimates for selected States or areas, these are published separately as information becomes available from all sample firms in the State or area unit. Industry surveys limited to selected areas do not provide a basis for the examinations of pay levels by size of community, 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, average pay levels separately for time and incentive workers.

Area wage survey percent increases, adjusted for changes in employment, are computed for broad occupational groups; e.g., office clerical, electronic data processing, skilled maintenance, and unskilled plant. These increases are computed annually, separately for all industries, manufacturing, and nonmanufacturing, for each metropolitan area studied, for all metropolitan areas combined, and for four broad Census regions. Pay relatives for the four occupational categories, expressing area pay as a percentage of the national average, are published annually, permitting ready comparisons of average pay levels among areas. Estimates of labor-management agreement coverage are presented every third year. Occupational pay relationships within individual establishments are summarized annually.

Bulletins on the National Survey of Professional, Administrative, Technical, and Clerical Pay present occupational 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 for industry division are shown as percentages of the all-industry averages. Year-to-year salary trend estimates for occupations are reported.

Industry wage and area wage survey reports are issued throughout the year as the surveys are completed. The bulletin on the National Survey of Professional, Administrative, Technical, and Clerical Pay is available in October.

Summaries of the data in the bulletins and special analyses appear also in the *Monthly Labor Review.*

Uses and Limitations

Occupational wage data developed in these 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 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 connection with 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 the selection of location 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 his needs, the user may find it necessary to interpolate for occupations or areas missing from the survey on the basis of knowledge of pay relationships.

Because of interestablishment variation 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 relationships found in the majority of establishments.

The incidence of incentive methods of payment may vary greatly among the occupations and establishments studied. Since hourly averages for incentive workers generally exceed those for hourly rated workers in the same job, averages for some incentive-paid jobs may equal or exceed averages for jobs positioned higher on a job evaluation basis but normally paid on a time basis. Wherever possible, data are shown separately for time workers and incentive workers in the 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 year-to-year changes in 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 changes in the labor force resulting from labor turnover, labor force expansions and reductions for other reasons, as well as changes in the proportion of workers employed in establishments with different pay levels. A labor force expansion might increase the proportion of lower paid workers and thereby 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 surveys by holding establishment employment constant while computing percent increases in earnings. That is, the previous and current-year earnings of each establishment are weighted by that establishment's previous year's employment.

Reliability of surveys. Results of the surveys generally will be subject to sampling error. This error will not be uniform, since, for most occupations, the dispersion of earnings among establishments and the frequency of occurrence of the occupation differ. In general, the sample is designed so that the chances are 9 out of 10 that the published average does not differ by more than 5 percent from the average that would be obtained by enumeration of all establishments in the universe.

The sampling error of the percentages of workers receiving any given supplementary 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 are subject to 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 these estimates subject to sampling error of as much as 20 percent.) Hence, the estimated number of workers can be interpreted only as a rough measure 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 fieldwork, 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.

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Chapter 10. 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.[1] 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 general 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 1,900 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 general 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; (3) wages are determined by collective bargaining; and (4) at least 5,000 workers are covered by the bargaining agreement. As of 1980, almost one-fourth of all State and local government employees covered by collective bargaining agreements were included in the series.

Data presented

Wage changes. Two types of information are presented on wage changes. *Settlement data* measure wage changes specified in the bargaining settlements reached during a particular time period (e.g., quarter or year). 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. Both the changes scheduled during the first 12 months of the contract (first-year changes) and the total of wage changes scheduled over the life of the contract, expressed as an annual rate, are presented. *Effective wage change data* measure all wage changes effective in the period stemming from current settlements and also from deferred wage changes specified in earlier settlements and from COLA adjustments. Con-

[1] Where information is available, unilateral management decisions in nonunion situations also are listed.

tracts providing no wage adjustments during the period also are taken into account.

Compensation changes. Although at one time the economic terms of collective bargaining settlements involved wage rates almost exclusively, today, changes in a wide variety of benefits also must be considered. "Compensation" refers to the total of pay and benefits. As with wage change data, the Bureau publishes compensation change 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. Changes scheduled for the first year of the contract, and those scheduled over the entire contract term, expressed as an annual rate, are published.

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 average hourly earnings in the establishment, and 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 priced

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, bonuses, 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 vacation 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.

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 intercompany comparisons by eliminating 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 affected, to determine average percent change. Effective wage change data are handled in similar fashion. Since collective bargaining agreements generally are for 2-year periods or longer, BLS expresses the total percent change 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 increase take into account the compounding of successive changes. In addition, the Bureau computes first-year changes as a percent of current hourly wages (or compensation). Generally, the first-year increase is larger than the average annual increase over the full term of the agreement.

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). Grouped by industry, 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 changes 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 in CWD each year.

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

Uses and Limitations

The series on wage and compensation changes 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 changes are not strictly comparable because some factors (e.g., pension benefits) are not subject to collective bargaining in many State and local government jurisdictions.

Chapter 11. 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.[1] 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.[2] It measures the change in a fixed set of labor costs so that 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 2 months 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 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.

Future development of the ECI will include increases in the number of published series 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 1970 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 1980 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 occupations and establishments in the economy. The wage and salary component of the index is represented by average straight-time hourly earnings in the 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, 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 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.

[1] The measure was initially referred to as the General Wage Index; the term Employment Cost Index was substituted as a more accurate description. See Norman J. Samuels, "Developing a General Wage Index," *Monthly Labor Review,* March 1971, pp. 3-8.

[2] 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.

Since pay rates generally relate to the job rather than to the incumbent worker, the basic unit of data collection is an occupation in an establishment. The occupation is comprised of all those workers employed in jobs classified under an ECI occupation in an establishment.

While shifts in the types of workers within the occupation in an establishment may affect wage movements, shifts in employment among occupations and establishments are controlled by measuring wage change for the same occupations in the same establishments and applying fixed employment weights to the results. The unit of observation is standardized to a certain extent below the occupation level by measuring only certain types of labor within the occupation; e.g., full or part time, incentive or time rated, depending on the predominant type.

The benefit data portion of the ECI encompasses 23 distinct benefit categories, which can be grouped as follows:

Hours-related benefits

1. Premium pay for overtime and work on holidays and weekends
2. Vacations
3. Holidays
4. Sick leave
5. Other paid leave

Supplemental pay

6. Shift differentials
7. Nonproduction bonuses
8. Severance pay
9. Supplemental unemployment benefit funds

Insurance

10. Life insurance
11. Health benefits
12. Sickness and accident insurance

Pension and savings plans

13. Pension and retirement benefits
14. Savings and thrift plans

Legally required benefits

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

Merchandise discounts

23. Merchandise discounts (retail trade—department stores only)

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 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, information is 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 x 40 hours/week = 112 (average annual hours of vacation)

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

($778.40/year) / (1,950 hours/year) = $0.399 (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 hours-related 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 is based on the classification system used for the 1970 Census of Population.[3] The Census system classifies all occupations reported into 441 3-digit occupational categories (such as accountant, stockhandler, etc.) which are then combined into 12 major occupation groups:

Professional, technical, and kindred workers
Managers and administrators, except farm
Sales workers
Clerical and kindred workers
Craft and kindred workers
Operatives, except transport
Transport equipment operatives
Laborers, except farm
Farmers and farm managers
Farm laborers and farm supervisors
Service workers, except private household
Private household workers

Only 9 of these 12 major occupational groups are currently within the scope of the survey. Farmers and farm managers, farm laborers and farm supervisors, and private household workers are excluded.

For ECI samples initiated after 1976, many of the 3-digit Census occupation categories were combined into broader occupational groups, designated ELO's. More detailed occupations within the ELO's are then selected on a probability basis by BLS field representatives from data provided by the respondents. It is for these detailed occupations that wage and benefit data are collected initially and on a continuing basis.

The Census occupational classification system only lists occupations to be included under each of the 441 occupation categories. For data collection purposes, definitions of the Census occupations and ELO's have been developed.[4]

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.

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 which is defined in appendix C. Statistics are also published for metropolitan areas (establishments located in a Standard 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 quarterly from a sample of about 2,800 establishments and a sample of occupations 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; perform job matches; develop establishment reporting procedures; and complete the first schedule. Quarterly reports thereafter are normally collected by mail or telephone by the BLS regional office.

A major task in the initial contact is job matching; that is, determining which establishment jobs and workers match the occupation definitions in the survey. At this time, characteristics of the occupations are determined—whether the majority of incumbents are full or part time, time or incentive workers, or covered by collective bargaining agreements.

The wage data are collected on a "shuttle" form (see ECI Wage Data Form at the end of this chapter) which is sent to the respondent each quarter for the addition of new data. 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 benefit provisions are summarized and sent to the respondents to review the information and 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

[3] *Classified Index of Industries and Occupations, 1970 Census of Population* (Bureau of the Census, 1971).

[4] *Employment Cost Index Occupation Classification System Manual* (Bureau of Labor Statistics, June 1981).

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 x 0.9 = $51.75.) The current quarter's cost of the plan would equal $58.05 ($64.50 x 0.9 = $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 from affecting 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 cost changes caused by the adoption of a new overtime rate and eliminates the effect of changes in the number of hours of overtime worked from period to period.

The Survey Design

The current ECI survey design consists of three parts: (a) The private sector, initiated in 1975; (b) the public sector, initiated in 1981; and (c) the replenishment samples, to be initiated from 1981 through 1984.

Private sector—respondent universe and sample design

Principal features of the design for the private sector are:

1. Selection of a set of sample occupations by industry based on the 1970 census occupational employment distributions.

2. Establishment sampling in two phases. The first phase consisted of about 10,000 employing units, the second phase of about 2,200. Collection of employment data for the occupations selected in (1) was undertaken in the first phase. Use was made of available data from BLS Occupational Employment Surveys whenever feasible.

3. A two-way controlled selection[5] of sample establishments and occupations after the second phase of establishment sampling. The resulting sample was used for wage and benefit data collection.

4. Data collection by mail survey in the first establishment phase, by personal visit in the final initiation, and by mail or telephone thereafter.

In the private sector, a sample of approximately 10,000 establishments[6] was selected from a larger BLS sample of 200,000 establishments drawn from the unemployment insurance universe and other supplementary files. Prior to selection of the 10,000 establishments, the larger sample was first ordered by State, within a State by 2- or 3-digit SIC, and within SIC by size class. The 10,000 establishments were then systematically selected with probability of selection proportionate to the measures of size. The measures of size used were the Unemployment Insurance File employment weighted by the larger sample weight. Establishments with greater than 4,000 employees were selected with certainty.

A survey to determine occupational employment (phase 1 survey) was taken of approximately 23 occupations selected for each 2-digit SIC. The basis for this occupational selection was the 1970 Census of Population. In each 2-digit SIC, five occupations with the largest employment were taken with certainty. Then one to four occupations (usually two) were selected, again proportionate to their employment as determined in the 1970 census, within each major occupation group (MOG). This was done to insure the publishability of the MOG indexes. Since there was not a 100-percent response to the phase 1 survey, it was necessary to impute for partial responses and total refusals. The imputed employment used for a given nonresponding establishment/occupation was the estimated proportion of total employment for that occupation multiplied by the establishment's employment. This resulted in every establishment/occupation having a probability of being selected unless it had specifically reported zero employment.

The occupational employment was then used in calculating the measures of size for the next phase of the selection. These measures of size enhanced the probability of retaining any establishment with a large proportion of the occupational employment in any 1 of the 23 occupations. Approxmately 2,000 establishments were selected in this fashion, selection being done separately within each 2-digit SIC.

Finally, the specific occupations for a given establishment were selected within each 2-digit SIC using a two-way controlled selection technique. Generally, larger establishments tended to have a larger sample of occupations.

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

[6] The term establishment generally indicates a single, physical location. This is particularly true in the private sector. 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.

Subsequent to the selection of the basic sample, a number of supplemental samples were constructed. The purpose of most of those was to bolster the level of response in certain industries and, in one instance, to expand the scope of the survey to include Alaska and Hawaii. The survey designs for these supplemental samples were somewhat different from the design used for the basic sample. In the construction supplement, for example, which replaced the original sample of construction establishments, sample occupations were more broadly defined than the level of the 441 Census occupations used in the original sample. These broader occupations, designated ELO's, were constructed by combining several similar Census occupations within the same MOG. This was done to increase the probability of getting an occupational match at the time of initiation. Once the broader occupation was matched, a single, more detailed job title within the occupation was selected with probability proportionate to its employment. The selected job title became the unit for which data were requested.

The expansion of the ECI to include Alaska and Hawaii consisted of a single phase sample similar to the rest of the private sector; i.e., systematically with probability proportionate to size of employment from a frame ordered by 2-digit SIC.

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 case of the construction supplement, Census occupations were combined into ELO's. When an ELO is matched in an establishment, a single, more detailed job title is selected using probability proportionate to size (employment) sampling procedures. The use of ELO's and the sampling to a specific job title increases the probability of finding occupational matches while retaining the advantages of surveying narrowly defined occupations. Different sets of ELO's were chosen for States than for local governments.

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 includes 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 ELO's for schools were defined, a phase 1 survey was conducted by mail to determine the employment within each of the ELO's 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 ELO's 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 proportionate to size and with a certainty cutoff. The establishment sampling frame was the 1976 HEW list of public hospitals. Two sets of occupations were selected: One for State hospitals and one for local government hospitals. The occupational selection was essentially a systematic sample within each establishment. The 106 establishments in the final sample were then requested to supply data for the appropriate occupations.

State and large local governments

No universe listing of establishments was available for State and large local governments; it was, therefore, necessary to conduct a refinement survey to develop a list of potential sample units. This refinement 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 and over employees. 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-

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

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.

The selection of States that underwent refinement 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 phase 1 data on occupational employment were collected. 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 1 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 replenishment and sample rotation

Beginning in 1981, the existing sample of private sector establishments is gradually being replaced by a new sample. A few very large establishments may be included in both the old and new sample. Sample replenishment is necessary to ensure sufficient data to allow continued publication of detailed occupation and industry rates of change in employee compensation. Replenishment will be done in stages, with part of the sample being replenished each quarter.

As in the case of the construction supplement and the public sector, in the new replenishment samples, detailed Census occupations within MOG's are being combined into ELO's.

Planning is also being done to redesign the ECI survey and build sample rotation into the program. The cycle of sample rotation has not been established but a 3- to 5-year rotation plan is under consideration.

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. Although the adjustment factors are calculated and applied only once, their effects on the estimates are constant for the duration of the specific samples.

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 value that respondents have. Therefore, for a temporary nonresponse, an establishment/occupation's prior quarter data 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 the 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 estimation cell, with base-period wage bills as the fixed weights. The simplified formula is:

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

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

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 ith 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 ith 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 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 1970, 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, 62 SIC industries have been identified, most at the 2-digit level. For the public sector, separate cells are identified for State and for 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:

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 × d) (e)	Base period wage bill (f)	Current quarter wage bill (f × e) (g)	Prior quarter wage bill (f × 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

I_t = (g/f)*100 =
($25,995.28/$20,929.77)* = 124.2
I_{t-1} = (h/f)*100 =
($25,186.00/$20,929.77)*100 = 120.3
Link relative (percent change) I_t/I_{t-1} = 1.032
(3.2 percent)

I_t refers to the index for the current quarter.
I_{t-1} is the index for the prior quarter.

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 divisions 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 importance 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.

Presentation

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

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 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 cost, and employment and is used as an escalator of wage costs in long-term purchase contracts.

The limitations of the index must be kept in mind. Because the ECI is an index, it measures changes in employee compensation rather than levels of employee compensation. Further, the index is not a measure of 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. July 1978)

VACATION

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

1. Description

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

2. Computation

Weeks X Workers = Weighted Workers

Total Weighted Workers ÷ Total Workers = Average Vacation Weeks

OR

Percent X Workers = Weighted Workers

(Total Weighted Workers ÷ Total Workers) ÷ 2 = Average Vacation Weeks

Total Weighted Workers ÷ Total Workers = Value Entry

3. 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		.		.

End of card → 80 | 07

Chapter 12. Employee Benefit Plans

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. In the pre-1940 period, key developments in the growth of benefit plans occurred in nonunion environments; after the outbreak of World War II, many initiatives in supplementary 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.

[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 by the Department of Labor in accordance with 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 9.

The rapid growth of employee benefits has raised questions about the validity of a comparability process limited to wages and salaries alone. Expenditures for supplementary benefits accounted for nearly one-fourth of all employer outlays for employee compensation in 1977, the last year they were measured by the Bureau. In the 1970's, the General Accounting Office and two Presidential review groups recommended that the 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. It developed a method of evaluating and comparing benefits—known as the "level of benefits" or "standardized costing" method. Under this approach, the provisions of each benefit plan being evaluated are measured against a common standard to determine their value; the standard used is the Federal work force. This "standard cost" approach determines the cost of providing non-Federal sector benefit plans to the Federal work force, and compares this with the cost of providing Federal benefit plans to the same work force. Comparisons of benefit plans, therefore, are not affected by differences in the characteristics of the work forces involved, employer financing procedures, or economic assumptions. Only actual differences in provisions can affect the relative worth of the plans. Plans with identical provisions will always be evaluated as having the same worth.

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 Bureau participated in a series of tests to determine the feasibility of collecting and analyzing the provisions of non-Federal benefits in sufficient detail to meet the requirements of OPM's cost estimating models.

In 1979, the first full-scale test was conducted in conjunction with the PATC survey. Data were collected on plan provisions and participation for six paid leave items, including sick, holiday, and vacation pay; health, life, and disability insurance; and pension plans. Formal analysis was limited to these benefit areas since they account for a significant portion of personnel costs.[8] Starting in 1980, the survey was expanded to include data on the incidence—but not plan provisions—of approximately 25 other benefit and paid leave items as a means of providing more information on the wide spectrum of employee benefits provided in private industry. The survey is now conducted annually and has replaced the benefit surveys conducted in the 1960's and 1970's. The remaining discussion is limited to this survey.

[8] The last Bureau survey of employer expenditures for employee compensation, in 1977, showed that the cost of paid leave, insurance, and pension plans accounted for 15 percent of total compensation. Other surveyed private supplements to wages and salaries amounted to less than 1.5 percent of compensation.

Description of the Survey

The Bureau's annual survey of the incidence and characteristics of employee benefit plans covers private sector establishments in the United States, excluding Alaska and Hawaii, employing at least 50, 100, or 250 workers, depending on the industry. Industrial coverage includes: Mining; construction; manufacturing; transportation, communications, electric, gas, and sanitary services; wholesale trade; retail trade; finance, insurance, and real estate; and selected services.

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.

Sampled establishments are requested to provide data on work schedules and details of plans in each of the following benefit areas: Paid lunch periods; paid rest periods; paid holidays; paid vacation; personal leave; sick leave; accident and sickness insurance; long-term disability insurance; health insurance; private retirement pension; and life insurance. These 11 benefit areas, and the specific characteristics studied, were selected by OPM for use in the Total Compensation Comparability process.

BLS also collects for OPM limited data on the incidence of the following additional benefits: Funeral leave; military leave; profit sharing plans; saving and thrift plans; stock bonus plans; stock purchase plans; other stock plans; severance pay; employee discounts; gifts; relocation allowances; recreation facilities; subsidized meals; educational assistance; automobile parking; personal use of company-owned car; and in-house infirmary.

Detailed study of retirement benefits is restricted to pension plans providing monthly cash income for life to eligible workers. The analysis of employment-related health plans yields separate information on such benefits as hospitalization, surgical, medical, major medical, dental and vision care, and out-of-hospital diagnostic and laboratory services.

Data Sources and Collection Methods

Data for the survey are collected primarily by visits of Bureau field representatives to the sampled establishments. To reduce the reporting burden, respondents are asked to provide documents describing their private pension plans and plans covering the four insured benefit areas within the scope of the survey. These are analyzed by BLS staff in Washington to obtain the required data on plan provisions. Whenever possible, the field representative also obtains the identifica-

tion number for each plan filed with the Department of Labor under the reporting requirements of the Employee Retirement Income Security Act (ERISA). If plan documents are not available at the establishment or are incomplete, the Bureau attempts to obtain the necessary information from the ERISA filings. Because of the time period given plan officials to submit updated plan summaries, ERISA material is usually not as current as descriptions received from the establishment. 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 OPM's evaluation of employee benefits is based largely on plan provisions, respondents are seldom asked to provide data on employer costs. 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.

Information obtained from respondents and plan documents is entered on computer files. These files contain the data required for both OPM evaluation of individual benefit plans and BLS estimation of the number of workers covered by specified plan provisions.[9]

The data resulting from the analysis and coding of plan documents are not directly linked to a particular establishment. Instead, two computer data files are created—a control file and a plan data file. The control file contains information on the establishment surveyed, including: Number of employees, number of plan participants, industry, geographic location, and sampling weight.

The plan data file contains 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 corporate-wide health insurance program or a multiemployer pension plan).

Survey Design

The scope of this survey is the same as that of the Bureau's PATC survey. The list of establishments from which the sample is selected (called the sampling frame) is the same as 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.

[9] BLS provides OPM with the data collected in individual establishments in a way that does not reveal the identity of respondents.

The sample for this survey is a subsample of the PATC sample to reduce the costs and resources required for data collection. The sample of about 1,500 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.

Each of the 36 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 36 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 when the number is not reported. Each of these participant values is imputed by randomly selecting a similar plan from another establishment in a similar industry and size class. The participation rate from this plan is used to approximate the number of participants for the plan which is missing a participation value but is otherwise usable. 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 developed during the adjustment for nonresponse. The estimator, after modification to account for the weight adjustment factor, f_i, developed during the adjustment for nonresponse, is:

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

where:

n_l = 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 meet the specific needs of the Office of Personnel Management for 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—professional-administrative, technical-clerical, and production workers.

Presentation

Annual BLS bulletins summarize major survey findings. Estimates show the percent of employees that are covered by paid leave plans, participate in insurance or pension plans, or are eligible for other benefits. Counts of workers covered by 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. 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.

A 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 Bureau develops and publishes selected estimates from the data of general interest to the public. There is a wide range of detailed information on the employee benefits for which estimates and tables are not developed by BLS. Although these items are too narrow in scope to warrant publication, researchers may purchase computer tapes of the survey results (with establishment identifying information removed).

Uses and Limitations

The survey of the incidence and characteristics of employee benefits was designed for OPM as a major part of the Total Compensation Comparability system described previously. The survey scope and design and the selection of employee benefit characteristics were dictated by the requirements of OPM's actuarial models. The extensive body of information on employee benefits generated in this survey provides a unique data resource.

Results of the survey provide a major source of data on the extent to which workers receive paid leave and are protected by job-related insurance and pension plans. The survey data provide information for labor and management representatives involved in contract negotiations, 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. BLS tabulations and analyses of employee benefits can be of use to teachers, students, and others in the academic field; private consultants; researchers; writers; and others not directly involved in legislation or collective bargaining but concerned with the development, status, and trends in employee benefits.

Users of the employee benefits survey data should keep in mind that the scope of the survey excludes small firms—those with up to 50, 100, or 250 employees, depending on the industry. Studies of employee benefits that include all firms typically report lower participation rates for most benefits. The survey also excludes executive management and traveling operating employees (such as airline pilots), as well as part-time, temporary, and seasonal employees. Alaska and Hawaii are not surveyed; neither are the public sector and some industries such as agriculture, education, and health services. The data, therefore, do not statistically represent all employees in the United States, or even all employees in private industry.

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Chapter 13. Productivity Measures: Business Economy and Major Sectors

Indexes of labor productivity and compensation per hour, unit labor cost, and related measures for broad economic sectors are published by the Bureau of Labor Statistics. These measures provide information about the relationship between productivity, prices, wages, employment, and economic growth. Measures of output per hour have been developed for the business sector, and nonfarm and farm subsectors, from 1909 to the present. Since 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. These productivity measures, first published in 1959, represent the culmination of a long series of developments in productivity measurement in the Bureau.[1]

Productivity and related measures are prepared for the following sectors of the U.S. economy:

Quarterly and annual measures

Business sector
Nonfarm business sector
Nonfinancial corporations
Manufacturing, total, durable, nondurable

Annual measures only

Agriculture
Mining
Transportation
Communications
Utilities
Wholesale and retail trade
Finance, insurance, and real estate
Government enterprises

Description of Measures

The Bureau's output per hour measures are constructed as the ratio between gross domestic product—GDP—originating in the private business economy and its subsectors, and the corresponding hours of all persons engaged in each sector.[2] The changes through time in these major indexes reflect efficiency in the use of labor, and indirectly, the effect of other input factors in the domestic production of goods and services. The changes in the productivity and related measures through the business cycle typically show patterns which differ substantially from those found in long-term movements, and, therefore, are the objects of special analytic studies.

Labor input measures are based primarily on BLS establishment payroll data on employment and hours and reflect hours at work and paid time off for vacations, holidays, and sick leave as well. 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. (See BLS form 2000M at end of chapter.)

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 cost measures the cost of labor input required to produced one unit of output and is 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 profit and profit-type income of proprietorships and partnerships.

The Bureau has begun a program of multifactor productivity measurement to supplement the labor productivity measures and to provide additional insights into productivity growth and economic changes. This program is an outgrowth of analytic studies undertaken by the Bureau investigating some of the factors contributing to productivity growth.[3] The multifactor productivity measures for the business and nonfarm business sectors will be published based upon capital and labor inputs. Subsequently, measures based on

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

[2] Gross domestic product is gross national product less the net return on foreign investments. Net return on foreign investments is considered as originating in the "rest-of-world" sector.

[3] 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.

capital, labor, energy, and materials[4] will be introduced for the manufacturing sector and 2-digit Standard Industrial Classification (SIC) manufacturing industry groups. For these new measures, labor input is measured according to the same principles as in the present labor productivity measures. For the private business and nonfarm business sectors, output is also measured according to the same principles as in the present measures. When energy and materials are introduced, new measures of output for the manufacturing sector will also be developed.

Data Sources and Estimating Procedures

Output

Real gross domestic product originating in the business sector and subsectors is the basis of the output component of the productivity estimates. Thus, the output components of the entire set of measures are based upon and consistent with the National Income and Product Accounts (NIPA) prepared by the U.S. Department of Commerce. Gross product is the market value of final goods and services produced within a given period, and includes purchases of goods and services by consumers, gross private domestic investment, net foreign investment, and purchases by government.

Gross national product (GNP) is equal to income received by labor and property 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 gross national product less "rest-of-world" output, and excludes net factor payments to domestic owners of factors of production located outside the United States.

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 (BEA) in the U.S. Department of Commerce prepares estimates of constant-dollar GDP for the business economy and its major sectors; these estimates exclude changes in the value of production resulting from price change. Therefore, they reflect only changes in real product, which is the basis for output-per-hour measures.[5]

Output for the business economy equals GDP less gross housing product of owner-occupied dwellings and gross product of nonprofit institutions and private household workers.

Output data for the manufacturing sector based on gross product are derived 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. These statistics 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*.

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 underestimated 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 compensation 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

[4] The term "materials" is commonly used in this context to describe all intermediate goods and services exclusive of energy.

[5] A detailed description of the methods and procedures for estimating GNP and GDP in current and constant dollars is given in the *1954 National Income Supplement to the Survey of Current Business*, U.S. Department of Commerce. Further information on estimates for major industry sectors is presented in the October 1962 issue of the *Survey of Current Business*.

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 cost relates hourly compensation of all persons to output per hour and is defined as compensation per unit of constant-dollar output.[6] 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, and nonlabor cost: Interests, depreciation, rent, indirect business taxes, etc.

Since CES data include only nonfarm wage and salary workers, data from other sources (National Income and Product Accounts or the Current Population Survey) are used for farm employment and, in the nonfarm sector, proprietors, unpaid family workers, and private household workers.

Separate estimates for employment and hours paid are developed for each major sector and are aggregated to private 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.

In the manufacturing sector, separate estimates for production and nonproduction worker hours are derived and aggregated to the manufacturing total. Employment and average weekly hours for production workers are taken directly from CES data. Average weekly hours for nonproduction workers are developed from BLS studies of wages and supplements in the manufacturing sector which provide data on the regularly scheduled workweek of white-collar employees.

For nonmanufacturing sectors, employment and average weekly hours are taken from the CES survey. Although CES weekly hours data 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.

Multifactor productivity measures

The major new elements of multifactor productivity measurement, as distinct from labor productivity measurement, for the private business sector are the measurement of capital and the method of aggregating dissimilar inputs. The capital measures will be developed from investment data in the national accounts using the same methodology for both the private business and nonfarm business sectors.

The multifactor productivity measures for the business and nonfarm business sectors will be developed from 1948 to the present. The subsequent measures for the manufacturing sectors and the 2-digit SIC manufacturing industry groups will be developed from 1958 forward.

Analysis and Presentation

Indexes of output per hour show changes in the ratio of output to hours of labor input; however, these indexes should not be interpreted as representing solely labor's contribution to production. Rather, they reflect the interaction of many factors working in cooperation with the hours of labor input, including technology, capital investment, human capital (education and skill), energy, and raw materials.

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 sector.[7] Within industries, other shifts occur which are not accounted for adequately—changes in income and tastes, for example, may contribute to shifts in consumption patterns to higher quality goods, or to services rather than goods.

Short-term movements in productivity and unit labor costs often result from cyclical variation in output; this tends to distort the long-term relationship between output and labor input, as noted below, or output and multifactor input. A number of studies are being conducted to separate cyclical from long-term productivity movements.

Indexes of output per hour, compensation per hour, and related cost data are published quarterly in two series of BLS news releases: "Productivity and Costs in the Business Sector," and "Productivity and Costs in Nonfinancial Corporations." In addition, quarterly and annual analyses are published regularly 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.

Indexes of output per hour and related cost data are published monthly in *Employment and Earnings* and the *Monthly Labor Review,* and in each edition of the *Handbook of Labor Statistics.*

[6] Unit labor cost is explained and discussed in detail in J.R. Norsworthy and L.J. Fulco, "Productivity and Costs in the Third Quarter," *Monthly Labor Review,* February 1976.

[7] The farm-nonfarm shift is examined in some detail in J.R. Norsworthy and L.J. Fulco, "Productivity and Costs in the Private Economy," *Monthly Labor Review,* June 1974, pp. 3-9.

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 is equivalent to the computation of output per hour. Unit labor cost (ULC) is 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 among unit labor cost, 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):[8]

$$RC = (C/H) \div \text{CPI-U}$$

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:

$$UNLP = (OC-C) / O$$

and

$$UNLC = (OC-C-PR) / O$$

where:

OC 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:

$$LS = C / OC$$

and, analogously, the nonlabor or capital share is defined as

$$CS = (OC-C) / OC = 1-LS$$

Most of the measures noted above are prepared quarterly in index form for the major sectors of the private economy. In addition, quarterly percent changes at a compound annual rate and percent changes from the same quarter in the previous year are computed:[9]

$$Q_t = 100 (V_t/V_{t-1})^4 - 100$$

$$Y_t = 100 (V_t/V_{t-4}) - 100$$

where:

t is a time subscript denoting the quarter
V is a series described above
Q_t is the quarterly percent change in series V from quarter t-1 to quarter t, measured at a compound annual rate
Y_t is the percent change in series V from quarter t-4 (the same quarter 1 year before) to quarter t

In order to achieve greater precision in reported measures, all computations are made from the measures themselves rather than from their corresponding indexes.

Multifactor productivity

The computational method used by BLS for its multifactor productivity measure is defined as a Tornquist index. (A Tornquist index is the discrete approximation to the continuous Divisia index.) Some of the basic proper-

[8] Changes in real hourly compensation are analyzed in J.R. Norsworthy and L.J. Fulco, "Productivity and Costs, First Quarter 1976," *Monthly Labor Review*, July 1976.

[9] The handling of quarterly (or subannual) changes at compound annual rates 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 caused by the recent periods of inflation, sharp recession, and rapid recovery.

Since most of the productivity and cost 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 the final decimal place.

ties 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 weighted average of the relative compensation shares of the components in the 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 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 ith input, calulated as

$$\dot{x}_{it}/x_{it} = \ln x_{it} - \ln x_{it-1}$$

The weights (w_{it}) are defined as the average 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:

$$MFP = \dot{O}/O - \dot{I}/I$$

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 at work

Uses and Limitations

Measures of output per hour, output per unit of input (multifactor productivity), and related costs are designed for use in economic analysis and public and private policy planning. The data are used in forecasting and analysis of price, wage, and technological change.

The labor productivity, multifactor productivity, and related cost measures are useful in understanding and investigating the relationships among productivity, wages, price, profits, and costs of production. As noted above, gross domestic product represents the sum of all production costs: Compensation, profits, depreciation, interest, rent, indirect business taxes, etc. Unit labor cost, or compensation per unit of output, represents a major portion of total unit costs and so reflects 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 cost while an increase in output per hour tends to reduce it, other things being equal. Therefore, through its impact on unit labor cost, 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 in various constituent industries as well as shifts in the relative importance of these industries: A significant portion of labor productivity growth from 1947 to the present is attributable to the relative shift of workers from the farm to the nonfarm sector. 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 estimation 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 financial services sector where output is an imputed value of labor and other inputs. In consequence, the productivity and cost measures for these sectors should be interpreted with caution.

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Bureau of Labor Statistics
Hours At Work
Mining, Manufacturing, and Construction

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.

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PLEASE READ INSTRUCTIONS ON REVERSE BEFORE ENTERING DATA

Number of Employees During Payroll Period which Includes March 12, 1981	**All Employees** 13-17	**Production Workers** 18-22	**BLS Use Only** 23-24
Quarterly Period	**Production Workers Only**		
	Hours Paid *(omit fractions)*	**Hours at Work** *(omit fractions)*	
First Quarter 1981 January–March	25-32	33-40	41-42
Second Quarter 1981 April–June	43-50	51-58	59-60
Third Quarter 1981 July–September	61-68	69-76	77-78
Fourth Quarter 1981 October–December	79-86	87-94	95-96
Annual Total 1981 January–December	97-105	106-114	115-116

1a. What records did you use to compile the above information? — 117
1☐ Payroll 2☐ Personnel 3☐ Other _____

b. Are these records computerized? 1☐ Yes 2☐ No — 118

2. On what basis are these records kept? — 119
1☐ Weekly 2☐ Biweekly 3☐ Monthly 4☐ Quarterly 5☐ Annually 6☐ Other _____

3. If your records cannot be easily transcribed to reflect quarterly totals, please attach additional sheets reporting the data requested above in the format in which your records are kept.

4. Enter below any unusual factors responsible for significant differences from normal hours worked during any quarter. Please indicate which quarter these factors occurred. Examples are: More business, layoffs, strikes, fire, weather, etc.

If questions arise concerning this report, whom should we contact?

Name Title Date Area Code Telephone

BLS-2000M (Jan. 1982)

INSTRUCTIONS FOR COMPLETING REPORT (BLS 2000M)

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 period which includes March 12, 1981.

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 reported which includes March 12, 1981.

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 Natural 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, cafeterias, 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 14. Productivity Measures: Industries and the Federal 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 readily available data can be used to construct measures.

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 between 1947 or 1958 and the most recent year for which data are available.

Coverage has been expanded to include industries in trade and services, and with the increasing importance of the public sector, to various functional areas in the Federal Government. Productivity measurement in the Federal Government was initiated by a request from the Joint Economic Committee in the fall of 1970 to the General Accounting Office in conjunction with the Office of Management and Budget and the Civil Service Commission (now Office of Personnel Management). A joint Federal productivity measurement task force consisting of these agencies, with technical assistance and support from BLS, was established. This task force collected data and constructed indexes for fiscal years 1967–71. In July 1973, the Office of Management and Budget endorsed the continuation of the project to measure Federal productivity, and BLS assumed full responsibility for collecting input, output, and related information, in addition to the development of productivity measures.

Since July 1973, the Bureau has been expanding coverage to include organizational units not previously covered, improving the quality of some of the input and output data, and refining the methodological procedures used to construct productivity indexes. The measurement program is part of a multifaceted effort sponsored by the Office of Personnel Management and includes analysis, enhancement, and diffusion of productivity improvement ideas.

The Bureau is also expanding its productivity measurement program by explicitly accounting for other inputs besides labor in the industry measures and developing a supplementary set of productivity measures. The new measures are referred to as multifactor productivity measures. (The conceptual basis for

these is discussed in chapter 13 with reference to the major sectors of the economy.) The industry multifactor series are designed to measure changes in productivity by relating changes in an industry's output not only to changes in labor input but also to changes in 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 employee hour or labor productivity.

Concepts

Indexes of output per employee hour measure changes in the relationship between the physical volume of an organization's output and the employee hours expended in that output. Although traditionally output per employee hour has been the most frequently used measure, the expression of physical output per employee hour often is simplified if stated in terms of its reciprocal: Employee hour requirements per unit of output (unit employee hours). This form of index is used in the following description.

For an industry producing a single uniform output, the unit employee hours index is simply the ratio of the employee hours expended to produce a unit of output over two periods of time. This ratio may be expressed as follows:

$$I_u = \frac{1}{I_r} = \frac{L_i}{L_o}$$

where:

I_u represents the unit employee hour index

I_r represents the output per employee hour index

L_i and L_o denote unit employee hours expended in the current and base periods, respectively.

For an industry producing a number of products or services (the more typical case), the unit employee hours index is the ratio for two periods of the total hours required for the output of a given composite of products or services. Indexes of such industries vary with the composite specified and can take many forms. Letting Q_o and Q_i represent base period and current period quantities of a given product respectively, two of these forms are:

a. Using a current period composite

$$I_u = \frac{\Sigma q_i \, l_i}{\Sigma q_i \, l_o}$$

b. Using a base period composite

$$I_u = \frac{\Sigma q_o \, l_i}{\Sigma q_o \, l_o}$$

An index constructed according to (a) compares the employee hours expended in the production of the current composite with the employee hours which would have been required to produce the current composite in the base period. An index constructed according to (b) compares the employee hours required in both periods to produce the base period composite. Thus, these indexes eliminate the effects of variations over time in the relative importance of products or services on unit employee hours.

In either form, an index of unit employee hours also can be viewed as the quotient of an index of employee hours and an index of output:

Employee hours index ÷ Output index (Laspeyres) = Unit employee hours index (Paasche)

$$I_u = \frac{\Sigma l_i \, q_i}{\Sigma l_o \, q_o} \div \frac{\Sigma l_o \, q_i}{\Sigma l_o \, q_o} = \frac{\Sigma l_i \, q_i}{\Sigma l_o \, q_i}$$

Employee hours index ÷ Output index (Paasche) = Unit employee hours index (Laspeyres)

$$I_u = \frac{\Sigma l_i \, q_i}{\Sigma l_o \, q_o} \div \frac{\Sigma l_i \, q_i}{\Sigma l_i \, q_o} = \frac{\Sigma l_i \, q_o}{\Sigma l_o \, q_o}$$

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 unit employee hours index uses a base period weighted output index divided into the employee hours index. Conversely, a base period weighted unit employee hours index is consistent with an output index which utilizes current period weights.

Methods and Sources

Industries

Output per employee hour

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.

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. This procedure is used almost exclusively for the nongoods-producing industries. For manufacturing and mining industries, quantity data on physical output are usually most comprehensive for years covered by a 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. The mathematical form of the output index calls for the use of unit employee hour weights. Such weights, used whenever possible, 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. Consequently, 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 work 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 1947–58, 1958 weights for 1959–63, 1963 weights for 1964–67, 1967 weights for 1968–72, 1972 weights for 1973–77, and 1977 weights for years after 1977. The Bureau revises the weights as more current data become available from the periodic censuses.

Benchmark indexes. For most manufacturing, trade and services, and all mining industries, indexes reflecting changes in output between census years are constructed. These are called benchmark indexes.

[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.

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 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 necesary, 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 the U.S. Department of Energy, the U.S. Department of Agriculture, the Fish

[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)

$$\frac{\Sigma p_i q_i}{\Sigma p_o q_o} \div \frac{\Sigma p_i q_o}{\Sigma p_o q_o} = \frac{\Sigma p_i q_i}{\Sigma p_i q_o}$$

and Wildlife Service, U.S. Department of the Interior, the Interstate Commerce Commission, the Internal Revenue Service, and the Civil Aeronautics Board. 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. Employee hours are treated as homogeneous and additive with no distinction made between hours of different groups of employees. Data on changes in qualitative aspects of employee hours, such as skill, efficiency, health, experience, age, and sex of persons comprising the aggregate are not used and generally are not available. For mining and manufacturing industries, employee hour indexes are constructed for employees, production workers, and nonproduction workers. For service and trade industries, indexes are constructed for the hours of all 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 or the Bureau of the Census. For trade and service industries, these data are supplemented with data from the Internal Revenue Service. For most private nonagricultural industries (including manufacturing), BLS publishes employment and average weekly hours data for production or nonsupervisory workers and employment data for all employees. For manufacturing industries, 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. Census data include all hours at the plant, whether worked or paid for, and exclude paid time for vacations, holidays, or sick leave when the employee is not at the plant. Overtime and other premium pay hours are included on the basis of actual time at the plant. In contrast, BLS data include time for paid vacations, holidays, and sick leave, as well as plant employee hours. Differences in the data from the two sources for the same industry, however, also stem from the difference in sampling and reporting methods.

Generally, whenever employment and hours data are available from both the Bureau of the Census and the Bureau of Labor Statistics, the labor input data which are used are those consistent with the data on output. Thus, when output data from the Bureau of the Census are used, employment and hours data from the same source usually are preferred.

Nonproduction worker hours. While both the Bureau of the Census and BLS provide data on production worker employee hours, neither source provides annual data by industry on nonproduction worker or all-employee hours. Therefore, these measures are 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 are calculated by multiplying the number of workweeks in the year times the scheduled weekly hours. This produces an estimate of average annual hours paid. Estimated hours for vacations, holidays, disability, and personal time off are subtracted from average annual hours paid to obtain an estimate for average annual hours worked.

Estimated hours for vacations, holidays, and disabilities are based on data from various BLS surveys and studies of the Department of Health and Human Services. Personal time off has been 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 Mining 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 industries other than in trade and services, employee hours data are based on total employee hours of establishments classified in an industry, whether the

employee hours are applied to production of primary or secondary products. Annual physical output data, on the other hand, usually include only primary products of an industry and are usually 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 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 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.

Federal Government

Indexes of output per employee year, output, and employee years for selected functional areas of Government activity[4] and for the more than 400 participating organizations are constructed in a manner similar to that described for industries. At the present time, these measures cover about 67 percent (1.9 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 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.

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. For fiscal years 1967–1972, fiscal year 1967 weights are used; for years 1972–1977, fiscal year 1972 weights are used; for years after 1977, fiscal year 1977 weights are used. The three output segments are combined and referenced to a fiscal year 1977 base.

The organizational indexes are grouped into 28 functional categories, based on type of Government activity. Some of these categories, such as standard printing and electric power production, are more homogeneous than others, such as specialized manufacturing and information services. 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).

Employee year indexes are developed from agency data submissions. 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 40 hours a week, 52 weeks a year.

Presentation

BLS industry indexes are published annually in the bulletin, *Productivity Measures for Selected Industries.* 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

[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.

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. Federal Government indexes are published annually in the *Monthly Labor Review.*

Indexes of output per employee hour also are published in the *Statistical Abstract of the United States* and in the *Handbook of Labor Statistics.* Some indexes for earlier years are published in *Historical Statistics of the United States.*

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.

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.

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 for nonproduction workers, however, have a relatively insignificant effect on the estimates of hours for all employees. 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.

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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 15. 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 technological changes and displacement of workers in various industries. During World War II, emerging technologies were studied for purposes of improving manpower 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 manpower implications of various changes. Later, broader studies were undertaken, including a survey of the manpower 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 future changes. Research now underway pinpoints technologies which will become increasingly important over the next decade in key industries and attempts to provide advance information about their manpower implications.

Description of Studies

The Bureau's research program on technological change involves a variety of reports and studies of different degrees of detail and approach. The current program thus provides: Summary reports surveying trends in major industries; detailed industry studies; and studies of major technological innovations, such as computers, that affect workers in different industries.

Summary reports in 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 change is rapid. The first version of this 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. Bulletins containing more recent reports for 30 industries were published in 1974–82.

The emphasis of the report 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 that are taking place.

Detailed industry studies

Intensive studies are made of selected major industries where far-reaching changes, on a large scale, are taking place, such as coal and printing. These studies involve detailed analysis of the economic implications of major technological developments within individual industries. Factors analyzed include investment trends and factors affecting the prospects for the diffusion of recent technological advances, such as the

structure of the industry. Estimates are developed of the displacement of present by new methods over the next 10 years. Unit labor requirements under new and old technologies are compared, wherever possible. Since the focus of the study is on the industry as a whole, data on recent industry trends in output per employee hour, production, and employment are examined in relation to long-term trends, and projections of future trends are developed.

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 utilized 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; Bureau of Industrial Economics, *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 future 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 ade-

quacy 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 in this type of research are, therefore, 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 industrial 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 manpower implications.

Impact on productivity

Since one of the principal consequences of technological change, so far as manpower 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 manpower 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 created by quits, deaths, and retirement of employees, 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.

Since many changes exert their effects on employment through the competitive market, 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 whole 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 expanding and displacing 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 within the plant or office by transfer or promotion, the setting of wage rates, and selection of persons for new 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 of technological change are prepared as part of the U.S. Department of Labor's program for carrying out the objectives and responsibilities of the Manpower Development and Training Act of 1962 and the subsequent Comprehensive Employment and Training Act (CETA) of 1973. Under these acts, the Secretary of Labor is required "to establish techniques and methods for detecting in advance the potential manpower impact of automation, technological progress, and other changes in the structure of production." As part of such an early warning system, 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 manpower 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, new developments are constantly appearing so that assessments of 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.

Technical References

Bureau of Labor Statistics

Computer Manpower Outlook, BLS Bulletin 1826, 1974.

Presents information on the current employment and education and training characteristics of computer occupations; explores the impact of advancing computer technology on computer manpower and education; and projects computer occupational requirements and their implications for training.

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.

Outlook for Technology and Manpower in Printing and Publishing, BLS Bulletin 1774, 1973.

Describes changes in technology in the printing and publishing industry and its impact on productivity, employment, occupational requirements, and methods of adjustment.

Railroad Technology and Manpower in the 1970's, BLS Bulletin 1717, 1972.

Describes changes in technology and their impact on productivity, employment, occupational requirements, and methods of adjustment.

Technological Change and Its Labor Impact in Five Energy Industries (coal mining, oil and gas extraction, petroleum refining, petroleum pipeline transportation, electric and gas utilities), BLS Bulletin 2005, 1979.

Appraises major technological changes emerging in five key energy industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technological Change and Its Labor Impact in Five Industries (apparel, footwear, motor vehicles, railroad, retail trade), BLS Bulletin 1961, 1977.

Appraises major technological changes emerging in five key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technological Change and Manpower Trends in Five Industries (pulp and paper, hydraulic cement, steel, aircraft and missiles, wholesale trade), BLS Bulletin 1856, 1975.

Appraises major technological changes emerging in five key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technological Change and Manpower Trends in Six Industries (textiles, lumber and wood products, tires and tubes, aluminum, banking, health services), BLS Bulletin 1817, 1974.

Appraises major technological changes emerging in six key industries and discusses their impact on productivity and occupations over the next 5 to 10 years.

Technology and Labor in Five Industries (bakery products, concrete, air transportation, telephone communication, insurance), BLS Bulletin 2003, 1979.

Appraises major technological changes emerging in five 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 four 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 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 manpower.

Vickery, Mary L. "New Technology in Laundry and Dry Cleaning Services," *Monthly Labor Review,* February 1972. Reprint No. 2792.

Discusses the impact of technology on manpower and productivity in laundry and dry cleaning establishments. Discusses outlook to 1980.

Zeisel, Rose N. "Modernization and Manpower in Textile Mills," *Monthly Labor Review,* June 1973. Reprint No. 2893.

Analyzes the impact of technology on manpower in textile mills. Includes data on capital expenditures and research and development.

Chapter 16. Foreign Labor Statistics and Trade Monitoring

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 BLS foreign labor statistical reports cover a variety of international comparative measures, mainly for the Western industrial countries. The principal measures cover the labor force, employment, and unemployment; productivity and labor costs; hourly compensation of manufacturing production workers; and trends in consumer prices.

Labor force, employment, and unemployment. Comparative measures of the labor force, employment, and unemployment 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.

Productivity and labor costs. Comparative trends in manufacturing 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, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden, and the United Kingdom. Trends are expressed in index form (1977 = 100) 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 in national currency and in U.S. dollars converted at prevailing commercial exchange rates.

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 (1977 = 100) and at annual rates of change.

Comparative levels (United States = 100) and trends (1977 = 100) in gross domestic product (GDP), GDP per capita, and GDP per employed person are calculated on an average-annual basis for the United States, Canada, Japan, Belgium, France, Germany, Italy, the Netherlands, and the United Kingdom beginning with 1950. The GDP level comparisons, which are based on estimated purchasing-power-parity 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. Measures of total compensation per hour worked for production workers in all manufacturing and in over 30 selected manufacturing industries are prepared annually for about 30 countries. The measures are developed from data on average earnings, as published by each country, plus information on other direct payments to the worker and employer expenditures for legally required insurance programs and contractual and private benefit plans. They are expressed in national currency and in U.S. dollars at prevailing commercial exchange rates. Hourly compensation, when converted to U.S. dollars at commercial exchange rates, indicates 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 for 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 11 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 14 countries; selected producer price indexes for 8 countries; implicit price deflators for GDP and consumer expenditures for 9 to 11 countries; and ratios of capital investment, excluding residential construction, to output for 11 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, Organization for Economic Cooperation and Development, and the European Community; 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 labor force and unemployment comparisons, the Bureau adjusts each country's published data, if necessary, to provide measures approximately consistent with U.S. definitions and standards. The labor force and unemployment 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 (France, biannually; Germany and the United Kingdom, annually; the Netherlands, biennially) which contain benchmark data that are used to adjust the level of the labor force and total unemployment for greater comparability with U.S. concepts. Measures of current labor force and unemployment are obtained by applying adjustment factors from the most recent year's labor force surveys to published labor force and unemployment registration figures.

Productivity and labor costs. Indexes of manufacturing productivity, hourly compensation, and unit labor costs are constructed from three basic aggregative measures; i.e., 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. However, the Italian figures for 1970 forward relate to mining and manufacturing less energy-related products.

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 for 1969 forward, which are indexes of industrial production. Methods of deriving national accounts measures of manufacturing output differ substantially from country to country, however, and the Canadian and British national accounts measures are identical to their indexes of industrial production. 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. For Belgium, France, and the Netherlands, the hours-worked measures may not reflect all random hours changes, such as time lost because of industrial disputes. The compensation measures are from national accounts—except those for France, from 1967 forward, and Belgium, which are developed by the Bureau using statistics of employment, average hours, and hourly compensation. 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 comparative 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 (1970 and 1973) level comparisons of GDP for Japan, Belgium, France, Germany, Italy, the Netherlands, and the United Kingdom are from Irving B. Kravis, Alan Heston, and Robert Summers, *International Comparisons of Real Product and Purchasing Power* (United Nations International Comparison Project: Phase II). The benchmark (1965) level comparisons for Canada were derived from E.C. West, "Real Output Comparison, Canada and the United States," appendix to Dorothy Walters, *Canadian Income Levels and Growth, An International Perspective* (Ottawa, Staff Study No. 23, prepared for the Economic Council of Canada, 1968). The benchmark figures were derived by combining output quantities, at detailed levels of expenditure, according to a common set of price weights. Because of differences in price structures, however, no single set of price weights is ideal for combining the outputs of different countries. Therefore, the GDP comparisons are shown using "international" price weights (except for Canada), U.S. price weights, own (foreign country) price weights, and the geometric mean of U.S. and own price weights. Output quantities at the detailed levels of expenditure were obtained by converting national accounts expenditures data into a common currency (U.S. dollars) using purchasing-power-parity exchange rates for each detailed category. The base-year comparisons of real GDP are extrapolated or interpolated to other years using relative changes in GDP at constant market prices, as measured by each country.

Hourly compensation. Measures of hourly compensation for production workers in all manufacturing and in selected manufacturing industries 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 plans for the benefit of employees. In addition, taxes on payrolls or employment are included even if they are not for the direct benefit of employees, because such taxes are

regarded as labor costs. However, some items of labor cost—the costs of recruitment, training, and plant facilities and services (e.g., cafeterias, medical clinics, and employee parking)—are excluded because data are not available for all countries. 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. 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 and the national accounts implicit price deflator for consumer expenditures. Definitions of worker 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 or implicit price deflators for GDP and consumer expenditures except to link indexes published on different base years and to convert them to a common index base. Ratios of fixed capital investment to output include government, exclusive of government outlays for military use, as well as private investment. They are adjusted for definitional consistency where possible; e.g., by the exclusion of breeding stocks, which are classified as inventories in the United States.

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 change 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.* Also, an annual news release is issued on comparative trends in manufacturing productivity and labor costs. The *BLS 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 Inter-

national 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 comparisions 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.

Trade Monitoring

Background

Section 282 of the Trade Act of 1974 provides that the Secretary of Commerce and the Secretary of Labor shall establish and maintain a trade monitoring system, which will reflect (a) changes in the volume of imports into the United States; (b) the relation of such imports to changes in domestic production; (c) changes in employment within domestic industries producing articles like or directly competitive with such imports; and (d) the extent to which such changes in production and employment are concentrated in specific geographic regions of the United States. The primary responsibility for the trade monitoring program has been delegated to the BLS.

Description of Measures

The trade monitoring program is intended to measure changes in U.S. imports, output, and employment in sufficient detail to permit analysis of the relationships between trade and employment. The principal measures developed thus far by the Bureau cover U.S. merchandise trade, comparable domestic production, and related industry employment.

Merchandise imports. Quarterly measures (with annual totals) of the customs value and quantity of U.S. imports for consumption are prepared regularly. Quarterly series for all commodities begin with 1975; annual series begin with 1972. Value and quantity data are available on a *Tariff Schedule of the United States Annotated* (TSUSA) basis; only value data are available on a Standard Industrial Classification (SIC) basis. At present, country-of-origin, duty, and other information are not included. Data are not seasonally adjusted; value data represent current value measures.

Merchandise trade as related to output. Annual value-based measures of U.S. merchandise imports as a percent of new supply (domestic shipments plus imports) and U.S. merchandise exports as a percent of domestic shipments are calculated each year for over 300 manufacturing SIC-based product groups, beginning with 1972.

Industry employment. Quarterly measures of national mining and manufacturing industry employment are prepared from the Bureau's monthly establishment survey on employment and earnings, beginning with 1972. State and area employment tabulations are prepared from the same survey for selected manufacturing industries.

Data Sources

The principal data sources for trade monitoring are (a) for imports, the Bureau of the Census' monthly data tape on U.S. imports (IM-145), supplemented by annual concordance tapes which relate import data to the SIC classification system; (b) for exports, annual issues of the Bureau of the Census' EA-675, *U.S. Exports of Domestic and Foreign Merchandise, SIC Division by SIC-based 2-digit, 3-digit, and 4-digit Product Code;* (c) for domestic output, the quinquennial industrial censuses and annual surveys of manufacturing conducted by the Bureau of the Census; and (d) for employment, the BLS monthly establishment survey of employment and earnings.

Estimating Procedures

Several adjustments are made in the trade and domestic data used in the trade monitoring system because U.S. imports, U.S. exports, and domestic production and employment are reported on different classification bases. U.S. imports are reported on the basis of (over 10,000) legal tariff commodity classifications designed for the collection of duties in the *Tariff Schedules of the United States Annotated.* U.S. exports are reported on the basis of the U.S. Department of Commerce's (over 4,000) *Statistical Classification of U.S. Exports* (Schedule B). Domestic production and employment are reported on a classification of domestic

economic activity of establishments based upon the *Standard Industrial Classification Manual,* 1972 edition and its 1977 *Supplement*. Furthermore, while manufacturers' shipments (used as a proxy for output) are available on both an industry basis—total shipments of firms classified in a given industry, including shipments of secondary products—and on a product-class basis—total shipments of the primary products of an industry, including shipments of the same products made by firms classified in other industries—employment data are only available on an industry basis. Since international trade classifications are commodity-based, imports and exports have been matched with domestic product-class shipments on a wherever-made basis.

For the purposes of relating imports to domestic output and employment, imports classified by TSUSA number are assigned by the Bureau of the Census to 5-digit SIC-based product classes. An SIC-based product class is a group of individual products primary to a 4-digit SIC industry and is designated by a 5-digit code, the first four digits indicating the SIC industry and the fifth digit, the specific group of products. In cases where the TSUSA numbers include items which should be classified in two or more SIC-based product classes, an assignment is made to the SIC-based product class to which the principal content of the TSUSA number belongs, if this will not result in signficant classification distortions. In cases where distortions will result from such an assignment, the principal SIC-based product classes are combined to form an SIC-based import code and the TSUSA number assigned to the combination. For the 1972 edition of the SIC manual, and its 1977 supplement, there are 555 (452 in manufacturing) 4-digit SIC-based industry codes and 414 (347 in manufacturing) 4-digit SIC based import codes. Of the 414 SIC-based import codes, 266 coincide entirely with a corresponding 4-digit SIC-based industry code and 31 represent combinations of 72 4-digit SIC-based industry codes; the remaining 117 correspond to only a part of an SIC-based industry code, to an SIC-based industry code plus parts of other SIC-based industry codes, or are residual import categories that are not comparable to domestically produced products. Of the 555 SIC-based industry codes, 41 are not covered by import classifications.

The current SIC-based import code assignment for each TSUSA number is obtained from an annual Bureau of the Census import edit master tape. Since these assignments may change over time, BLS maintains a master file of current and past assignments and adjusts for historical consistency. SIC-based export data are obtained directly from the Bureau of the Census and are not adjusted except for historical consistency.

Some adjustments of output (shipments) data are also made for the purpose of relating domestic output to the SIC-based import and export groups. The value of manufactures product shipments at the 4-digit industry level often includes a small amount which is not distributed among the individual 5-digit product classes (manufactures shipments not specified by kind). When SIC-based import (export) codes represent combinations of product classes from different 4-digit industry groups, a share of the undistributed output is allocated to each 4-digit SIC-based import (export) code according to the 5-digit product class share of the total. Since this allocation is an approximation, the value of shipments for the 4-digit SIC-based import (export) codes might be slightly over or under stated.

Analysis and Presentation

Analyses of U.S. imports and related domestic production and employment focus both on long-term and short-term changes. Merchandise imports are monitored quarterly for significant increases in current dollar value over the year-ago quarter and the prior 12 months, and industry employment is monitored quarterly to note significant declines over the same time spans. In addition, measures of import penetration, which are updated annually, with about a 2-year lag, are monitored for substantial long-term increases or sustained high levels.

Since the trade monitoring program is still in the early stages of development, the form of presentation thus far has been confined almost entirely to statistical data tabulations and summary rankings. However, several papers have been prepared describing the measures, and staff papers have been developed on the concordance problems.

Uses and Limitations

The purpose of the Bureau's trade monitoring system is to provide information, for policy analysts and those engaged in the administration of trade adjustment assistance programs, that might help in identifying domestic industries which possibly are experiencing adverse employment effects because of changing international trade patterns. However, the Bureau does not make estimates of jobs potentially lost as a result of rising imports—because of the limitations associated with such estimates.

There are several conceptual and measurement difficulties in comparing trade, output, and employment data. These problems vary by the product or industry considered and the scope of the measure. Perhaps the most critical problem is the incongruity among classifications used for reporting imports, exports, and domestic output and employment. In addition to the differences in the basic classification systems, there are other problems affecting comparability between trade

and domestic economic data. Differences in methods of valuation present the principal such problem in comparing imports with domestic output. Aggregation of 5-digit product-class shipments to a 4-digit SIC level will result in duplication to the extent that these commodities are used as materials in other commodities produced within the industry considered, whereas there are no similar problems for imports since only final products are recorded; low-value transactions are excluded from the data for individual import commodity classifications; and a small portion of manufacturing shipments that are not allocated to detailed commodity lines has been distributed over constituent product classes. All these factors affect comparability to some degree. For this reason, the measures of import penetration should be considered only as approximations. Furthermore, since the output data used for comparison with the trade data are product-based, they are not directly comparable to industry-based measures such as employment.

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Chapter 17. 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

Two major changes in the recordkeeping system have taken place since it began in July 1971. The first, in January 1975, involved the classification of lost workdays as either days away from work or days of restricted work activity. The second change, in January 1978, represented an effort to reduce the burden on the employer and to streamline OSHA recordkeeping and the reporting system. A new recordkeeping form—OSHA No. 200, Log and Summary of Occupational Injuries and Illnesses—made it easier for employers, employees, and safety and health officers to identify the major injury and illness problems. (An example of OSHA 200 is included at the end of the chapter.)

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 the duties of his or her regular job. 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. A copy of the summary totals of the injuries and illnesses must be posted at each establishment where notices to employees are posted no later than February 1 and remain in place until March 1.

Virtually all employers are covered by the act. However, to ease the recordkeeping burden on employers, Federal regulations exempt groups of employers from mandatory keeping of OSHA records of occupational injuries and illnesses. This exemption

does not affect the obligation of employers to observe all safety and health standards, to report within 48 hours any accident which results in one or more deaths or the hospitalization of five or more employees, and to participate in the annual survey when notified of their selection for the survey sample. Farm employers with 10 or fewer employees are totally exempt from any OSHA regulation or activity involving Federal funds and are omitted from the survey sample.

Concepts

Definitions used in the annual survey are the same as those used in the OSHA recordkeeping system. Reports for all 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 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.

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:

$$\text{Incidence rate} = \frac{\text{(Sum of characteristic reported) x 200,000}}{\text{Sum of number of hours worked}}$$

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 a series of industry guides. The industry guides provide an explanation of how to compute an incidence rate for a firm and how to compare this rate with the national rate for each industry and employment-size group. The data also 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. 22151.

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, with the exception of Louisiana, 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 length of service, extent of disability, indemnity compensation, and medical costs, some of which may be defined differently from State to State. For example, "length of service" may refer to time with an employer, in a particular occupation, or in a particular job. The following optional items as of 1980 may be submitted by participating States. (The number in parentheses indicates the number of States providing that information.)

Day of occurrence (31)
Time of accident (15)
Time workday began (7)
Lapsed time (4)

Associated object or substance (19)
Age of employee (34)
Length of service (26)
Weekly wages (25)
Extent of disability (18)
Kind of insurance (13)
Indemnity compensation (13)
Medical payments (6)
Rehabilitation costs (2)

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 1970 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.

The national office screens and edits all State SDS data tapes. Standard tabulations produced for each State are also reviewed for further validation of the data.

By applying the percent distributions of the SDS data to annual survey data, it is possible to arrive at estimated numbers of injuries and illnesses on a national basis by various characteristics. Despite differences in the number of cases among States, the percentage distributions of injuries and illnesses are relatively consistent across the States—patterns that have been observed in several consecutive years of data from approximately 30 States. Observations, statistical tests, and the geographic and industrial diversity of the States support the hypothesis that these data are representative of the national experience. An example of how SDS data can be used in conjunction with the annual survey data follows: In 1979, disabling injuries or illnesses affecting the back accounted for 22.5 percent of all cases in the SDS program; the total number of lost workday injuries or illnesses collected through the annual survey was approximately 2.8 million, resulting in a national estimate of 630,000 disabling back injuries for that year (22.5 percent x 2.8 million).

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 1980, 35 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.

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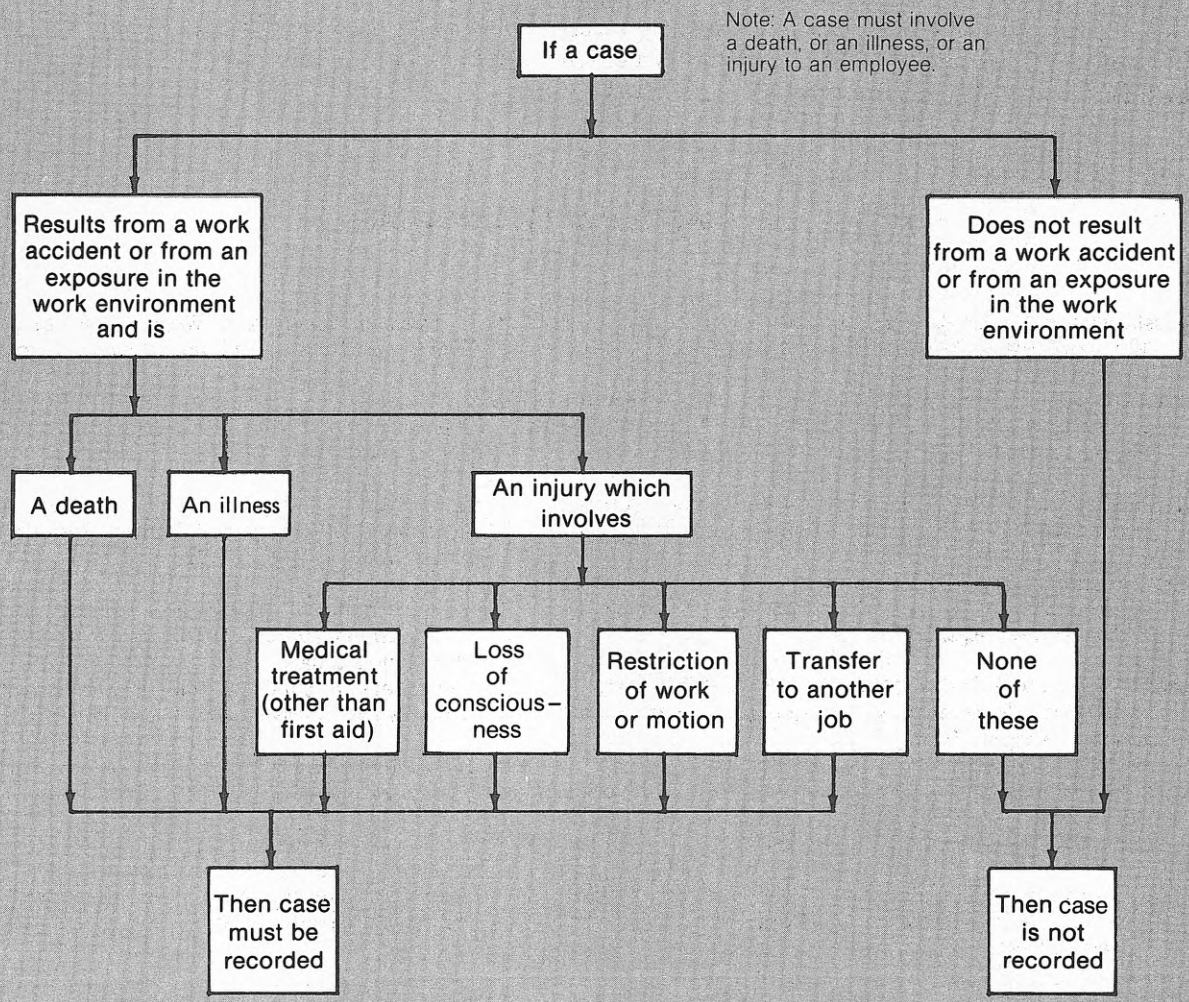
Chart 1

Guide to recordability of cases under the Occupational Safety and Health Act



1981 OSHA No. 200-S
Annual Occupational Injuries and Illnesses Survey Covering Calendar Year 1981

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 expires 9/30/82

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

Complete and return ONLY THIS FORM within 3 weeks

I. ANNUAL AVERAGE EMPLOYMENT IN 1981

Enter the average number of employees who worked during calendar year 1981 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 1981

Enter the total number of hours actually worked during 1981 by **all** employees covered by this report. DO NOT include any non-worktime even though paid such as vacations, sick leave, etc. If employees worked low hours in 1981 due to layoffs, strikes, fires, etc., explain under Comments (section VII). ***(Round to the nearest whole number.)***

III. NATURE OF BUSINESS IN 1981

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 1981 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 1981, 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 1981?

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.

RETURN REPORT TO:

For Information Call:

OSHA No. 200-S (Rev. Oct. 1981)

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VI. OCCUPATIONAL INJURY AND ILLNESS SUMMARY (Covering Calendar Year 1981)

- ***Complete this section by copying totals from the annual summary of your 1981 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 1981.
- ***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)	
							DEATHS

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 FATALLTIES 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 1981 OCCUPATIONAL INJURIES AND ILLNESSES SURVEY (Covering Calendar Year 1981)

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 1981

Enter in Section I the **average** (not the total) number of full and part-time employees who worked during calendar year 1981 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 1981 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 1981

Enter in Section II the **total** number of hours actually **worked** by all classes of employees during **1981.** 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 1981

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 **1981.**

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 1981 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 **1981** 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 1981.

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)

[redacted]

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 1981. 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,

THORNE G. AUCHTER
Assistant Secretary for
Occupational Safety and Health

Chapter 18. Labor Force Projections

BLS develops and publishes long-term projections of the labor force—estimates of its future size and composition—as part of a comprehensive and integrated framework for analyzing the implications of growth for the national economy and for employment by industry and occupation. Projections, based on specified assumptions, are made for about 15 years ahead. Seven sets of labor force projections have been prepared since 1959. The most recent projections, for the labor force as a whole and for 54 separate age-sex-race groups, were published in December 1980 for 1985, 1990, and 1995.[1]

The basic assumptions that underlie all the labor force projections are: (1) Work patterns will not change significantly over the projection period; for example, the average workweek will not be sharply reduced; (2) social and educational trends will continue, such as the trend toward increased schooling beyond high school; and (3) there will be no major war or significant change in the size of the Armed Forces.

Methods

Projections of the labor force require, first, projections of the population. These are prepared by the Bureau of the Census by age, sex, and race, based on trends in birth rates, death rates, and net migration. Since birth rates pose the most uncertainty in projecting the population, the Bureau of the Census prepares several series of projections based on differing assumptions with respect to birth rates. The most recent BLS labor force projections incorporated the Bureau of the Census middle (Series II) birth rate projections, which have the total fertility stabilizing at 2.1 births per woman by the year 2050.[2]

Once population projections have been prepared, BLS projects labor force participation rates—the proportion of various groups in the population who will be working or seeking work. Projections are made for 54 separate demographic groups since both the level and trends of participation vary considerably by age, sex, and race. The labor force participation projection for each age, sex, and race group is developed by : (1) Analyzing past rates of growth, (2) selecting a time period deemed most appropriate for each group, and (3) modifying that rate if past trends are not likely to continue throughout the entire projection period.

The projected participation rate for each group is then multiplied by the corresponding population projection to obtain the labor force projection for that group. These are summed to obtain the total labor force. At each stage of projection, the results for specific age, sex, and race groups are reviewed and modified if not consistent with other demographic groups.

In recent years, three alternative sets of assumptions (scenarios) regarding labor force participation have been developed for each set of projections. In the latest projections, for example, one scenario, a *high-growth* scenario, assumes a 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 the age of 65. (These rates have been diverging since 1955.) A second scenario, the *middle-growth* scenario, assumes only the rapid growth of women's participation. The *low-growth* scenario assumes a moderate rather than a rapid increase in women's participation and a continued divergence in the participation rates of black and white men.

New approaches

Since the last set of projections was prepared, the Bureau has been examining alternative ways to prepare labor force projections. The alternative under consideration is an economic model of labor force participation rates. The model just described is an extrapolation of past trends in participation rates to some target year with no explicit consideration of economic influences on participation rates.

Uses and Limitations

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

[1] Howard N Fullerton, Jr., "The 1995 Labor Force: A First Look," *Monthly Labor Review*, December 1980.

[2] Bureau of The Census, *Projections of the Population of the United States: 1977 to 2050*, Current Population Reports, series P-25, No. 704, 1977.

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, and evaluate expansion programs.

As is the case for all projections, users of labor force projections need to be aware of the underlying assumptions and should consider projections as likely outcomes in the light of current and expected trends, not as forecasts of the future.

Technical References

Bureau of Labor Statistics

BLS Economic Growth Model System Used for Projections to 1990. BLS Bulletin 2112, 1982.

Flaim, Paul O., and Fullerton, Howard N, Jr. "Labor Force Projections to 1990: Three Possible Paths," *Monthly Labor Review*, December 1978. Originally presented at the August 1978 meeting of the American Statistical Association. Reprinted in Richard L. Rowan (ed.), *Readings in Labor Economics and Labor Relations*, Chicago, Richard D. Irwin, 1980; also in *Employment Projections for the 1980's*, BLS Bulletin 2030, 1979.

Fullerton, Howard N, Jr. "How Accurate Were Projections of the 1980 Labor Force?" *Monthly Labor Review*, July 1982.

Fullerton, Howard N, Jr. "The 1995 Labor Force: A First Look," *Monthly Labor Review*, December 1980. Reprinted in *BLS Projections to 1990*, BLS Bulletin 2121, 1982.

Fullerton, H. N, Jr., and Flaim, P. O. "New Labor Force Projections to 1990," *Monthly Labor Review*, December 1976. Reprinted as Special Labor Force Report 197.

Ryscavage, Paul M. "BLS Labor Force Projections: A Review of Methods and Results," *Monthly Labor Review*, April 1979.

Bureau of the Census

Projections of the Population of the United States: 1977 to 2050, Current Population Reports, series P-25, No. 704, 1977.

Chapter 19. Economic Growth Studies

The primary objective of the Bureau's studies of economic growth is to develop projections of industry employment opportunities under alternative assumptions in order to analyze various economic problems such as the future utilization of available labor resources. A system of models serves as a basis for making the economic and employment projections.

Methods

Macroeconomic model

A macroeconomic model is used to project gross national product (GNP) and its major demand components under different sets of assumptions. These assumptions involve such factors as demographic trends, the unemployment rate, inflation, government tax and expenditure policies, and long-run productivity trends.

The macroeconomic model provides estimates of growth in the major sectors of the economy that are consistent with all assumptions and conditions of a particular projection scenario. The purpose of the aggregate projections is to provide consistent and integrated control totals for the projected industry purchases that are developed later in the system.

A macro model used recently was a relatively small-scale model (approximately 50 equations) whose purpose was to capture the impact of those factors which affect aggregate demand and supply over the medium to long term. The model was structured around a framework in which the output produced is balanced with output demanded via income flows. To bring about this balance between supply and demand GNP, the model was structured to respond to fiscal policy changes, which affect the level and distribution of spendable income in the personal and corporate sectors.

Assumptions made in developing the macro projections. There were 51 variables in this BLS macroeconomic model that were exogenous, or that had to be estimated externally in various ways for the projected periods. From a solution point of view, all exogenous variables are considered assumptions. From a structural approach, however, the exogenous variables were grouped in three ways. First were those items projected with sophisticated techniques outside the Office of Economic Growth and Employment Projections such as the population projections. Second were items which represented either policy instruments or policy goals. The policy instruments, such as Federal tax rates or Federal employment levels, represent the Federal Government's position at any particular time. The policy goals, such as the unemployment rate or the Federal deficit, were the result of such measures. Finally, there were those exogenous variables which were assumptions in the narrowest sense; i.e., a judgment as to the probable course of a particular item. An example of this category would be interest rates.

Balancing the macro model. Summation of the derived real components of demand yields the demand-side estimate of GNP. The demand- and supply-side estimates of GNP ordinarily will not agree, and the magnitude of such an imbalance is calculated. A positive sign for this gap represents a situation of excess supply, while a negative sign indicates excess demand. Although the sum of disposable incomes for all of the sectors necessarily equals the estimate of the GNP, demand for GNP will fall short of or exceed the supply of GNP unless the total purchases of the various sectors happen to equal their combined incomes.

The gap between supply and demand GNP depends in part on the government policies incorporated in the model. If there is a gap, this implies that the target rate of unemployment cannot be achieved with the existing fiscal assumptions. Thus, the various policy instruments in the model are modified to effect a balance between supply and demand. Many combinations are possible, and a final choice is made on the basis of many considerations that are outside the model.

Final demand projections

Gross national product is the final output of the economy measured from the demand side, or the output of the economy distributed among its final users. Final users are broadly categorized as persons, businesses,

governments, and foreign. Final demand consists of the purchases made by these groups, or the purchases of the demand sectors of GNP. Final demand projections involve estimating the future purchases of each demand sector, by industry of origin. For recent projections, the economy was disaggregated into 156 different industries. These industries defined the bills of goods, or lists of purchases, prepared for each final demand sector. The output of the macro model provides control totals for each final demand sector. The first step in projecting distributions of purchases for each sector is to develop data series for the purchases each made in past years. The years studied are primarily years for which the U.S. Department of Commerce has published input-output studies (1958, 1963, 1967, and 1972);[1] 1972 became a base year for the recent projections. In addition, many other data series are available. These historical data are used with a variety of techniques and submodels to project purchases.

Personal consumption. The distribution of total personal consumption expenditures (PCE) to producing industries is accomplished in two major steps. After total consumption is determined by the macroeconomic model, the first step is to project consumption by type of expenditure for 12 major product groups, which the Department of Commerce has defined and for which it maintains data series. These 12 major product groups are summed and then scaled to the projected total consumption provided by the macro model. Next, using these 12 product groups, a set of 82 lower level product categories, also maintained by the Department of Commerce, are projected. These 82 detailed product categories are also scaled to sum to the appropriate 12 aggregate controls. Historical data for each of these 82 categories are available from the Department of Commerce as part of the National Income and Product Accounts.

The second step is to distribute each of the 82 product expenditures to the producing industries. This is accomplished using projected "bridge tables" or matrices which distribute each of the 82 categories to its component industries as well as to the transportation, insurance, and trade industries. The results are aggregated to form the PCE bill of goods, the largest component of final demand.

A consumption submodel is used to project the 12 major product groups as well as the 82 detailed product categories. This model, which relates consumer expenditures primarily to income and prices, was originally developed by Houthakker-Taylor,[2] with the 1958 constant-dollar data from 1929 to 1964 used to estimate a set of 82 product expenditure categories. Total PCE and the annual change in PCE are primary variables used as a proxy for disposable income. PCE has a high level of explanatory power in these equations. Relative prices, which are calculated as the implicit price deflator for that good or service divided by the implicit price deflator for total PCE, are also used extensively. The lag structure of the equations allows the effect of changes in explanatory variables to be distributed over time.

A bridge table distributes the 82 product categories to their component goods and services and the margin industries, i.e., wholesale and retail trade margin and transportation costs. The products are expressed in purchasers' values, while the bills of goods or the producing industries are expressed in producers' values. The difference is the cost added to a particular industry's output in getting that output from the point of production to the consumer, including transportation costs (railroad, truck, water, air, and pipeline costs), insurance costs (for imports only), and wholesale and retail trade markups. The bridge table accomplishes two tasks at once—it allocates each of the 82 product categories to its producing industries, and removes the transportation and trade margins from the product and allocates them accordingly.

Investment. The development of historical bills of goods for producers durable equipment (PDE) involves two approaches that provide a check on the consistency of the data base from which the projections are made. The first approach studies the growth of demand in equipment over time. Annually, the national income accounts show PDE distributed among 24 major categories such as agricultural machinery, construction machinery, communication equipment, etc. Each of the 24 categories is in purchaser prices and contains a varying number of supplying industries. For the years for which input-output tables were prepared (I–O years), bridge tables are available which allocate each of these 24 categories to the margin and the supplying industries. Bridge tables for non-I–O years are constructed by interpolation.

The second approach makes use of the assumption that an industry's investment is a function of its output. The *Annual Survey of Manufacturers* and the *Census of Manufactures* are the sources for equipment investment of the historical period. For I–O years, capital flows tables are available which allocate the total investment of each industry to the supplying industries, thus, producing a PDE bill of goods. Bills of goods derived by these two approaches can be compared to show changes that are occurring in the bridge table and the capital flows matrix.

To make PDE projections, both investment output ratios and capital flows are projected based on historical

[1] *Input-Output Structure of the United States 1958; 1963; 1967; and 1972* (U.S. Department of Commerce, Bureau of Economic Analysis).

[2] H.S. Houthakker and Lester D. Taylor, *Consumer Demand in the United States: Analyses and Projections* (Cambridge, Mass., Harvard University Press, 1970).

trends. Projected outputs by industry are first derived, then the projected investment output ratios are applied to derive the level of investment by each industry. This level of investment is run through a capital flows table giving a PDE bill of goods. This total investment is made to equal total PDE as derived from the macro model runs. Obviously, changes in the distribution of PDE by industry change the output level of each industry which causes a further change in the required investment. Adjustments are made repeatedly to the PDE column until PDE demand in each industry equals the level of investment that was actually required by the distribution of output.

Foreign trade projections. For most industries, the foreign trade projections rely on an analysis of the trends of imports and exports as shares of total output. The ratios for 1963, 1967, 1972, and, for merchandise trade, in 1977 are compared, and the trend carried out to future years. Ratios are applied initially to estimate imports and exports. The industry levels of imports and exports are added and scaled to the total values of the macro model.

The results are modified, in some cases, based on a comparison with previous BLS projections of imports and exports and special analyses. Where the previous projections relied on special analyses or special trade agreements that were still in effect, these are taken into account. Special studies are conducted for important import and export goods. For example, studies are made for automobile and electronic imports. Specific assumptions are made for the energy industries based, to the degree possible, on the Department of Energy's projected rates of growth for domestic output and imports under certain price conditions.

Government. The macroeconomic model estimates of projected State and local government purchases are consistent with all macro assumptions and estimates, including grants-in-aid. This model provides a purchase total for each projected year, with subtotals for education and for all other functions as a group. Both of these categories are divided into compensation and all other purchases.

A State and local government model has been recently used which predicts expenditures and employment in current dollars for 20 functions. These functions are projected based upon Census and BEA data by calendar year. They include: (1) Elementary and secondary education, (2) higher education, (3) other education, (4) libraries, (5) highways, (6) health, (7) hospitals, (8) sewerage, (9) public utilities, (10) natural resources, (11) corrections, (12) police, (13) fire, (14) sanitation, (15) public welfare, (16) local parks and recreation, (17) general government, (18) other government enterprises, (19) public housing, and (20) water and air terminals. The model structure is based upon data for the years 1960–73. Equations for each function are first estimated for expenditures and employment. Expenditures in the model are in current dollars and apply to all outlays, not just purchases of goods and services. Another set of equations is used to convert expenditures to purchases and compensation. A final set of equations is used to convert purchases to constant dollars. Employment is estimated in full-time equivalent units. The model is driven by four major groups of variables: Growth in personal income; demographic data; grants-in-aid; and an "all other" category that includes interest rates, prices, and unemployment rates.

The macro model levels of projected Federal purchases are established exogenously in the process of balancing supply and demand GNP. This model provides values for total purchases, total compensation of military and civilian employees, as well as the number of civilian and military employees. The levels are established to insure consistency with overall projection assumptions. Assumptions are of major importance in the Federal sector since, in many cases, past experience is not useful for projection. For example, the projections have always assumed peaceful conditions without international tensions. A contrary assumption of war would result in large Federal purchases and a much larger defense share.

Regression equations are used to derive the total purchases of the six Federal Government subfunctions used in deriving these projections. These are modified based upon expected program levels in the case of defense and space. The six subfunctions are modified until they come to the established macro totals for Federal Government expenditures. Real compensation is also derived for each subfunction using regression equations. Historical data for defense and nondefense new construction are used to derive regression equations to project purchases from the six new construction industries for each major component of the Federal sector; these two values are then allocated to the six subfunctions based on historical trends.

Projecting input-output coefficients

The input-output tables used as a base in the economic growth model are developed by the Bureau of Economic Analysis, Department of Commerce. However, these input-output tables incorporate the technology and product mix for a base year, and may not reflect the technology and product mix which may prevail during the period for which the projection is being made. Thus, it is necessary to project changes in the input-output coefficients.

Input-output coefficients are projected to change for several reasons—technological change is an important factor, but not the only one. Changes in product mix or relative prices could also cause significant changes in

coefficients. Because the BLS industries are aggregates of the more detailed sectors used by the Bureau of Economic Analysis in compiling the base year input-output table, a simple change in the relative importance of those sectors could have a large impact on the coefficients. Also, as the relative price or availability of substitute inputs changes, substitutions might occur.

Several different methods are used in projecting coefficients. Energy coefficients, both as inputs to other industries and as inputs from other sectors to energy producing industries, are based, in part, on projections available from the Department of Energy. Several industries are studied intensively to pick up structural changes which have occurred since the most recent Department of Commerce I-O study and are then projected forward (for example, the metals industries). In other industries, changes in tastes are incorporated (for example, a decrease in sugar in foods and soft drinks). For other commodities, the rows of the input-output tables are evaluated and increases or decreases throughout the economy are made based upon overall trends in the industry. In some cases, old coefficients are reweighted based upon expected changes in the relative importance of detailed industries. Where resources are not available to study specific coefficients, they are left unchanged from their previous level.

Employment projections

Employment projections by industry are developed using a set of industry productivity projections. The model used to project annual industry employment and productivity is a factor demand model which takes into account the interdependence of both labor and capital requirements in each industry. In this model, the demand for labor is a function of the industry's output, capacity utilization (measured by the unemployment rate of last industry employed), technical change (as approximated by a time trend), and the stock of capital measured in efficiency units. The form of the model utilizes a CES (constant elasticity of substitution) production function, involving factor-augmenting technical change. Allowing for economies of scale, the production function can be written as follows:

$$(1)\quad Y = Cap^{u}\left[x(AL*L)^{-w} + y(BE*E)^{-w} + z(CP*P)^{-w}\right]^{v/w}$$

where:

Y = output
L = labor services
E = equipment stocks
P = plant stocks
AL = efficiency augmenting function for labor
BE = efficiency augmenting function for equipment stock
CP = efficiency augmenting function for plant stock
Cap = capacity utilization

and x, y, and z are distribution parameters which are greater than zero and sum to unity.

w = substitution parameter
v = economies of scale
u = utilization parameter

The elasticity of substitution is equal to $1/(1+w)$.

The factor demand model has been estimated for only 76 industries, due to the limited amount of employee compensation data which is an input in the estimation of labor services. In order to expand the results to the 156 industries currently in the Economic Growth system, least squares time trends of labor productivity and average hours are computed for each of the 156 industries and combined with the 156-order output projections to calculate hours and employment. Then, these estimates are scaled to the projections from the factor demand model.

Further disaggregation is required in order to develop occupational projections. Occupational forecasts are estimated at the 3-digit Standard Industrial Classification (SIC) level, totaling about 450 individual industries. Only wage and salary employment data are prepared at this level. The estimates of jobs at this level of detail are based on an equation for each industry expressing employment as a function of total civilian employment, the level of the Armed Forces, output of the corresponding economic growth sector (156-order), and employment at the appropriate aggregate 2-digit SIC level.

Since projections contain many complex relationships among economic variables that are developed through a lengthy sequence of operations, it is necessary to have a set of checks and balances to insure that the various stages of the projections make up an internally consistent model. The primary element in this balancing is analysis of results of each stage, modification where results seem inconsistent, and rerunning the entire projection system until results are consistent. The economic growth model is designed to provide a feedback and balancing procedure with respect to three of its elements: Imports, investment, and employment. In practice, all three of these elements must be brought into balance simultaneously.

Uses and Limitations

The projections developed in the economic growth program serve a number of uses. The employment projections by industry are used in developing occupational outlook projections. The projections developed by the Bureau form an important part of the U.S. Govern-

ment'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. The projections of GNP and industry growth patterns are also used in private industry to make diversification studies, market analyses, and long-term capital plans.

The economic growth model permits analytical uses in addition to long-term employment projections. Specifically, the model can be used to generate the industry-by-industry labor requirements of various economic sectors or types of demand for recent years. Estimates of this type have been made for some time for national defense, consumption, exports, and other demand categories as a basis for the long-term projections and for special projects. The model also has been applied to estimate labor requirements for a variety of specific Federal Government programs, such as the sales of military equipment to foreign governments, defense expenditures, and energy programs.

The projections developed using the BLS Economic Growth system are prepared on a 2-year cycle and published in the *Monthly Labor Review*. The special studies of job requirements are also published in the *Review* but not on a regular basis.

The preparation of economic projections is, to a degree, both a science and an art. Thus, misunderstandings may arise between the 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 projections analysts generally employ a framework which develops numerical answers to specific questions, and users are inevitably tempted to attribute to those numbers an exactness which they should not be accorded. The Bureau attempts to address this dilemma, in at least a small way, by making clear all of the important assumptions underlying its projections, by developing alternative versions which reflect some of the uncertainties about the future, by evaluating past projections to assist users in appreciating the unpredictable nature of certain future events, and by updating the projections on a regular 2-year cycle.

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Bureau of Labor Statistics

BLS Economic Growth Model System Used for Projections to 1990, Bulletin 2112, 1982.

Capital Stock Estimates for Input-Output Industries: Methods and Data, Bulletin 2034, 1979.

Economic Projections to 1990, Bulletin 2121, March 1982.

Time-Series Data for Input-Output Industries, Bulletin 2018, 1979.

Chapter 20. National Industry-Occupational Matrix

The Bureau develops comprehensive data on employment in detailed occupations cross-classified by industry in the form of a matrix, or table. The matrix can be presented in absolute numbers or in ratios which show the proportion of total employment in each industry accounted for by each occupation. The data can also be transposed to show how total employment in an occupation is distributed by industry. The Bureau develops matrices for current and future years.

Sources of Data

Data used to develop industry-occupational matrices come from a variety of sources. Since 1980, the major source of occupational data has been the Occupational Employment Statistics (OES) survey.[1] (See chapter 3.) The OES survey collects data from employers on the occupational distribution of workers in all nonagricultural industries, except private households. Each industry is surveyed every 3 years.

The occupational distribution of wage and salary workers in agriculture and private households, not covered by the OES survey, is derived from the Current Population Survey (CPS) (chapter 1). Data on self-employed and unpaid family workers in each occupation also come from the CPS. The industry distribution of wage and salary employment is obtained through the BLS Current Employment Statistics (CES) program (chapter 2).

Methods

Current-year matrix

Separate estimates of current employment are developed for wage and salary workers in OES survey industries, for wage and salary workers in agriculture and private households, and for self-employed and unpaid family workers. Data on wage and salary worker employment are prepared by detailed occupation for each industry. Estimates of occupational employment of self-employed and unpaid family workers are prepared at the total (all-industry) level only. They are added to the total of wage and salary workers to derive total employment by detailed occupation for the entire economy.

Wage and salary workers in OES survey industries. OES data on occupational employment of wage and salary workers cover all industries except agriculture and private households. To develop current-year occupational employment estimates for OES industries, staffing patterns are calculated from the most recent survey for each industry. (Staffing patterns are the ratios of employment in each detailed occupation in an industry to total employment in the industry.) These staffing patterns are then applied to the current-year annual averages of industry employment taken from CES data.

In some industries, employment data for some detailed occupations are not collected in the OES surveys because the numbers are too small to be measured accurately and because the survey questionnaire in each industry is limited to 200 occupations. To develop total employment estimates for an occupation not included in a survey questionnaire, but which is known to be present, detailed occupational employment is disaggregated from the appropriate survey residual by using ratios derived from decennial census data. The disaggregation procedure is used to estimate employment in selected industries for about 100 occupations. The proportion of total 1978 employment estimated through the procedure was less than 4 percent.

The preliminary matrix developed through the procedures indicated above is reviewed in detail. The focus of the review is on the estimates generated through the disaggregation procedure. These are updated when the preliminary data are believed to be in error. Analytical judgment is used to make the updates.

Wage and salary workers in agriculture and private households. Total wage and salary worker employment in agriculture and in private households is developed from CPS data, although these are not strictly comparable with CES and OES data.[2]

[1] The 1978 and 1980 matrices, developed in 1980 and 1981, were the first to be based on OES survey data. Prior to 1980, sufficient OES survey data were not available to develop national estimates, and national matrices were based primarily on the decennial census modified by more current data from the Current Population Survey (CPS). The primary source was changed from census/CPS data to OES survey data because OES data, collected from employers according to specific occupational definitions, are believed to be more accurate than CPS data, derived from a survey of households.

[2] In the CPS, each person is counted only once,in his or her primary job; in the CES and OES, a person is counted in all jobs he or she holds. Also, CPS and OES data may include workers younger than 16. Workers on unpaid absences are counted in the CPS but excluded from the CES.

The occupational distributions of wage and salary workers in the agriculture and private household industries are based on data from the last census modified by subsequent trends based on CPS data for large occupations in these industries. The census/CPS employment data are distributed into the detailed occupations in the matrix.[3] In this procedure, CPS data are generally used as control totals, and the distribution is based on established relationships between the census and OES occupational classifications. Many analytical judgments are necessary to establish relationships for many occupations because a perfect match between OES and CPS occupations is not always possible.

Self-employed and unpaid family workers. Estimates of self-employed and unpaid family workers by occupation are based on annual averages from the CPS, since no alternative data series exist. Similar to the procedure used for wage and salary workers in agriculture and private households, the employment data in the detailed census occupations are distributed to the detailed occupations in the matrix. In general, CPS data are used as control totals, and the distribution is based largely on the distribution of wage and salary employment in OES data unless other data are available or judgment derived from analyses indicates that this procedure would result in incorrect data. For example, certain jobs found only in government (such as health inspector) often fall into a broader CPS category (inspector) which contains self-employed and unpaid family workers. In such cases, the distribution is not based on the wage and salary worker distribution.

Data for self-employed and unpaid family workers are developed only at the all-industry level because of the unreliability of these data at the detailed industry level.

Projections

The basic procedure for projecting occupational employment is to develop data on past trends in the staffing patterns of industries and to extend these trends to the target year of the projections. These preliminary projections of the ratios are then reviewed in detail for consistency with knowledge about technological change and other factors likely to affect the occupational composition of industries. Based on this review, changes are made in the ratios and each industry is checked to see that the ratios add to 100 percent. Finally, the projected ratios are applied to projected industry employment totals.

Wage and salary workers in OES survey industries. To project staffing patterns, data are compiled from all previous surveys of each industry to establish a trend. These trends are extrapolated to the target year to develop preliminary projected staffing patterns. When an occupation is added, deleted, or changed in definition from one OES survey to the next, extrapolated trends are not developed; the current-year ratios for those occupations are held constant in the preliminary projected matrix.

The projected ratios in each industry are applied to projected industry employment totals for wage and salary workers from the Bureau's economic model (see chapter 19) to derive preliminary target-year occupational projections. These projections are analyzed in detail based on studies of occupations and industries conducted during preparation of the *Occupational Outlook Handbook*. Factors considered include likely changes in production methods, technological changes which would affect the occupational mix, changes in the product mix of industries, changes in the average size of establishments in industries, and other factors affecting specific occupations.

In addition, some occupations are projected independently of the matrix based on the relationship of the occupation to more closely associated variables. For example, projections of elementary and secondary school teachers are based on estimates of the school-age population and pupil-teacher ratios. Projections developed in this manner are placed in the matrix and adjustments in the staffing patterns for other occupations are made when necessary.

A review of the pattern is then made to assure that the staffing pattern in each industry adds to 100 percent. The resulting ratios are applied again to total projected employment of wage and salary workers in each industry to develop the final occupational projections of wage and salary workers in OES survey industries.

Wage and salary workers in agriculture and private households. For agriculture and private households, past trends in occupational distribution are developed based on data in the last decennial census and Current Population Surveys conducted during subsequent years. The census-based occupational distribution is converted to the OES survey distribution in the manner described above for the current-year matrix.

The projected ratios are then applied to the target-year industry employment projections. The resulting employment and ratios are reviewed in detail; changes in patterns that result from this review are incorporated into the final matrix.

Self-employed and unpaid family workers. To develop the projections, the percent distributions of self-employed and unpaid family workers by occupation from census/CPS data are extrapolated to the target year and adjusted to add to 100 percent. A distribution of these proportions is made to OES survey occupations

[3] There were 1,678 detailed occupations in the 1978 matrix.

based on the distribution of current-year data. These distributions are reviewed and changes made where deemed appropriate. The resulting distribution is applied to projected totals for self-employed and unpaid family workers developed through the Bureau's economic model. The resulting projected employment totals are reviewed for consistency with information developed in the course of other occupational research, and changes are made where necessary.

Presentation

A current-year and projected-year matrix are developed on a 2-year cycle which coincides with the cycle used by the Bureau to develop economic, industry, and occupational projections. Summary data from the matrix are published in the *Occupational Outlook Handbook* and in other Bureau publications.

Because of the large size of the latest set of matrices—for 1980 and 1990—which include about 1,600 occupations and 378 industries, they have not been published as a Bureau bulletin. However, data for 689 detailed occupations and 378 detailed industries are available on computer tape which may be obtained at cost from the Bureau.[4] In general, only occupations with 5,000 or more workers are included on the tape. Hard copy of the data on the tape is available through the National Technical Information Service.

[4] Contact the Division of Occupational Outlook, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212, for details on how to purchase this tape.

Uses and Limitations

The industry-occupational matrix provides a comprehensive set of data on the distribution of occuptional employment by industry and enables comparison of the occupational structure of industries. Other uses include studies of the changing utilization of workers by industry over time, analyses of occupational skill requirements in new and emerging industries, and market research.

The industry-occupational matrix also is used in studies which measure the occupational effects of changes in the level of expenditures by the Federal Government for specific programs. The national matrix is also used by State employment security agencies to develop estimates of current and projected employment for States and areas within States.

Because the matrix is based on information obtained from the OES survey and the CPS, it is subject to the response and sampling limitations typical of surveys. (See the sections on limitations of these surveys in chapters 1 and 3.) Further errors result from some of the necessary analytical adjustments in combining data from the two surveys and in estimating employment for detailed occupations not included in the OES survey questionnaire. The matrix data, therefore, indicate only the general level and position occupations hold in relation to other occupations within each industry. Consequently, the estimates should not be viewed as precise measurements. In general, the smaller the occupational estimates, the less the reliability.

Technical References

Bureau of Labor Statistics

The BLS Economic Growth Model System Used for Projections to 1990, Bulletin 2112, 1982.

The National Industry-Occupational Matrix, 1970, 1978, and Projected 1990, Bulletin 2086, 1981.

The National OES-Survey-Based Industry-Occupational Employment Matrix, 1978 and 1990, scheduled for release in 1982 through U.S. Department of Commerce, National Technical Information Service.

Chapter 21. Occupational Outlook

The major objective of the occupational outlook program is to provide information on future employment opportunities by occupation for use by counselors, educators, and others helping young people choose a field of work and for local and national officials who plan education and training programs. Analyses of occupations include information on the nature of the work, employment, education and training requirements, the job outlook for about 10 years ahead, earnings, and related occupations.

Sources of Data

Many sources are used to develop occupational information. The basic statistics on current employment are derived from the Bureau's Occupational Employment Statistics surveys, which provide data by occupation for wage and salary workers in nonagricultural industries, except for private household workers. (See chapter 3.) Employment data for workers in agriculture and private households and for self-employed and unpaid family workers are derived from the Current Population Survey. (See chapter 1.) Employment data by industry are derived from the Bureau's Current Employment Statistics program (chapter 2). The occupational distribution of employment within industries—industry staffing patterns—is available through the Bureau's industry-occupational matrix (chapter 20).

Analyses of past and projected changes in employment make use of statistics on output, hours of work, and output per worker hour from BLS studies of productivity and technological developments. Information from the Office of Personnel Management is used to study trends in employment of Federal Government workers, and data compiled by Federal regulatory agencies, such as the Federal Aviation Administration and the Interstate Commerce Commission, are used to study employment trends in activities associated with those agencies. Data are also obtained from unions, industry and trade associations, and professional societies.

Analyses of past and probable future supply of workers use still other sources of information. The National Center for Education Statistics provides data on graduates from high school, junior or community colleges, vocational education programs, and 4-year colleges and universities. The Bureau of Apprenticeship and Training of the U.S. Department of Labor supplies information on apprenticeship completions, and the Employment and Training Administration of the department supplies data on enrollments and completions in training programs supported by funds provided under the Comprehensive Employment and Training Act (CETA). Also used are studies conducted by a variety of private organizations on the supply and occupational mobility of trained workers.

Earnings information is drawn primarily from BLS wage and earnings surveys. These are supplemented with information from Federal regulatory agencies, labor organizations, professional societies, and other groups.

Information also is obtained from: (1) Interviews with employers, union officials, and others closely associated with an industry or occupation; (2) reports of professional and trade associations and licensing agencies; and (3) labor publications, trade journals, annual reports, and related materials.

Methods

Projections of occupational employment are developed as described in chapters 18-20. This broad, systematic framework of projections develops projections of the population, labor force, and national and industry output and employment. For many occupations, employment is projected on the basis of its relationship to certain independent variables rather than on proportional representation in each industry. Projections for these occupations are developed by methods tailored to fit the available data and the nature of the occupation under study. For example, employment for elementary school teachers is projected based on trends in pupil-teacher ratios applied to projected school attendance. Projections developed through these independently conducted analyses are then integrated with other occupational data in the matrix.

Projections of changes in employment by occupation provide only one part of the information needed on job openings in the years ahead. In most occupations, the majority of job opportunities arise either as a result of the transfer of experienced workers to other occupa-

tions or through retirements and deaths. To estimate the number of such openings likely to arise in an occupation, data have been developed on the proportions of workers who generally leave an occupation during a year, those who transfer to another occupation, or those who leave the labor force to attend school, care for family responsibilities, retire, or become too ill to work. Replacement needs are affected by many factors, including the age and sex distribution of workers in an occupation, the nature of the occupation, the career ladder pattern, stability of work, factors related to the desirability of an occupation such as wage rates and working conditions, and specialized retirement programs.

To appraise the future employment situation in an occupation, estimates also must be made of the supply of workers. Persons enter the job market from many sources—schools and other training institutions, transfers from other occupations, and reentries to the labor force.

Analysis of supply is limited to those fields where the supply is identifiable. Statistics on college enrollments and graduations are the chief source of information on the potential supply of workers in many professions and occupations requiring extensive specialized education. Data on the number of apprentices and graduates of vocational and technical training programs provide some information on new entrants into skilled trades. However, in many occupations, workers learn on the job through company training programs, and statistics on such training activities are not available.

Not all persons who complete formal training or education in a particular field enter that field. As a result, special surveys are used to provide additional information on the actual supply of workers from a training program or a field of study. These include studies of job placements of college graduates.

Presentation

The *Occupational Outlook Handbook* is the major publication of the occupational outlook program. Oriented toward career guidance, the *Handbook* is a basic reference source, published every other year, which includes comprehensive and nontechnical job information on approximately 250 occupations covering the entire spectrum of white-collar, blue-collar, and service occupations. A reprint series provides individual statements from the *Handbook*.

The *Occupational Outlook Quarterly* provides current occupational and job information between editions of the *Handbook*, together with the most recent information available on earnings, training requirements, and other related topics.

Occupational Projections and Training Data, published every 2 years, presents detailed statistics on employment, job openings, and education and training completions for many occupations.

In addition, technical and detailed studies are published on specific occupations and industries in order to furnish information to employment experts, educational planners, personnel departments, and others interested in the more technical aspects of the Nation's future employment needs. These have covered such topics as the demand for and supply of scientists and engineers and workers in computer occupations, and the employment effects of Government programs for mass transit, pollution abatement, and highways.

Technical References

Bureau of Labor Statistics

The BLS Economic Growth Model System Used for Projections to 1990, Bulletin 2112.

Measuring Labor Force Movements: A New Approach, Report 581, 1980.

Occupational Outlook Handbook, 1982-83 edition, Bulletin 2200, 1982.

Occupational Projections and Training Data, 1980 edition, Bulletin 2052, 1980. The 1982 edition, Bulletin 2202, is scheduled to be released in late 1982.

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 produced 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 data. 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

[1] Julius Shiskin, *Electronic Computers and Business Indicators*, Occasional Paper No. 57 (New York, National Bureau of Economic Research, 1957).

time. The time series are generally run through the seasonal adjustment program once a year to provide the projected 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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The report and proceedings of an international conference held in November 1960. Describes experience in the United States, Canada, and several European counties. Includes theoretical sections relating to calendar (trading day) variation and general properties of moving averages.

Shiskin, Julius. *Electronic Computers and Business Indicators,* Occasional Paper No. 57. New York, National Bureau of Economic Research, 1957. Also published in *Journal of Business,* Vol. 30, October 1957.

Describes applications of the first widely used computer program for making seasonal adjustments.

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Proceedings of a 1976 conference jointly sponsored by the National Bureau of Economic Research and the Bureau of the Census.

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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.

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; (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. 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 electric 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.[1]

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

[1] Certain BLS programs may deviate from the SIC due to operational and conceptual reasons. These deviations are noted in the chapters on such programs.

(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.

In 1972, classification 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.

This change from the 1967 edition removes "Government" as an industry division, per se, and treats it as an ownership characteristic. Government establishments, therefore, are now classified by their primary economic activity, rather than by type of owner. Because of this change, it will be necessary to determine if a particular statistic covers all of the industry or only the private sector, and also if it includes all government or only public administration.

The 1977 supplement to the 1972 SIC manual contained new, deleted, and modified industries, titles, definitions, and index items. This supplement reflected the experience of Government agencies in using the 1972 SIC manual. It serves primarily to make corrections to the 1972 edition in areas crucial to statistical programs.

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 different geographic classifications; individual States, the District of Columbia, and outlying areas (Puerto Rico, Guam, and the Virgin Islands); individual cities; MSA's (Metropolitan Statistical Areas); and labor areas and other classifications developed to meet specific survey objectives.

BLS regions

For survey estimates and indexes (including estimates of the civilian labor force and unemployment, area wage surveys,[1] 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;

North Central: 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 Producer Price Index and Industry Wage Surveys are published for nine regions.[3] [4]

Data published by State, e.g., annual employment estimates, are aggregated by BLS in accordance with the 10 Federal Administrative Regions established by the Office of Management and Budget. A map of these regions appears on the inside back cover of this *Handbook.*

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.[5]

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

[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] The Producer Price Index is published for the nine regions: *New England:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; *Middle Atlantic:* New Jersey, New York, Pennsylvania; *South Atlantic:* Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia; *North East Central:* Illinois, Indiana, Michigan, Ohio, Wisconsin; *South West Central:* Arkansas, Louisiana, Oklahoma, Texas; *East South Central:* Alabama, Kentucky, Mississippi, Tennessee; *West North Central:* Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota; *Mountain:* Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming; *Pacific:* Alaska, California, Hawaii, Oregon, Washington. These are the same nine divisions used in Bureau of the Census publications.

[4] Industry wage surveys are published for the nine regions: *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.

[5] 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.

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.

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.*[6]

Labor areas

A labor area consists of a central city or cities and the surrounding territory within commuting distance. It is an economically integrated geographical unit within which workers may readily change jobs without changing their place of residence. Labor areas include one or more entire counties, except in New England where towns are considered the major geographical units.

Major labor areas usually have at least one central city or Bureau of the Census urbanized area with a population of 50,000 or more. In most instances, boundaries of major labor areas coincide with those of metropolitan statistical areas. Geographical boundaries of all classified areas are listed in an Employment and Training Administration publication, *Directory of Important Labor Areas.*

[6] *Federal Register,* Vol. 45, No. 2, Jan. 3, 1980, pp. 956-63.

Geographic areas currently used in selected BLS programs

Program and major publication	Nation	Region	State	MSA	Labor areas	Other areas[1]	Cities
Labor Force Statistics							
Labor Force and Unemployment, *Employment and Earnings*	x						
Nonagricultural Employment, *Employment and Earnings*	x		x	x	x	x	
Local Area Unemployment Statistics, *Employment and Earnings*			x	x	x	x	x
Occupational Employment, *Occupational Employment—*	x		x				
Employment and Wages, *Employment and Wages*	x		x				
Prices and Living Conditions							
Consumer Expenditures and Income, *Consumer Expenditures and Income*	x	[2]					
International Prices, *U.S. Import Price Indexes; U.S. Export Price Indexes*	x						
Consumer Prices, *Consumer Price Index*	x	[2]		x			
Producer Prices, *Producer Prices and Price Indexes*	x	[3]					
Wages and Industrial Relations							
The 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]					
Industry Wage Surveys *Industry Wage Surveys*	x	[4]	x	x			
Productivity and Technology							
Construction Labor Requirements, *Construction Labor Requirement Studies*	x	[2]					
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.
[4] Nine-region classification designated in footnote 4.

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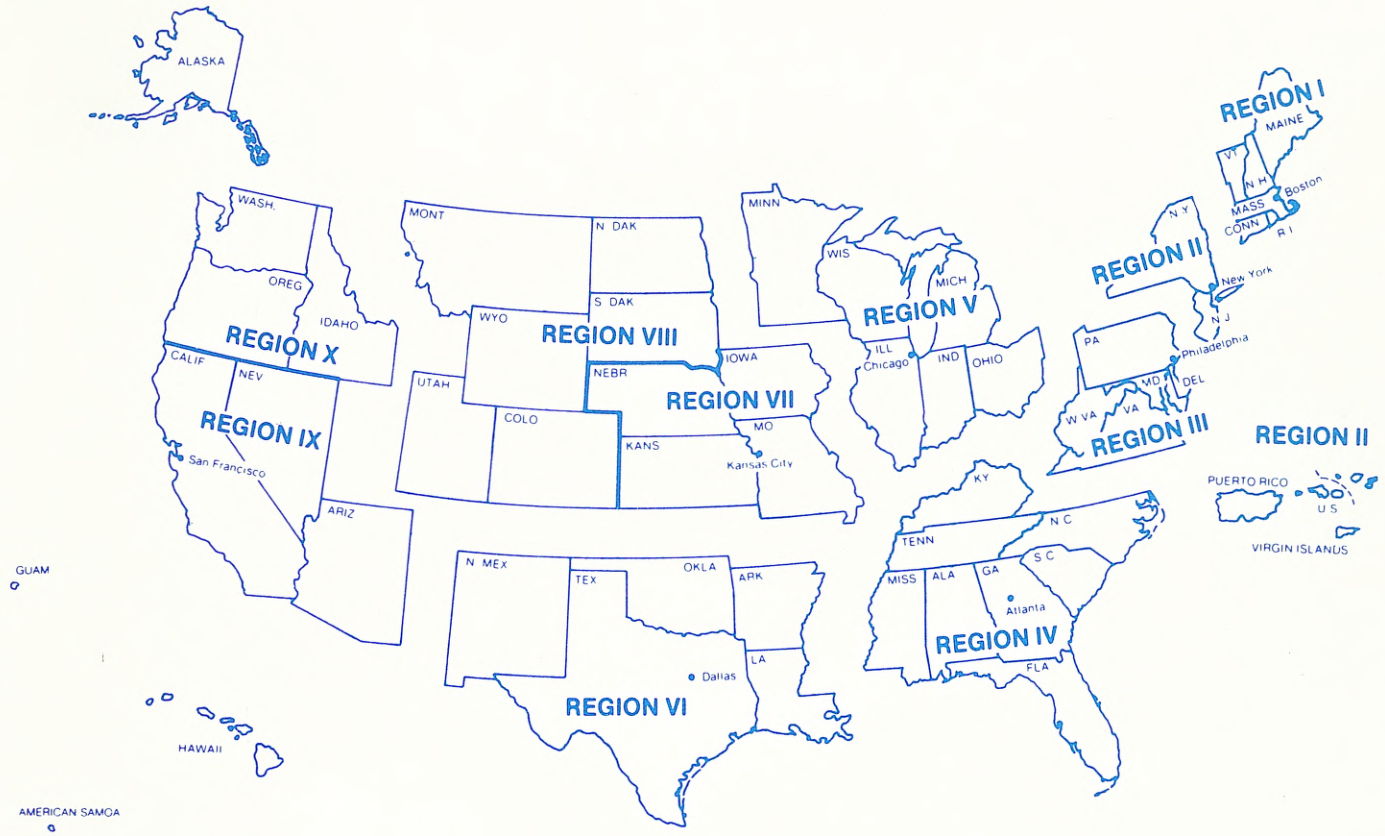
Bureau of Labor Statistics
Regional Offices



Region I
1603 JFK Federal Building
Government Center
Boston, Mass. 02203
Phone: (617) 223-6761

Region II
Suite 3400
1515 Broadway
New York, N.Y. 10036
Phone: (212) 944-3121

Region III
3535 Market Street
P.O. Box 13309
Philadelphia, Pa. 19101
Phone: (215) 596-1154

Region IV
1371 Peachtree Street, N.E.
Atlanta, Ga. 30367
Phone: (404) 881-4418

Region V
9th Floor
Federal Office Building
230 S. Dearborn Street
Chicago, Ill. 60604
Phone: (312) 353-1880

Region VI
Second Floor
555 Griffin Square Building
Dallas, Tex. 75202
Phone: (214) 767-6971

Regions VII and VIII
911 Walnut Street
Kansas City, Mo. 64106
Phone: (816) 374-2481

Regions IX and X
450 Golden Gate Avenue
Box 36017
San Francisco, Calif. 94102
Phone: (415) 556-4678