

# Chapter 8

## National Compensation Measures

The Office of Compensation Levels and Trends of the U.S. Bureau of Labor Statistics (BLS) produces a diverse set of data from the National Compensation Survey (NCS) program and the Work Stoppages program.

The links to each of the NCS data products are as follows:

- Occupational earnings by geographic area, <http://www.bls.gov/ncs/ocs/#tables>
- Occupational pay comparisons between areas, <http://www.bls.gov/ncs/ocs/payrel.htm>
- Employment cost levels and trends, <http://www.bls.gov/ncs/ect/>
- Incidence of employer-provided benefits, <http://www.bls.gov/ncs/ebs/>
- Benefit plan provisions, <http://www.bls.gov/ncs/ebs/>

The link to Work Stoppages data products is <http://www.bls.gov/wsp>

### NCS Background

BLS collection and publication of wage data can be traced back to the late 19th century, employee benefits data to the mid-20th century. The NCS, introduced in 1996, collects a broad range of compensation data that formerly had been collected by three separate BLS programs. The Occupational Compensation Survey program published national and local area wage data for survey years 1991 through 1996. The Employment Cost Index has been published since 1975. The Employee Benefits Survey program started in 1979 and collected and published data on employee benefits for survey years 1980 through 1998. The NCS currently collects data on employee compensation from a large sample of establishments providing data on about 800 detailed occupations in more than 150 local areas. The number of establishments surveyed for a particular set of estimates is stated in the technical

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notes of the original NCS publication on those estimates.

### Description of the NCS

The NCS is an establishment-based survey that provides comprehensive measures of occupational earnings, employer costs of employee compensation, compensation trends, wages in one geographic area relative to other geographic areas, the incidence of employer-provided benefits among workers, and provisions of employer-provided benefit plans. The Employment Cost Index (ECI)—a Principal Federal Economic Indicator—is estimated from data collected by the NCS.

The NCS surveys workers in private industry establish-

ments, and in State and local government, in the 50 States and the District of Columbia. For the NCS, the term *civilian workers* denotes workers in private industry and workers in State and local government. Establishments with one or more workers are included in the survey. Major exclusions from the survey are workers in Federal and quasi-Federal agencies, military personnel, agricultural workers, workers in private households, the self-employed, volunteers, unpaid workers, individuals receiving long-term disability compensation, and individuals working overseas. Currently, the NCS also excludes individuals who set their own pay (for example, proprietors, owners, major stockholders, and partners in unincorporated firms) and family members being paid token wages; however, these exclusions are being reevaluated.

## NCS Sample Design and Sampling Procedures

The NCS sample covers *civilian workers*, including workers in private industry establishments and workers in State and local governments across all 50 States and the District of Columbia. The NCS samples a portion of all occupations in a portion of all establishments in a portion of all local areas in the Nation. The statistics compiled from the survey, such as *median weekly earnings, by occupation, in private industry establishments*, are called *estimates* because they estimate the actual value for the entire population.

NCS data are collected from probability samples selected in three stages: (1) a probability sample of geographic areas, (2) a probability sample of establishments within sampled areas, and (3) a probability sample of occupations within sampled establishments. Probability samples are subject to sampling error and nonsampling error, which are discussed under the section “**Computations of Compensation Measures and Reliability of Estimates for All NCS Data Products.**”

### Selecting geographic areas (Stage 1)

In stage 1, the NCS selects a sample of geographic areas in the Nation. The *sampling frame* is the list of establishments from which the survey sample is selected. Selection of the geographic areas has resulted in the methodology currently used by the NCS. (See the topic “Area Sample Selection” in the “**Technical References for NCS, by Topic**” section at the end of this chapter for references regarding the research and the decisionmaking process by which the current NCS sample frame was created.) The paragraphs that follow describe, in general terms, the methods by which the area sample was selected for the NCS.

For the NCS sample, *certainty areas* are any individual areas with employment greater than 80 percent of the sampling interval. (The sampling interval is the total employment across all areas, divided by the number of areas to be selected.) Certainty areas represent only themselves in NCS local area estimates; however, smaller areas represent them-

selves and other areas that are not part of the sample. The larger the area, the greater is its chance of being selected.

In stage 1, certainty areas are identified, noncertainty areas are stratified, and the remaining sample areas are selected in accordance with the NCS Probability-Proportionate-to-Size (PPS) technique, in which local areas are allocated approximately proportionally to total employment across county clusters. These clusters consist of Metropolitan Areas, Micropolitan Areas, and Outside Core Based Statistical Areas (CBSAs), for each of the nine census divisions and for the United States as a whole. Furthermore, NCS combines most contiguous Outside CBSA counties within the same Census (area) division, to create clusters with employment of at least 10,000 and with heterogeneous wage levels. The result is a list of 436 county clusters formed from an original list of 1,359 Outside CBSA counties. Stage 1 resulted in a sampling of 152 areas, broken out as follows: 57 certainty areas, 60 noncertainty Metropolitan Areas, 22 noncertainty Micropolitan Areas, and 13 noncertainty Outside CBSA county clusters.

### Area definitions

Geographic areas of the United States are defined by the Office of Management and Budget (OMB) once every 10 years and are based on the results of the most recent decennial census. In December 2003, OMB defined 361 Metropolitan Statistical Areas and 573 Micropolitan Statistical Areas in the Nation. OMB also defined a list of Combined Statistical Areas (CSAs) such that adjacent Metropolitan and Micropolitan Statistical Areas, in various combinations, form a CSA if specified criteria are met. There are 1,359 counties in the Nation that are not included in either type of statistical area. Any county not included in a Metropolitan or Micropolitan Statistical Area is referred to as an Outside Core Based Statistical Area (CBSA).

To keep NCS products representative of the areas it surveys, NCS must phase in the new OMB-defined sampled areas and phase out the old. The previous NCS area sample was based on the December 1994 OMB definitions. The 1994 area sample consisted of 152 areas; however, because of a difference between the 1994 and 2003 OMB area definitions, and because of the NCS clustering of Outside CBSAs, only a portion of the 2003 area sample’s 152 areas include exactly the same municipal and county areas as those of the 1994 sample.

NCS converted the State and local government sample of *index establishments* to the December 2003 OMB area definitions in December 2007. NCS began the conversion of the private industry sample of index establishments to 2003 OMB area definitions in December 2008, with the replacement of one-fifth of the private industry sample under the new area definition each year through 2012. (Definitions of index and wage-only establishments are described in detail in the section “**NCS Data Collection.**”) The transition has resulted in the collection of private industry data from 227 areas. Thus, NCS publications with reference periods of

December 2007 through December 2012 may include data from as many as 227 local areas. (For more information, see “Phase-in of the Redesign National Compensation Survey Area Sample,” on the Internet at <https://www.amstat.org/sections/srms/Proceedings/y2005/Files/JSM2005-000156.pdf>; for a list of current and historical OMB area definitions, see <https://www.census.gov/population/www/metroareas/metrodef.html>.)

## Selecting establishments (Stage 2)

In stage 2, the NCS uses the Probability-Proportionate-to-Size (PPS) technique to select a sample of private industry and State and local government establishments within each of the sampled areas. That is, the larger the establishment, the greater is its chance of being selected.

An *establishment* is commonly a single economic unit that engages in one, or predominantly one, type of economic activity. For private industries in the survey, the establishment usually is at a single physical location, such as a mine, a factory, an office, or a store, that produces goods or provides services. If a sampled establishment is owned by a larger entity with many locations, only the employment and characteristics of the immediate establishment are considered for the survey. For State and local governments, an establishment can include more than one physical location, such as a school district, a college, a university, a hospital, a nursing home, an administrative body, a court, a police department, a fire department, a health or social service operation, a highway maintenance operation, an urban transit operation, or some other governmental unit within a defined geographic area or jurisdiction. Each establishment is assigned a six-digit code from the North American Industry Classification System (NAICS). When a single physical location encompasses two or more distinct economic activities, it is treated as two or more separate establishments if separate payroll records are available and certain other criteria are met.

The *sampling frame*, or *universe*, is the list of establishments from which the survey sample is selected. It is developed from State unemployment insurance reports. The most recent month of reference available at the time the sample is selected is used to develop sampling frames.

### *Industry classification of establishments*

All Federal statistical agencies currently use NAICS for defining industries and classifying survey establishments. The NCS, which originally used Standard Industrial Classification (SIC) codes to stratify establishments for selection, began a transition from SIC to the 2002 version of NAICS in 2004; the transition was completed in July 2007. NAICS revises its industry classifications every 5 years to stay current with industrial taxonomy in North America. In selecting new establishment samples, NCS uses the most recent version of NAICS as one of the stratification variables. The

NCS sample was stratified beginning in August 2007 on the basis of the 2007 version of NAICS. NCS publications with collection periods that include August 2007 contain data from both the 2002 and 2007 NAICS industry codes. The 2007 NAICS includes revisions across several sectors. The most significant revisions are in the information sector, particularly within the telecommunications area; overall, the change from the 2002 NAICS to the 2007 NAICS had little effect on the resulting NCS estimates. (For more information about the differences between the 2002 NAICS and the 2007 NAICS, see <http://www.census.gov/epcd/naics07/>.)

### *Panel structure*

The NCS uses a panel structure to rotate establishments in and out of the survey. A *panel* is a subset of all establishments sampled for the survey that begin their participation in the NCS at the same time. Each panel is composed of a representative cross section of industries and geographic areas throughout the United States that are within the scope of the survey.

Approximately one-fifth of the private industry sample is reselected each year. The private industry establishment sample is divided into five panels that enter and exit the survey on a rotational basis. A panel of establishments is introduced into the survey once each year. Private industry panels stay in the survey for 5 years. Establishments that go out of business or refuse to participate in the survey are not replaced within the panel; rather, the NCS adjusts for establishments' and occupations' refusals as the panel proceeds. With one panel of new establishments entering the survey, and one exiting, each year, the sample is fully replaced over an approximately 5-year period. This practice helps to reduce respondent burden and keep the sample current. When a new replacement panel is introduced into the survey, field economists conduct the initial interviews of establishments in the new panel while updating the establishment records of the other four panels.

Each panel is divided into two parts: *index establishments* and *wage-only establishments*. The definitions and the purpose of this division are described in detail in the section “**NCS Data Collection.**”

The State and local government establishment sample includes only one panel, replaced approximately once every 10 years. This arrangement differs from the private industry 5-year rotation because State and local government establishments are, generally, more stable in terms of establishment births and deaths as well as number employed. NCS replaced its State and local government index-establishment sample in its entirety in December 2007, using 2007 NAICS to stratify the sampling frame for the selection of new establishments.

In areas newly surveyed in 2007, data were collected only in State and local government establishments. From 2008 through 2012, NCS is using the 2007 NAICS to stratify the sampling frame in introducing panels of new private industry establishments from newly selected areas based on the December 2003 OMB area definitions.

### Probability sample of occupations within sampled establishments (Stage 3)

In stage 3, field economists use a technique to randomly select the jobs to be sampled during the initial contact with the sampled establishment. (See the section “NCS Occupational Selection and Classification” for details.)

#### *Occupational classification and the transition to new occupational definitions*

Before 2004, the NCS used the Occupational Classification System (OCS), which was based on the 1990 Census of Population, to classify jobs in its selection and publication of occupational data. The NCS phased in the use of Standard Occupational Classification (SOC) codes over several years. The NCS first published Employer Costs for Employee Compensation (ECEC) estimates using SOC codes in March 2004; the ECI in March 2006; and NCS benefits publications in March of 2007. The NCS first published local area earnings estimates using the SOC in September 2006 and followed with the NCS national and Census division publications in September 2007.

Starting in May 2010, the NCS began to use SOC 2010 definitions for initial data collection at an establishment. Updates (followup data collection at an establishment) will begin September 2010. The 2010 SOC system contains 840 detailed occupations, aggregated into 461 broad occupations. (For more information on SOC 2010, see <http://www.bls.gov/SOC/>. The first NCS publication tentatively scheduled to use SOC 2010 is the March 2011 ECI release.)

## NCS Data Collection

BLS field economists employ a variety of methods to obtain data from NCS survey respondents, including personal visits, mail, telephone, and email. Field economists ask a series of questions at the initial and subsequent contacts, such as the following:

- *What is the primary business activity of the establishment?* The field economist determines the correct industry code for the establishment.
- *What types of occupations does the establishment employ?* The field economist determines the correct SOC code and work level for each sampled job.
- *How many employees are there in each sampled job that is matched to an occupational description?* The field economist determines how many employees in the establishment can be defined by the occupational code for the sampled job.
- *Do workers in the matched, sampled occupation work full or part time? Are they union or nonunion workers? Paid by time or incentive?* The field economist determines these three work attributes of the employee in the matched occupation. The field econ-

omist proceeds to collect wage and benefits data on all of the workers with the same work attributes in the matched occupation.

- *What are the employees in the sampled, matched occupation paid?* The field economist collects data on hours and wages from the payroll records covering the 12th of the month.
- *What are the duties and responsibilities of the job?* The field economist collects the information and uses it to determine the number of points for each of the pay factors of the job. From the sum of the points of all of the pay factors, the “work level” of each job surveyed is determined. (For more information on pay factors and work levels, see “National Compensation Survey: Guide for Evaluating Your Firm’s Jobs and Pay,” on the Internet at <http://www.bls.gov/nsc/ocs/sp/nabr0004.pdf>.)
- *How many hours does the employee work?* The field economist collects data on the usual work schedule of each sampled, matched occupation. This helps to determine the hourly, weekly, and annual earnings, as well as the cost of benefits.
- *What types of benefits do the employees receive?* The field economist gathers data on the availability and cost to the employer of 18 surveyed types of benefits that are provided to the worker in each sampled, matched job. The field economist collects summary plan descriptions (SPDs) of the health and retirement plans offered by the employer. Data on the availability of a number of other benefits also are collected. Then the SPDs are sent to the national office in Washington, DC, where they are analyzed for data on benefit plan provisions (the terms of coverage of the plan).

#### *Collection period*

A BLS field economist contacts the sampled establishment for the initial collection of data. Establishments in each sample panel are divided into two parts: *wage-only establishments* and *index establishments*. Wage-only establishments are contacted once per year during their tenure in the sample, and only for wage data. Data from wage-only and index establishments are used to produce NCS wage (earnings) publications. Although the ECI and ECEC publications include estimates of employer costs of total compensation, of which wages and salaries are a major component, wage data collected from wage-only establishments are not used in the production of ECI and ECEC estimates.

NCS collects *local area earnings* data from wage-only establishments over a 14-month period for larger survey areas and a 4-month period for smaller areas. The data’s *reference date* is the *average payroll reference date* over that 14-month or 4-month period. The reference date of NCS data

publications is listed in the title of the publication as well as in every table title. The publication date is included on the cover page of the publication. (See, for example, the bulletin *New York–Newark–Bridgeport, NY–NJ–CT–PA, National Compensation Survey, May 2008*, U.S. Department of Labor, Bureau of Labor Statistics, December 2008, on the Internet at <http://www.bls.gov/ncs/ocs/sp/ncbl1197.pdf>.) The data in this publication have a reference date of May 2008 and a publication date of December 2008.

The reference periods for the *national earnings* and *Census division earnings* estimates are the *average of the payroll reference dates* of all the local area data collected. For example, for the 2008 survey data, earnings data were collected from December 2007 through January 2009 in the 87 larger areas. For the 140 smaller areas, earnings data were obtained in one of four 4-month periods over the same timeframe. The average reference date for the 2008 national estimates is July 2008; the 2008 national earnings bulletin has a publication date of August 2009. (See *National Compensation Survey: Occupational Earnings in the United States, 2008*, on the Internet at <http://www.bls.gov/ncs/ncswage2008.htm>.) The reference dates for annual earnings estimates apply to the NCS annual *pay comparisons* (also known as *pay relatives*) estimates as well. (See <http://www.bls.gov/ncs/ocs/payrel.htm>.)

NCS contacts index establishments for data on wages, the cost of benefits, and the incidence and provisions of benefits. Data from index establishments are used to produce ECI, ECEC, and NCS benefits estimates. Although initial data collection occurs at any time of the year, ECI and ECEC updates are collected over a 6-week period for the pay period that includes the 12th day of the month for the months of March, June, September, and December. For example, the news release “Employment Cost Index—June 2009” includes data collected for the pay period that included June 12, 2009, from each employer scheduled for an ECI update. The publication date of the news release was July 31, 2009. (See <http://www.bls.gov/news.release/pdf/eci.pdf> for the most recent ECI news release.) The news release for “Employer Costs for Employee Compensation—June 2009,” includes data collected for the same pay period—in this example, the pay period that included June 12, 2009; however, its publication date was September 10, 2009. (See <http://www.bls.gov/news.release/pdf/ecec.pdf> for the most recent ECEC news release.) The ECEC publication dates are 3 months after the reference month, while the ECI publication dates are a month after the reference month.

NCS collects *benefits incidence and key provisions data* from index establishments that are being contacted for survey updates in March of the collection cycle. The March data are published in the summer or fall of the same year. (See for example, *National Compensation Survey: Employee Benefits in the United States, March 2009*, on the Internet at <http://www.bls.gov/ncs/ebs/benefits/2009/ebb10044.pdf>.)

NCS *detailed benefits provisions* data are collected from the private industry index establishments that are in their

initial 14 months in the survey, which, for the NCS, is May of one year through July of the next year. Annual data are published in the summer of the next year. (See, for example, *National Compensation Survey: Health Plan Provisions in Private Industry in the United States, 2008*, on the Internet at <http://www.bls.gov/ncs/ebs/detailedprovisions/2008/ebb10042.pdf>, which has a publication date of July 2009.) Detailed benefits provisions in State and local governments are collected and published when the government sample is initiated. The latest NCS detailed benefits provisions publication for State and local government is “National Compensation Survey: Retirement Benefits in State and Local Governments in the United States, 2007,” U.S. Department of Labor, Bureau of Labor Statistics, Summary 08-03, published May 2008, on the Internet at <http://www.bls.gov/ncs/ebs/sp/ebsm0008.pdf>.

## NCS Occupational Selection and Classification

The NCS collects data on *workers who are employed by the owner of the establishment*. Persons working onsite at a surveyed establishment, but paid by a contracted firm, are not included in data collection from the establishment. If a contracted firm is part of the sample, the NCS collects data on employees of the contracted firm who are working offsite at other establishments, as well as those working onsite. To be included in the NCS, employees in sampled occupations must receive cash payments (cash, check, or direct deposit payments) from the establishment for services performed, and the establishment must pay the employer’s portion of Medicare taxes on those individuals’ wages.

*Number of workers in establishment* includes workers on paid vacation or other types of leave; salaried officers, executives, and staff members of incorporated firms; employees temporarily assigned to other units; and noncontract employees for whom the reporting unit is the permanent duty station, regardless of whether that unit prepares their paychecks.

In sampling *jobs* at an establishment, BLS field economists use a method that ensures a random sampling. Field economists then match employees working in the sampled jobs with an occupation (as defined in the SOC structure).

*Workers are classified into occupations on the basis of the work performed and the skills required in each occupation*, and not on the basis of their education. For example, an employee trained as an engineer, but working as a drafter, is reported as a drafter. An employee who performs the duties of two or more occupations is reported in the occupation that requires the highest level of skill or in the occupation in which the employee spends the most time if there is no measurable difference in skill requirements. A *quote* is a sampled job that has been matched with an SOC occupation; it includes all workers in the job that have the same occupational attributes: full-time or part-time status, union or nonunion status, and

whether they are paid on a time or an incentive basis.

Stages 1 and 2 of the NCS sampling procedures are described in the section titled “**NCS Sample Design and Sampling Procedures.**” Stage 3, occupational selection and classification, is conducted by field economists during the initial contact with the sampled establishment. There are four main steps in this stage:

1. Selection of establishment jobs by the NCS Probability Selection of Occupations (PSO) technique. With this technique, the probability of selecting a given job is proportional to the number of workers in the job in the establishment
2. Classification of jobs into occupations based on the SOC system
3. Determining attributes of the worker in the job, such as full-time or part-time status, union or nonunion status, and whether the worker is paid on a time or incentive basis
4. Determining the work level of each job

*Selecting occupations.* In step 1, the field economist receives the establishment’s complete list of employees and their job titles. The field economist then uses the NCS Probability Selection of Occupations (PSO) technique to randomly select the jobs to be sampled. The number of selected jobs for which data are collected is based on the establishment’s employment size, according to the following criteria:

|                         |         |        |             |
|-------------------------|---------|--------|-------------|
| Number of employees     | 1–49    | 50–249 | 250 or more |
| Number of jobs selected | Up to 4 | 6      | 8           |

Exceptions include State and local government units, for which up to 20 jobs may be selected, and the aircraft-manufacturing industry units—those matching NAICS code 33-6411—for which up to 32 jobs may be selected.

*Classifying jobs.* In step 2, the field economist classifies the sampled jobs into occupational categories based on the workers’ actual job duties and responsibilities, not on their job titles.

Today, the Standard Occupational Classification (SOC) system is used by all Federal statistical agencies to classify occupations. Under the SOC, a job may fall into any one of about 800 occupational classifications. Each occupation is designated by a six-digit code that is part of a hierarchical structure: detailed occupations are grouped under broad occupations, broad occupations are part of a minor group, and minor groups are part of a major group. The SOC designates 23 major groups. Major group codes end with 0000, minor groups codes end with 000, and broad occupation codes end with 0. For example, the detailed occupation Orthodontists (code 29-1023) is under the broad occupation Dentists (code 29-1020), which is under the minor group Health Diagnosing and Treating Practitioners (code 29-1000), which is under

major group Health Care Practitioner and Technical Occupations (code 29-0000). (See the entire list of SOC occupational categories at [http://www.bls.gov/soc/soc\\_majo.htm](http://www.bls.gov/soc/soc_majo.htm).) For the NCS, occupations can fall into any of 22 major groups; the NCS excludes major group 23 (SOC code 23-0000), military-specific occupations.

*Determining occupational attributes of the worker.* In step 3, for each selected occupation, the field economist records specific attributes of the worker in the sampled job. Each selected occupation must include only workers with the same attributes; for example, the occupation cannot include both full-time and part-time workers. The occupational attributes of workers, as determined by NCS, are as follows:

- *Full-time/part-time status.* The field economist identifies the worker as holding either a full-time job or a part-time job. For the NCS, full-time and part-time status is not determined by number of hours worked; rather, the status is based on the establishment’s definition of those terms.
- *Time-based/incentive-based pay.* The field economist identifies the worker as having time-based or incentive-based pay, depending on whether any part of the pay was based directly on the actual production of the worker, rather than solely on the number of hours worked. Time workers are those whose wages are based solely on an hourly rate or salary. Incentive workers are those whose wages are at least partially based on productivity payments, such as piece rates, commissions, and production bonuses.
- *Union/nonunion workers.* The field economist records whether the occupation is filled by union or nonunion workers. The NCS defines a union worker as any employee in a union occupation when all of the following conditions are met: a labor organization is recognized as the bargaining agent for all workers in the occupation; wage and salary rates are determined through collective bargaining or negotiations; and settlement terms, which must include earnings provisions and may include benefit provisions, are embodied in a signed, mutually binding collective bargaining agreement. A nonunion worker is an employee in an occupation not meeting all of the NCS-defined conditions for union coverage.

*Determining the work level of the job.* In step 4, field economists evaluate the job, using a “point-factor” system to determine the work level of a selected occupation. The NCS system uses four distinct factors:

- Knowledge
- Job controls and complexity
- Contacts
- Physical environment

Each factor consists of several degrees, each with an associated description and number of points. Generally, the

greater the consequence, complexity, or difficulty of the factor, the higher is the number of points assigned.

Except for the knowledge factor, the descriptions apply to all occupational categories. Knowledge has a separate set of descriptions for each of several broad occupational categories. For example, the knowledge factor of a professional accounting occupation is based on a different set of descriptions by which levels and points are assigned than the knowledge factor of an engineering occupation. The broad occupational categories for which unique descriptions are given are as follows:

- Business Administration
- Professional Accounting and Auditing
- Information Technology
- Professional Mathematics and Statistics
- Professional Engineering and Architecture
- Engineering and Scientific Technician
- Professional Biological and Physical Science
- Professional Economics, Sociology, Geography, Psychology, and Similar Jobs
- Social, Welfare, and Health Administration
- Professional Legal
- Administrative Legal
- Professional Education
- Professional Librarian, Museum Curator, and Archivist
- Communications and Arts
- Professional Medical
- Medical, Hospital, Dental, Public Health, and Veterinary Technician
- Protective Service
- Investigation, Inspection, and Compliance
- Service
- Sales
- Office and Administrative Support
- Miscellaneous Technician
- Blue Collar
- Pilots and Air Transportation

The job is assigned points for the highest level at which *all* requirements are met. This entire process is known as *point-factor leveling*. If a specific work level cannot be determined for a selected occupation, the data for that occupation are recorded as *not able to be leveled*.

NCS publishes data on 15 work-level categories. The work levels, which reflect a hierarchy of primary duties and responsibilities, can be used to compare different occupations that have the same broad occupational knowledge factors. For example, a level-9 registered nurse would have a total number of points within the same range as a level-9 pharmacist; however, the factors of knowledge, job controls and complexity, personal contacts, and physical environment

may have contributed in different portions to that point total. Work levels, from lowest to highest, vary by occupation. Lower levels are found in occupations that require limited training, such as equipment cleaners, cashiers, and personal care workers. Higher levels are found in occupations that require extensive knowledge and independent decisionmaking, such as operations managers, engineers, and lawyers.

During data production, data on work levels are combined by common traits and estimates are published in four broad groups, called *combined work levels*. (See the section “**Occupational Earnings Estimates**” for details.)

*Determining supervisory responsibilities.* According to the current version of the SOC, “Supervisors of professional and technical workers usually have a background similar to the workers they supervise, and are therefore classified with the workers they supervise. Likewise, team leaders, lead workers and supervisors of production, sales, and service workers who spend at least 20 percent of their time performing work similar to the workers they supervise are classified with the workers they supervise.”<sup>1</sup> Typically, supervisors have the authority to hire, transfer, lay off, promote, reward, and discipline other employees. For the NCS, field economists record whether the occupation includes supervisory responsibilities and, if so, the level of responsibility. By NCS definition, first-line supervisors direct their staff through face-to-face meetings and are responsible for conducting the employees’ performance appraisals; second-line supervisors typically direct the actions of their charges through first-line supervisors. NCS also evaluates most supervisory jobs on work levels based on the four point factors previously described. A modified approach is used for professional and administrative supervisors when they direct professional workers and are paid primarily for their supervisory and managerial skills; the levels of such supervisory jobs are determined on the basis of the duties and responsibilities of the highest reporting position. (For a complete description of point-factor leveling and the determination of supervisory levels, refer to the publication *National Compensation Survey: Guide for Evaluating Your Firm’s Jobs and Pay*, on the Internet at <http://www.bls.gov/ncs/ocs/sp/ncbr0004.pdf>.)

## **Processing the NCS Data: Weighting, Nonresponse Adjustment, Imputation, and Benchmarking**

Participation in the survey is voluntary; therefore, a company official may refuse to participate in the initial survey or may be unwilling or unable to update previously collected data for one or more occupations during a subsequent contact. In addition, some establishments selected from the sampling frame may be out of scope or may have gone out of business. To address the problems of nonresponse and missing data, the NCS adjusts the weights of the raw data and imputes

<sup>1</sup> Standard Occupational Classification User Guide, Classification Principles, #3, on the Internet at <http://www.bls.gov/soc/socguide.htm>.

missing values, ultimately to ensure that published compensation estimates are representative of compensation in the civilian, private industry, and State and local government sectors—for the Nation, broad geographic regions, and local areas. Beginning in 2006, the NCS implemented a number of significant changes in the survey, including imputing for temporary nonresponse situations and benchmarking estimated employment. This section includes a description of the current imputation and benchmarking methods. (For more information on recent changes in the NCS methodology with respect to NCS wage products, see “Change Comes to the National Compensation Survey Locality Wage Bulletins,” on the Internet at <http://www.bls.gov/opus/cwc/cm20070122ar01p1.htm>. For more information on these changes with respect to the ECI, see <http://www.bls.gov/ncs/ect/ecsm0001.htm>, and with respect to the benefits publications, see <http://www.bls.gov/ncs/ebs/ebsm0005.htm>.)

Weight adjustments and imputation are made in accordance with the following steps:

1. An establishment is considered *responding* if it provided information on at least one usable occupation. An occupation is classified as usable if the following data are present: occupational attributes (full-time or part-time schedule; union or nonunion status; and time or incentive type of pay); work schedule; and wage data. Wages account for roughly 70 percent of compensation; therefore, if wage data are not available, other data from the establishment cannot be used in calculating estimates. *Establishment nonresponse* occurs when an establishment did not provide earnings, occupational classification, worker attributes, and work schedule data for any occupation. Establishment nonresponse during the initial interview is treated with adjustments that redistribute the weights of nonrespondents to similar respondents on the basis of characteristics such as the industry and size class of the establishment. For example, if the nonresponding establishment was in the manufacturing industry with an employment of 350 workers, NCS would adjust the weights of responding manufacturing establishments with 250–499 workers by a nonresponse factor. This factor is calculated by dividing the sum of the product of establishment employment and sample weight for responding and nonresponding establishments by the sum of the product of establishment employment and sample weight for responding establishments. At subsequent interviews of an establishment, establishment nonresponse is treated by imputation, in which missing values for an initially responding establishment are replaced by values from the original interview, adjusted by the rate of change among responding establishments. Establishments no longer in operation or out of the scope of the survey, and establishments with no workers within the scope of the survey, are excluded from the survey estimates.
2. *Item nonresponse* occurs when an establishment responds to the survey but is unable or unwilling to provide some of the benefits data, occupational classifications, or worker attributes for a given sampled occupation. Item nonresponse is treated by item imputation in certain situations. In item imputation, missing values for an item are replaced by values derived from establishments with similar characteristics that completed the item. For NCS *benefits* estimates, items can be imputed for nonresponse at initial and subsequent data collection. For example, suppose that, during the initial contact, an establishment reports earnings data for a sampled occupation but refuses to report whether those in the occupation receive paid vacation leave; NCS then imputes the incidence of vacation leave for the occupation on the basis of the incidence of vacation leave among similar occupations in similar establishments. For NCS *earnings* estimates, items are not imputed for item nonresponse during the establishment’s initial data collection but are so imputed at subsequent data collections. For example, if a manufacturing establishment gave no information on the earnings per hour of its full-time, nonunion assembly workers at the initial collection of data, NCS would not use *any* of the data on those workers. However, if the establishment reported earnings per hour for its full-time, nonunion assembly workers during the initial collection, but not in a subsequent collection, NCS would use the most recent reported hourly earnings of full-time, nonunion assembly workers in the establishment, adjusted for the rate of change in hourly earnings of workers in similar manufacturing establishments, to impute the missing data.
3. A third factor adjusts for any special situations that may have occurred during data collection. For example, when a sample unit is one of two establishments owned by a given company and the respondent provides data for both locations combined instead of the sampled unit, the weight of the sampled unit is adjusted to reflect the employment data actually collected.
4. Finally, *poststratification*, or *benchmarking*, is the process of adjusting the weight of each establishment in the survey to match the most current distribution of employment by industry. The NCS establishment sample is drawn from the Quarterly Census of Employment and Wages (QCEW). Because the sample of establishments used to collect NCS data was chosen over the past several years, establishment weights reflect employment when sampled. The benchmark process updates that weight on the basis of current employment. Benchmarking ensures that survey estimates reflect the most current industry-ownership employment counts in proportions consistent with the private industry, State government, and local government sectors. For example, suppose that 40 private industry, 10 local government, and 5 State government units in the service sector were selected from the NCS



sampling frame containing 200,000 private workers, 30,000 local government workers, and 10,000 State government workers, respectively. Suppose also that, by the time of survey processing, the private service sector experienced an employment increase of 10,000 workers, or 5 percent, and no increase in employment was experienced in local and State government. Then, if NCS did not benchmark, the sample would under-represent current private service sector employment. In this example, the NCS would adjust the sample weights of the 40 service sector firms to ensure that the number of private service sector workers in the sampling frame rises to 210,000. The industry-ownership employment counts would then reflect the current proportions of 84 percent for private, 12 percent for local government, and 4 percent for State government employment in the service sector.

The benchmark calculation is essentially the same for all NCS data products; however, the *input* to the benchmark calculation differs by data product. The ECI uses fixed employment weights; the benchmark adjustment for the ECI is calculated each quarter, currently with the use of 2002 employment counts from the Occupational Employment Statistics survey. (See <http://www.bls.gov/oes/>.) Before December 2006, the ECEC used only QCEW employment counts for benchmarking; starting with the December 2006 quarter, the ECEC began using employment data from two BLS programs—the QCEW and the Current Employment Statistics (CES) program—for benchmarking. The CES data are used to update the QCEW data that are about 6 months old. Combined, data from the two programs provide the appropriate industry coverage and timeliness needed for the ECEC. Starting with the publication of the March 2007 estimates, the NCS benefits incidence and key provisions (I&P) series began using employment data from the two BLS programs as well. The NCS continues to use employment counts from the most recent QCEW data to benchmark national, Census division, and local area wage estimates and for estimates of detailed NCS benefits provisions. (For more information on ECEC benchmarking, see “Changes in Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007,” on the Internet at <http://www.bls.gov/ncs/ect/sp/ececcalc.pdf>.)

NOTE: In NCS benefits and earnings data publications, an appendix table on *survey establishment response* in the technical notes shows the number of establishments by sector in the sampling frame and in the sample; the number responding to the survey; the number out of scope or out of business; and the number unable or unwilling to participate in the survey. A second appendix table shows the estimated *number of workers represented by the survey*; this estimate includes the number of all workers in all establishments within the

scope of the NCS, by sector and by occupational group, represented by the survey—not the number of workers actually surveyed. The number of workers represented by the survey is not intended as an accurate employment count; rather, it indicates only the relative importance of the occupational groups studied in the survey.

## Computations of Compensation Measures and Reliability of Estimates for All NCS Data Products

The NCS sample provides (1) data for the Employment Cost Index (ECI) series and the Employer Costs for Employee Compensation (ECEC) series, (2) estimates of occupational wages by work level, (3) occupational wage comparisons between geographic areas, and (4) data on employer-provided benefits. This section describes computations and reliability measures that apply to all NCS data products. At the end of the section are links to Web pages for each NCS data product; these pages include a description of the computations and reliability measures specific to the individual product.

NCS estimates are derived from a sample of occupations selected from the responding establishments. Two types of errors are possible in an estimate based on a sample survey: sampling errors and nonsampling errors. *Sampling errors* occur because the sample makes up only a part of the population. The sample used for the survey is one of a number of possible samples that could have been selected under the sample design, each producing its own estimate. A measure of the variation among sample estimates is the *standard error*. *Nonsampling errors* are data errors that stem from any source other than sampling error, such as data collection errors and data-processing errors.

Standard errors can be used to measure the precision with which an estimate from a particular sample approximates the expected result of all possible samples. The chances are about 68 out of 100 that an estimate from the survey differs from a complete population figure by less than the standard error. The chances are about 90 out of 100 that this difference would be less than 1.6 times the standard error. Statements of comparison appearing in NCS publications are significant at a level of 1.6 standard errors or better. This means that, for differences cited, the estimated difference is greater than 1.6 times the standard error of the difference. To assist users in ascertaining the reliability of NCS series, standard errors for all NCS estimates are available online at <http://www.bls.gov/ncs/>.

The ECI, ECEC, and NCS wage and benefits publications all use some variation of *balanced repeated replication* (BRR) methodology to estimate the standard error. The procedure for BRR is first to partition the sample into variance strata composed of single sampling strata or clusters of sampling strata and then to split the sample units in each variance stratum evenly into two variance primary sampling units (PSUs). Next, half-samples are chosen so that each half-sample contains exactly one variance PSU from each

variance stratum. Choices are not random, but designed to yield a “balanced” collection of half-samples. For each half-sample, a “replicate” estimate is computed with the same formula for the regular, or “full-sample,” estimate, except that the final weights are adjusted. If a unit is in the half-sample, its weight is multiplied by  $(2 - k)$ ; if not, its weight is multiplied by  $k$ . For all NCS publications,  $k = 0.5$ , so the multipliers are 1.5 and 0.5. (Some of the weighting adjustments done as part of the calculation of final weights also are recalculated for each replicate.)

The BRR estimate of standard error with  $R$  half samples is

$$SE(\hat{Y}) = \sqrt{\frac{1}{R(1-k)^2} \sum_{r=1}^R (\hat{Y}_r - \hat{Y})^2},$$

where the summation is over all half-samples  $r = 1, \dots, R$ ,

$\hat{Y}_r$  is the  $r$ th replicate estimate, and

$\hat{Y}$  is the full-sample estimate.

The *percent relative standard error* data are provided alongside earnings estimates in NCS earnings and ECEC publications. ECEC and NCS wage publications display the standard error as a percentage of the full-sample estimate.

The percent relative standard error is given by

$$\%RSE = 100 \times SE(\hat{Y})/\hat{Y}.$$

*Data collection and processing errors* are mitigated primarily through quality assurance programs that include the use of data collection reinterviews, observed interviews, computer edits of the data (validation), and systematic professional review of the data. The programs also serve as a training device to provide feedback to the field economists, or data collectors, on errors. They provide information as well on the sources of errors that can be remedied by improved collection instructions or computer-processing edits. Extensive training of field economists is conducted to maintain high standards in data collection.

Once estimates of compensation cost changes, of wage and compensation cost levels, or of benefit provisions are produced, the *estimates are verified, or validated*. The focus of the verification at this stage is a comparison of the estimates with expectations. Expectations are based on economic conditions, recent trends in similar data, historical relationships among industries, occupations, union status, region of the country, types of compensation, and so on. Computer checks are used to identify anomalies, such as wage changes outside the historical range. Another set of checks verifies that there are enough observations supporting each estimate and that there will be no way in which data from a respondent could be identified. Once estimates that are anomalies or that differ

substantially from expectations in other ways are identified, the data underlying those estimates are examined in detail to try to explain the results. When the review staff is convinced that the data are accurate and that they are based on enough observations, they designate the data as “fit for use” and the data are published.

Not all calculated series meet the *criteria for publication*. Before any series is published, it is reviewed to make sure that it meets specified statistical reliability and confidentiality requirements. The review prevents the publication of a series that could reveal information about a specific establishment or have a large sampling error.

The following are links to descriptions of the methods used to compute estimates for specific NCS products and the reliability of those estimates:

### Employment Cost Index (ECI) Series

### Employer Costs for Employee Compensation (ECEC) Series

### Occupational Earnings Estimates

### Area-to-Nation and Area-to-Area Pay Comparisons

### Incidence and Provisions of Benefits

### Employment Cost Index (ECI) Series

The Employment Cost Index (ECI) is a measure of the change in the cost of labor, free from the influence of employment shifts among occupations and industry categories. The total compensation series includes changes in **wages and salaries** and in employer costs for employee benefits. The ECI calculates indexes of total compensation, wages and salaries, and benefits separately for all civilian workers in the United States (as defined by the NCS), for private industry workers, and for workers in State and local government, and, within each of these sectors, by occupational group, worker attributes, industry group, and establishment characteristic. Seasonally adjusted series are calculated as well.

Employer costs for employee benefits are collected for paid leave—vacations, holidays, sick leave, and personal leave; supplemental pay—premium pay for work in addition to the regular work schedule (such as overtime, weekends, and holidays) and for shift differentials, and nonproduction bonuses (such as yearend, referral, and attendance bonuses); insurance benefits—life, health, short-term disability, and long-term disability insurance; retirement and savings benefits—defined benefit and defined contribution plans; and legally required benefits—Social Security, Medicare, Federal and State unemployment insurance, and workers’ compensation.

The ECI is a Principal Federal Economic Indicator. (Principal Federal Economic Indicators are the major statistical

series that describe the current condition of the economy. For more detail, see OMB Statistical Policy Directive No. 3, at <http://www.bea.gov/about/pdf/federalregister09251985.pdf>.)

### Computation of index series

The ECI is a Laspeyres index. The basic computational framework for the ECI is the standard formula for an index number with fixed index weights, modified by the special statistical conditions that apply to the ECI. The text that follows describes ECI measures of wage changes, but indexes of changes in benefits and in total compensation (defined by the NCS as the sum of changes in wages and benefits) are calculated in essentially the same manner.

An index for the ECI is simply a weighted average of the cumulative average wage changes within each of the ECI basic cells, with base-period “wage bills” serving as the fixed weights. A basic cell for the ECI is composed of raw wage data from a narrowly defined set of workers, sorted by ownership sector, industry, and occupational groups in which they work. The ECI cell structure sorts the industry codes into 1 of 3 ownership sectors: private, State government, or local government. Workers within private establishments are sorted into 1 of 58 industry categories that are defined primarily by three-digit NAICS codes. Workers in either State or local governments are sorted into 13 industry categories; the government industry categories are as broad as “all goods-producing industries” and as narrow as “hospitals.” Each of these private and government industry groups is arrayed across nine aggregate occupational groups, which are ordered numerically, by their SOC codes. Altogether, there are 522 private industry occupational cells ( $58 \times 9$ ) and 234 State and local government industry occupational cells ( $13 \times 9 \times 2$ ), for a total of 756 ECI basic cells.

For each of these basic cells, a base-period wage bill ( $W_o$ ) is computed, and the wage bill is updated each quarter by observed rates of change from the ECI survey sample. The simplified formula for a basic cell is

$$I_t = \frac{\sum (W_{o,i} M_{t,i})}{\sum W_{o,i}} \times 100,$$

where

$I_t$  is the symbol for the index at period  $t$ .

$W_{o,i}$  is the estimated base-period wage bill for the  $i$ th cell. The wage bill is the average wage of workers in the cell at the base period (0), times the number of workers represented by the cell. For the ECI, the number of workers represented by the cell is held fixed.

$M_{t,i}$  is the multiplicatively accumulated average wage change in the  $i$ th cell from time 0 (the base period) to time  $t$  (the current quarter). In essence,  $M_{t,i}$  projects the base-period average

wage level for the cell forward to the current quarter.

$M_{t,i}$  can be written as  $M_{t,i} = M_{t-1,i} \times R_{t,i}$ ,

where

$R_{t,i}$  is the ratio of the current-quarter weighted average wage in the cell to the previous-quarter weighted average wage in the cell, both calculated in the current quarter from matched-sampled quotes. Using only matched quotes in the ratio eliminates the inclusion of wage changes that might be caused by shifting of workers within establishment jobs. That is, the ECI sample tracks changes in wages within establishment jobs and not for individual workers of the establishment. The weights applied are the “sample weights” of the survey.

All wage indexes are computed from the following data:

- Average straight-time hourly earnings for six-digit SOC code occupations, or groups of those occupations, in those sample establishments for which data are available for both the current and previous quarters. These earnings are called *matched quotes*. In addition to being identified by the six-digit SOC code, a quote within an establishment is identified from quarter to quarter by its union status, full-time or part-time status, method of pay (time or incentive), and job level.
- Employment for each of the basic cells, enumerated with the use of 2002 employment data from the BLS OES survey.
- Sample weights that reflect both employment in each establishment or occupation surveyed and the probability of selection of that establishment or occupation.

The index computation for a calendar quarter involves five principal steps:

1. Sampled occupation (quote) weights are applied to the average occupational hourly wage for every quote in a sampled establishment that has reported both current-quarter and previous-quarter wage data. These data are used to calculate a weighted average wage for each basic cell (that is, for each occupational group within each industry) for the current and previous survey periods.
2. The ratio of the current-quarter to the previous-quarter weighted average wage is then calculated for each cell  $i$ . This ratio ( $R_{t,i}$ ) is used as an estimate of the current-quarter ( $t$ ) wage change for that

basic cell and is multiplied by the previous-quarter ( $t - 1$ ) cumulative average wage change for the cell ( $M_{t-1,i}$ ). The product  $M_{t,i}$  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 ( $W_{o,i}$ ) to generate an estimate of the current-quarter wage bill for the cell.
4. Both the current-quarter and previous-quarter wage bills are then summed over all cells within the scope of the index. For example, for the manufacturing wage index, the wage bills would be summed across all cells in manufacturing.
5. The summed current-quarter wage bill ( $\sum W_{o,i} M_{t,i}$ ) is divided by the summed base-period wage bill ( $\sum W_{o,i}$ ). The result, when multiplied by 100, is the current-quarter index ( $I_t$ ). That index is divided by the previous-quarter index ( $I_{t-1}$ ) to provide a measure of quarter-to-quarter change, referred to as an “index link relative.”

Computations for the occupational and industry group indexes follow the same procedures as those for the overall indexes, except for summation. For example, for an index for a broad occupational group, the wage bills are summed across all cells which are a subset of that occupational group, with indexes for industry groups calculated analogously.

For the private industry nursing care facilities indexes, however, some caution is warranted. Those indexes are estimated with the use of fixed-employment weights derived from staffing patterns estimated from the four-digit NAICS industry group 6231, nursing care facilities, a subindustry of the larger industry group, nursing and residential care facilities (NAICS 623). The basic-cell cost weights for the nursing care facilities were constructed after the basic-cell fixed weights for 623 were computed and prepared for use in the index computation system. Consequently, the fixed weights for the four-digit industry 6231, nursing care facilities, were not directly constructed as linear disaggregates of NAICS 623. Because the nursing care facilities indexes are not linearly associated with their higher level aggregates, they are not strictly comparable to those aggregates.

Computation procedures for measures of change in the regional, union and nonunion, and excluding-incentive-workers series differ from those of the national wage indexes because the sample is not large enough to hold constant the wage bills at that level of detail. For these subseries, each quarter the prevailing distribution in the sample (for example, between union and nonunion attributes within each ownership/industry/occupation cell) is used to apportion the previous-quarter wage bill in that cell (for example, 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 the union wages in the cell, and similarly for the nonunion sector. Therefore, the relative employment of the union sector in each cell is not held constant over time. Since the weights of the region, union, and less-incentive-workers subcells are allowed to vary over time, the indexes for these series are not strictly comparable to those for the aggregate, industry, and occupation series.

#### *Recent changes to the index computations*

For a fixed-weighted index to remain economically relevant over a span of periods, it is necessary on occasion to make changes to the computations of the indexes. Beginning with the release of the March 2006 data, the following major changes were made in the way the ECI is calculated:

- Indexes were rebased to December 2005 = 100 (from June 1989 = 100).
- New fixed employment weights were introduced, using 2002 employment counts from the Bureau’s Occupational Employment Statistics survey;
- Industry classification was changed from the Standard Industrial Classification (SIC) system to the North American Industry Classification System (NAICS);
- Occupational classification was changed from the Occupational Classification System of the 1990 Census of Population to the Standard Occupational Classification (SOC); and
- Imputation methods were changed.

In 2009, the NCS began publishing continuous-series historical information, to assist data users in locating ECI data on occupational and industry series that ran before and after the changes just noted. (See the subsection “Publication of index series,” to follow; for more information on all the changes, see <http://www.bls.gov/ncs/ect/sp/ecsm0001.htm>.)

#### *Reliability of the index estimates*

To assist users in ascertaining the reliability of series, standard errors for all ECI estimates (excluding seasonally adjusted series) are available on the BLS Web site at <http://www.bls.gov/ect/ectvar.htm> shortly after publication of the news release.

#### *Publication of index series*

The ECI publishes indexes of total compensation, wages and salaries, and benefits separately for all civilian workers in the United States (as defined by the NCS), private industry workers, and State and local government workers, and, within each of these sectors, by occupational group, worker attributes, industry group, and establishment characteristic.

More than 400 unique index series and their associated quarterly and 12-month changes in employers' costs are published quarterly. Seasonally adjusted series are published as well.

In 2008, ECI estimates were published for 14 selected local areas for the first time; they are now published quarterly. A 15th local area was added in 2009. Local area data are limited to estimates for total compensation and for wages and salaries, for 12-month periods beginning with reference date December 2005 and for subsequent 12-month periods ending in March, June, September, and December. The data are available at <http://www.bls.gov/ect>, as well as in news releases, for each of the 15 local areas. (For additional information, see "BLS Introduces New Employment Cost Indexes for 14 Metropolitan Areas," on the Internet at <http://www.bls.gov/opub/cwc/cm20080922ar01p1.htm>. ECI estimates for the four Census regions and nine Census divisions are included in tables 6 and 10 of the national "Employment Cost Index" news release.)

Historical current-dollar ECI series that use industry categories based on the Standard Industrial Classification (SIC) System and classify jobs into occupational classifications according to the Occupational Classification System (OCS) of the Census Bureau are available dating from the first publication of each series through December 2005 at <http://www.bls.gov/web/echistry.pdf>. ECI current-dollar series based on the 2002 and 2007 North American Industry Classification Systems (NAICS) and the 2000 Standard Occupational Classification (SOC) also are available beginning in March 2001, with December 2005 = 100 as the base period, at <http://www.bls.gov/web/echistrynaics.pdf>.

In addition, historical constant-dollar ECI series derived from the Consumer Price Index for All Urban Consumers (CPI-U) are available. The constant-dollar series are calculated by converting the CPI-U to the same base as the ECI. The ECI for each quarter is then divided by the converted CPI-U for the same reference period. The *CPI-U U.S. City Average All Items* is used to compute all series except for the regional estimates, which use corresponding CPI regional data. Historical constant-dollar ECI series that use industry categories based on the SIC and that classify occupations according to the OCS are available, dating from the first publication of each series through December 2005, except for seasonally adjusted series, at <http://www.bls.gov/web/econst.pdf>. ECI constant-dollar series based on the 2002 and 2007 North American Industry Classification Systems (NAICS) and the 2000 Standard Occupational Classification (SOC) also are available beginning in March 2001, with December 2005 = 100 as the base period, at <http://www.bls.gov/web/econst-naics.pdf>.

Historical continuous-series listings are available for all ECI occupational and industry series that existed before the March 2006 revisions and continued afterwards. This historical listing, which uses December 2005 = 100 as the base period, is available online at <http://www.bls.gov/web/eci/ecicois.pdf>.

NOTE: Official ECI series—those designated for use by agencies of the Federal Government—are based on the SIC and OCS through December 2005 and on NAICS and SOC from March 2006 forward.

### *Seasonal adjustment*

Over the course of a year, rates of change in the cost of wages and benefits, as measured in the Employment Cost Index (ECI), reflect events that follow a more or less regular pattern. These events include expansions and contractions of economic activity that occur in specific periods of the year, such as increased work in the construction industry during warm weather. For another example, ECI 3-month rates of change for wage-and-benefit costs in State and local governments, which include State and local education as a substantial part, show larger rates of increase in September, reflecting new contracts associated with the beginning of new school sessions. Such regular patterns in an economic time series are typically referred to as *seasonal effects*. The process of estimating and removing these effects from an economic series is called *seasonal adjustment*. Seasonal adjustment makes it easier for analysts to observe long-run and other movements in an economic time series, exclusive of seasonal effects. Economists and other researchers are particularly interested in observing cyclical and long-run movements of economic series to better understand the economic behavior of various sectors of the economy.

In evaluating changes in a seasonally adjusted series, it is important to note that seasonal adjustment is an approximation based on past experience. Seasonally adjusted estimates have a broader margin of error than the original data on which they are based, because they are subject to errors associated with seasonal factor estimation in addition to sampling and nonsampling errors.

Seasonal adjustment is performed with the X-12 ARIMA program developed by the time-series staff in the Statistical Research Division of the Census Bureau, U.S. Department of Commerce. The X-12 ARIMA program includes enhancements to the X-11 variant of the Census Method II seasonal adjustment program, as well as the X-11 ARIMA program developed by Statistics Canada.

At the beginning of each calendar year, seasonal adjustment factors are calculated for use during the coming year. The seasonal factors for the coming year are published on the BLS Web site. Revisions of seasonally adjusted indexes and 3-month percent changes for the most recent 5 years also are published on that Web site.

ECI series are seasonally adjusted by either direct or indirect methods. In the direct method, an original or unadjusted index is divided by its seasonal factor. In the indirect method (also called composite seasonal adjustment), the seasonally adjusted index is calculated as a weighted sum of seasonally adjusted index components. (For more information about seasonal adjustment issues, see "Transitional Employment Cost Indexes for seasonal adjustment," on the Internet at <http://www.bls.gov/opub/mlr/2008/04/art3full.pdf>. For more information on the ECI conversion to new industry and occupational classification systems, see "Seasonal adjustment in the ECI and the conversion to NAICS and SOC," on the Internet at <http://www.bls.gov/opub/mlr/2006/04/art3full.pdf>.)

The following *Monthly Labor Review* articles also are informative: "Introducing 2002 weights for the Employment

Cost Index,” April 2006, pp. 28–32, on the Internet at <http://www.bls.gov/opub/mlr/2006/04/art5full.pdf>; and “Accounting for missing data in the Employment Cost Index,” *Monthly Labor Review*, April 2006, pp. 22–27, on the Internet at <http://www.bls.gov/opub/mlr/2006/04/art4full.pdf>.

#### *ECI data uses and limitations*

The ECI has been designated 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 that provides consistent subseries by occupation and industry. The ECI is used by the Federal Reserve Board to monitor the effects of fiscal and monetary policies and to formulate those policies. It enables analysts and policy-makers to assess the effects of labor cost changes on the economy, both in the aggregate and by sectors. The ECI is particularly important in studies of the relationships among prices, productivity, labor costs, and employment. The ECI also is used to determine increases in Medicare payments to hospitals and doctors and as a labor cost escalator in long-term contracts.

In determining data to be used in contract negotiations, it is important to note that differences by bargaining status may be due to factors other than union status, such as occupational and industry mix. An important consideration in choosing a series for escalation is the sampling error. (For more information, see <http://www.bls.gov/ect/escalator.htm>.)

To update wage data from any source to the most recent quarter, see “Aging Wage Data Using the Employment Cost Index,” on the Internet at <http://www.bls.gov/opub/cwc/cm20080122ar01p1.htm>.

#### *Examples of ECI data uses*

- *Federal pay adjustments.* The ECI is used to determine Federal white-collar pay adjustments under the Federal Employees Pay Comparability Act.
- *Active-duty military pay adjustments.* In November 2003, Congress passed a permanent law requiring that annual basic pay increases for active-duty military personnel be indexed to the annual increase in the ECI for Fiscal Year 2007 and beyond. (Section 602 of the Fiscal Year 2004 National Defense Authorization Act; and P.L. 108-136, November 24, 2003; 117 Stat. 1498, amending 37 USC 1009.) However, each year since Fiscal Year 2004, Congress has enacted a special “National Defense Authorization Act” that sets the annual military increase at a level superseding that of 37 USC 1009. Prior to this legislation, the wages of active-duty military personnel had been linked to the annual percent increase in the General Schedule (GS) Federal civil service pay scale under the Federal Employees Pay Comparability Act of 1990. In 1999, with a widening pay gap between military and private industry pay, Congress enacted legislation that tied annual military pay increases to the annual increase in the ECI plus 0.5 percent. The legislation was in effect for Fiscal Years 2001–06.
- *US economic policy decisions.* The Federal Reserve uses the ECI as a major economic indicator for monetary policy decisionmaking.
- *Escalator clauses in collective bargaining contracts.* Wage escalator clauses can allow for a pay increase that is dependent upon the ECI.
- *Escalator clauses in U.S. government contracts.* Various ECI series are used as labor cost escalators in U.S. government contracts. For example, the production and logistics division of the Department of Defense uses both the wages and salaries cost series and the benefits costs series as escalators in numerous defense contracts, including contracts for computer research. The Contracts Division of the Environmental Protection Agency uses the total compensation private industry/white-collar series as the designated cost escalator in at least 10 contracts for systems design services.
- *Adjustments to Medicare reimbursements for hospital, physician, and related services.* The U.S. Department of Health and Human Services, Centers for Medicare and Medicaid Services, uses data from the ECI to determine allowable increases in reimbursements to hospitals, skilled-nursing facilities, home health care organizations, and physicians under Medicare’s Prospective Payment Systems (PPS). The PPS designates the level of reimbursement for Medicare-covered services, in accordance with the diagnosis and geographic location of care. PPS reimbursements are adjusted annually on the basis of a number of factors, including changes in compensation for medical and related personnel. (For more information, see “The Employment Cost Index and the Impact on Medicare Reimbursements,” on the Internet at [http://www.bls.gov/ncs/ect/medicare2008\\_impact.pdf](http://www.bls.gov/ncs/ect/medicare2008_impact.pdf).)
- *School district property taxes.* The Pennsylvania Department of Education uses the ECI as a measure of inflation to determine the maximum increase allowed for school district property taxes. Pennsylvania began using the index in 2005 after the General Assembly passed, and the Governor signed into law, Act 72, titled “The Homeowner Tax Relief Act.” This tax reform initiative was designed to reduce the property tax burden on Pennsylvania residents.
- *Economic price adjustments in long-term purchase contracts.* Long-term purchase contracts may specify that the ECI is to be used to adjust the labor cost portion of contracts.
- *Escalator clauses in foreign government contracts.*

Foreign governments sometimes use ECI series in contracts with U.S. firms. For example, the Swiss government uses the series on durable-goods manufacturing as a wage escalator in a contract with a U.S. firm that makes computers.

- *Economic consulting and forecasting.* Various ECI series are used in models for economic forecasting, including forecasting ECI values for clients' use in budgeting and other activities. ECI series also are used in developing inflation indexes of personnel costs and other costs for elementary and secondary schools and for colleges.

### Employer Costs for Employee Compensation (ECEC) Series

The Employer Costs for Employee Compensation (ECEC) series measures the average cost to employers for wages and salaries, and for benefits, per employee hour worked. The ECEC series provides quarterly data on employer costs per hour worked for total compensation, wages and salaries, total benefits, and the following types of benefits: paid leave—vacations, holidays, sick leave, and personal leave; supplemental pay—premium pay for work in addition to the regular work schedule (such as overtime, weekend, and holiday work) and for shift differentials, and nonproduction bonuses (such as yearend, referral, and attendance bonuses); insurance benefits—life, health, short-term disability, and long-term disability insurance; retirement and savings benefits—defined benefit and defined contribution plans; and legally required benefits—Social Security, Medicare, Federal and State unemployment insurance, and workers' compensation. Cost data are presented both in dollar amounts and as percentages of total compensation. The ECEC uses current weights to reflect the composition of today's labor force.

Beginning with the December 2006 data, the NCS implemented new benchmarking procedures for ECEC estimates. Current employment weights are used to calculate cost levels. The weights are derived from two BLS programs: the Quarterly Census of Employment and Wages (QCEW) and the Current Employment Statistics (CES) survey. Combined, these programs provide the appropriate industry coverage and currency of data needed to match the ECEC. All other NCS data products are benchmarked with QCEW data only. (For more information, see "Changes in Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007," at <http://www.bls.gov/ncs/ect/sp/ececcalc.pdf>.)

In most instances, private industry employment weights used in the ECEC are total employment estimates for two-digit industry groups, such as utilities (NAICS 22) or wholesale trade (NAICS 42). In a few cases, more detailed private industry employment weights are used. These cases include four-digit educational establishments—elementary and secondary schools (6111), junior colleges (6112), and colleges and universities (6113)—as well as the six-digit aircraft-manufacturing industry (336411). For State and local governments, a more aggregated level reflecting the level of detail

published by the CES program is typically used.

For private and government establishments, the employment data were apportioned on the basis of the sampling weights assigned to the Employment Cost Index (ECI) sample. The ECI, which measures the change in employer costs for employee compensation, is calculated with fixed 2002 employment counts in order to prevent employment shifts among occupations and industries from influencing the measurement. Therefore, changes over time in the ECEC series will differ from those in the ECI.

Historical ECEC data appear in three listings, all available at <http://www.bls.gov/ect/#tables>. The first historical listing covers data for the March reference periods from 1986 to 2001. These data use the Standard Industrial Classification (SIC) and Occupational Classification System Manual (OCSM) classification systems. The second listing contains data for the March, June, September, and December reference periods from March 2002 to December 2003. These data also are based on the SIC and OCSM. The final listing includes data for March 2004 to the current reference period. These data are based on the NAICS and the SOC classification system. Beginning with the March 2004 quarter, historical data based on the NAICS and the 2000 SOC system became available. The new historical tables are available on the Internet site <http://www.bls.gov/ncs/ect/home.htm> or upon request. Information on how costs are calculated appears in "Measuring Trends in the Structure and Levels of Employer Costs for Employee Compensation," on the Internet at <http://www.bls.gov/opub/cwc/archive/summer1997art1.pdf>.

ECEC estimates are shown as costs per hour worked for total compensation (wages and benefits), expressed both as dollar amounts and as percentages of compensation. ECEC estimates are computed for various costs  $c$ , including wages, individual benefits, combinations of benefits, total benefits, and total compensation (total wages plus total benefits).

The ECEC estimates of percent of total compensation are calculated from cost aggregates and then rounded to the published level of precision. This method provides the most precise estimates of the percent of total compensation; however, estimates calculated from the published cost estimates may differ slightly from those calculated from the unpublished cost aggregates.

The formula for the mean hourly cost  $c$  for domain  $D$  is

$$\hat{Y}_{cD} = \frac{\sum_{q \in D} W'_q Y_{cq}}{\sum_{q \in D} W'_q},$$

where

$D$  is the domain of interest,

$W'_q$  is the final quote weight for quote  $q$ , calculated as in the description of the final quote weight in the section on the calculation of wage levels, with one additional factor included to

account for changes in the employment distribution, and

$\hat{Y}_{cq}$  is the mean hourly cost  $c$  for quote  $q$ .

In addition, the formula for the mean hourly cost  $c$  as a percentage of total compensation is

$$P_{cd} = \frac{\hat{Y}_{cd}}{\hat{Y}_{TD}} \times 100,$$

where

$\hat{Y}_{cd}$  is the mean hourly cost  $c$  for domain  $D$ , as before, and

$\hat{Y}_{TD}$  is the mean hourly cost for total compensation for domain  $D$ .

### *ECEC data use and limitations*

Differences between the State and local government and private industry sectors stem from factors such as variation in work activities and in occupational structures. Manufacturing and sales, for example, make up a large part of private-industry work activities but are rare in State and local government. Professional and administrative support occupations (including teachers) account for two-thirds of the State and local government workforce, compared with less than one-half of private industry. A detailed examination of differences in compensation levels and trends between private industry and State and local government is found in “Cost of Employee Compensation in Public and Private Sectors,” *Monthly Labor Review*, May 1993, on the Internet at <http://www.bls.gov/opub/mlr/1993/05/contents.htm>, and in “Compensation Cost Trends in Private Industry and State and Local Governments,” *Compensation and Working Conditions*, fall 1999, at <http://www.bls.gov/opub/cwc/archive/fall1999art2.pdf>.

For more information on the calculation procedure, see “Changes in Variance Estimation Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007,” at <http://www.bls.gov/ncs/ect/sp/ececvmet.pdf>.

The relative standard errors (RSEs) for all estimates are available at <http://www.bls.gov/ncs/ect/#tables> shortly after the quarterly news release is issued.

For a detailed explanation of how to use standard error data to analyze differences in changes over time, see “Analyzing Year-to-Year Changes in Employer Costs for Employee Compensation,” *Compensation and Working Conditions*, spring 1998, at <http://www.bls.gov/opub/cwc/archive/spring1998art3.pdf>. This article supplements an article titled “Explaining the Differential Growth Rates of the ECI and ECEC” from the summer 1997 issue of *Compensation and Working Conditions*. The latter article, available at <http://www.bls.gov/opub/cwc/archive/summer1997art2.pdf>, examines how differences in the construction of these measures contribute to differing trends.

When respondents do not provide all the data needed, a procedure for assigning missing values is used. This imputation procedure is comparable to that used for the Employment Cost Index (ECI). (For a description, see “Accounting for missing data in the Employment Cost Index,” in the April 2006 issue of the *Monthly Labor Review*, on the Internet at <http://www.bls.gov/opub/mlr/2006/04/art4abs.htm>).

### *An example of ECEC data use*

- *Costs associated with employee compensation.* The International Union of United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) has posted tables using ECEC data on its Web site. The data are given in “The Union Advantage at a Glance,” which has appeared every quarter since December 2006. The tables highlight wage and benefit data from the ECEC for union and nonunion workers in private industry and for goods-producing and service-providing industries. (See <http://www.uaw.org/facts/09/unionadvantage1208.pdf>. NOTE: Links to non-BLS Internet sites are provided for your convenience and do not constitute an endorsement.)

### **Occupational Earnings Estimates**

*Data on earnings* of civilian workers and for workers in private industry and State and local government, the two components of the civilian sector as defined by the NCS, are published for the Nation, Census divisions, and selected Metropolitan Statistical Areas (MSAs). Earnings data are presented as mean and median hourly, weekly, and annual earnings (along with hours worked weekly and annually); as percentiles; by selected worker attributes (such as full time and part time, and union and nonunion); and by establishment characteristics (such as number of employees and geographic area).

To calculate earnings for various periods (hourly, weekly, and annual), the NCS collects data on *work schedules*. For hourly workers, scheduled hours worked per day and per week, exclusive of overtime, are recorded. The number of weeks worked annually is determined as well. For salaried workers, field economists record the typical number of hours actually worked; salaried workers who are exempt from overtime provisions often work beyond the assigned work schedule. Estimates for hours worked are given in the NCS earnings publications. Earnings estimates for aircraft pilots, flight engineers, and flight attendants include flight pay and flight hours only; these estimates may not reflect the total earnings and hours worked. (For more information on work schedules, see <http://www.bls.gov/opub/cwc/cm20080722ar01p1.htm>.)

The NCS publishes earnings estimates for occupational groups and detailed occupations, and earnings estimates also are presented by work level. *Work levels* represent a ranking of the duties and responsibilities within an occupation, and the latter permit comparisons of wages across occupations. The NCS also provides earnings estimates by *combined work level*.



The broad groups and the combined work levels are as follows:

| Group I         | Group II        | Group III        | Group IV          |
|-----------------|-----------------|------------------|-------------------|
| Work Levels 1–4 | Work Levels 5–8 | Work Levels 9–12 | Work Levels 13–15 |

### Earnings formulas

The following is a list of earnings estimates provided by the NCS and the formulas that describe them:

(1) Mean annual earnings

$$\frac{\sum_{q \in D} \sum_l (Y_{ql} X_{ql} W_q)}{\sum_{q \in D} \sum_l (X_{ql} W_q)}$$

(2) Mean weekly earnings

$$\frac{\sum_{q \in D} \sum_l (Y_{ql} X_{ql} W_q H_q A_q)}{\sum_{q \in D} \sum_l (X_{ql} W_q H_q A_q)}$$

3) Mean hourly earnings

$$\frac{\sum_{q \in D} \sum_l (Y_{ql} X_{ql} W_q A_q)}{\sum_{q \in D} \sum_l (X_{ql} W_q A_q)}$$

(4) Total employment

$$\sum_{q \in D} \sum_l (X_{ql} W_q)$$

### Exhibit 1. Concepts and Definitions of Wages and Salaries

*Wages and salaries, or earnings*, are defined as regular payments from the employer to the employee as compensation for straight-time hourly work or for any salaried work performed. The following components are included as part of earnings:

- Incentive pay, including commissions, production bonuses, and piece rates
- Cost-of-living allowances
- Hazard pay
- Payments of income deferred because of participation in a salary reduction plan
- Deadhead pay, defined as pay given to transportation workers returning in a vehicle without freight or passengers

The following items are not considered part of straight-time earnings, and no data on such items are collected by the NCS:

- Uniform and tool allowances
- Free or subsidized room and board
- Payments made by third parties (for example, tips)
- On-call pay

The following forms of payments are considered benefits and not part of straight-time earnings:

- Payments for shift differentials, defined as extra payment for working a schedule that varies from the norm, such as night or weekend work
- Premium pay for overtime, holidays, and weekends
- Bonuses not directly tied to production (such as Christmas and profit-sharing bonuses)

In the preceding formulas,

$D$  is the domain of interest (for example, occupation  $\times$  level or occupational group  $\times$  level),

$q$  is the quote,

$l$  the wage record,

$Y_{ql}$  is the annual wage rate in formula (1), the weekly wage rate in formula (2), and the hourly wage rate in formula (3) of a particular worker or group of workers in a particular quote,

$X_{ql}$  is the number of workers who receive a particular earnings rate,

$H_q$  is the number of weekly hours paid to a particular worker and is assumed to be the same for each worker in a quote (*NOTE*: Weekly hours paid are used only in computing average hourly earnings),

$A_q$  is the number of annual weeks worked by a particular worker, which is assumed to be the same for each worker in a quote, and

$W_q$  is the individual weight.

The individual weight is calculated by dividing the final quote weight by the number of employees in the quote. The final quote weight for local area occupational earnings estimates is the product of (1) the reciprocal of the

probability of selecting the establishment, given the set of sample areas; (2) a correction factor to adjust for cases in which data are collected for a different number of employees than data should be collected for; (3) the establishment nonresponse adjustment factor; (4) the occupational nonresponse adjustment factor; and (5) the probability of selection of an occupation interval—that is, the number of eligible employees divided by the number of occupational selections. For national and Census division estimates, the final quote weights are a product of the same factors and one additional factor: the reciprocal of the probability of selecting the sample area in which the establishment is located. The benchmark factors are aggregated for geographical areas, Census divisions, and national earnings computations. The individual weight contains an additional benchmark factor to account for changes in the employment distribution.

#### (5) Hourly earnings percentiles

Hourly earnings percentiles in NCS wage publications are computed from earnings reported for individual workers in sampled establishment jobs and their scheduled hours of work. Establishments in the survey are asked to report earnings of individual workers for each sampled job. For the calculation of percentile estimates, the individual-worker hourly earnings are appropriately weighted and then arrayed from lowest to highest within the establishment. If the establishment reports only the average earnings of all of the workers in a sampled job, rather than the earnings of each worker in the sampled job, the job's average hourly earnings are appropriately weighted for the number of workers in the sampled job. Then the resulting average is arrayed along with all other individual-worker earnings and occupational average earnings, from lowest to highest, within the establishment. The published 10th, 25th, 50th, 75th, and 90th percentiles designate position in the earnings distribution within each published occupation. At the 50th percentile—the median—half of the hours are paid the same as or more than the rate shown and half are paid the same as or less than the rate shown. At the 25th percentile, one-fourth of the hours are paid the same as or less than the rate shown. At the 75th percentile, one-fourth of the hours are paid the same as or more than the rate shown. The 10th and 90th percentiles follow the same logic.

#### *Earnings publications*

The NCS annually publishes national, Census division, and local area occupational earnings estimates on mean hourly earnings, mean and median weekly and annual earnings, and weekly and annual hours, for civilian workers (as defined by the NCS), private industry workers, and State and local government workers. Occupational earnings data are published for some major and minor industry groups, by worker attributes (such as collective bargaining status) and by establishment characteristics (such as number of workers in the establishment). Percentile earnings by worker attributes and establishment characteristics also are published.

Relative standard errors are provided for each of the earnings estimates. (For information on relative standard errors and standard errors calculated by the NCS, see the section “**Computations of Compensation Measures and Reliability of Estimates for All NCS Data Products.**”)

#### *Examples of NCS earnings data use*

- *Negotiating wage contracts.* Mean and median wages for occupations and for occupational groups in an area can be used as a point of departure for wage negotiations. If certain occupations are not published, data on “benchmark occupations”—those occupations which may be common in a number of establishments—may be used to compare an employer's pay with pay in the area.
- *Determining compensation rates.* Private companies, labor organizations, and government agencies use the NCS to help determine compensation rates for pay ranges or merit increases.
- *Determining prevailing wage rates.* Legislation such as the Service Contract Act and the Davis-Bacon Act require employers to pay the “prevailing wage rate” of the area for certain types of work. In such cases, a Federal Government agency, such as the Employment Standards Administration (ESA), may use BLS survey data as a tool in determining the prevailing rate. The survey results, however, are not automatically “the prevailing rate.” BLS neither sets nor enforces prevailing wage rates.
- *Setting compensation rates for workers with different duties and responsibilities.* The NCS frequently is used to help evaluate wage rates for different job levels of an occupation. Job levels represent the different duties and responsibilities within the occupation. Levels are derived from generic standards used for all occupations or for certain occupational groups, so occupational pay can be compared at each job level. A common point-factor analysis is applied to each occupation to measure the requirements of the position and derive the job levels. Each job selected can be slotted into a work level based on nine factors: knowledge, supervision received, guidelines, complexity, scope and effect, personal contacts, purpose of contacts, physical demands, and work environment.
- *Comparing geographical area wages.* Frequently, private companies use wage data to identify areas for expansion or relocation. Individuals find wage data useful for choosing an area to seek employment.
- *Evaluating wage distributions.* Wages are presented in many formats, including percentiles (10th, 25th, 50th,

75th, and 90th). Percentiles describe the distribution of an occupation's employment by the average wage rates for its jobs.

- *Paying market wage rates.* Many users want to pay at or above the mean wage rate to attract top-quality professionals into a job that is hard to fill. Users can access data on percentiles to target a specific value at which to compete.
- *Federal pay adjustments.* Under the Federal Employees Pay Comparability Act, wage data are used to determine pay adjustments by locality for Federal white-collar workers.

### Area-to-Nation and Area-to-Area Pay Comparisons

The NCS publishes area-to-Nation and area-to-area pay comparisons, also known as *pay relatives*, for Metropolitan Statistical Areas. The pay relatives are calculated for civilian workers in each of nine major occupational groups. For the NCS, civilian workers are composed of workers in private industry and State and local government. The estimates are expressed as the ratio of workers' earnings in one area relative to the earnings of workers in a base area, which can be the Nation or another local area. Multivariate regression modeling controls for many interarea differences in employment composition. NCS annually publishes area-to-Nation pay relatives and area-to-area pay relatives. Area estimates that differ significantly from the national average are noted as such.

Multivariate regression analysis controls for the following 10 factors:

- Occupational type
- Industry type
- Work level
- Full-time/part-time status
- Time/incentive status
- Union/nonunion status
- Ownership type
- Profit/nonprofit status
- Establishment employment
- Payroll reference date

Changes in pay relatives from year to year do not necessarily imply changes in underlying economic conditions. Because the NCS is a sample survey, pay relatives are subject to sampling error, which means that they may differ from the true pay relatives one would derive from sampling the entire population. It is important to assess whether area-to-area or area-to-Nation differences are likely to be the result of sampling error or whether they are attributable to true differences

in pay levels. To perform this assessment, a test of statistical significance is conducted.

The test constructs a 90-percent confidence interval which assumes that the given area's true pay level is equal to the Nation's or to another area's. The confidence interval is constructed so that there is a 90-percent probability that the pay relative calculated from any one sample is contained within the confidence interval. If, from a single sample, a calculated pay relative falls within the confidence interval, then the pay relative is not statistically significant and the hypothesis that the area's true pay level is equal to the Nation's or to another area's is accepted. However, if the pay relative falls outside of the constructed confidence interval, then the pay relative is statistically significant at the 10-percent level. In that case, the hypothesis that the given area's pay level is equal to the pay level for the Nation or some other comparison area is rejected and one can conclude with reasonable confidence that the true pay level is different from that in the base area.

Regression models, such as the ones used in the pay relative methodology, are subject to specification error. The significance test does not measure specification error. However, care was taken to minimize this form of error by an extensive search across specifications for the model that performs best in terms of predictive accuracy. (For more details, see Maury B. Gittleman, "Pay relatives for metropolitan areas in the NCS," *Monthly Labor Review*, March 2005, pp. 46–53, on the Internet at <http://www.bls.gov/opub/mlr/2005/03/art4full.pdf>; and "Pay Relatives for U.S. Census Regions and Divisions, 2006," on the Internet at <http://www.bls.gov/opub/cwc/cm20080826ar01p1.htm>.)

### Incidence and Provisions of Benefits

The NCS collects and annually publishes data on the incidence of employer-provided benefits and on the provisions (terms) of employee benefit plans, for civilian workers (as defined by NCS), workers in private industry, and State and local government workers. The employer-provided benefits data include the following:

- Health care (medical, dental, vision, and prescription drug plan coverage, and employee and employer premiums for single coverage and family coverage) and the percentage of establishments offering health benefits;
- Retirement plan coverage (defined benefit and defined contribution) and the percent of establishments offering retirement benefits;
- Life, short-term disability, and long-term disability insurance coverage;
- Paid leave (sick, vacation, jury, personal, and family), paid holidays, unpaid family leave, and nonproduction bonuses and stock options;
- Health promotion benefits;

- Pretax benefits; and
- “Quality of life” benefits, such as long-term care insurance, a flexible-workplace option, and subsidized commuting.

In addition, NCS provides more extensive, detailed data on provisions for two major benefit areas: health insurance and retirement plans.

*Medical premiums.* Estimates of employer and employee medical premiums include participants in all medical plans, with calculations for both single and family coverage. The calculations are based, not on actual decisions regarding medical coverage made by employees within the occupations, but rather on the assumption that all employees in the occupation have identical coverage.

*Leave benefits for teachers.* Primary, secondary, and special education teachers typically have a work schedule of 37 or 38 weeks per year. Because of this work schedule, they generally are not offered vacation or holidays. In many cases, the time off during winter and spring breaks during the school year is not considered as vacation days for the purposes of this survey.

The NCS measures of employer-provided benefits are as follows:

- *Incidence of benefits.* The percent of all workers that are provided a particular benefit plan. Incidence can refer to either rates of access to, or rates of participation in, a benefit plan.
- *Provisions of benefits.* The terms of a benefit plan. For example, a medical plan might charge a \$20 copayment for a doctor’s office visit.
- *Access to a benefit.* Employees are considered to have access to a benefit if the benefit is available for their use. Access is expressed as a percentage of all workers with access.
- *Participation in a benefit plan.* Employees in contributory plans are considered as participating in an insurance or retirement plan if they have paid required contributions and fulfilled any applicable service requirements. Employees in noncontributory plans are counted as participating regardless of whether they have fulfilled the service requirements.
- *Takeup rates.* Takeup rates are the percentages of workers with access to a plan who participate in the plan. Takeup rates are computed as the number of workers participating in a plan, divided by the

number of workers with access to the plan, times 100 and rounded to the nearest 1 percent. Because the computation of takeup rates is based on the number of workers collected, rather than the rounded percentage estimates, the takeup rates in published tables may not equal the ratio of participation to access.

- *Establishment offering a benefit.* The concept of benefits “offered” currently is used in terms of the percent of all establishments that make a benefit available for use.

For a list of benefits terms used by the NCS and their definitions, see *National Compensation Survey: Glossary of Employee Benefits Terms* (published July 2010), available on the Internet at <http://www.bls.gov/ncs/ebs/glossary20092010.htm> and <http://www.bls.gov/ncs/ebs/glossary20092010.pdf>.

*Formulas used to calculate NCS estimates of benefits*

*Access.* The formula for the percentage of employees with access to a benefit area such as life insurance, for domain  $D$ , is

$$A_D = \frac{\sum_{q \in D} W'_q X_q}{\sum_{q \in D} W'_q} \times 100,$$

where

$D$  is the domain of interest,

$W'_q$  is the final quote weight for  $q$ , calculated as described in the previous section on the calculation of ECEC estimates, and

$X_q$  is 1 if the quote has access to the benefit being estimated and 0 otherwise.

*Participation.* The formula for the percentage of employees participating in a benefit area such as medical care, for domain  $D$ , is

$$I_D = \frac{\sum_{q \in D} \sum_{j \in q} W'_q P_{qj}}{\sum_{q \in D} W'_q} \times 100,$$

where

$D$  is the domain of interest,

$W'_q$  is the final quote weight for quote  $q$ ,

calculated as described in the previous section on the calculation of ECEC estimates, and

$P_{qj}$  is the percentage of workers in quote  $q$  who are participating in plan  $j$ .

Other estimates of incidence, such as the percentage of participants in a benefit area or subset of a benefit area, can be computed in a similar manner, in which the base includes only those workers who participate in the benefit. For example, to calculate the percentage of medical insurance participants in domain  $D$  participating in fee-for-service plans, a ratio is calculated such that the denominator is the same as the numerator of the previous formula and the numerator is of the same form as well, except that the summation is restricted to those participants in fee-for-service plans.

*Average (Means)*. The formula for the average flat monthly employee contribution for medical insurance, for domain  $D$ , is

$$\hat{Y}_D = \frac{\sum_{q \in D} \sum_{j \in q} W'_q Y_{qj} P_{qj}}{\sum_{q \in D} \sum_{j \in q} W'_q P_{qj}},$$

where

$D$  is the domain of interest,

$W'_q$  is the final quote weight for quote  $q$ , calculated as described in the previous section on the calculation of ECEC estimates,

$Y_{qj}$  is the average monthly employee contribution for plan  $j$  in quote  $q$ , and

$P_{qj}$  is the percentage of workers in quote  $q$  who are participating in plan  $j$ .

Other means, such as the average annual deductible for medical insurance, can be calculated by a similar formula. In all cases, the averages include only those workers with the provision.

The weighted plan employment of a record is calculated by multiplying the final benchmarked quote weight by the participation rate for only those plans in the quote that meet the specific conditions defined by the quote condition and the plan conditions. The formula is

$$\text{WPE}_{igj} = (\text{OccFW}_{ig}) \times X_{ig} \times Y_{igj} \times Z_{igj} \times P_{igj},$$

where

$i$  = establishment,

$g$  = occupation within establishment  $i$ ,

$j$  = plan in occupation  $g$  in establishment  $i$ ,

$\text{WPE}_{igj}$  = weighted plan employment of record  $igj$ ,

$\text{OccFW}_{ig}$  = final benchmarked quote weight for occupation  $g$  in establishment  $i$ ,

$X_{ig}$  = 1 if quote  $ig$  meets the condition set in the quote (row) condition

= 0 otherwise,

$Y_{igj}$  = 1 if plan  $igj$  meets the condition set in the base (denominator) plan condition

= 0 otherwise,

$Z_{igj}$  = 1 if plan  $igj$  meets the condition set in the additional (numerator) plan condition

= 0 otherwise, and

$P_{igj}$  = percent of workers in occupation  $g$  and establishment  $i$  who are participating in plan  $j$ .

### Calculation of percentiles

*Percentiles of benefit provisions* are calculated with data only from those workers with plans that include the provision. The following percentiles  $p$  are calculated: 10, 25, 50 (median), 75, and 90.

The  $p$ th percentile is the value  $Q_{igj}$ , where plan value of a quantity for a specific benefit or a subset of a benefit area, such that

- the weighted plan employment ( $\text{WPE}_{igj}$ ) across plans with a value less than  $Q_{igj}$  is less than  $p$  percent of the total weighted plan employment and
- the weighted plan employment ( $\text{WPE}_{igj}$ ) across plans with a value more than  $Q_{igj}$  is less than  $(100 - p)$  percent of the total weighted plan employment.

It is possible that there are no specific plan records  $igj$  for which both of these properties hold. This occurs when there exists a plan for which the  $\text{WPE}_{igj}$  of records whose value is less than  $Q_{igj}$  equals  $p$  percent of the total weighted plan employment. In that situation, the  $p$ th percentile is the average of  $Q_{igj}$  and the value on the record with the next-lowest value. The  $Q_{igj}$  values must be sorted in ascending order.

### *A distinction between percentiles in wage and benefits publications*

For NCS *earnings* publications, hourly earnings percentiles are computed from earnings reported for individual workers in sampled establishment jobs and their scheduled hours of work. Establishments in the survey are asked to report individual workers' earnings for each sampled job within the establishment. If the establishment reports only the average earnings of all of the workers in a sampled job, rather than the earnings of each worker in the sampled job, the job's average hourly earnings are appropriately weighted for the number of workers in the sampled job. Then the resulting average is arrayed, along with all other individual-worker earnings and occupational average earnings of sampled occupations within the establishments, from lowest to highest. Wage percentiles as a *worker characteristic*, which are published in NCS *benefits* publications, are based on an array of individual-worker hourly earnings. Estimates of benefits for a worker group's average hourly pay within six national earnings intervals are calculated from data published in the most recent issue of *National Compensation Survey: Occupational Earnings in the United States*. An example of such an estimate is "Twenty-six percent of private industry workers who receive hourly wages below the 10th percentile of the wage distribution had access to medical care benefits through their employer."

### *Use and limitations of NCS benefits data*

*Standard errors* are available for incidence estimates from 2008 onward. In 2009, NCS published its first benefits estimates that include imputed data. (See <http://www.bls.gov/ebs/> for the latest benefits news release; for more information on NCS imputation for benefits data, see "BLS Resumes Estimation of Sample Errors for Benefits Measures," *Compensation and Working Conditions Online*, May 22, 2008, on the Internet at <http://www.bls.gov/opub/cwc/cm20080520ar01p1.htm>.)

### *Examples of Use of NCS Benefits Data*

- *Planning and improving company benefits.* NCS data commonly are used as a guide when companies choose the provisions for their benefit plans. In addition, companies may improve benefit packages to remain competitive in the labor market. For example, a computer company may have a difficult time finding qualified computer engineers, or a car dealership may not be able to attract the best salesperson. Instead of simply raising the wage, many companies will enhance or add benefits.
- *Lowering turnover rates.* To attract and retain workers, employers may provide additional benefits. These prospective benefits may be traditional or emerging benefits. Employers can search NCS benefits data to evaluate benefits that employees are currently being offered nationwide.

- *Aiding collective bargaining negotiations.* Collective bargaining units go through renegotiation of their contracts at various times. The bargaining unit may want to add a new benefit, such as subsidized commuting, to an agreement. The bargaining unit and the employer can use NCS benefits data to assist them in making decisions.
- *Understanding health benefits data.* Health benefits data are broken out into average contributions for medical coverage and average plan limits. A new company can reference these averages when it selects group health plan coverage, comparing the averages with proposals that health plan companies have given the new company. An established company can compare its current premiums paid for health benefits with nationwide averages. This comparison helps the established company assess its health benefits or negotiate contracts with health benefit companies.
- *Assessing and formulating public policy.* NCS benefits data were used to design defined benefit and savings and thrift plans for Federal employees. In the debate over a universal health care system, benefits data on employee premium sharing was considered in formulating proposals. Data on the amount of retirement income from employer plans have helped to frame the debate over Social Security reform. Policymakers used NCS benefits data in drafting the Family and Medical Leave Act of 1993.
- *Researching current benefit issues.* Students, consultants, and researchers use benefits data frequently. Students may be writing a thesis or trying to identify a noteworthy item on which to focus an assignment. Consultants may be trying to recommend benefit-related actions to a company or provide supporting data to clients. Researchers sometimes want to investigate a particular issue pertaining to benefits or may focus on a few years of previous data to develop research on trends or other benefit issues.

## **Use and limitations of NCS Data**

NCS data have a variety of uses. For example, NCS data are used in economic analysis. Knowledge of levels, structures, and trends of pay rates and benefit practices is required in the analysis of current economic developments and in studies relating to wage dispersion and differentials. The NCS provides unique measurement of the labor market, in that it collects data on earnings, employer costs of compensation, and benefits under the same survey methodology and definitions, allowing employer costs to be linked to specific benefit practices.

Also, Federal, State, and local government agencies use NCS estimates in administering compensation and in the formulation of public policy on compensation. The data are of value to Federal and State mediation and conciliation services

and to State employment compensation agencies in judging the suitability of job offers. In addition, NCS data are used by government agencies to

- Evaluate benefits packages,
- Analyze contract settlements,
- Aid in collective bargaining negotiations, and
- Index Medicare payments.

NCS data are used in private industry to

- Adjust wages in long-term contracts,
- Evaluate benefit packages,
- Analyze contract settlements,
- Aid in collective bargaining negotiations,
- Guide decisions in locating businesses or plants, and
- Assist in administering wages and salaries.

In determining data to be used in contract negotiations, it is important to note that differences in bargaining status estimates (union versus nonunion estimates) may be due to factors other than union status, such as occupational and industry mix. An important consideration in choosing a series for escalation is the sampling error. (For more information, see <http://www.bls.gov/ect/escalator.htm>.)

The Employment Cost Index, a Principal Federal Economic Indicator, is the only measure of labor costs that

provides not only consistent series for compensation and for the two components of compensation—wages and benefits—but also consistent subseries by occupation and industry. The ECI is used by the Federal Reserve Board to monitor the effects of fiscal and monetary policies and to formulate those policies. It enables analysts and policymakers to assess the effects of labor cost changes on the economy, both in the aggregate and by sectors. The ECI is particularly important in studies of the relationships among prices, productivity, labor costs, and employment.

For additional information, see the subsection “Examples of Data Use” for each data product in the section **“Computations of Compensation Measures and Reliability of Estimates for All NCS Data Products.”**

For an overview, see “Earnings and Other Compensation Data at BLS: What Users Seek and What We Offer,” *Compensation and Working Conditions Online*, February 26, 2003, on the Internet at <http://www.bls.gov/opub/cwc/cm20030224ar01p1.htm>.

Although NCS compensation measures have many uses, their limitations must be kept in mind. The data are subject to sampling error, which may cause deviations from the results that would be obtained if the actual records of all establishments could be used. Nonsampling error is present in surveys as well. (See the section **“Computations of Compensation Measures and Reliability of Estimates for All NCS Data Products”** for more information.)

*Standard errors* are available for estimates of the incidence and provisions of benefit plan coverage from 2008 onward. (For more information, see “BLS Resumes Estimation of Sample Errors for Benefits Measures,” *Compensation and Working Conditions Online*, May 22, 2008, on the Internet at <http://www.bls.gov/opub/cwc/cm20080520ar01p1.htm>.)

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# Appendix: Major Work Stoppages Program

The Bureau compiles data on work stoppages—strikes or lockouts—involving 1,000 or more workers for at least a full day or shift. Such data have been collected since 1947, with detailed information available since 1993. Detailed work stoppages data include monthly and annual listings of companies and governments involved in a work stoppage, along with the name of the union involved in the dispute, the location of the stoppage, the North American Industry Classification System (NAICS) code, the beginning and ending dates of the dispute, the number of workers idled by the stoppage, the number of days of idleness during the reference month, and the cumulative number of days of idleness from the beginning of the work stoppage.

## *Definitions and methods*

A *work stoppage* is a strike or lockout. Because of the complexity of most labor-management disputes, BLS makes no attempt to distinguish between strikes and lockouts in its statistics. A strike is a temporary stoppage of work by a group of employees to express a grievance, enforce a demand, or protest the terms, conditions, or provisions of a contract. A lockout is a temporary withholding or denial of employment by management, typically during a labor dispute. The group of employees involved in a strike or lockout may or may not be members of a union.

The *number of workers* involved includes all workers made idle for one shift or longer in establishments directly involved in a stoppage. Workers involved include those who initiate the strike, as well as others in the establishment who honor picket lines or are idled because the facility is closed down. This number does not account for secondary idleness—that is, the effects of a stoppage on other establishments or industries whose employees may be made idle as a result of shortages of material or services.

The *number of days of idleness* is computed by multiplying the number of workers idled during the period by the number of workdays lost, based on a 5-day workweek (Monday through Friday), excluding Federal holidays. The cumulative

number of days of idleness also is computed for each work stoppage beyond the beginning reference month.

## *Sources of information*

Information on work stoppages is obtained from reports from the Federal Mediation and Conciliation Service, State labor market information offices, BLS Strike Reports from the Office of Employment and Unemployment Statistics, and media sources. One or both parties involved in the work stoppage (employer, union, or other organization) is contacted to verify the duration and number of workers idled by the stoppage.

## *Availability of data*

Data for the major work stoppages series are uninterrupted and date back to 1947. For statistics on monthly and annual work stoppages and detailed monthly data since 1993, see <http://www.bls.gov/wsp/>. Monthly detailed data include both monthly and cumulative totals for each work stoppage, as well as the number of stoppages beginning and in effect during the month. Annual data present the cumulative totals for the calendar year. You may obtain a searchable worksheet containing data on major work stoppages from 1993 to the present by sending an e-mail request to [WorkStoppagesInfo@bls.gov](mailto:WorkStoppagesInfo@bls.gov).

From 1947 to 2007, the Bureau of Labor Statistics had acted under the mandate of the Taft-Hartley Act to solicit collective bargaining agreements and make them available in a publicly accessible file. In September 2007, responsibility for the maintenance of collective bargaining agreements and for the continued collection of these agreements was officially moved to the U.S. Department of Labor, Office of Labor-Management Standards. (For more information, see “Collective Bargaining Agreements File Moves to New Home,” *Compensation and Working Conditions Online*, November 30, 2007, on the Internet at <http://www.bls.gov/opub/cwc/cb20071128ar01p1.htm>.)