

Chapter 8

National Compensation Measures

The U.S. Bureau of Labor Statistics (BLS, the Bureau) 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:

- 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>

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. Until 2011, the NCS collected data on employee compensation from a large sample of establishments providing data on about 800 detailed occupations in more than 150 local areas.

The NCS data are used to set pay levels of some federal workers. With the enactment of the 2011 federal budget, the Locality Pay Survey (LPS) portion of the NCS was eliminated. Occupational data by locality will still be available through the Occupational Employment Statistics (OES) program. To continue to meet the requirement of the Federal Employees Pay Comparability Act of 1990, data from the OES and NCS programs will be used collaboratively. The OES program will provide wage data by occupation for all localities nationwide;

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the NCS will provide data by detailed worker characteristics, such as work levels, union status, and part-time or full-time work schedules.¹

Description

The NCS is an establishment-based survey that provides comprehensive measures of (1) employer costs for employee compensation, (2) compensation trends, and (3) the incidence of employer-provided benefits among workers. The NCS also collects data on provisions of selected employer-provided benefit plans. The Employment Cost Index (ECI)—a Principal Federal Economic Indicator—is estimated from data collected by the NCS.

The NCS includes establishments with one or more workers in private industry and in state and local government, in the 50 States and the District of Columbia. All workers covered by the survey are referred to by the NCS as *civilian workers*. Major exclusions from the

¹For the history of how BLS occupational wage surveys were used for federal pay comparability, see John E. Buckley, “Fifty Years of BLS surveys on Federal employees’ pay,” *Monthly Labor Review*, September 2009, pp. 36–46, <http://www.bls.gov/opub/mlr/2009/09/art3full.pdf>. For information on historical NCS publications, link to [Occupational Employment Statistics](#), [Employment Cost Index](#), [Employment Cost Trends](#), and [NCS Benefits](#).

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 those working overseas. The NCS also excludes individuals who set their own pay (e.g., proprietors, owners, major stockholders, and partners in unincorporated firms) and family members paid token wages.

Sample Design and Sampling Procedures

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 “[Calculation and Reliability of the Estimates](#).”

In February 2011, the Bureau began implementing a change to the LPS component of the NCS; the component is used to produce annual occupational earnings data for the nation, each Census division, and selected geographic areas. When this change is fully implemented, a modeling technique that combines the national data from the NCS with the locality data from the OES survey will be used to produce these occupational earnings estimates. All other data estimates computed with the use of NCS data, including the ECI, Employer Costs for Employee Compensation (ECEC), and various measures of access and participation in employer-provided benefits, will continue to be produced. With the elimination of a need to produce locality estimates directly from the NCS sample, a more efficient nationally based sample design is being introduced. This new sample design, which began with collection in June 2012 and is expected to be completely phased in with the December 2016 estimates, eliminates the current stage 1 process of selecting geographic areas. (For more information on the new sample design, see Gwyn R. Ferguson, Joan L. Coleman, and Chester H. Ponikowski, “Update on the evaluation of sample design issues in the National Compensation Survey,” paper presented at the Joint Statistical Meetings of the American Statistical Association, Alexandria, VA, August 31, 2011, www.bls.gov/osmr/pdf/st110230.pdf.)

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.² The paragraphs that follow describe, in general terms, the methods by which the NCS selects area samples.

² See the topic “Area sample selection” in the section titled “[Technical References](#)” at the end of this chapter for references regarding the research and the decisionmaking process by which the current NCS sample frame was created.

In 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; smaller areas represent themselves 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-Proportional-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, the 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 certain 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 CBSA.

To keep NCS products representative of the areas surveyed, the 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 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.

The NCS converted the state and local government sample of *index establishments* to the December 2003 OMB area definitions in December 2007. The NCS began to convert 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

establishments are given in detail in the section titled “[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.³

Selecting establishments (Stage 2)

In stage 2, the NCS uses the 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.

With some minor exceptions, an *establishment* is 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 establishment selected for the sample 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 to define industries and classify 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 organization in North America. In selecting

new establishment samples, the 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, however, the change from the 2002 NAICS to the 2007 NAICS had little effect on the resulting NCS estimates.⁴

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 establishment sample is reselected each year. The private industry 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.

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 in the number of employees. The NCS replaced its state and local government index–establishment sample in its entirety in December 2007, using the 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, the NCS used the 2007 NAICS to stratify the sampling frame in order to introduce panels of new private industry establishments from newly selected areas based on the December 2003 OMB area definitions. Currently, the NCS is transitioning to the 2012 NAICS.

³ For more information, see Jason Tahonica, Lawrence R. Ernst, and Chester H. Ponikowski, “Phase-in of the Redesigned National Compensation Survey Area Sample,” paper presented at the American Statistical Association Section on Survey Research Methods, Alexandria, VA, August 2005, <https://www.amstat.org/sections/srms/Proceedings/y2005/Files/JSM2005-000156.pdf>; for a list of current and historical OMB area definitions, see “Metropolitan and Micropolitan: Metropolitan and Micropolitan Statistical Areas Main” (U.S. Census Bureau, May 2012), <https://www.census.gov/population/www/metroareas/metrodef.html>.

⁴ For more information about the differences between the 2002 NAICS and the 2007 NAICS, see “North American Industry Classification: Introduction to NAICS” (U.S. Census Bureau), <http://www.census.gov/epcd/naics07>.

Probability sampling 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 titled “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 and Housing, to classify jobs in the survey’s selection and publication of occupational data. The NCS phased in the use of Standard Occupational Classification (SOC) codes over several years. The survey first published ECEC estimates using SOC codes in March 2004, the ECI in March 2006, and NCS benefits publications in March of 2007. The survey 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) began in September 2010. The 2010 SOC system contains 840 detailed occupations, aggregated into 461 broad occupations.⁵ The first NCS publication to use SOC 2010 was the March 2011 ECI release.

Data Collection

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

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

⁵For more information on SOC 2010, see “Standard Occupational Classification” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/SOC>.

- *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 requested and uses it to determine the number of points ascribed to 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.⁶
- *How many hours does the employee work?* The field economist collects data on the usual work schedule of each sampled, matched occupation. This information helps to determine the employee’s hourly, weekly, and annual earnings, as well as the employer’s cost of benefits.
- *What types of benefits do the employees receive?* The field economist gathers data on the availability to the worker and cost to the employer of 18 selected benefits that the employer may offer to the worker in each sampled, matched job. The field economist collects summary plan descriptions 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 descriptions are analyzed to generate 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. From each establishment, the NCS collects data on wages, the cost of benefits, and the incidence and provisions of benefits. These data are used to produce ECI, ECEC, and NCS estimates of benefits. Although initial data collection occurs at any time of the year, ECI and ECEC updates are conducted over a 6-week timeframe 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—March 2012” contains data collected for the pay period that included March 12, 2012, from each employer scheduled for an ECI update. The publication date of the news release was April, 27, 2012.⁷ The news release “Employer Costs for Employee Compensation—March 2012” contains data collected for the same pay period—in this example, the pay period that included March 12, 2012; however, its publication date was June 7, 2012.⁸ The ECEC publication dates are 3 months after the reference month, the ECI publication dates 1 month after the reference month.

⁶For more information on pay factors and work levels, see “National Compensation Survey: Guide for Evaluating Your Firm’s Jobs and Pay” (U.S. Bureau of Labor Statistics, October 2003), <http://www.bls.gov/ncs/ocs/sp/ncbr0004.pdf>.

⁷Visit <http://www.bls.gov/news.release/pdf/eci.pdf> for the most recent ECI news release.

⁸Visit <http://www.bls.gov/news.release/pdf/ecec.pdf> for the most recent ECEC news release.

Each March of the collection cycle, the NCS collects *benefits incidence and key provisions data* from establishments contacted for survey updates that quarter. The March data are published in the summer or fall of the same year.⁹

NCS *detailed benefits provisions data* typically are collected from establishments at initiation visits over approximately 18 months and are published the next year.¹⁰

Occupational Selection and Classification

The NCS collects data on workers who are employed by the sampled establishment. Persons working onsite at a surveyed establishment, but paid by a contractor, are not included in data collection from the establishment, unless the contractor is part of the sample, in which case the NCS collects data on employees of the contractor 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.

The number of workers in an 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 issues their paychecks.

In sampling *jobs* at an establishment, BLS field economists use a method that ensures a random sample. 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, 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 as working 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 who 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 “[Sample Design and Sampling Procedures](#).” Stage 3, occupational selection and classifica-

tion, 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. Identification of attributes of the worker in the occupation, such as full-time or part-time status, union or non-union status, and whether the worker is paid on a time or incentive basis
4. Identification of the work level of each occupation

Selection of 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 PSO technique to randomly select the jobs to be sampled. The number of jobs selected 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 336411—for which up to 32 jobs may be selected.

Classification of 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.

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 group 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 the major group Health Care Practitioner and Technical Occupations (code 29-0000).¹¹ In the NCS, occupations can fall into any of 22 major groups; only the major group 23 (SOC code 55-0000), military specific occupations, is excluded.

⁹See, for example, *National Compensation Survey: Employee Benefits in the United States, March 2011*, Bulletin 2771 (U.S. Bureau of Labor Statistics, September 2011), <http://www.bls.gov/ncs/eps/benefits/2011/ebb10048.pdf>.

¹⁰See, for example, *National Compensation Survey: Health Plan Provisions in State and Local Government in the United States, 2011*, Bulletin 2772 (U.S. Bureau of Labor Statistics, March 2012), <http://www.bls.gov/ncs/eps/detailedprovisions/2011/ebb10049.pdf>.

¹¹See the entire list of SOC occupational categories in “Standard Occupational Classification” (U.S. Bureau of Labor Statistics, November 18, 2010), <http://www.bls.gov/soc/home.htm>.

Identification of occupational attributes of the worker. In step 3, the field economist records specific attributes of the worker in the sampled job, for each selected occupation. Each such 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 the NCS, are as follows:

- *Full-time or 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 or part-time status is not determined by the number of hours worked, but is based instead on the establishment's definition of those terms.
- *Time-based or 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 based at least partially on productivity payments, such as piece rates, commissions, and production bonuses.
- *Union or 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 who satisfies all of the following conditions: 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 of points ascribed to pay factors 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 impact, 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
- Pilots and Air Transportation

The job is assigned points for the highest level at which all requirements are met. The 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*.

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 that of the workers they supervise are classified with the workers they supervise.¹²

¹²"Standard Occupational Classification: Standard Occupational Classification (SOC) User Guide" (U.S. Bureau of Labor Statistics, March 25, 2011), Classification Principles, #3, <http://www.bls.gov/soc/socguide.htm>.

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 whereas second-line supervisors typically direct the actions of their subordinates through first-line supervisors. The 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 who 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.¹³

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 the scope of the survey or may have gone out of business. To address the problems of nonresponse and missing data, the NCS adjusts the weights of the remaining establishments and imputes missing values, to ensure that published compensation estimates ultimately are representative of compensation in the civilian, private industry, and state and local government sectors. 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 describes the current imputation and benchmarking methods.¹⁴

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. An establishment is considered *nonresponding* if it provided neither earnings, occupational classification, worker attributes, nor 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 and had an employment of 350 workers, the NCS would adjust the weights of responding manufacturing establishments with 250–499 workers by a nonresponse factor 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 that had provided data at initiation, 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; the 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 estimates other than benefits estimates, earnings data are not imputed for item nonresponse during the establishment's initial data collection but are 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, the NCS would not use *any* of

¹³For a complete description of point-factor leveling and the determination of supervisory levels, see *National Compensation Survey: Guide for Evaluating Your Firm's Jobs and Pay* (U.S. Bureau of Labor Statistics, October 2003), <http://www.bls.gov/ncs/ocs/sp/ncbr0004.pdf>.

¹⁴For more information on these and other changes in NCS methodology with respect to NCS wage products, see James E. Smith and Robert W. Van Giezen, "Compensation and Working Conditions: Change Comes to the National Compensation Survey Locality Wage Bulletins" (U.S. Bureau of Labor Statistics, January 24, 2007), <http://www.bls.gov/opub/cwc/cm20070122ar01p1.htm>. For more information on these changes with respect to the ECI, see "Employment Cost Trends: Change Has Come to the ECI" (U.S. Bureau of Labor Statistics, May 12, 2006), <http://www.bls.gov/ncs/ect/ecsm0001.htm>, and with respect to BLS publications on benefits, see "Employee Benefits Survey: Change to the NCS Benefits Products" (U.S. Bureau of Labor Statistics, April 14, 2008), <http://www.bls.gov/ncs/ebs/ebsm0005.htm>.

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, the 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 data for 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 at the time of sampling. The benchmark process updates those weights on the basis of current employment. Benchmarking ensures that survey estimates reflect the most current industry–government (hereafter, ownership) employment counts in proportions consistent with the private industry, state government, and local government sectors. For example, assume 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. 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 the service sectors of state and local government. Then, if the NCS did not benchmark, the sample would underrepresent current employment in the private industry service sector. In this example, the NCS would adjust the sample weights of the 40 service sector firms in private industry to ensure that the number of workers in the sampling frame rises to 210,000. The ownership employment counts for the private industry service sector would then reflect the current proportions of 84 percent for private industry, 12 percent for local government, and 4 percent for state government employment.

The benchmark calculation is essentially the same for all NCS data products; however, the *input* to the 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.¹⁵

Before December 2006, the ECEC used only QCEW employment counts for benchmarking; starting with the quarter including December 2006, 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 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 same two BLS programs as well. The NCS continues to use employment counts from the most recent QCEW data to benchmark estimates of detailed NCS benefits provisions.¹⁶

In NCS publications on benefits data, 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 the scope of the survey 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.

Calculation and Reliability of the Estimates

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; the 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 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 of interest. 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

¹⁵ See “Occupational Employment Statistics” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/oes>.

¹⁶ For more information on ECEC benchmarking, see “Changes in Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007” (Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/sp/ececcalc.pdf>.

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 is 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 less 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.¹⁷

The ECI, ECEC, and benefits publications all use some variation of *balanced repeated replication* (BRR), a methodology employed 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 that each contain exactly one variance PSU from each variance stratum. Choices are not random, but are 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.

Percent relative standard error data are provided alongside estimates in NCS ECEC publications, which 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 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; and values prevalent in the recent past 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, the staff designates 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 of the methods for calculating the reliability of those estimates:

Employment Cost Index (ECI) series

Employer Costs for Employee Compensation (ECEC) series

Incidence and provisions of benefits

ECI series

The ECI is a measure of the change in the cost of labor, independent of 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. For all of these categories, the ECI calculates the same indexes by occupational group, worker attribute, 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;

¹⁷ See “National Compensation Survey” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs>.

supplemental pay—premium pay for work done in addition to that performed during 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.

As mentioned earlier, the ECI is a Principal Federal Economic Indicator.¹⁸

Computation of ECI 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 of changes in total compensation (the latter defined by the NCS as the sum of changes in wages and benefits) are calculated in essentially the same manner.

An index number 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 government 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 (58×9) private industry occupational cells and 234 ($13 \times 9 \times 2$) state and local government industry occupational cells, for a total of 756 ECI basic cells.

For each basic cell, a base-period wage bill (W_0) 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

$$I_t = \frac{\sum (W_{0,i} M_{t,i})}{\sum W_{0,i}} \times 100,$$

¹⁸Principal Federal Economic Indicators are the major statistical series that describe the current condition of the economy. For more details, see OMB Statistical Policy Directive No. 3, in the *Federal Register*, September 25, 1985, <http://www.bea.gov/about/pdf/federalregister09251985.pdf>.

where

I_t is the index at period t ,

$W_{0,i}$ is the estimated base-period wage bill for the i th cell, and

$M_{t,i}$ 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 the preceding equation, $W_{0,i}$, the wage bill, is the product of the average wage of workers in the cell at the base period (0) and the number of workers represented by the cell. For the ECI, the number of workers represented by the cell is held fixed. Also, in essence, $M_{t,i}$ projects the base-period average wage level for the cell forward to the current quarter.

Note that $M_{t,i}$ 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 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 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.

Computation of the index for a calendar quarter involves five principal steps:

1. Sampled occupation (i.e., 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 (i.e., 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 percent wage change in the cell since the base period.
3. The measure of cumulative percent wage change is multiplied by the base-period wage bill ($W_{0,i}$) to generate an estimate of the current-quarter wage bill for the cell.
4. 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 ($\sum W_{0,i} M_{t,i}$) is divided by the summed base-period wage bill ($\sum W_{0,i}$). The result, multiplied by 100, is the current-quarter index (I_t), which is then 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.

Some caution is warranted in calculating the indexes for private industry nursing care facilities. 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 623, nursing and residential care facilities. The basic-cell cost weights for nursing care facilities were constructed after the basic-cell fixed weights for group 623 were computed and prepared for use in the index computation system. Consequently, the fixed weights for the four-digit industry were not directly constructed as linear disaggregates of NAICS group 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 indexes differ from those of the national wage indexes because the sample is not large enough to hold the wage bills constant at the level of detail of the former indexes. For these indexes, the prevailing distribution in the sample (e.g., between union and nonunion attributes within each ownership–industry–occupation cell) is used to apportion the previous-quarter wage bill in that cell (e.g., between the union and nonunion indexes) each quarter. The portion of the wage bill assigned to the union index is then moved by the percent change in the union wages in the cell, and similarly for the nonunion index. Therefore, the relative employment of the union index in each cell is not held constant over time. Because the weights of the region, union, and time-paid

workers indexes are allowed to vary over time, these indexes are not strictly comparable to the aggregate, industry, and occupation indexes.

Keeping the index current

For a fixed-weighted index to remain economically relevant over a span of periods, it is necessary to make changes to the computations of the indexes on occasion. 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 from June 1989 = 100 to December 2005 = 100.
- New fixed employment weights were introduced, using 2002 employment counts from the OES survey.¹⁹
- The BLS classification of industries was changed from the SIC system to the 2002 NAICS.
- The BLS occupational classification was changed from the OCS to the 2000 SOC.
- Imputation methods were changed.²⁰

In August 2007, the NCS introduced the 2007 NAICS, which, overall, had little effect on NCS estimates.

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.²¹

Reliability of the ECI estimates

To assist users in ascertaining the reliability of indexes, standard errors for all ECI estimates (excluding seasonally adjusted series) are available on the BLS website.²²

Publication of the ECI 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 characteristics. More than 400 unique indexes and their associated quarterly and 12-month changes in employers’ costs are published quarterly. Seasonally adjusted indexes are published as well.

In 2008, ECI estimates were published for 14 selected metropolitan areas for the first time; they are now published quarterly. A 15th metropolitan area was added in 2009. Metropolitan area data are limited to estimates of total

¹⁹ See Stephanie L. Costo, "Introducing 2002 weights for the Employment Cost Index," April 2006, pp. 28–32, <http://www.bls.gov/opub/mlr/2006/04/art5full.pdf>.

²⁰ See Song Yi, "Accounting for missing data in the Employment Cost Index," *Monthly Labor Review*, April 2006, pp. 22–27, <http://www.bls.gov/opub/mlr/2006/04/art4full.pdf>.

²¹ See the subsection “Publication of index series”; for more information on all the changes, see “Employment Cost Trends: Change Has Come to the ECI” (U.S. Bureau of Labor Statistics, July 14, 2006), <http://www.bls.gov/nce/ect/sp/ecs0001.htm>.

²² See “Employment Cost Trends” (U.S. Bureau of Labor Statistics, October 26, 2009), <http://www.bls.gov/ect/ectvar.htm>, published shortly after publication of the news release.

compensation and of 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.²³

Historical current-dollar ECI series that use industry categories based on SIC and that classify jobs into occupational classifications according to OCS are available beginning with the first publication of each series through December 2005.²⁴ ECI current-dollar series based on the 2002 and 2007 NAICS and the 2000 SOC also are available beginning March 2001, with December 2005 = 100 as the base period.²⁵

Historical constant-dollar ECI series also are available. The constant-dollar ECI measures trends in compensation, adjusted for changes in consumer prices as measured by the CPI. The *CPI-U, U.S. City Average, All Items* is used to adjust all ECI series except for the regional ECI series, which are adjusted by the corresponding CPI regional indexes. ECI constant-dollar series based on the 2002 and 2007 NAICS and the 2000 SOC are available beginning with March 2001 data, with December 2005 = 100 as the base period.²⁶ Historical constant-dollar ECI series that use industry categories based on the SIC and that classify occupations according to the OCS also are available, dating from the first publication of each series through December 2005.²⁷ Seasonally adjusted constant-dollar ECI series are not available.

A historical listing that uses December 2005 = 100 as the base period is available for all continuous ECI occupational and industry series that existed before the March 2006 revisions and continued afterwards.²⁸

²³ For available data, see “Employment Cost Trends” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ect>, as well as news releases, for each of the 15 local areas. (For additional information, see Albert E. Schwenk, “BLS Introduces New Employment Cost Indexes for 14 Metropolitan Areas” (U.S. Bureau of Labor Statistics, September 24, 2008), <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. The Census regions and divisions are as follows:

Northeast region: New England division—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; Middle Atlantic division—New Jersey, New York, Pennsylvania. Midwest region: East North Central division—Illinois, Indiana, Michigan, Ohio, Wisconsin; West North Central division—Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. South region: South Atlantic division—Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia; East South Central division—Alabama, Kentucky, Mississippi, Tennessee; West South Central division—Arkansas, Louisiana, Oklahoma, Texas. West region: Mountain division—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming; Pacific division—Alaska, California, Hawaii, Oregon, Washington.

²⁴ See *Employment Cost Index: Historical Listing, Current-dollar, 1975–2005* (U.S. Bureau of Labor Statistics, May 10, 2006), <http://www.bls.gov/web/echistry.pdf>.

²⁵ See, for example, *Employment Cost Index Historical Listing—Volume III* (U.S. Bureau of Labor Statistics, January 2013), <http://www.bls.gov/web/echistrynaics.pdf>.

²⁶ See, for example, *Employment Cost Index Historical Listing—Volume IV* (U.S. Bureau of Labor Statistics, January 2013), <http://www.bls.gov/web/econstnaics.pdf>.

²⁷ See, for example, *Employment Cost Index Historical Listing—Volume II* (U.S. Bureau of Labor Statistics, January 2013), <http://www.bls.gov/web/econst.pdf>.

²⁸ See, for example, *Employment Cost Index Historical Listing—Volume V* (U.S. Bureau of Labor Statistics, January 2013), <http://www.bls.gov/web/ecicois.pdf>.

Data from the ECI that provide 12-month percent changes in employer costs for health insurance in private industry also are available, from March 1982 to the present.²⁹

Seasonal adjustment

Over the course of a year, rates of change in the cost of wages and benefits, as measured in the 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. As 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 typically are 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 changes in data exclusive of seasonal effects. Economists and other researchers are particularly interested in observing cyclical and long-run movements of economic series so that they can 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 staff of the Statistical Research Division of the U.S. Census Bureau. The X-12 ARIMA program includes enhancements to both the X-11 variant of the Census Method II seasonal adjustment program and 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 website. Revisions of seasonally adjusted indexes and 3-month percent changes for the most recent 5 years also are published on that site.

ECI series are seasonally adjusted by either a direct or an indirect method. In the direct method, an original, or unadjusted, index is divided by its seasonal factor. In the indirect method (also called composite seasonal adjustment),

²⁹ See, for example, *Employment Cost Index: Health Benefits* (U.S. Bureau of Labor Statistics, January 2013), <http://www.bls.gov/ect/sp/echealth.pdf>. Note that official ECI series—those designated for use by agencies of the federal government—are based on SIC and OCS through December 2005 and on NAICS and SOC from March 2006 forward.

the seasonally adjusted index is calculated as a weighted sum of seasonally adjusted index components.³⁰

More information on ECI data

The ECI has been designated a Principal Federal Economic Indicator by the Office of Management and Budget. It provides a measure of labor costs that has continuous series on wages and salaries and on total compensation, as well as subseries by occupational and industry group. 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 sector. The ECI is particularly important in studies of the relationships among prices, productivity, labor costs, and employment. The index also is used to determine increases in Medicare payments to hospitals and doctors and as a labor cost escalator in long-term contracts.

In identifying 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 the occupational and industry mix. An important consideration in choosing a series for escalation is the sampling error.³¹

Examples of ECI data uses

- *Federal pay adjustments.* The ECI is used to determine white-collar³² 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, beginning with Fiscal Year 2007.³³ 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

³⁰For more information about seasonal adjustment issues, see E. Raphael Branch, James A. Buszuwski, Albert E. Schwenk, and Mark Gough, “Transitional Employment Cost Indexes for seasonal adjustment,” *Monthly Labor Review*, April 2008, pp. 25–39, <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 E. Raphael Branch and Lowell Mason, “Seasonal adjustment in the ECI and the conversion to NAICS and SOC,” *Monthly Labor Review*, April 2006, pp. 12–21, <http://www.bls.gov/opub/mlr/2006/04/art3full.pdf>. Also informative is E. Raphael Branch, “Changes in the publication of seasonally adjusted Employment Cost Index series,” *Monthly Labor Review*, March 2013, pp. 68–85, <http://www.bls.gov/opub/mlr/2013/03/art5full.pdf>.

³¹For more information on choosing a series for escalation, see “Employment Cost Trends: How to Use the Employment Cost Index for Escalation” (U.S. Bureau of Labor Statistics, June 17, 2008, <http://www.bls.gov/ect/escalator.htm>). For information on how to update wage data from any source to the most recent quarter, see Wayne M. Shelly, “Aging Wage Survey Data Using the Employment Cost Index” (U.S. Bureau of Labor Statistics, January 29, 2008), <http://www.bls.gov/opub/cwc/cm20080122ar01p1.htm>.

³²With the switch to the new occupation (SOC) and industry (NAICS) classification systems, the Bureau of Labor Statistics no longer uses the term “white collar.” In its place is the designation “professional and related.”

³³Section 602 of the Fiscal Year 2004 National Defense Authorization Act, P.L. 108-136, November 24, 2003, and 117 Stat. 1498, amending 37 USC 1009.

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 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.

- *U.S. 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 Department of Defense uses both the wages and salaries cost series and the benefits costs series as escalation factors in numerous defense contracts, including contracts for computer research, and the Environmental Protection Agency uses the series “total compensation for professional and related workers” as the designated cost escalator in a number of 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.³⁴
- *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 state 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 the contract.

³⁴For more information, see “The Employment Cost Index and the Impact on Medicare Reimbursements” (U.S. Bureau of Labor Statistics), http://www.bls.gov/ncs/ect/medicare2008_impact.pdf.

- *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.

ECEC series

The ECEC series measures the average cost to employers for wages and salaries, and for benefits, per employee hour worked. As mentioned earlier, the series provides quarterly data on employer costs per hour worked for total compensation, wages and salaries, total benefits, and the following 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 employment 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 QCEW and the CES. Combined, these programs provide the appropriate industry coverage and currency of data needed to benchmark all the ECEC series. All other NCS data products are benchmarked with QCEW data only.³⁵

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, the employment weights associated with more detailed industrial categories are used. Among such categories are the four-digit NAICS categories elementary and secondary schools (6111), junior colleges (6122), and colleges and universities (6133), and the six-digit NAICS category aircraft manufacturing (336411). For state and local governments, a more aggregated level reflecting the level of detail published by the CES program is typically used.

³⁵For more information, see "Changes in Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007" (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/sp/ececcalc.pdf>.

For private and government establishments, employment data were apportioned on the basis of the sampling weights assigned to the 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.³⁶ The first historical listing covers data for the March reference periods from 1986 to 2001. These data use the SIC and OCS 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 SIC and OCS. The final listing includes data from March 2004 to the current reference period. These data are based on NAICS and SOC. Beginning with the quarter including March 2004, historical data based on NAICS and on SOC 2000 became available. The new historical tables are available on request.³⁷

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, benefit groups (such as paid leave), combinations of benefits, total benefits, and total compensation (total wages plus total benefits).

The ECEC estimates of percentage of total compensation are calculated from cost aggregates and then rounded to the first decimal place. This method provides the most precise estimates of the percentage of total compensation; estimates calculated from published cost estimates may differ slightly from those calculated from unpublished cost aggregates.

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

$$\hat{Y}_{cD} = \frac{\sum_{q \in D} W_q' \hat{Y}_{cq}}{\sum_{q \in D} W_q'}$$

where

D is the domain of interest,

W_q' is the final quote weight for quote q , calculated as the product of the inverse of the selection probabilities at each stage of sampling, with one additional factor included to account for changes in the employment distribution, and

³⁶See "Employment Cost Trends" (U.S. Bureau of Labor Statistics), section titled "ECEC Listings," <http://www.bls.gov/ect/#tables>.

³⁷See also "Employment Cost Trends" (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/home.htm>.) Information on how costs are calculated appears in Albert E. Schwenk, "Measuring Trends in the Structure and Levels of Employer Costs for Employee Compensation," *Compensation and Working Conditions*, summer 1997, pp. 3–14, <http://www.bls.gov/opub/cwc/archive/summer1997art1.pdf>.

\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 .

More information on ECEC data

Differences in the estimates for 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. In contrast, professional and administrative support occupations (including teachers) account for two-thirds of the state and local government workforce but less than one-half of private industry.³⁸

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 ECI.³⁹

³⁸A detailed examination of differences in compensation levels and trends between private industry and state and local government is found in Bradley R. Braden and Stephanie L. Hyland, "Cost of employee compensation in public and private sectors," *Monthly Labor Review*, May 1993, pp. 14–21, <http://www.bls.gov/opub/mlr/1993/05/art2full.pdf>, and in Albert E. Schwenk, "Compensation Cost Trends in Private Industry and State and Local Governments," *Compensation and Working Conditions*, fall 1999, pp. 13–18, <http://www.bls.gov/opub/cwc/archive/fall1999art2.pdf>.

For more information on the ECEC calculation procedure, see "Changes in Variance Estimation Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007" (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/sp/ececvmet.pdf>.

Relative standard errors for all estimates are available to users. (See "Employment Cost Trends" (U.S. Bureau of Labor Statistics), section titled "ECT Databases," <http://www.bls.gov/ncs/ect/#tables>), published 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 Martha A. C. Walker and Bruce J. Bergman, "Analyzing Year-to-Year Changes in Employer Costs for Employee Compensation," *Compensation and Working Conditions*, spring 1998, pp. 17–27, <http://www.bls.gov/opub/cwc/archive/spring1998art3.pdf>. This article supplements Michael K. Lettau, Mark A. Loewenstein, and Aaron T. Cushner, "Explaining the Differential Growth Rates of the ECI and the ECEC," *Compensation and Working Conditions*, summer 1997, pp. 15–23, <http://www.bls.gov/opub/cwc/archive/summer1997art2.pdf>, which examines how differences in the construction of these measures contribute to differing trends.

³⁹For a description, see Song Yi, "Accounting for missing data in the Employment Cost Index," *Monthly Labor Review*, April 2006, pp. 22–27, <http://www.bls.gov/opub/mlr/2006/04/art4full.pdf>.

An example of ECEC data use

• *Costs associated with employee compensation.* The International Union of United Automobile, Aerospace and Agricultural Implement Workers of America, also known as the United Auto Workers (UAW), has posted tables using ECEC data on its website. The data are given in "The Union Advantage—September 2010: 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.⁴⁰

Incidence and Provisions of Benefits

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

- Health care (medical, dental, vision, and prescription drug plan coverage, and employee and employer premiums for individual coverage and family coverage) and the percentage of establishments offering health benefits;
- Retirement plan coverage (defined benefit and defined contribution) and the percentage of establishments offering retirement benefits;
- Life, short-term disability, and long-term disability insurance coverage;
- Paid leave (sick, vacation, jury duty, 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, the NCS publishes detailed provisions of coverage in two major benefit areas: health insurance and retirement plans. A basic set of tables listing detailed provisions of these plans is published annually, with additional tables published on a rotating basis. Health data include medical plan provisions, such as deductibles, coinsurance, and out-of-pocket maximums, as well as details of dental, vision, and prescription drug benefits. Provisions of defined benefit and defined contribution retirement plans, such as eligibility requirements and benefit formulas, also are published.

⁴⁰Visit <http://www.uaw.org/sites/default/files/unionadvantage0910.pdf>. Note: Links to non-BLS websites are provided for the reader's convenience and do not constitute an endorsement.

Medical premiums. Estimates of employer and employee medical premiums are for participants in all medical plans, with calculations for both individual and family coverage. The calculations are based on the assumption that all employees in the occupation have identical coverage, rather than on actual decisions regarding medical coverage made by employees within the occupations.

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 schedule, they generally are not offered paid vacation or holidays. In many cases, time off during winter and spring breaks during the school year is not considered paid vacation days for the purposes of this survey.

The NCS measures of employer-provided benefits are as follows:⁴¹

- *Incidence of benefits.* The percentage of all workers who are provided a particular benefit plan. The incidence can be either a rate of access to, or a rate 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 plan.* Employees are considered to have access to a benefit plan if the plan is available for their use.
- *Participation in a benefit plan.* Employees in contributory plans are deemed to be 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 whole percentage. Because the computation of takeup rates is based on the number of workers, rather than the rounded percentages, the takeup rates in published tables may differ slightly from the ratio of participation to access.
- *Establishments offering a benefit.* The percentage of establishments (instead of employees, as in the majority of benefits tables) offering a given benefit.

Formula used to calculate NCS estimates of access to benefits. The formula for the percentage of employees with access to a benefit area, such as life insurance, for domain D is

⁴¹ For a list of NCS terms and definitions pertaining to benefits, see *National Compensation Survey: Glossary of Employee Benefits Terms* (U.S. Bureau of Labor Statistics, July 2012), <http://www.bls.gov/ncs/ebs/glossary20112012.htm> and <http://www.bls.gov/ncs/ebs/glossary20112012.pdf>.

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

where

D is the domain of interest,

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

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

Incidence (participation). The formula for the incidence, or 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 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 in a subset of a benefit area, can be computed in a similar manner, such that the base includes only those workers who participate in the benefit. For example, to calculate the percentage of medical insurance participants in fee-for-service plans in domain D , a ratio is calculated such that the denominator is the same as the numerator in 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 (mean). The formula for the average flat monthly employee contribution for medical insurance for domain D is

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

where

D is the domain of interest,

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

Y_{qj} is the average monthly employee contribution to plan j by workers 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 in question.

The weighted count of workers participating in plans offered to workers in the sampled occupation and establishment 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

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

where

i = establishment,

g = occupation within establishment i ,

j = plan in occupation g within establishment i ,

WPE_{igj} = weighted plan employment of record igj ,

OccFW_{ig} = final benchmarked quote weight for occupation g in establishment i ,

X_{ig} , Y_{igj} , and Z_{igj} are dummy variables such that

$$X_{ig} = \begin{cases} 1 & \text{if quote } ig \text{ meets the condition set in the quote (row) condition} \\ 0 & \text{otherwise,} \end{cases}$$

$$Y_{igj} = \begin{cases} 1 & \text{if plan } igj \text{ meets the condition set in the base (denominator) plan condition} \\ 0 & \text{otherwise,} \end{cases}$$

$$Z_{igj} = \begin{cases} 1 & \text{if plan } igj \text{ meets the condition set in the additional (numerator) plan condition} \\ 0 & \text{otherwise, and} \end{cases}$$

P_{igj} = percentage 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 in plans that include the provision in question. Percentile data are used to describe the distribution of a numeric value, such as a median annual deductible of \$400 and the value \$600 at the 90th percentile. The following percentiles p are calculated: 10, 25, 50 (median), 75, and 90.

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

- the weighted plan employment (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 (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 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.

More information on NCS benefits data

Standard errors are available for incidence estimates from 2008 onward. In 2009, the NCS published its first benefits estimates that include imputed data.⁴²

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. Employers can search NCS benefits data to evaluate benefits that employees currently are being offered nationwide.
- *Aiding collective bargaining negotiations.* Collective bargaining units renegotiate 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 the premiums it currently pays for health benefits with nationwide averages. The comparison helps the established company

⁴²For the latest news release on benefits, see “Employee Benefits Survey” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ebs>; for more information on NCS imputation with benefits data, see Omolola E. Ojo and Jonathan J. Lisic, “BLS Resumes Estimation of Sample Errors for Benefits Measures,” *Compensation and Working Conditions*, May 22, 2008, <http://www.bls.gov/opub/cwc/cm20080520ar01p1.htm>.

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 plans and savings and thrift plans for federal employees. In the recent debate over a universal health care system, benefits data on employee premium sharing were considered in formulating proposals. Data on the amount of retirement income from employer plans have helped to frame the debate on the subject of Social Security reform.
- *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 the Data

NCS data have a variety of uses.⁴³ One use is in economic analysis, in which a knowledge of levels, structures, and trends of pay rates and benefit practices is required in analyzing current economic developments and in studying wage dispersion and differentials. By using the same survey methodology and definitions as it goes about collecting data

⁴³ See, for example, "Employment Cost Trends: How to Use the Employment Cost Index for Escalation" (U.S. Bureau of Labor Statistics, June 17, 2008), <http://www.bls.gov/ect/escalator.htm>. For additional information, see the subsection "Examples of Data Use" for each data product in the section "[Calculation and Reliability of the Estimates](#)." For an overview, see Natalie Kramer, "Earnings and Other Compensation Data at BLS: What Users Seek and What We Offer," *Compensation and Working Conditions*, February 26, 2003, <http://www.bls.gov/opub/cwc/cm20030224ar01p1.htm>.

on earnings, employer costs of compensation, and benefits, the NCS provides a unique measurement of the labor market, allowing employer costs to be linked to estimates of specific plan provisions.

Also, federal, state, and local government agencies use NCS estimates in administering compensation programs and in formulating 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.

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 "[Calculation and Reliability of the Estimates](#)" for more information.)

Technical References

Area sample selection

The criteria for defining Metropolitan, Micropolitan, and Combined Statistical Areas are published in the *Federal Register* (65 FR 82228–82238, December 27, 2000), <http://www.whitehouse.gov/omb/fedreg/metroareas122700.pdf>.

The criteria for defining Core Based Statistical Areas are published in the *Federal Register* (65 FR 82228–82238, December 27, 2000), <http://www.whitehouse.gov/omb/fedreg/metroareas122700.pdf>.

Izsak, Yoel, Lawrence R. Ernst, Erin McNulty, Steven P. Paben, Chester H. Ponikowski, Glenn Springer, and Jason Tehonica, “Update on the Redesign of the National Compensation Survey,” *Proceedings of the American Statistical Association, Section on Survey Research Methods*. Alexandria, VA: American Statistical Association, 2005, <http://www.bls.gov/ore/pdf/st050140.pdf>.

Izsak, Yoel, Lawrence R. Ernst, Steven P. Paben, Chester H. Ponikowski, and Jason Tehonica, “Redesign of the National Compensation Survey,” *Proceedings of the American Statistical Association, Section on Survey Research Methods*. Alexandria, VA: American Statistical Association, 2003, pp. 1978–1985, <http://www.amstat.org/sections/srms/proceedings/y2003/Files/JSM2003-000382.pdf>.

Tehonica, Jason, “New Area Sample Selected for the National Compensation Survey,” *Compensation and Working Conditions*, April 25, 2005, <http://www.bls.gov/opus/cwc/cm20050318ar01p1.htm>.

Tehonica, Jason, Lawrence R. Ernst, and Chester H. Ponikowski, “Phase-in of the Redesigned National Compensation Survey Area Sample,” *Proceedings of the American Statistical Association, Section on Survey Research Methods*. Alexandria, VA: American Statistical Association, 2005, pp. 2993–2997, <https://www.amstat.org/sections/srms/Proceedings/y2005/Files/JSM2005-000156.pdf>.

Benchmarking

“Changes in Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/sp/ececcalc.pdf>.

Seasonal adjustment

Branch, E. Raphael, James A. Buszuwski, Albert E. Schwenk, and Mark Gough, “Transitional Employment Cost Indexes for seasonal adjustment,” *Monthly Labor Review*, April 2008, pp. 25–39, <http://www.bls.gov/opus/mlr/2008/04/art3full.pdf>.

Branch, E. Raphael, and Lowell Mason, “Seasonal adjustment in the ECI and the conversion to NAICS and SOC,” *Monthly Labor Review*, April 2006, pp. 12–21, <http://www.bls.gov/opus/mlr/2006/04/art3full.pdf>.

Survey concepts

Braden, Bradley R., and Stephanie L. Hyland, “Cost of employee compensation in public and private sectors,” *Monthly Labor Review*, May 1993, pp. 14–21, <http://www.bls.gov/opus/mlr/1993/05/art2full.pdf>.

Buckley, John E., “Fifty years of BLS surveys on Federal employees’ pay,” *Monthly Labor Review*, September 2009, pp. 36–46, <http://www.bls.gov/opus/mlr/2009/09/art3full.pdf>.

Buckley, John E., “Pay Relatives for U.S. Census Regions and Divisions, 2006,” *Compensation and Working Conditions*, August 28, 2008, <http://www.bls.gov/opus/cwc/cm20080826ar01p1.htm>.

Ford, Jason L., “The New Health Participation and Access Data from the National Compensation Survey,” *Compensation and Working Conditions*, October 26, 2009, <http://www.bls.gov/opus/cwc/cm20091022ar01p1.htm>.

Gittleman, Maury B., “Pay relatives for metropolitan areas in the NCS,” *Monthly Labor Review*, March 2005, pp. 46–53, <http://www.bls.gov/opus/mlr/2005/03/art4full.pdf>.

Kramer, Natalie, and Alan Zilberman, “New Definitions of Employee Access to Paid Sick Leave and Retirement Benefits in the National Compensation Survey,” *Compensation and Working Conditions*, December 23, 2008, <http://www.bls.gov/opus/cwc/cm20081219ar01p1.htm>.

Lettau, Michael K., Jonathan Lisic, Jesus Ranon, Bradley D. Rhein, Thuy T. Shipp, and Sarah J. Stafira, “Local Area Employee Benefits Estimates for 15 Metropolitan Areas,” *Compensation and Working Conditions*, September 28, 2009, <http://www.bls.gov/opus/cwc/cm20090924ar01p1.htm>.

Moehrle, Thomas G., “The Cost and Incidence of Referral, Hiring, and Retention Bonuses,” *Compensation and Working Conditions*, winter 2000, pp. 37–42, <http://www.bls.gov/opus/cwc/archive/winter2000art4.pdf>.

Morton, John, “Variable Pay in the BLS National Compensation Survey,” *Compensation and Working Conditions*, January 30, 2003, <http://www.bls.gov/opus/cwc/cm20030121yb02p1.htm>.

National Compensation Survey: Guide for Evaluating Your Firm's Jobs and Pay (U.S. Bureau of Labor Statistics, October 2003), <http://www.bls.gov/ncs/ocs/sp/ncbr0004.pdf>.

Schumann, Richard, "Work schedules in the National Compensation Survey," *Compensation and Working Conditions*, July 22, 2008, <http://www.bls.gov/opub/cwc/cm20080722ar01p1.htm>.

Schwenk, Albert E., "Compensation Cost Trends in Private Industry and State and Local Governments," *Compensation and Working Conditions*, fall 1999, pp. 13–18, <http://www.bls.gov/opub/cwc/archive/fall1999art2.pdf>.

Weinstein, Harriet, and Elizabeth Dietz, "Towards a Working Definition of Compensation," *Compensation and Working Conditions*, June 1996, pp. 3–9, <http://www.bls.gov/opub/cwc/archive/summer1996art1.pdf>.

Imputation methods

Yi, Song, "Accounting for missing data in the Employment Cost Index," *Monthly Labor Review*, April 2006, pp. 22–27, <http://www.bls.gov/opub/mlr/2006/04/art4full.pdf>.

Stafira, Sarah, "Recent Modification of Imputation Methods for National Compensation Survey Benefits Data," *Compensation and Working Conditions*, August 28, 2009, <http://www.bls.gov/opub/cwc/cm20090825ar01p1.htm>.

Measurement of variance

"Changes in Variance Estimation Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007" (U.S. Bureau of Labor Statistics), <http://www.bls.gov/ncs/ect/sp/ececvmet.pdf>.

Lettau, Michael K., Mark A. Loewenstein, and Aaron T. Cushner, "Explaining the Differential Growth Rates of the ECI and the ECEC," *Compensation and Working Conditions*, summer 1997, pp. 15–23, <http://www.bls.gov/opub/cwc/archive/summer1997art2.pdf>.

Ojo, Omolola E., and Jonathan J. Lisic, "BLS Resumes Estimation of Sample Errors for Benefits Measures," *Compensation and Working Conditions*, May 22, 2008, <http://www.bls.gov/opub/cwc/cm20080520ar01p1.htm>.

Schwenk, Albert E., "Measuring Trends in the Structure and Levels of Employer Costs for Employee Compensation," *Compensation and Working Conditions*, summer 1997, pp. 3–14, <http://www.bls.gov/opub/cwc/archive/summer1997art1.pdf>.

Walker, Martha A.C., and Bruce Bergman, "Analyzing Year-to-Year Changes in Employer Costs for Employee Compensation," *Compensation and Working Conditions*, spring 1998, pp. 17–27, <http://www.bls.gov/opub/cwc/archive/spring1998art3.pdf>.

Use of fixed weights and estimation of indexes

Costo, Stephanie L., "Introducing 2002 weights for the Employment Cost Index," *Monthly Labor Review*, April 2006, pp. 28–32, <http://www.bls.gov/opub/mlr/2006/04/art5full.pdf>.

Ruser, John W., "The Employment Cost Index: what is it?" *Monthly Labor Review*, September 2001, pp. 3–16, <http://www.bls.gov/opub/mlr/2001/09/art1full.pdf>.

Schwenk, Albert E., "Measuring Trends in the Structure and Levels of Employer Costs for Employee Compensation," *Compensation and Working Conditions*, summer 1997, pp. 3–14, <http://www.bls.gov/opub/cwc/archive/summer1997art1.pdf>.

Schwenk, Albert E., "BLS Introduces New Employment Cost Indexes for 14 Metropolitan Areas," *Compensation and Working Conditions*, September 24, 2008, <http://www.bls.gov/opub/cwc/cm20080922ar01p1.htm>.

NCS conversion to new industry and occupational classification systems

Branch, E. Raphael, and Lowell Mason, "Seasonal adjustment in the ECI and the conversion to NAICS and SOC," *Monthly Labor Review*, April 2006, pp. 12–21, <http://www.bls.gov/opub/mlr/2006/04/art3full.pdf>.

Smith, James E., and Robert W. Van Giezen, "Change Comes to the National Compensation Survey Locality Wage Bulletins," *Compensation and Working Conditions*, January 24, 2007, <http://www.bls.gov/opub/cwc/cm20070122ar01p1.htm>.

Weinstein, Harriet G., and Mark A. Loewenstein, "Comparing Current and Former Industry and Occupation ECEC Series," *Compensation and Working Conditions*, August 25, 2004, <http://www.bls.gov/opub/cwc/cm20040823ar01p1.htm>.

Use of NCS data products

Buckley, John E., "Beyond Basic Benefits: Employee Access to Other Types of Benefits, 1979–2008," *Compensation and Working Conditions*, May 29, 2009, <http://www.bls.gov/opub/cwc/cm20090527ar01p1.htm>.

Buckley, John E., "Recent Modifications of Employee Benefits Data in the National Compensation Survey," *Compensation and Working Conditions*, May 29, 2009, <http://www.bls.gov/opub/cwc/cm20090518ar01p1.htm>.

Kramer, Natalie, "Earnings and Other Compensation Data at BLS: What Users Seek and What We Offer," *Compensation and Working Conditions*, February 26, 2003, <http://www.bls.gov/opub/cwc/cm20030224ar01p1.htm>.

Schwenk, Albert E., "BLS Introduces New Employer Costs for Employee Compensation Data for Private Industry Workers in 15 Metropolitan Areas," *Compensation and Working Conditions*, September 28, 2009, <http://www.bls.gov/opub/cwc/cm20090921ar01p1.htm>.

Shelly, Wayne M., "Aging Wage Survey Data Using the Employment Cost Index," *Compensation and Working Conditions*, January 29, 2008, <http://www.bls.gov/opub/cwc/cm20080122ar01p1.htm>.

Wiatrowski, William J., "BLS at 125: using historic principles to track the 21st-century economy," *Monthly Labor Review*, June 2009, pp. 3–25, <http://www.bls.gov/opub/mlr/2009/06/art1full.pdf>.

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 data on work stoppages 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 lost workdays during the reference month and the cumulative number of lost workdays from the beginning of the work stoppage, the number of workers idled by the stoppage, and 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 a lockout. Because of the complexity of most labor–management disputes, the Bureau 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 lost workdays* is based on a 5-day workweek (Monday through Friday), excluding weekends and federal holidays. If applicable, the cumulative number of lost workdays also is computed for each work stoppage beyond the beginning reference month.

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 reference month by the number of lost workdays, based on a 5-day workweek (Monday through Friday), excluding federal holidays. If applicable, 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 (the employer, the union, or some other organization) is contacted to verify the duration of the stoppage and number of workers idled thereby.

Availability of data

Data for the major work stoppages series are uninterrupted and date back to 1947.⁴⁴ Detailed monthly 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.

From 1947 to 2007, the Bureau of Labor Statistics 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 those agreements was officially moved to the U.S. Department of Labor, Office of Labor–Management Standards.⁴⁵

⁴⁴For statistics on monthly and annual work stoppages and for detailed monthly data since 1993, see “Work Stoppages” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/wsp>.

⁴⁵For more information, see Drew M. Simmons, “Collective Bargaining Agreements File Moves to New Home,” *Compensation and Working Conditions Online*, November 30, 2007, <http://www.bls.gov/opus/cw/cb20071128ar01p1.htm>.