2023 Annual Survey of Public Employment & Payroll Methodology

The Annual Survey of Public Employment & Payroll (ASPEP) measures the number of state and local civilian government employees and their gross payroll for the pay period including March 12 of the calendar year. Federal government agencies and institutions are excluded from this survey.

Population of Interest

The population of interest for the Annual Survey of Public Employment & Payroll includes the civilian employees of all agencies of the 50 state governments and approximately 91,800 local governments (i.e., counties, municipalities, townships, special districts, and school districts), including the District of Columbia.

Content of the Survey

The survey provides state and local government employment and payroll statistics, which include full- and part-time employment and total full-time equivalent employment, by governmental function, such as financial administration, other government administration, judicial and legal, police protection (persons with power of arrest and other police protection), fire protection (firefighters and other fire protection), corrections, highways, air transportation, sea and inland port facilities, public welfare, health, hospitals, social insurance administration, solid waste management, sewerage, parks and recreation, housing and community development, natural resources, water supply, electric power, gas supply, transit, elementary and secondary education (instructional and other elementary and secondary education), higher education (instructional and other higher education), other education, libraries, and state liquor stores.

Beginning with the release of the 2019 Annual Survey of Public Employment & Payroll, part-time hours are no longer included in the content that is collected and published.

The questionnaires that were used to collect these data can be viewed on the Questionnaires page of the Annual Survey of Public Employment & Payroll Website.

Critical definitions include the following:

Employment: Employment refers to all persons gainfully employed by, and performing services for, a U.S. state or local government (excluding the federal government).

Employees: State and local government employees include all persons (excluding federal employees) paid for personal services performed, including such employees paid from federally funded programs, paid elected or appointed officials, persons in a paid leave status, and persons paid on a per meeting, annual, semi-annual, or quarterly basis. Unpaid officials, pensioners, persons whose work is performed on a fee basis, and contractors and their employees are excluded from the count of employees.

Full-time employees: Full-time employees are defined to include those persons whose hours of work represent full-time employment in their employing government.

Part-time employees: Part-time employees are those persons who work less than the standard number of hours for full-time work in their employing government.

Full-time equivalent: Full-time equivalent (FTE) is a computed statistic representing the number of full-time employees plus part-time employees converted to represent their contributions in full-time terms.

FTE is calculated using a linear model based on historical data from the 2014-18 period. The model estimates FTE values in each state by governmental function cell using values for full-time employees and part-time employees along with ratios based on linear relationships between part-time equivalent and part-time employee variables in the historical data. This model may be revised in the future based on new research.[1]

Payroll: Payroll amounts represent gross payroll for the 1-month period of March (31 days). Gross payroll includes all salaries, wages, fees, commissions, bonuses, or awards paid to employees during the pay period that includes the date of March 12 of the survey year. Payroll amounts reported for a period other than 1-month are converted to represent an amount for the month of March. All payroll figures are represented in current whole dollars and are not adjusted for inflation.

Conversion of a reported payroll to a payroll amount that would have been paid during a 31-day month is accomplished by multiplying the reported payroll by an appropriate factor. For example, a 2-week payroll is multiplied by the ratio of 31/14, a 1-week payroll is multiplied by the ratio of 31/7, and a twice-a-month payroll is multiplied by 2.

[1] Prior to 2019, full-time equivalent (FTE) was calculated by summing the number of full-time employees and part-time equivalent (PTE) variables, where PTE was a function of part-time hours paid. Starting with the 2019 Annual Survey of Public Employment & Payroll, part-time hours are no longer collected.

Data Collection

Authority and Confidentiality

Title 13, United States Code, Sections 161 and 182, authorizes the U.S. Census Bureau to conduct this collection. These data are subject to provisions of Title 13, United States Code, Section 9(b), which exempts data that are customarily provided in public records from rules of confidentiality.

Methods

Statistics in these files are based on information obtained in the Annual Survey of Public Employment & Payroll. Nearly all the *state governments'* data are provided from central payroll records for all or most of their *state's* agencies/institutions. Data for agencies and institutions for the remaining state governments and all local governments are obtained by an online collection instrument. However, some elementary and secondary school system data are supplied by special arrangements with the state government.

Sample Design

The Annual Survey of Public Employment & Payroll consists of the 50 state governments and a sample of local governments. The sample of local governments for the Survey of Public Employment & Payroll is selected from the local governments in the Census of Governments conducted in years ending in 2 and 7, and after that, the sample is updated annually with government births and deaths, i.e., by adding all or a sample of new local governments identified and verified as active during the sample year (births) and removing any local governments that have been confirmed as closed or inactive (deaths).

During a sample redesign after a census, an original two-stage sample design and the choice of estimators are selected to produce estimates with coefficient of variations falling within an expected three percent or less for the main ASPEP variables at the national level. Note that there are five types of local governments-- counties, municipalities, townships, special districts, and school districts. In the first stage, the sample design is stratified by state and type, using without replacement probability proportional to size sampling (πPS) methodology. In the second stage, a modified cut-off sample method is used to reduce the number of small municipalities, townships, and special districts included in the final sample. In 2023 there were approximately 78,900 local governments from the population that were eligible for sampling. To ensure appropriate representation, the 50 state governments, all Hawaii local units, and the District of Columbia are all classified as certainty units with a weight of 1.0. As a result of the sample selection, additional units may be identified as certainties due to their sizes.

Weighting

The base weight for each unit in the original sample (first sample after the census year) is the reciprocal of that unit's probability of selection. The weight was obtained as the product of two components: the weight applied for first stage πps sampling multiplied by the weight applied for second stage cutoff sampling. The value of total payroll was used as the unit's measure of size.

Births are new active units that are identified either in the census year or on subsequent survey years. Births could be of any of the five different governmental types. Births could be selected as either certainty (weight=1.0) or noncertainty cases (weight greater than 1.0) depending on the state and number of employees. Usually births of non-special district type governments are selected as certainties. However, for special district births, which can be more numerous, sampling is required. If the number of births is not too large, all births are selected as certainties. Otherwise, a sample of births is selected and added to the initial sample.

Deaths are closed or inactive units removed from the population and may reduce the sample size. Weight adjustments will be performed, or replacement units will be added to account for the removed units.

Sample Size

The 2023 ASPEP sample contains approximately 11,200 state and local governments. Of the total number of local governments in the sample, approximately 13.8 percent are counties, 30.1 percent are cities and townships, 25.1 percent are special districts, and 31.0 percent are school districts.[2]

Data Processing

Editing

Efforts are made at all phases of collection, processing, and tabulation to minimize reporting, keying, and processing errors.

Edits are built into the Internet data collection instrument and the data entry programs. Edits are also performed post collection. Post collection edits consist primarily of two types: (1) *consistency edits* and (2) *ratio edits*.

The *consistency edits* check the logical relationships of data items reported on the questionnaire. For example, if a value exists for employees for a governmental function then a value must exist for payroll also.

[2] Due to rounding, numbers presented throughout this report may not add up precisely to the totals indicated and percentages may not precisely reflect the absolute figures for the same reason.

For each governmental function with reported employees, the *ratio edits* compare data for the number of employees and the average salary for the function between reporting years. If data fall outside of acceptable tolerance levels, the item is flagged for review.

For *ratio edits* and *consistency edits*, the edit results are reviewed by analysts and adjusted as needed. When the analyst is unable to resolve or accept the edit failure, contact is made with the respondent to verify or correct the reported data.

Imputation

Imputation is the process of replacing missing data with estimated values. When substituting estimated data for an entire governmental unit, it is known as "unit imputation"; when substituting for specific missing data items for a respondent unit, it is known as "item imputation".

There are three main problems that missing data causes: missing data can introduce a substantial amount of bias, make the handling and analysis of the data more arduous, and create reductions in efficiency. Imputation preserves all cases by replacing missing data with an estimated value based on other available information.

For nonresponding general purpose governments, dependent and independent school districts, and special district governments, the imputations are based on recent historical data from either a prior year annual survey or the most recent Census of Governments, Public Employment & Payroll, if available. These data are adjusted by a growth rate that is determined by the growth of responding units that were similar (in geography and type of government) to the nonrespondent, i.e., homogeneity. If there is no recent historical data available, the imputations are based on the data from a randomly selected responding donor that was similar (based on the same criteria) to the nonrespondent. For general purpose governments, and for dependent and independent school districts, the selected donor’s data are adjusted by dividing each data item by the population (or enrollment) of the donor and multiplying the result by the nonrespondent’s reported population (or enrollment) data.

Estimation

Estimates of totals for employment and payroll statistics, total full-time employment, total full-time payroll, total full-time equivalent employment, total part-time employment, and total part-time payroll are calculated for each state-by-function “cell” (e.g., Housing and Community Development for Minnesota). We employed a hybrid estimation approach, i.e., a combination of three estimation methods, resulting in selection of the best of the three estimators to use for each specific cell.

The three estimation methods used in this hybrid approach are as follows. First, the Horvitz-Thompson (HT) estimator applies a weighted sum of the sample data. To calculate the HT estimate, each data point in the sample is multiplied by its sampling weight, and then these values are summed over the corresponding area of interest. The HT estimator is used in cells where the sample size is large enough to produce reliable coefficients of variation (CV). Second, when the cell sample size is small, the Empirical Best Linear Unbiased Prediction (EBLUP) estimator is used with a robust estimation approach that uses the last census data (2022) as covariates. Third, the Synthetic estimator is based on a Decision-based estimator of the state total and the assumption that employment in 2023 is proportional to employment in 2022 for the same state and function. The Synthetic estimator is used only when the cell has all missing data, i.e. complete nonresponse for the cell. See the “For Further Information” section for papers related to these three estimation methods.

These methods have different tradeoffs. The HT estimator is unbiased, but it has high variability. The model-based EBLUP estimator, which is used most often of the three estimation methods, could be biased but it often performs very well and provides CV’s within 3 percent of the estimates at the national level. Similarly, the synthetic estimator can have a large bias, but it often has lower variance than that of the HT estimator and can be used even if no sample data are available for the cell.

Sampling Variability

The statistics that are provided during non-census years come from a sample rather than a census of all possible units. The estimated coefficient of variation, which is provided for each estimate, is an estimate of the sampling variability. In this tabulation, the coefficients of variation are expressed as percentages. The coefficient of variation (CV) is the ratio of the standard error to the expectation of the estimate. The higher the value of the coefficient of variation, the greater the extent of deviation around the estimates. A Taylor series method from the direct estimator (Horvitz-Thompson), or the resulting Markov Chain Monte Carlo (MCMC) posterior distributions from the hierarchical Bayes procedure, is used to estimate the standard errors.

All state governments are selected with certainty; therefore, state government employment and payroll data are not subject to sampling error. Consequently, the *combined state and local government* estimates for individual states are more reliable statistically than the *local government only* estimates.

Data Quality

Nonsampling Errors

In addition to sampling error or variability, such as coverage errors, sample estimates are also subject to nonsampling errors (such as errors resulting from

inability to obtain data for every variable from all units in the sample), inaccuracies in classification, response errors, misinterpretation of questions, and mistakes in keying, coding and processing errors. These same nonsampling errors may be evident in census collections and may affect the Census of Governments data used to adjust the sample during the estimation phase and used in the imputation process. We do not account for nonsampling errors in our estimates.

Overall Unit Response Rate

Further details about the most recent response rates can be found in the link below.

2023 Annual Survey of Public Employment & Payroll Response Rates and Notice - [PDF, <1.0 MB]

For Further Information:

Barth, Joseph, Yang Cheng, and Carma Hogue. "Reducing the Public Employment Survey Sample Size," Joint Statistical Meetings, 2009

Tran, Bac and Brian Dumbacher. "An Evaluation of Different Small Area Estimators for the Annual Survey of Public Employment and Payroll," Joint Statistical Meetings, 2014

Tran, Bac and Franklin Winters. "An Evaluation of Different Small Area Estimators and Benchmarking for the Annual Survey of Public Employment and Payroll," Joint Statistical Meetings, 2015

Tran, Bac and Yang Cheng. "Application of Small Area Estimation for Annual Survey of Employment and Payroll," Joint Statistical Meetings, 2011

Tran, Bac. "Small Area Estimation Applications in the US Census Bureau Annual Survey of Employment and Payroll Evaluation," Small Area Estimation Conference, Thailand 2013

Tran, Bac. "An Evaluation of Different Small Area Estimators and Benchmarking for the Annual Survey of Public Employment and Payroll," Small Area Estimation Conference, Poland 2014

Tran, Bac and Partha Lahiri. "Mean Square Errors Estimates for Different Small Area in the Annual Survey of Public Employment and Payroll," Small Area Estimation Conference, Chile 2015

Tran, Bac and Partha Lahiri. "Hierarchical Bayesian Estimation of Employment & Payroll Using Survey and Census Data," Small Area Estimation Conference, Holland 2016

Tran, Bac. “Small Area Estimation in the Annual Survey of Public Employment and Payroll (U.S. Census Bureau),” Small Area Estimation Conference, Shanghai 2018

Tran, Bac and Giang Trinh. “Estimation Methods of Public Sector Surveys in Economic Statistical Method Division of the U.S. Census Bureau – The Path to Small Area Estimation,” Small Area Estimation Conference, Singapore 2019