

Changes in Variance Estimation Calculations for the BLS Employer Costs for Employee Compensation Data, March 2007

The BLS Employer Costs for Employee Compensation (ECEC) series produces quarterly estimates of employer costs for wages, salaries, and benefits. Data for the ECEC are collected from employers as part of the BLS National Compensation Survey (NCS). Other NCS products include the Employment Cost Index (ECI), local and national wage estimates by occupation, and data on the incidence and provisions of employee benefits. Changes to the variance estimation procedure for the December 2006 ECEC, released in March 2007, were introduced to standardize the variance estimation calculations among all NCS products.

The ECEC survey uses a variance calculation method called balanced repeated replication, or BRR. BRR involves creating variance strata, assigning sample units to one of the two half-samples within each variance stratum, and calculating a number of replicate estimates based on different combinations of half-samples across the variance strata. Occupational sample weights are adjusted up or down in different proportions depending on the replicate, resulting in replicate estimates that are usually different from each other and from the full-sample estimate. Then the variance is calculated using the differences between the full-sample estimate and each replicate estimate. The specific changes being introduced with the December 2006 data deal with the way that the occupational sample weights are adjusted up or down in the calculation of the replicate estimates.

The first change is to the occupational sample weights used in variance computations. Previously, occupational sample weights within a particular replicate were adjusted by a factor of 0 or 2, depending on whether a sample quote was in half-sample 1 or 2 within a given variance stratum for the replicate. Thus, a given quote was either included (factor of 2) or excluded (factor of 0) from the replicate estimate. In the revised procedure, the occupational sample weights within a particular replicate are adjusted by a factor of 0.5 or 1.5. With these new adjustment factors, each replicate estimate includes all the data for the survey but with different weight adjustment factors than are used in the full sample estimates.

The second change being implemented with December 2006 data is in the computation of the variance from the replicate estimates. Previously, the final multiplying factor for the variance was equal to:

$$\frac{1}{\# \text{ of replicates}} = \frac{1}{128} = 0.0078125.$$

The variance was then calculated as:

$$V(\hat{Y}_{ct}) = 0.0078125 * \sum_{r=1}^R [\hat{Y}_{ctr} - \hat{Y}_{ct}]^2$$

where:

$\hat{V}(\hat{Y}_{ct})$ is the variance estimate for average cost per hour worked for characteristic c at time t

\hat{Y}_{ctr} is the average cost per hour worked for replicate r in characteristic c at time t (estimated using replicate weights)

\hat{Y}_{ct} is the average cost per hour worked for the full sample in characteristic c at time t

In the revised variance calculation, the final multiplying factor was changed to reflect the changes in the adjustments for the occupational weights. The revised final multiplying factor for the variance is equal to:

$$\frac{1}{R \times (1 - k)^2} = 0.0313, \text{ where}$$

R is the # of replicates = 128, and

k is the minimum adjustment factor = 0.5.

The revised variance is then calculated as:

$$V(\hat{Y}_{ct}) = 0.0313 * \sum_{r=1}^R [\hat{Y}_{ctr} - \hat{Y}_{ct}]^2$$

where:

$\hat{V}(\hat{Y}_{ct})$ is the variance estimate for average cost per hour worked for characteristic c at time t

\hat{Y}_{ctr} is the average cost per hour worked for replicate r in characteristic c at time t (estimated using replicate weights)

\hat{Y}_{ct} is the average cost per hour worked for the full sample in characteristic c at time t