Aging Wage Survey Data Using the Employment Cost Index

by Wayne M. Shelly
Bureau of Labor Statistics

Originally Posted: January 29, 2008

The Employment Cost Index provides a valuable tool that can be used to adjust wage survey data--a process known as "aging"--to account for the time lag between the last published survey data and the present. Making such adjustments is critical for many users, such as human resource professionals, who use the data to set wage levels at their firms, and job seekers, who use the data to evaluate job offers.

Among their other uses, wage survey data are used by human resource professionals to set wage levels, by job seekers to evaluate job offers, and by employees to compare their wages to those of other workers. One of the problems these users face is the lag between the time the survey is collected and the time it is applied for pay setting and other purposes. Data users are, in effect, evaluating tomorrow's pay with yesterday's data. When labor markets are stable, wage growth is more predictable and thus the time lag is of less concern to users. But when competition for workers with specific skills translates into rapidly changing wages, the need for current wage data is very important. Using a process known as "aging," the Employment Cost Index (ECI), which is part of the BLS National Compensation Survey (NCS), is one data source that can be used to help minimize the effect of the time lag between published wage data and current market conditions. The ECI is well suited for aging wage survey data to account for time lags, because it measures percent change and is conducted quarterly.

The NCS collects data using a statistically valid, nationally and locally representative sample of approximately 36,000 establishments. From these data, BLS publishes:

- detailed occupational wage estimates for metropolitan and nonmetropolitan areas, broad geographic regions, and the Nation (published annually);
- the Employment Cost Index, a measure of change in the cost of compensation--wages and benefits--over time (published quarterly)[1]
- Employer Costs for Employee Compensation (ECEC), an estimate of cost per hour worked for wages and specific benefits (published quarterly); and
- benefit incidence and provisions--specifically, the percent of workers with access to, and/or participating in, specific employer provided benefits, as well as detailed benefit plan provisions (published annually).

The NCS collects data on wages and benefits by occupation within a randomly selected sample of establishments. Each occupation is further defined by its bargaining status, pay method (time or incentive), and full- or part-time status. The NCS publishes wage survey data by means, medians, and percentile estimates. Standard errors are also published to assist data users in determining the reliability of the data.[2]

As with most wage surveys, the NCS wage data are published well after the time period that they represent. Once BLS field economists contact and meet with respondents, time is needed to collect and process the data, review the estimates, and prepare the data for publication. The frequency of the survey--the NCS is usually conducted annually--also impacts the time lag. Wage estimates from the NCS for the Nation as a whole are released approximately 15 months after the reference period. For metropolitan areas, the lag is typically 9 or 10 months. Changes that occur after data collection are not reflected until the next round of the survey. To minimize the impact of this time lag, data users can use the ECI to age survey data to more recent time periods. Although this article focuses on using the ECI to adjust wage data from the NCS, the process can be applied to almost any wage survey.[3]

The ECI is computed from a subsample of the NCS. In recent publications, the ECI was computed using data from approximately 13,000 establishments. Rather than report on wage *rates*, the ECI measures the *percent change* in employer cost of compensation over time. Unlike percent change estimates that use wage data from the NCS and Employer Costs for Employee Compensation data, the ECI estimates are free of the influence of changes in the occupational and industry mix

because it uses fixed weights to control for shifts among occupations and industries. The ECI is published quarterly, with the reference months being March, June, September, and December. The data are available 1 month after the reference month-- for example, the data for March are published in April.

In the ECI, compensation has two components: wages and benefits. For the purpose of aging wage data to account for time lags, only the wage component of the ECI is needed. Unique ECI wage series are published for all civilian workers,[4] all private industry workers, all State and local government workers, and for more than 160 other series--by sector, industry, occupation, bargaining status, and metropolitan area status.[5] Currently, indexes are produced for the Nation as a whole, 4 census regions, and 9 census divisions.

Each ECI series that is published includes the 3-month percent change, the 12-month percent change, and an index number for that series. It is the index number that allows one to calculate percent changes between any 2 reference months. By using the ECI to calculate the change from the reference period to the most current period and then applying that change to the estimate, a more current estimate can be obtained.

For example, when the NCS published its June 2005 national wage estimates in September 2006, the mean hourly earnings for all workers in private industry was $17.82. If a data user, in August 2007, wanted to calculate a more current estimate, the user could use the ECI to calculate a percent change from June 2005 to June 2007 and thus reduce the time lag from 26 months to 2 months. Using the ECI in this way, a data user could learn that wages for all private industry workers in the United States increased by 6.3 percent during that 2-year period. Applying that increase to the June 2005 wage estimate would yield a June 2007 wage estimate of $18.94 (17.82 × 1.063). The result is not as precise as an estimate produced directly from a wage survey, but it provides an estimate closer to the current time period than would otherwise be possible. (See the exhibits below for detailed instructions and examples.)

Limitations

When using the ECI to age wage survey data to account for time lags, one should be aware of certain limitations. First, in the ECI, the occupational mix of employees is held constant. If the proportion of all occupations that are higher wage occupations increases over the time period that wages are being updated, the ECI will not reflect that change. This should have little practical effect, however, because such changes tend to be small over short periods of time. Second, establishments in the ECI survey remain in the sample for several years, with only a portion replaced each year.[6] Structural changes that occur in the economy may only be partially reflected in the ECI sample until all sample members are replaced. Again, this should have minimal impact because such changes that affect wages tend to occur gradually over time. Third, the ECI is reported for broad occupational groups at the national level or for all workers in a geographic region. The rate of change in wages for individual occupations in a specific area may differ from these broader trends. Finally, the ECI is a sample-based survey and thus is subject to sampling and nonsampling errors inherent in all such surveys.

Sampling errors are measured by calculating standard errors, which are published on the NCS page at http://www.bls.gov/ncs/ect/ectvar.htm. Standard errors can be used to assess the reliability of the estimates. Nonsampling errors, which include survey nonresponses, data collection errors, and data processing errors, cannot be measured, but they are thought to be small because several procedures are in place to minimize them, such as staff training, computer microdata and macrodata edits, and structured review.

Conclusion

The ECI does not eliminate the need for wage surveys, because over longer periods of time the estimates obtained using the aging process become less reliable. Nevertheless, using the Employment Cost Index to age wage survey data to account for time lags is a valuable technique that improves the quality of the data used for determining pay scales and other purposes when current wage data are critical.

Exhibits

Exhibit 1 provides detailed instructions for how to use the ECI to adjust wage survey data to account for time lags. Exhibit 2 shows step-by-step instructions for the example used in the text. Exhibit 3 is a sample worksheet that users can use for adjusting the data. Exhibit 4 gives instructions on how to interpolate data when the user wants to calculate an index number for a month other than the ECI reference month. Exhibit 5 shows an example of interpolating data.

Exhibit 1. How to use the ECI to age wage survey data to account for time lags.

1. **Select an appropriate ECI series.** For general wage increases, an aggregate series--such as private industry, all workers--is an appropriate choice because it is easy to use and less likely to fluctuate greatly. If there is reason to believe that the data to be adjusted trend differently than the overall average, then it might be better to choose a more specific series, such as one that is occupation or industry specific. The sector--meaning, whether the ECI data pertain to private industry, State and local government, or civilian workers--is also an important factor to consider. Bargaining status, census region, or census division also can be used. To view a complete list of possible series, see tables 8-11 of the *Employment Cost Index news release*, available on the Internet at www.bls.gov/news.release/pdf/eci.pdf. Users might also want to review historical data of specific series to see how they have performed in the past. Historical data series can be obtained by using the *Create Customized Tables* tool, which is located at http://data.bls.gov/cgi-bin/dsrv?ci.
2. **Determine the beginning and ending time periods.** Typically, the beginning period will be the reference period of the wage survey you wish to update, and the ending period will be the most current month for which ECI data are available. If the beginning period or the ending period is not one of the ECI reference months (March, June, September, or December), use the closest reference month or else interpolate the data.
3. **Retrieve the ECI index values.** There are several ways to retrieve ECI data, but the *Create Customized Tables* option, mentioned previously, is the easiest to use. Use this tool to request the selected series index numbers for the appropriate time periods.
4. **Calculate an adjustment factor.** To calculate an adjustment factor, the user will need the index numbers for the beginning and ending time periods for the selected series. The factor is calculated as follows: Ending period index number ÷ beginning period index number. The quotient should be rounded to three decimal places.
5. **Apply the adjustment factor to the original data.** Multiply the adjustment factor by the original estimate. The product should be rounded to two decimal places.

Exhibit 2. Example of how to age wage survey data using the ECI (based on the example used in the text).

1. **Select an appropriate ECI series.**

    Private industry, all workers

2. **Determine the beginning and ending time periods.**

    Beginning period = June 2005; ending period = June 2007

3. **Retrieve ECI index values.**

    Request Screen:

Employment Cost Index

Larger

Results Screen:

Larger

Beginning period index number = 98.9; ending period index number = 105.1

4. **Calculate an adjustment factor and round to three decimal places.**

    A. *105.1 ÷ 98.9 = 1.0626895*
    B. *1.063 (rounded)*

5. **Apply the adjustment factor to the original data and round to two decimal places.**

    A. *Original data = $17.82*
    B. *$17.82 × 1.063 = $18.94266*
    C. *$18.94 (rounded)*

Exhibit 3. Worksheet: Aging Wage Survey data using the Employment Cost Index.

1. **Select ECI Series: _____**
2. **Determine the beginning and ending time periods:**

    _____ Beginning month and year

    _____ Ending month and year

3. **Retrieve ECI index values:**

    _____ Index number for beginning month and year

    _____ Index number for ending month and year

4.   A. _____ **Calculate adjustment factor (unrounded)**

    (Ending month divided by beginning month)

    B. _____ **Round value in 4.A to 3 decimal places**
5.   A. $ _____ **Original wage data value**
    B. $ _____ **Updated wage value (unrounded)**

    (The value in 5.A multiplied by the adjustment factor in 4.B)

    C. $ _____ **Round value in 5.B to two decimal places**

Exhibit 4. Interpolating data

To calculate an index number for a month other than an ECI reference month, you can interpolate the number if you assume that the change over the 3-month period occurred at the same rate each month.[7]

1. **Retrieve the index numbers for the ECI reference month immediately before and immediately after the time period needed.**
2. **Calculate the change between the two index numbers, as follows:**

    Latter reference period - earlier reference period

3. **Divide the difference obtained in the above step by 3 (for the 3 months between reference periods).**
4. **Calculate index numbers for the interpolated months.**

    A. For the *first* month between the 2 reference months, add the quotient calculated in step 3 to the index number for the reference month immediately before the desired month.
    B. For the *second* month between the two reference months, multiply the quotient calculated in step 3 by 2, and then add that product to the reference month immediately before the desired month.
    C. Round the results to one decimal place.

5. **Use the interpolated index number(s) in step 3 of exhibits 1, 2, and 3.**

Exhibit 5. Example of interpolating data

Interpolate index numbers for July 2007 and August 2007 for the series private industry, all workers:

1. **Retrieve the index numbers for the ECI reference month immediately before and immediately after the time period needed.**

    June 2007 = 105.1   September 2007 = 106.0

2. **Calculate the change between the two index numbers, as follows:**

    106.0 - 105.1 = 0.9

3. **Divide the difference obtained in the above step by 3 (for the 3 months between reference periods).**

    0.9 ÷ 3 = 0.3

4. **Calculate index numbers for the interpolated months.**

    A. *July 2007 = 105.1 + 0.3 = 105.4*
    B. *August 2007 = 105.1 + (2 × 0.3) = 105.1 + 0.6 = 105.7*

5. **Use the interpolated index number(s) in step 3 of exhibit 1.**

Wayne M. Shelly

Economist, Division of Compensation Data Analysis and Planning, Office of Compensation and Working Conditions, Bureau of Labor Statistics.

Telephone: (202) 691-6205; E-mail: Shelly.Wayne@bls.gov

Notes

[1] For a more thorough discussion of the ECI, see John W. Ruser, "The Employment Cost Index: what is it?," *Monthly Labor Review*, September 2001; available on the Internet at http://www.bls.gov/opub/mlr/2001/09/art1full.pdf.

[2] For more technical information on the National Compensation Survey, see "National Compensation Measures," *BLS Handbook of Methods* (online version, 2007), ch. 8; available on the Internet at http://www.bls.gov/opub/hom/pdf/homch8.pdf.

[3] For more information on BLS wage surveys, see Natalie Kramer, "Earnings and Other Compensation Data at BLS: What Users Seek and What We Offer," *Compensation and Working Conditions Online*, February 26, 2003; available on the Internet at http://www.bls.gov/opub/cwc/cm20030224ar01p1.htm.

[4] The National Compensation Survey defines civilian workers as the sum of all private industry and State and local government workers. Members of the U.S. military, Federal Government employees, and agricultural workers are excluded.

[5] Although seasonally adjusted data are available for some series, only not seasonally adjusted data should be used for aging wage survey data.

[6] Private industry establishments remain in the sample for approximately 5 years, with approximately 20 percent of the private industry establishments replaced each year. State and local government establishments are replaced less frequently. Unlike the private industry establishments, the State and local government establishments are all replaced at the same time.

[7] This exhibit is a simplified procedure that does not take into account the effects of compounding. Because of the relatively small changes between quarters and the short time period, compounding will have very little impact on the interpolated data and does not improve its precision.