

Introducing 2002 weights for the Employment Cost Index

Beginning in March 2006, ECI estimates were modified to reflect 2002 employment counts; disruptions to the most-aggregated historical series from this change alone were slight

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The Employment Cost Index (ECI), an employment-cost-weighted Laspeyres index,¹ is a measure of the change in the cost of employing a fixed set of labor inputs.² Most Laspeyres indexes update their fixed weights periodically, and the ECI is no exception. In March 2006, the ECI introduced 2002 fixed employment weights to replace the 1990 weights used from 1995 through 2005.³ The new weights are based primarily on data from the BLS Occupational Employment Statistics (OES) survey.⁴

In addition to using new employment weights, the ECI changed in several other ways. One dramatic change was the conversion to the 2002 North American Industry Classification System (NAICS) and the 2000 Standard Occupational Classification (SOC) system in order to classify, respectively, industries and occupations. Other changes to the ECI in March 2006 included new imputation methods and the introduction of new series. These changes affected the historical continuity between the old and new indexes, as well as our ability to measure the impact of the new weights.⁵

This article examines the reweighting of the ECI and discusses its effects.

Introducing new weights into the ECI

Fixed weights in the ECI. Weights are used to derive population estimates from the survey sample. With regard to the ECI, data from the sample

are multiplied by the appropriate weights in order to obtain unbiased estimates for U.S. civilian, State and local government, and private-industry workers.

Two sets of weights are used in the ECI: sample weights and fixed weights. Sample weights are assigned to each establishment-occupation pair in the ECI sample and reflect the probability of selection of the establishment and the occupation within the establishment. The sample weights are used to calculate current- and previous-quarter average hourly compensation costs for broad industry and occupation groups within private industry and State and local governments. These groups are known as estimation cells.

The average hourly compensation costs for each estimation cell are then multiplied by the second set of weights, a measure of base-period employment costs in the cell. The base-period costs are the product of 2002 employment in the estimation cell and the December 2005 average wage and total benefit cost in the cell. These fixed weights are what make the ECI a Laspeyres index, defined by the fact that the relative importance of each estimation cell does not change.

Since the inception of the ECI in 1975, its industry structure was based on the Standard Industrial Classification (SIC) system, as defined by the U.S. Office of Management and Budget. For the ECI, most industry categories for private industry were specified at the two-digit SIC level; examples are textile manufacturing and personal

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services. For State and local governments, the industry categories varied from specific three-digit SIC's, such as elementary and secondary schools, to broader industry divisions, such as public administration. With the switch to NAICS in March 2006, the same general approach was used, except that, under the NAICS structure, three-digit codes generally correspond to SIC two-digit codes.

Until March 2006, the occupation categories for the ECI were based on the structure developed for the 1990 Census of Population. The scope of the ECI was restricted to more than 400 jobs in 10 major groups. With the switch to the SOC, about 800 occupations are defined within 9 aggregate occupational groups.⁶

A sampling procedure is used in each establishment to select a set of jobs. Then, wage and benefit information pertaining to the selected jobs is collected in the initial visit to the establishment and is updated each quarter. The fixed employment weights, however, apply to the occupational category that the specific jobs represent.

For example, in a particular industry, data might be collected from 20 establishments, in each of which a set of occupations will be selected on a probability basis. In one establishment, the field economist might select industrial engineers, secretaries, and janitors. In another establishment in the industry, the field economist might select architects, order clerks, and cooks. The engineers and architects would be included in the professional and related occupations category, the secretaries and order clerks in the office and administrative support occupations category, and the janitors and cooks in the service occupations category. The fixed employment weights would be applied to these broader categories.

Reasons for reweighting. ECI measures are used in essentially three different types of analysis:

- Measurement of the total change in labor cost from the base period, December 2005, to any subsequent period;
- Comparisons of changes in labor costs over different subperiods (for example, comparison of the change between December 2005 and December 2006 with that between December 2003 and December 2004);
- Measurement of the current rate of increase in labor costs.

No single index can be ideal for all three types of analysis. For instance, an index that is appropriate for analyzing long-run changes will not be the best for measuring the current rate of labor cost increases, and vice versa.

If the ECI were used only to measure the longrun change in labor costs, the weights would seldom need to be updated. Similarly, the value of the ECI in comparing changes in labor costs over different subperiods depends on holding the weights fixed for extended periods. The unchanging weights are necessary in these cases to ensure that the same set of labor inputs is being priced over time.

In contrast, if the ECI is to be used to measure the recent rate of labor cost increases, the weights should be as current as possible. With current weights, the index of labor cost would measure the change between December 2004 and March 2005 in the cost of purchasing the set of labor inputs employed in December 2004. The index with current weights differs from the existing ECI Laspeyres index, which would estimate current labor cost increases as the change between December 2004 and March 2005 in the cost of purchasing the set of labor inputs employed *at the reference point of the 1990 Occupational Employment Statistics (OES) survey*. In general, the accuracy of a Laspeyres index as a measure of current labor cost change varies inversely with the magnitude of shifts in employment among industries and occupations since the reference period of the employment counts.

If the ECI's employment weights were changed every quarter to improve the measurement of current rates of labor cost increases, it would be possible to derive a type of Laspeyres index by multiplying together quarter-to-quarter changes (expressed as ratios). Such a "chain" index would provide a better estimate of the rate of labor cost increase for each quarter than the current ECI does. The chain index would not, however, provide the change in the cost of a fixed set of workers for periods longer than one quarter, and changes for different subperiods would not be for the same set of labor inputs.

The ECI is a compromise between a pure Laspeyres index and an index that uses new weights each quarter; that is, the ECI's weights are changed periodically after remaining fixed for a number of years. Because the ECI's employment weights remain fixed for long periods, the possibility arises that the index could lose its value as a measure of current change.

Fortunately, a number of price index studies have shown that the period-to-period change in a fixed-weight Laspeyres index is relatively insensitive to the weights used when the weights vary within the range common to many economic variables. Thus, the quarter-to-quarter changes calculated with a Laspeyres index are apt to be quite close to the quarter-to-quarter changes obtained by using the previous quarter's employment weights.⁷

For this reason, the ECI has employed one set of weights for a number of years. This approach preserves the analytical value of the Laspeyres index as a measure of change in labor costs over the longrun and over different subperiods.

As the weights become older, however, the danger grows

that current rates of change using the fixed weights could differ from those based on more recent weights by an amount great enough to be important in economic analysis. To ensure that the ECI will continue to provide a good approximation of the current rate of labor cost increase, more recent weights were introduced.

Consequences of reweighting

The new weights alter what the ECI is measuring when comparisons are made between estimates based on different sets of employment weights. That is, any change calculated by dividing an ECI index number based on new weights by an index number using earlier weights is not a proper Laspeyres estimate. Reweighting improves the currency of the index, but disrupts historical continuity.

For example, between any two periods before March 2006, when 1990 weights were used, the relative difference in the index would be the change in the cost of employing the 1990 workforce. Between any two periods after March 2006, the relative difference would be the change in the cost of employing the 2002 workforce. However, the ratio of an index for a period after March 2006 to one for a period before March 2006 cannot be interpreted in terms of the cost of employing any fixed workforce; that is, the ratio is not a Laspeyres index number.

In the past, when new weights were introduced into the ECI, all series were treated as continuous because there was little change in the overall structure of the industry and occupation. Unlike previous reweightings, however, the switch to NAICS-SOC resulted in much more substantial changes to the classification of industry and occupation. Fehmida Sleemi discusses these changes in greater detail in her article in this issue and gives guidance to users as to which series should be viewed as continuous.⁸ Part of her analysis is based on a comparison of previously published series with the NAICS-SOC series.

Subindexes. The impact of reweighting on each ECI subindex, considered separately, is the same as that on the aggregate index. The reweighting caused the change in cost for the subindex to be closer to the change in current cost, but it also resulted in a disruption of the subindex as a measure of longrun change and of change between periods before and periods after the new weights were introduced. An additional issue was raised, however, when the reweighted subindexes were introduced. This issue concerned the relationship between the change in the aggregate index and the changes in the component subindexes.

The aggregate Laspeyres index can be expressed as a weighted sum of any set of exhaustive and mutually exclusive Laspeyres subindexes where the weights sum to unity. This is a very desirable property, for two reasons. First, it guaran-

tees that the change in the aggregate index falls within the range of changes in the subseries; the change in the aggregate index cannot be greater than the largest change among the subindexes or less than the smallest. Second, the property also makes it possible to assign the increase in the aggregate index to the subseries; that is, one can determine how much of the change in the aggregate is attributable to the change in each subseries.

For comparisons spanning the date on which the new weights were introduced, however, the property that the aggregate Laspeyres index can be expressed as the weighted sum of any set of exhaustive and mutually exclusive subindexes was lost. For example, the change in the aggregate index between September 2005 and September 2006 might be larger or smaller than the change in any of the subindexes.

Effect of NAICS-SOC conversion on industry and occupation employment weights. The switch to NAICS-SOC changed the set of industries and occupations defined for the ECI. In some cases, only the names changed. However, even when an industry or an occupational category has the same name as it had under the Standard Industrial Classification-Occupational Classification System (SIC-OCS), it may be defined differently. Table 1 shows differences in employment due to definitional changes, for selected occupational

Table 1. Percent distribution of employment within the scope of the Employment Cost Index in private industry, by selected occupational and industry category, 1990 and 2002

Occupational or industry category	1990 (under SIC-OCS)	2002 (under NAICS-SOC)
All workers	100	100
Occupational category		
White-collar workers	55.1	53.8
Professional and related	12.5	14.0
Management, business, and financial	10.5	9.3
Sales and related	13.1	12.6
Office and administrative support	19.0	17.9
Blue-collar	29.8	27.9
Construction, extraction, farm, fishing, and forestry	—	5.3
Installation, maintenance, and repair	—	4.4
Production	—	10.1
Transportation and material moving	—	8.1
Service	15.2	18.3
Industry category		
Goods-producing industries	27.5	21.2
Mining8	.5
Construction	5.6	6.3
Manufacturing	21.1	14.4
Service providing	72.5	78.8
Transportation and public utilities	6.4	4.4
Wholesale trade	6.8	5.3
Retail trade	21.6	14.3
Financial activities	7.4	7.3

NOTE: Employment data are not available by NAICS-SOC classification. Dash indicates categories did not exist under SIC-OCS.

Table 2. Index levels and percent changes in compensation costs for civilian workers, 1990 and 2002 weights

[December 2000 = 100]

Quarter ending—	Based on 1990 weights (under SIC–OCS)			Based on 2002 weights (under NAICS–SOC)		
	Index level	3-month change	12-month change	Index level	3-month change	12-month change
December 2000	100.0	100.0
2001						
March	101.2	1.2	...	101.3	1.3	...
June	102.0	.8	...	102.3	1.0	...
September	103.2	1.2	...	103.5	1.2	...
December	104.1	.9	4.1	104.2	.7	4.2
2002						
March	105.1	1.0	3.9	105.1	.9	3.8
June	106.1	1.0	4.0	106.1	1.0	3.7
September	107.1	.9	3.8	107.1	.9	3.5
December	107.7	.6	3.5	107.7	.6	3.4
2003						
March	109.2	1.4	3.9	109.1	1.3	3.8
June	110.0	.7	3.7	110.0	.8	3.7
September	111.2	1.1	3.8	111.2	1.1	3.8
December	111.8	.5	3.8	111.8	.5	3.8
2004						
March	113.3	1.3	3.8	113.2	1.3	3.8
June	114.4	1.0	4.0	114.2	.9	3.8
September	115.4	.9	3.8	115.4	1.1	3.8
December	115.9	.4	3.7	116.0	.5	3.8
2005						
March	117.2	1.1	3.4	117.2	1.0	3.5
June	117.9	.6	3.1	117.9	.6	3.2
September	119.0	.9	3.1	118.9	.8	3.0
December	119.6	.5	3.2	119.6	.6	3.1

and industry categories.⁹ The effect of the conversion cannot always be isolated from the impact of the new weights. Two examples are illustrative.

For the manufacturing series, the conversion from SIC to NAICS increased the impact of the reweighting. Generally, manufacturing represents highly compensated jobs in the goods-producing industries and the private sector. Employment in manufacturing (as defined in SIC) declined by about 13 percent during the period between the use of the old and the use of the new weights (from 19.1 million in 1990 to 16.7 million in 2002). With the switch to NAICS, employment in manufacturing declined even further, to 15.3 million in 2002, due in part to a movement of printing and publishing out of manufacturing and into the information industry. (Compensation in printing and publishing is about average for manufacturing, so the shift of that industry out of manufacturing did not have much of an impact on average wages in manufacturing.) Therefore, what would have been a 13-percent reduction in employment from 1990 to 2002 effected by introducing the new weights alone was magnified to nearly 20 percent by the switch to NAICS.

In contrast, the conversion from SIC to NAICS reduced the effect of the reweighting for the retail trade series. After the conversion, employment in retail trade showed a decline, even though it increased from 19.4 million in 1990 to 23.3 million in 2002 under SIC. The explanation for this difference is that the employment growth in SIC-defined retail trade was more than offset by the movement under NAICS of about 8.1 million workers employed in eating and drinking places (now food services and drinking places) out of retail trade and into accommodation and food services.

Sources of new weights

The primary sources of the new weights were the BLS OES survey¹⁰ and Longitudinal Data Base (LDB). The OES survey is a periodic mail survey of 1.2 million nonfarm establishments over a 3-year cycle. The survey collects occupational employment data on workers by industry and represents the entire U.S. economy. The Bureau provides the procedures and technical assistance for conducting the survey; State employment agencies collect the data. The LDB includes every

establishment paying unemployment insurance in the U.S. economy, but does not provide information on occupational employment.

To compute the ECI's fixed employment weights, employment by industry was determined from the LDB for all of the industries within the scope of the ECI. Then, with the use of OES data, LDB industry employment was apportioned among the major occupational groups. In those industries excluded from the LDB—primarily railroads—unadjusted OES employment data were used. Except for railroads, industry employment from the OES survey was similar to that from the LDB; generally, LDB employment was used to determine industry employment in order to be consistent with cases in which the OES survey did not provide employment figures at the required level of industry or sector (private, State, or local) detail.

A major gap in the OES survey for purposes of computing ECI weights was that, for hospitals and educational services, employment data were not available separately by sector. Also, apart from hospitals and education, all other employment in State governments and in local governments was lumped together. To fill these gaps, LDB data were used to calculate employment counts by industry, by sector (private, State, or local), and then these counts were apportioned among occupational categories, again with the use of the OES data.

Once the employment counts by occupation within industry were determined, data from the 2000 Census of Population were used as a broad check on the calculated

employment distributions (although confidence in those data is limited because the industry and occupational classification is done by a member of each household). ECI data by industry and occupation provided the final check on the estimates.

Testing the effects of the new weights

As noted earlier, because of the many changes that were made to the ECI survey at the time the new weights were introduced, it was difficult to measure the separate impact of the change in weights. To evaluate the impact on the ECI of using 2002 weights in place of those for 1990, a test was conducted estimating rates of change for 2001–05. The test used 2002 employment weights applied to data generated by the old method of imputation and compared the results with the published figures based on the 1990 weights.

The test results show that, at the highest levels of aggregation—civilian workers—rates of change in compensation costs for 2001–05 vary only slightly when 2002 weights and NAICS–SOC definitions, rather than 1990 weights, are used. For example, on the basis of 2002 weights, the estimated change in compensation costs over the 5-year period ending December 2005 (19.6 percent) is the same as the change derived with 1990 weights. (See table 2.) The 3-month changes never differ by more than three-tenths of a percentage point over the entire December 2000–June 2005 period.¹¹ □

Notes

¹ A Laspeyres index is an index that measures the change in some aspect of a group of items over time, using weights based on values in a specific base year. Because the weights are constant from year to year, a whole run of index numbers can be compared with one another.

² For a more detailed discussion of the Employment Cost Index and its uses, see John W. Ruser, "The Employment Cost Index: what is it?" *Monthly Labor Review*, September 2001, pp. 3–16; and *Handbook of Methods* (Bureau of Labor Statistics, April 1997), on the Internet at www.bls.gov/opub/hom (last updated April 2003), Chapter 8.

³ Much of this article is based on two earlier ones discussing the shifts from the 1970-to-80 and 1980-to-90 employment weights. (See Albert E. Schwenk, "Introducing new weights for the Employment Cost Index," *Monthly Labor Review*, June 1985, pp. 22–27, and "Introducing 1990 Weights for the Employment Cost Index," *Compensation and Working Conditions*, June 1995, pp. 1–5.)

⁴ For more information on the OES survey, visit www.bls.gov/oes/home.htm on the Internet.

⁵ All of these changes are discussed in more detail in other articles in this issue.

⁶ For the 1990 ECI reweighting, professional and technical workers

were treated as separate occupation groups. The soc structure, by contrast, combines the two groups.

⁷ Schwenk, "Introducing new weights," p. 4, compared ECI indexes and changes obtained by using 1980 weights with those obtained by using 1990 weights and found little difference between the two sets of weights. For further analysis of the sensitivity of the ECI, see Michael K. Lettau, Mark A. Loewenstein, and Steve P. Paben, "Is the ECI insensitive to the method of aggregation? An update," *Monthly Labor Review*, December 2002, pp. 23–28.

⁸ Fehmida Sleemi, "ECI conversion to NAICS and soc codes," this issue, pp. 00–00.

⁹ Employment data are not available by NAICS–SOC classification before 2002.

¹⁰ The 1970 and 1980 fixed weights for the ECI were derived from the censuses for those years. For the 1990 reweighting, the primary data source was the OES survey.

¹¹ December 2000 was used as the index base in this test because it was necessary to do the analysis before December 2005 data became available.