

## CONGRESSIONAL BUDGET OFFICE

# Technical Appendix: Indexing with the Chained CPI-U for Tax Provisions and Federal Programs

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In *Budget Options, Volume 2* (August 2009), the Congressional Budget Office included three options to index federal programs for inflation using the chained consumer price index for all urban consumers, or chained CPI-U.<sup>1</sup> This appendix explains the methods and calculations that could be used to index the federal tax system, Social Security benefits, and federal pension benefits for the growth in the chained CPI-U. (The advantages and disadvantages of using that measure rather than other versions of the consumer price index are discussed in Congressional Budget Office, *Using a Different Measure of Inflation for Indexing Federal Programs and the Tax Code*, February 2010).

### Current Methods of Indexing

Under current law, parameters in the tax code that are indexed for inflation—such as the standard deductions and the dollar amounts that separate the various tax rate brackets—are equal to base-year values adjusted by the percentage change observed in the traditional, not-seasonally-adjusted CPI-U between the base year and the most recent year for which information is available. The years used are not calendar years but 12-month periods running from September to August. (The August value of the CPI-U is released in September, which allows enough time to update the indexed amounts and incorporate them into tax forms for the coming year.) Different tax parameters have different base years. The standard deduction, for example, currently uses a base year of September 1986 to August 1987. In 1987, the standard deduction for a single tax filer was \$3,000. Between the 12 months ending in August 1987 and the 12 months ending in August 2009, the CPI-U rose by 91.1 percent. As a result, the standard deduction (rounded down to the nearest \$50 increment) increased to \$5,700 in 2010.

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1. The three options are “Base Cost-of-Living Adjustments for Federal and Military Pensions and Veterans’ Benefits on an Alternative Measure of Inflation” (Spending Option 600-3, pp. 132–133); “Base Social Security Cost-of-Living Adjustments on an Alternative Measure of Inflation” (Spending Option 650-4, pp. 147–148); and “Use an Alternative Measure of Inflation to Index Some Portions of the Tax Code” (Revenue Option 6, p.186).

The annual cost-of-living adjustment (COLA) applied to Social Security benefits and federal pensions is currently equal to (or, in some cases, linked to) the increase in the not-seasonally-adjusted consumer price index for urban wage earners and clerical workers (CPI-W) between the third quarter of one calendar year and the third quarter of the next year. Like the traditional and chained CPI-U's, the CPI-W is calculated by the Bureau of Labor Statistics (BLS).

Social Security benefits are initially based on an individual's lifetime earnings and the past growth in wages nationwide.<sup>2</sup> After workers become eligible for benefits—in the case of retired workers, at age 62—benefits usually increase annually by a COLA. The adjustment is applied to December benefits, which are sent to recipients in January, and reflects growth in the CPI-W from the third quarter of the previous year to the third quarter of the current year. (Data for September, the final month of the third quarter, become available in October.) Specifically, the COLA applied to Social Security benefits in December of year  $y$  and paid in January of year  $y+1$  equals:

$$\frac{\text{CPI-W}_y}{\text{CPI-W}_{y-1}} - 1 \tag{1}$$

For example, the CPI-W increased from an average of 203.596 in the third quarter of 2007 to 215.495 in the third quarter of 2008.<sup>3</sup> Rounded to the nearest tenth of a percent, that represents a rise of 5.8 percent. Consequently, for most Social Security beneficiaries, the benefits paid in January 2009 were 5.8 percent higher than those paid in 2008. Current law specifies that COLAs cannot be negative, so when the CPI-W declines, Social Security benefits do not change. Such a decline occurred between the third quarter of 2008 and the third quarter of 2009, so there was no adjustment to Social Security benefits paid in 2010. A COLA will next apply in the first year in which the level of the third-quarter CPI-W is higher than it was in 2008.

Pensions paid to retired federal employees are also adjusted each year by an amount equal or linked to third-quarter-to-third-quarter growth in the CPI-W. However, the details of those adjustments differ somewhat from Social Security COLAs. They also vary for different types of pensioners.

Under the Civil Service Retirement System (CSRS), cost-of-living adjustments are applied to benefits for all annuitants who have been receiving benefits for at least one month as of the end of the calendar year. The COLA first applies to December benefits, which are paid at the beginning of January. Annuitants who have been receiving benefits for at least a year get the full adjustment; those who have been receiving ben-

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2. For a detailed explanation of how Social Security benefits are computed, see Congressional Budget Office, *Social Security: A Primer* (September 2001), Chapter 2.

3. Those values are relative to a base level of 100, which was the average value of the CPI-W from 1982 to 1984.

efits for less than a year get a prorated amount. The COLAs apply to all annuitants, regardless of age.

COLAs are computed in a similar manner under the Federal Employees Retirement System (FERS). The adjustment first applies to December benefits. Annuitants who have been receiving benefits for at least one year get the full COLA, and those who have been receiving benefits for less than a year get a prorated amount. But the cost-of-living adjustment under FERS differs from the adjustment under CSRS in two ways. First, nondisabled FERS annuitants receive COLAs only beginning at age 62. Second, pension benefits are fully indexed for inflation only if the CPI-W increases by less than 2 percent in a year. If the growth rate of that index is between 2 percent and 3 percent, the COLA is 2 percent; if the growth rate of the CPI-W is greater than 3 percent, the COLA is 1 percentage point less than that rate. As with Social Security, FERS benefits are not reduced in the case of deflation.

## **Indexing the Tax Code to the Chained CPI-U**

Unlike the traditional, not-seasonally-adjusted CPI-U and CPI-W, which are not revised, BLS revises the monthly value of the chained CPI-U twice: in February of the year after the initial estimate is released and again in February of the following year. For example, the initial values of the chained CPI-U for months in 2009 were revised on an interim basis in February 2010 and will be revised for the final time in February 2011.

One way to start using the chained CPI-U to index dollar amounts in the tax code would be to increase current amounts by the most recent estimate of growth in the chained CPI-U. To illustrate: The standard deduction for single tax filers in 2010 is \$5,700. An approach that could be implemented in the fall of 2010 would be to compute the 2011 deduction by multiplying \$5,700 by the best estimate of inflation from the 12 months ending in August 2009 to the 12 months ending in August 2010. Mathematically,

$$\text{deduction}_{2011} = \text{deduction}_{2010} \times \frac{\text{initial index}_{2010}}{\text{interim index}_{2009}} \quad (2)$$

Because the reference year for indexing tax parameters runs from September through August, *initial index*<sub>2010</sub> would actually consist of the average of the interim monthly values of the chained CPI-U for September 2009 through December 2009 and the initial values for January 2010 through August 2010. Similarly, *interim index*<sub>2009</sub> would be the average of the final values for September 2008 through December 2008 and the interim values for January 2009 through August 2009.

In later years, the amount of the standard deduction could continue to be indexed in the same way, keeping 2009 as the base year. In 2012, the deduction would equal the

2010 level adjusted for the most recent estimate of price growth from the 12 months ending in August 2009 to the 12 months ending in August 2011. Formulaically,

$$\text{deduction}_{2012} = \text{deduction}_{2010} \times \frac{\text{initial index}_{2011}}{\text{final index}_{2009}} \quad (3)$$

and thereafter,

$$\text{deduction}_y = \text{deduction}_{2010} \times \frac{\text{initial index}_{y-1}}{\text{final index}_{2009}} \quad (4)$$

Note that *final index*<sub>2009</sub> would be the average of the final values of the chained CPI-U for September 2008 through August 2009. And *initial index*<sub>y-1</sub> would be the average of the interim values for September through December of year y-2 and the initial values for January through August of year y-1.

Because the computation each fall would be based on preliminary estimates of the chained CPI-U, the increase in the deduction (or other tax parameter) would differ slightly from the growth in the final value of the chained CPI-U. However, using the most recent data available in each year means that the calculation would automatically incorporate any revisions to inflation estimates in past years.

For example, suppose the interim value of the index from September 2008 to August 2009 was 100 and the initial estimate of inflation from September 2009 to August 2010 was 3.1 percent (as shown in the table below). In that case, the initial value of the 2010 index would be 103.1. Now suppose that the estimate of inflation between 2009 and 2010 was later revised down to 3.0 percent and that the initial estimate of inflation from 2010 to 2011 was 2.0 percent. The initial index value for 2011 would be calculated by applying the initial growth estimate of 2.0 percent to the updated interim index value for 2010. As such, the initial 2011 index value would be 105.06 (103.0 x 1.02) rather than 105.162 (103.1 x 1.02).

	2009	2010	2011
Chained CPI-U			
Initial		103.1	105.06
Interim	100.0	103.0	
Inflation Rate Based on the Chained CPI-U (Percent)			
Initial	3.1	2.0	
Interim	3.0		

Note: The numbers in this table are hypothetical, not actual, values.

In that way, any changes made between the initial and interim values of the chained CPI-U for previous years would automatically be incorporated into the best estimate of the current year's initial value. Thus, when previous years' index values were revised

downward, the initial index values would be lower than they would be otherwise to correct for the previous overstatement of inflation. Conversely, when upward revisions occurred, the initial index values would be higher than they would be otherwise to correct for the previous understatement of inflation. (For the calculation of the 2012 deduction in equation (3), changes between the interim and final index values for 2009 would be incorporated in an analogous way.)

An additional complication stems from the rounding currently specified in law for indexed amounts in the tax code. As described above, the \$5,700 standard deduction for a single filer in 2010 equals the 1987 value of \$3,000 adjusted for the 91.1 percent increase in the traditional CPI-U since 1987 and rounded to the next-lowest multiple of \$50. That rounding reduces the deduction by 0.58 percent from what it would be otherwise (\$5,733.06). If the new formula was based on the rounded value, the effect of the rounding would continue indefinitely and the deduction would continue to be 0.58 percent lower, on average, than if the base-year value was calculated without rounding.

To avoid any persistent effect of rounding in the new base year, the law could specify that the value in the new base year be the unrounded amount. Equivalently, the law could reference the original base amount and multiply it by the ratio of the traditional CPI-U in the year before the original base year to the CPI-U in the year before the new base year and then multiply that product by the ratio for the chained CPI-U. In the case of the standard deduction, the formula for the deduction in 2011 would be:

$$\text{deduction}_{2011} = \text{deduction}_{1987} \times \frac{\text{CPI-U}_{2009}}{\text{CPI-U}_{1986}} \times \frac{\text{initial index}_{2010}}{\text{interim index}_{2009}} \quad (5)$$

For deductions in 2012 and thereafter, the formula would be:

$$\text{deduction}_y = \text{deduction}_{1987} \times \frac{\text{CPI-U}_{2009}}{\text{CPI-U}_{1986}} \times \frac{\text{initial index}_{y-1}}{\text{final index}_{2009}} \quad (6)$$

Any rounding would then be applied each year to the resulting value.

## **Basing Social Security COLAs on the Chained CPI-U**

Cost-of-living adjustments to Social Security benefits could be based on the chained CPI-U in much the same way that indexed parameters of the tax system would be. Each year, the COLA would equal the most recent estimate of inflation, based on the initial value of the chained CPI-U, adjusted for newly published corrections to the chained CPI-U in previous years. For example, if in a given year BLS increased its estimate of the previous year's inflation by 0.2 percent, that would mean that existing Social Security beneficiaries received too low a COLA in the previous year and that their COLA for the current year should be increased to offset the error. Each year's

COLA would be imperfect, but any errors would be offset by future COLAs over the next two years.

That methodology could be adjusted slightly for new beneficiaries. One approach would be to set the first COLA applied to a new retiree's benefit amount equal to the current best estimate of inflation in the past year. Under that approach, such COLAs should not include any adjustments for errors in past years' COLAs because new beneficiaries would not have benefited or suffered from past errors in preliminary values of the chained CPI-U. One way to avoid such unnecessary adjustments would be to compute the COLA for each cohort (everyone born in a given year) relative to the chained CPI-U in a different base year. For Social Security retirees, the COLA could be based on the growth in the chained CPI-U since the third quarter of the year in which they turned 61. With that method, different cohorts of beneficiaries would receive slightly different COLAs in certain years, but the differences would be small (generally about 0.1 percentage point).

The most straightforward way to implement cohort-specific COLAs would be to switch from the current system, in which an individual's benefit is based on the previous year's benefit and the COLA, to a computation in which the current-year benefit equals a base-year benefit (the primary insurance amount in the year of eligibility for Social Security benefits) adjusted for total estimated growth in the chained CPI-U between the base year and the current year.

Currently, price indexation through age 60 is done implicitly by indexing benefits to Social Security's national average wage index, which is based on the average of all wages over a calendar year. Because the wage index is a nominal value, it can be considered to include both real (inflation-adjusted) wage growth and price growth—including price growth from the year in which the beneficiary turns 59 to the year in which he or she turns 60. The COLA is then applied to benefits for the December of the year in which the person turns 62. That COLA equals the price growth between the third quarter of the year in which the beneficiary turns 61 and the third quarter of the year in which he or she turns 62. Benefit amounts are reduced for people who claim benefits before the normal retirement age and are raised for those who claim benefits after that age. But the age of claiming does not affect the initial computation or the application of COLAs, which apply regardless of when people claim benefits.

The chained CPI-U could be used to determine cohort-specific COLAs by setting benefits in a given year equal to initial benefits adjusted for growth in the chained CPI-U between the year in which the beneficiary turned 61 and the year before the benefit year. More formally, benefits in year  $y$  would equal initial benefits times the ratio of the chained CPI-U in year  $y-1$  to the chained CPI-U in the year in which the beneficiary turned 61. The computation would always use the most recent data available. Specifically, the numerator would always be the initial value of the chained CPI-U. In the first year in which a COLA was applied, the denominator would be the interim value of the chained CPI-U; thereafter, it would be the final value.

For example, if someone turned 62 in 2010, no COLA would be applied to benefits paid in that year; benefits would simply be the primary insurance amount (adjusted for the age of claiming). Then, for benefits paid in 2011,

$$\text{benefit}_{2011} = \text{benefit}_{2010} \times \frac{\text{initial index}_{2010}}{\text{interim index}_{2009}} \quad (7)$$

For benefits paid in 2012,

$$\text{benefit}_{2012} = \text{benefit}_{2010} \times \frac{\text{initial index}_{2011}}{\text{final index}_{2009}} \quad (8)$$

And in later years,

$$\text{benefit}_y = \text{benefit}_{2010} \times \frac{\text{initial index}_{y-1}}{\text{final index}_{2009}} \quad (9)$$

The following table shows third-quarter values for the chained CPI-U in recent years and third-quarter-to-third-quarter inflation rates.

	2002	2003	2004	2005	2006	2007	2008	2009
Chained CPI-U								
Initial	105.777	107.831	110.396	113.945	117.725	120.219	125.911	123.896
Interim	106.005	107.971	110.596	114.209	117.754	120.373	125.883	125.132
Final	106.008	108.123	110.790	114.519	118.066	120.434	126.688	
Inflation Rate Based on the Chained CPI-U (Percent) <sup>a</sup>								
Initial		1.72	2.25	3.03	3.08	2.09	4.60	-1.58
Interim		1.85	2.29	3.09	2.83	1.95	4.52	-1.23
Final		1.99	2.47	3.37	3.10	2.01	5.19	

a. Initial inflation is the initial index divided by the interim index from the previous year; interim inflation is the interim index divided by the final index from the previous year; and final inflation is the final index divided by the final index from the previous year.

Using that historical data illustrates how the above formulas would have applied to a beneficiary who turned 62 in 2005 with a primary insurance amount of \$1,000. That person would have received the following monthly benefits (with each value rounded to the nearest 10 cents):

$$\text{benefit}_{2005} = \$1,000.00 \quad (10)$$

$$\begin{aligned} \text{benefit}_{2006} &= \text{benefit}_{2005} \times \frac{\text{initial index}_{2005}}{\text{interim index}_{2004}} = & (11) \\ \$1,000.00 \times \frac{113.945}{110.596} &= \$1,030.30 \end{aligned}$$

That adjustment is the same as applying the initial estimate of inflation in 2005, 3.03 percent.

Benefits in 2007 would be:

$$\begin{aligned} \text{benefit}_{2007} &= \text{benefit}_{2005} \times \frac{\text{initial index}_{2006}}{\text{final index}_{2004}} = & (12) \\ \$1,000.00 \times \frac{117.725}{110.790} &= \$1,062.60 \end{aligned}$$

Applying the initial 2006 inflation estimate of 3.08 percent to the 2006 benefit of \$1,030.30 would have produced a 2007 benefit of \$1,062.00. The actual 2007 benefit is 60 cents higher, reflecting the upward revision to 2005 inflation (from an initial estimate of 3.03 percent to an interim estimate of 3.09 percent).

The table below shows the monthly benefit amounts that would occur under this example for 2005 through 2008 and the amounts that would have occurred if there had been no revisions to the preliminary values of the chained CPI-U. The revisions made during that period would have trimmed about 0.2 percent to 0.6 percent from each year's benefit amount. However, as discussed in CBO's report *Using a Different Measure of Inflation for Indexing Federal Programs and the Tax Code*, the Bureau of Labor Statistics is investigating better methods for estimating the preliminary values of the chained CPI-U. If it adopted such a method, future revisions could be significantly smaller than past ones.

	2005	2006	2007	2008	2009
Monthly Benefits Using the Revised Chained CPI-U for COLAs (Dollars)	1,000.00	1,030.30	1,062.60	1,085.10	1,136.50
Monthly Benefits Without Revisions to the Chained CPI-U (Dollars)	1,000.00	1,033.70	1,065.70	1,087.00	1,143.50
Difference (Percent)	0	0.33	0.29	0.18	0.62

## **Basing COLAs for Federal Pensions on the Chained CPI-U**

Indexing pension benefits paid under the Civil Service Retirement System to the chained CPI-U could be done the same way as for Social Security benefits, although the first COLA would continue to be prorated for people who claimed benefits in any month other than January. Indexing benefits paid under the Federal Employees



Retirement System to the chained CPI-U would be a bit more complicated. Besides prorating initial COLAs, analysts would have to account for the fact that, under current law, COLAs for FERS beneficiaries are slightly smaller than the growth in the CPI-W when that growth is at least 2 percent.

As noted above, if CPI-W growth is between 2 percent and 3 percent, FERS annuitants receive a COLA of 2 percent; if CPI-W growth exceeds 3 percent, the COLA is 1 percentage point lower than CPI-W growth. For instance, if inflation was 1 percent one year and 5 percent the next year, the adjustments to FERS benefits would be 1 percent and 4 percent. In that example, inflation would total 6.05 percent after the two years ( $1.01 \times 1.05 = 1.0605$ ), and the COLAs would total 5.04 percent. If inflation was 3 percent each year, however, total inflation over the period would be 6.09 percent (almost the same as in the previous example), but the COLAs under FERS would be 2 percent each year, for a total of 4.04 percent (1 percentage point less than in the previous example). Of course, when considering use of the chained CPI-U, policymakers would also have the option to implement a less complex COLA concept—for instance, making the COLA 0.5 percentage points less than the increase in the chained CPI-U, or zero whenever that index did not increase.

If the current links between annual inflation rates and the size of COLAs under FERS were retained, benefit levels could not simply be based on total growth since a base year. Rather, growth in the chained CPI-U would have to be defined separately for each year. It would also vary slightly for each cohort.

Assume, for example, that someone claimed FERS benefits at the beginning of 2012. The 2013 COLA would be based on the best available estimate of price growth in 2012 as measured by the chained CPI-U, which would equal:

$$\frac{\text{initial index}_{2012}}{\text{interim index}_{2011}} - 1 \quad (13)$$

The following year, the COLA would equal the growth in prices from 2012 to 2013 minus an adjustment for any error in estimating 2012 growth. That adjustment would equal the current estimate of 2013 price growth divided by the estimate that was used the previous year, so formulaically, the 2014 COLA would equal:

$$\frac{\text{initial index}_{2013}}{\text{interim index}_{2012}} \times \left( \frac{\text{interim index}_{2012}}{\text{final index}_{2011}} \div \frac{\text{initial index}_{2012}}{\text{interim index}_{2011}} \right) - 1 \quad (14)$$

which is equal to:

$$\frac{\text{initial index}_{2013}}{\text{final index}_{2011}} \times \left( 1 \div \frac{\text{initial index}_{2012}}{\text{interim index}_{2011}} \right) - 1 \quad (15)$$

That formula can be interpreted as the current best estimate of price growth from 2011 to 2013, minus the inflation that served as the basis for the COLA in the previous year.

For the 2015 COLA, the same approach would be required, but the calculation would need to remove any errors from the previous two years. In other words, the adjustment would equal total price growth from 2011 to 2014, minus the inflation that served as the basis for the COLAs that were applied in the previous two years. Formulaically, that would be:

$$\frac{\text{initial index}_{2014}}{\text{interim index}_{2013}} \times \left( \frac{\text{interim index}_{2013}}{\text{final index}_{2012}} \div \frac{\text{initial index}_{2013}}{\text{interim index}_{2012}} \right) \times \left( \frac{\text{final index}_{2012}}{\text{final index}_{2011}} \div \frac{\text{interim index}_{2012}}{\text{final index}_{2011}} \right) - 1 \quad (16)$$

with the first term reflecting the initial estimate of growth in the chained CPI-U from 2013 to 2014, the second term reflecting the interim update to the estimate of growth from 2012 to 2013, and the third term reflecting the final update to the estimate of growth from 2011 to 2012. That formula reduces simply to:

$$\frac{\text{initial index}_{2014}}{\text{initial index}_{2013}} - 1 \quad (17)$$

In other words, revisions to estimates of the chained CPI-U from previous years would not affect the inflation rate used as the basis for the FERS COLA in the current year because the effects would be offsetting. For example, if the value of the 2013 index was revised upward by 0.1 percent, that would also mean the initial estimate of the 2012 index would be 0.1 percent higher than it would be otherwise.

Although such revisions would not affect the inflation rate used for setting COLAs under FERS, they could affect the COLAs themselves in some cases. For instance, suppose that an initial estimate of inflation was 2.0 percent; that the following year, that value was revised to 2.2 percent; and that the initial estimate of inflation in the second year was 4.0 percent. In that case, the COLA in the first year would be 2.0 percent (because under current law, inflation of 2.2 percent results in a COLA of 2.0 percent). The COLA in the second year would be 3.2 percent (because inflation of 4.0 percent adjusted for the 0.2 percent revision would be 4.2 percent, resulting in a COLA of 3.2 percent). If, however, the initial estimate of inflation in the first year was 2.2 percent and was not revised, the COLAs for the two years would be 2.0 percent and 3.0 percent.

To ensure that such revisions did not affect the total size of FERS COLAs, the adjustments to benefits in future years could be based not directly on revisions to the

chained CPI-U but instead on the effects that those revisions would have on COLAs. First, revised data would be used to compute what the COLA in those years would have been without the revision, and that value would be compared with the COLA that was used. Next, the difference between the hypothetical and actual COLAs would be compared with the difference between the initial and interim estimates of the underlying inflation rates from the two years. The COLA for the second year would then be adjusted to account for any discrepancy between the two sets of differences.

In the example above, the COLA in the first year would be 2.0 percent regardless of whether inflation that year was 2.0 percent or 2.2 percent. Thus, with no difference between the COLAs but a difference of 0.2 percentage points between the inflation rates, the COLA for the second year would be adjusted to 3.0 percent.

### **Holding Social Security and Pension Benefits Constant in Cases of Deflation**

Under current law, deflation does not reduce Social Security or federal pension benefits. Retaining that policy while switching to the chained CPI-U would be simple: Benefits would equal the previous year's benefit or the benefit computed under the formula, whichever was greater. For benefits received in the year in which the beneficiary turned 62, either the formula could incorporate the effects of deflation or benefits could be set at the primary insurance amount. After a period of deflation occurred, benefits would readjust to where they should have been relative to their initial level once the price index returned to or exceeded the peak it reached before the deflation began.