The CPI Options: What They Are and What They Mean for Social Security

Introduction

“The job of designing a strategy that would actually improve the CPI as opposed to simply changing it by some arbitrary adjustment factor is a complex, time-consuming, and expensive process.” (Norwood, 1995)

The Consumer Price Index (CPI) is the nation’s primary measure of inflation. Based on a market basket of goods and services, the CPI measures average price changes over time.1

The CPI is thus an important and sometimes controversial measure because it directly affects both what the government takes in and what it pays out.

Reducing the CPI by half a percentage point each year beginning in 2005 reduces the federal budget deficit by $174 billion cumulatively over 10 years (2005–2014).2

1 The goods and services are broken into eight major categories: 1. Food and beverages, including full-service meals and snacks; 2. Housing; 3. Apparel, including jewelry; 4. Transportation, including air fares, fuels, and vehicle insurance; 5. Medical care; 6. Recreation, including sports equipment and pets; 7. Education and Communication, including tuition and telephone services; 8. Other goods and services, including haircuts and funeral expenses.

2 These projections were derived using the long-term model created for AARP by Macroeconomic Advisers (MA), LLC, St. Louis, MO. The present simulation uses assumptions identical to those in Sceneario 5 of the Detailed Long-Term Budget Scenarios used by the Congressional Budget Office (CBO). Congressional Budget Office: The Long-Term Budget Outlook, December 2003. Appendix: Details of the Long-Term Budget Scenario. Available at:

From 2005 to 2028, federal expenditures would decline by a total of $2.2 trillion, and federal revenues would rise by $957 billion, thus reducing the federal deficit by $3.1 trillion cumulatively.

The shaded area in Figure 1 represents the reduction in the federal budget deficit over 24 years if the CPI growth were reduced by half a percentage point. For further discussion of the model and its assumptions, see the Endnote to this paper.

Figure 1: Change in Federal Expenditures, Revenues, and Budget at CPI Growth Less 0.5 Percentage Point


Assumptions about growth in GDP, revenue, and expenditures are the same. The MA model, like CBO’s, also assumes no change in current law for personal tax rates. Our results in 2028 are fairly close to CBO’s results for scenario 5 in 2030. For details about the simulation assumptions and the monetary policy regime used in the simulation, see Endnote to this paper and Table A.
Because it measures inflation, the CPI is used to adjust the dollar values for a wide array of federal programs—most prominently, the annual cost-of-living adjustments for 46 million Social Security beneficiaries and federal income tax brackets for 127 million tax filers. Over the years, the CPI has been a topic of discussion and debate—not only about whether it is an accurate measure of inflation, but also whether it is the appropriate gauge for cost-of-living adjustments (COLAs) in programs such as Social Security and Supplemental Security Income (SSI).

This Data Digest provides an overview of the current CPI, discusses enacted CPI revisions, explains the differences between a CPI and a cost-of-living index (COLI), gives the reasoning behind some recent changes in the calculation, and describes a new measure, called the “chained” or “superlative” index, which takes better account of changes in consumer expenditures in every period, making the chained index a more accurate cost-of-living measure. Finally, the paper speculates on the impact of changes in the CPI on Social Security benefits, the Social Security trust funds, and Social Security as a share of the gross domestic product (GDP).

Updating and Revising the CPI

Analysis, revisions, and adjustments to improve the accuracy of the CPI have been ongoing at the Bureau of Labor Statistics (BLS) since the inception of the CPI. The primary review of the CPI is the decennial update process.

Approximately every 10 years, a new market basket is introduced that updates the expenditure weights for the categories of goods and services that make up the CPI. The most recent market basket decennial updating took place in January 1998. In addition to the regular updates, ad hoc revisions are made. Examples are the inclusion of discount airfares in 1991 and generic drugs in 1995.

Technological and methodological improvements are also made to the CPI on a continuing basis. Additionally, experimental indexes are developed to study how the CPI affects specific subgroups of the population.

CPI-U and CPI-W

Today, two CPIs are in common use, each of which reflects the spending patterns of a group of consumers. The CPI for all urban consumers (CPI-U), implemented in 1978,

5 The BLS, in the U.S. Department of Labor, is the government’s principal fact-finding agency in labor economics and statistics.

6 These updates/revisions are comprehensive, multiyear efforts. The changes involved in the 1998 revision ranged from new systems for collecting data to reselection of items and outlets.

7 Technological and methodological improvements are exemplified by the change in 1999 to calculate most basic index using the geometric mean. (For further information, see The Geometric Mean Index below.)

8 For example, the consumer price index-experimental (CPI-E) was an experimental index that measured the expenditure patterns of those age 62 and over. Attachment F: Experimental CPI for Americans 62 Years of Age and Older, BLS New Release, December 1996. Available at: http://www.bls.gov/news.release/cpi.br12396.

3 These CPI-based adjustments to the tax brackets prevent “bracket creep,” i.e., inflation-induced income increases that move people into higher tax brackets without increasing their real incomes.

4 The CPI is also used, for example, in setting the federal cost-of-living adjustment for Supplemental Security Income recipients, the poverty thresholds, and income eligibility levels for programs such as Food Stamps and Head Start.
represents almost 80 percent of the population, including the self-employed, professionals, the poor, and those over age 65. The CPI for urban wage earners and clerical workers (CPI-W), established in 1919, applies to about 32 percent of the population. It represents households in which at least half of the income comes from clerical or wage jobs.

Calculating the CPI

The Laspeyres Formula

Before January 1999, both the CPI-U and CPI-W, starting with a base year, measured the difference between what it cost the consumer to purchase a fixed market basket of goods and services “last year” and what it cost the consumer to purchase the same goods and services “this year.” To make these fixed market basket calculations, the BLS uses what is known as the Laspeyres formula. The problem with this formula is that it does not deal with several biases; some assert that it overestimates the CPI.

The Advisory Commission to Study the Consumer Price Index

In 1995, the federal budget deficit was $167.8 billion, or 2.2 percent of GDP. There was considerable pressure on the BLS to make changes to the CPI that would reduce the government’s obligations.

Among those who offered opinions on the CPI was Federal Reserve Board Chairman Alan Greenspan who, in congressional testimony, noted that, all other elements of the economy remaining the same, if annual inflation adjustments to indexed programs and taxes were reduced by one percentage point, the annual deficit would be lower by $55 billion after five years, and the cumulative deficit reduction over the same period would be nearly $150 billion lower. He went on to say, “I believe the evidence suggests that some adjustment to our indexing procedures is warranted” (Greenspan, 1995).

Then-Speaker of the House Newt Gingrich strongly concurred with Chairman Greenspan. The Senate Finance Committee suggested a study and in 1995 established the Advisory Commission to Study the Consumer Price Index.

The Commission, chaired by economist Michael Boskin and known as the Boskin Commission, concluded that several biases in the CPI calculation (including substitution bias, quality change bias, outlet bias, and new product bias) were responsible for understating inflation.

12 Changes in consumer spending patterns in response to price changes were not accounted for in the CPI in 1995. If the price of steak increased relative to ground beef, consumers on average would not experience a commensurate increase in their cost of living because many would not feel a significant loss of welfare if they substituted ground beef for steak. However, the CPI includes the full price increase of steak weighted by the pre-price increase share of steak in total purchases.

13 Another bias identified was the change in the quality of products from year to year. Not only do new cars cost more, but because of lightweight bumpers, they are less able to withstand a collision. If the CPI does not account for this drop in quality, inflation may be understated. In contrast, the quality of personal computers has improved faster than the CPI analysts can track. In this case, the CPI may overstate inflation.

14 Stores like Kmart and Wal*Mart are able to sell products at lower prices than full-service department stores can. As a result, if the discount store prices are not included in the point-of-purchase sample, the CPI will be biased upward.

15 There is usually a considerable lag before new products, such as high definition television, are represented in the CPI market basket. Initial
for overestimating the change in the cost-of-living by about 1.1 percentage points per year. The Commission suggested modifying the CPI’s fixed market basket structure, to make it closer to a cost-of-living index.

A Cost-of-Living Index

The Consumer Price Index (CPI) is used as a measure of inflation to determine the amount of the cost-of-living adjustment (COLA) in various programs. For example, the Social Security annual COLA for 2003 (paid in January of 2004) was 2.1 percent—an increase in benefits based on the third quarter to third quarter increase in the CPI-W of 2.1 percent.

However, while the CPI increase is used to set a cost-of-living amount, the CPI and a real cost-of-living index (COLI) are not technically the same. A cost-of-living index (COLI) would take into account the concept of a person’s welfare; thus it would reflect, over time, the changes in the amount that a consumer needs to spend to maintain a certain standard of living. In contrast, the CPI measures changes over time in the amount consumers need to spend to purchase a specific basket of goods and services.

It is more difficult to measure cost-of-living accurately because, in addition to measuring changing goods and services from a market basket, a COLI includes difficult-to-measure changes in non-market, government, or environmental factors that affect consumers’ well-being, such as safety, education, public health, pollution, traffic, and the many other factors that are not bought and sold in the market.16

A particularly important issue posed by the CPI/COLI discussion (and one highlighted by the Boskin Commission) is known as substitution bias—that is, when a good becomes too expensive or goes out of date, the consumer may substitute another good for the original.

The CPI and the COLI both reflect changes in the prices of goods and services, such as food and clothing. However, a COLI takes into account the fact that consumers do not continue to purchase the same goods as prices change, but instead may buy items whose relative prices have fallen. A COLI also accounts for consumers purchasing new items because of changes in income, tastes, and preferences, or because the quality of items has improved. (See footnotes 12–15 for descriptions of four biases.)

The BLS reported to Congress in 1997 that it had been using the cost-of-living concept as a framework for making decisions about the CPI, and that it accepted the COLI as the measurement objective for the index (Schultze and Mackie, 2002, p. 14). In 1998, the BLS asked the Committee on National Statistics17 to convene a panel to investigate and make recommendations for a more adequate cost-of-living measure.18

The panel, acknowledging both the “theoretical and measurement” problems with non-market public goods of the COLI, unanimously recommended a “conditional COLI.” This measure, which covers only the universe of market-based private goods

prices on new items are often high to recoup development costs, but then fall quickly before items are introduced into the market basket. The drop prior to inclusion in the basket is not captured, and thus inflation is overstated.

16 For further discussion of a COLI by BLS see: http://stats.bls.gov/dolfaq/bls_ques2.htm.

17 The Committee was established at the National Academy of Sciences, National Research Council, in 1972 at the recommendation of the President’s Commission on Federal Statistics. CNSTAT is part of the Division of Behavioral and Social Sciences and Education within the National Academies.

18 The Panel on Conceptual, Measurement, and Other Statistical Issues in Developing Cost-of-Living Adjustments was chaired by economist Charles Schultze and is known as the Schultze Panel.
and services, is called a cost-of-goods index (COGI) (Schultze and Mackie, 2002, p. 14).¹⁹

The panel also recommended that the BLS, along with other federal statistical agencies, undertake or sponsor on an experimental basis “more comprehensive measures of national output, income and prices” (Schultze and Mackie, 2002, p. 4).

The Geometric Mean Index

Researchers had discussed the geometric mean index as a way of eliminating certain biases in the CPI in 1993.²⁰ However, it was not considered seriously until 1996, when the Boskin Commission pointed out that the ability of consumers to substitute one good for another meant that maintaining a “level of well-being” could cost less than the increase in the cost of specific goods and services in the CPI market basket.

The Geometric Mean Index (GMI) and Category Substitution. The GMI was designed to adjust partially for substitution by averaging the prices within an item category using a geometric mean formula. According to the Bureau of Labor Statistics, the GMI is a better measure of changes in the cost of living when people reduce or change their consumption of items whose prices have risen recently and increase their consumption of items whose prices have not risen or have fallen.

The GMI reflects that consumers behave differently when relative prices change. For example, when the price of steak goes “too high,” consumers could change or redistribute their beef purchases by 1. switching brands; 2. switching stores; 3. purchasing three-quarters of a pound of steak instead of a full pound; 4. purchasing ground beef; or 5. purchasing steak only when it is on sale.

The GMI does have limitations. The averaging takes place only within categories. So, for example, a change from hamburger to portobello mushrooms would not be accounted for, but a change from steak to hamburger would. And, while it accounts for some substitution, the GMI represents only about 61 percent of the items in the CPI market basket.²¹

The GMI and Fixed Weights. A further limitation of the GMI is that, while it uses fixed expenditure proportions instead of fixed quantities as the weights for averaging the prices of items within the index, the GMI “expenditure proportion weights” are still based on Laspeyres’ base-year quantities, and therefore remain fixed.

Put another way, both Laspeyres and the GMI formula use the base-year weights, even when some of the items are replaced by new items.²² As a result, the GMI does not account for the latest items introduced in the basket (e.g., plasma televisions or hybrid engine cars). Nor does it account for consumers substituting more expensive items with cheaper items in period “t.” (See formulae comparisons in Technical Appendix.)

¹⁹ In the absence of a good measure of non-market public goods, the BLS uses the cost-of-goods index (COGI) as an appropriate proxy for the cost-of-living index (COLI).

²⁰ In particular, the BLS was looking at resolving the problem of functional form or “formula” bias. This upward bias occurred because of technical problems in using observed expenditure information to estimate the quantity weights used in the index formula. Because the geometric mean formula does not require quantity data, it does not have this bias.

²¹ Not accounted for are “selected shelter services, selected utilities, and government charges and selected medical services.” In Updated Response to the Recommendations of the Advisory Commission to Study the Consumer Price Index. Available at: http://stats.bls.gov/cpi/cpi0698a.pdf.

²² See Technical Appendix.
The GMI and the CPI Calculation. Between 1996 and 1999, the BLS researched the extent to which consumers change their spending patterns when relative prices change. Researchers found that consumers do alter their purchasing behavior in response to the numerous price options in the marketplace, and they concluded that a CPI calculation incorporating the GMI would better reflect the effects of this activity than would the CPI without it. The BLS research projected that the new formula would reduce the annual CPI by about 0.2 percentage points per year (Dalton et al., 1998). The GMI has been used to calculate most basic index within the CPI since 1999.

The Chained or Superlative Index

Using the GMI, by accounting for substitution within item categories, made the CPI calculation more closely approximate a COLI than had the Laspeyres calculation alone. The Chained Consumer Price Index for all Urban Consumers (C-CPI-U), created by the BLS and first published along with the CPI-W and the CPI-U as a supplement in August 2002, moves the index even closer to a COLI.

The Chained Index and Changes in Consumption

Sometimes called the “superlative index,” the chained index method of calculation adjusts for changes in consumer expenditures, due to changes in relative prices, in every period by using a “chain-base” instead of a fixed base year.23 The use of expenditure data for both base and current periods to average price changes across item categories distinguishes the C-CPI-U from existing measures, which use only a single expenditure base period to compute the price change over time. In other words, there is minimal substitution bias because consumers’ ongoing substitution of new items for old is accounted for in every expenditure period. (For a full discussion of the formula, see Technical Appendix.)

The C-CPI-U is a closer approximation of a COLI than either the CPI-U or the CPI-W (even after the inclusion of the GMI in 1999). Because a chained index is linked to expenditure weights that change for each period, the C-CPI-U accomplishes two things neither of the other calculations could: first, since the basket of goods is no longer fixed (as in the Laspeyres index), it captures consumers’ substitution purchases in all periods, and, second, for market-based goods and services, it measures the actual cost-of-living as time passes.

The Chained Index: Initial, Interim, and Final Values

Data reflecting changes in consumer expenditures from any given year are not available until the following year. Thus, while the CPI-U and CPI-W are considered to be final when they are released, the data for these two standard CPI measures are not current.

Similarly, expenditure data required for the calculation of the C-CPI-U are available only with a time lag. The C-CPI-U handles the timeliness problem by issuing the index in preliminary form first and then subjecting it to two annual revisions.

The initial and interim indexes are based on just the base-year weights, as in the Laspeyres index. Only in the calculation of the final index is the C-CPI-U formula chained. It does not use base-year weights (as in the Laspeyres index and the Geometric Index) or the current-year weight (as in the Paasches Index).24 Instead, it uses an average.

24 An index based on the current-year weights is known as the Paasche Index (P), defined as
\[ P = \frac{P_1^t Q_1^t + P_2^t Q_2^t}{P_1^0 Q_1^t + P_2^0 Q_2^t}. \]
Because of the time lag, only the final estimates for the C-CPI-U are based on the average of two time periods in a chain-base of base-year and current-year weights. For example, the 2000 C-CPI-U would use an average of 1999 and 2000 weights; the 2001 C-CPI-U would use an average of 2000 and 2001 weights; and so on. This further reduces any bias that may have been caused by using only one-year weights.

The C-CPI-U index revisions, from preliminary to intermediate to final, are expected to be small, but in principle each monthly index could be revised from its previously published level (U.S. Department of Labor, 2002a).

The Increase in the C-CPI-U versus the Increase in the CPI-U

The BLS estimated in February 2002 that the C-CPI-U would likely increase at an average annual rate of 0.1 to 0.2 percentage points less than the CPI-U. In fact, the difference between the increase in the C-CPI-U and the CPI-U over the last three years was notably larger than expected (see Chart 1).

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<thead>
<tr>
<th>Year and Month</th>
<th>12-Month Percent Price Change</th>
<th>CPI-U</th>
<th>CPI-W</th>
<th>C-CPI-U</th>
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<tr>
<td>2000.12</td>
<td>3.4</td>
<td>3.3</td>
<td>2.6</td>
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<tr>
<td>2001.12</td>
<td>1.6</td>
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<td>2002.12</td>
<td>2.4</td>
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<tr>
<td>2003.12</td>
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<td>2004.01</td>
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<td>2004.04</td>
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The data for the C-CPI-U from the year 2000 show that it increased 0.8 percentage points less than the CPI-U \( (3.4 - 2.6 = 0.8) \). For 2001, the C-CPI-U was 0.3 percentage points lower than the CPI-U. Data for 2004 show that the C-CPI-U increased by 0.6 percentage points less than the CPI-U and 0.5 percentage points less than the CPI-W (U.S. Department of Labor, Bureau of Labor Statistics, 2002b). The CPI-U consistently demonstrates faster growth than does the C-CPI-U; however, that difference relative to the CPI-U is declining.

Social Security and the CPI

How the COLA Calculation Works

Originally, Social Security benefits were not inflation-protected; benefits were increased by Congress on an ad hoc basis. In 1972, legislation was passed that required Social Security benefits to be adjusted annually beginning in 1975. This automatic COLA guaranteed that an individual’s Social Security benefit would retain its value over time.

Specifically, the annual Social Security COLA reflects the percent increase in the average CPI-W from the third quarter of the previous year to the third quarter of the current year. For example, the average CPI-W for the third quarter (July–September) of 2002 was 176.6; it was 180.3 for the same period in 2003. The increase from 2002 to 2003 is calculated as:

\[ 100 \times \frac{180.3 - 176.6}{176.6} = 2.1 \text{ percent} \]

This 2.1 percent increase in the CPI was the Social Security COLA, beginning with the January 2004 benefit checks.

26 These data are final. (See discussion of “final, interim, and initial” values in “The Chained Index: Initial, Interim, and Final Values.”)

27 Social Security COLAs are announced in December of a given year (e.g., 2003) and take effect in January of the following year (2004). If the increase is less than .1 percent, there is no automatic increase for the current year; the increase for the following year will then reflect

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25 For details, see www.bls.gov/news.
How the CPI Can Affect Social Security as a Percent of GDP

Many fiscal analysts and other experts have expressed concern that Social Security, along with other entitlements, will take a larger and larger share of the economy, eventually “crowding out” other spending. Although Social Security accounts for only about 4.3 percent of GDP today, Social Security Administration (SSA) actuaries project that by 2030 Social Security’s share of GDP will increase by slightly more than 50 percent, from 4 percent to about 6.4 percent of GDP (Board of Trustees, 2003, Table VI.F.5, p.174). For obvious reasons, changes in the method used to calculate the CPI can affect this number.

Figure 2: Social Security Payment as Percent of GDP

![Figure 2: Social Security Payment as Percent of GDP](image)

Benefit Payments. The MA model estimates that a one-half percentage point reduction\(^\text{28}\) in the CPI also reduces Social Security COLAs and thus reduces benefit payments as a percent of GDP—declining slightly, from 5.4 percent of GDP to 5.0 percent of GDP by 2028 (see Figure 2). \(^{29}\) (With no reduction in CPI growth, the SSA projects costs in 2025 to be 6.0 percent of GDP.)

Social Security Trust Funds. Reducing outgo increases the size of the trust funds, both in dollar terms and as a percent of GDP (see Figure 3). The MA model projects that reducing the CPI growth by half a percentage point would add $25 billion to the trust funds in 2010, $412 billion by 2020, and $1.57 trillion by 2028. The trust funds as a percent of GDP would increase from 14.9 percent in 2005 to 24.1 percent in 2028.

Figure 3: Trust Fund as Percent of GDP

![Figure 3: Trust Fund as Percent of GDP](image)

How the CPI Can Affect Social Security Solvency

Today, the Social Security program faces a projected long-term imbalance of 1.92 percent (under the intermediate assumptions) of taxable payroll over the next 75 years.\(^\text{30}\) In practical terms, this

\(^{28}\) We have chosen to reduce CPI growth by one-half of a percentage point because that is about the difference between the CPI-U growth and the superlative index growth.

\(^{29}\) Macroeconomic Advisers’ simulations project only up to year 2028.

\(^{30}\) The 2005 Annual Report of the Board of Trustees of the Old-Age and Survivors Insurance and Disability Insurance Trust Funds reports that if payroll taxes were increased by 0.96 of a percentage point each on employers and employees—from their present combined level
means Social Security has insufficient revenues to fully pay future obligations beyond 2041. By then, if no changes have been made, the trust funds’ assets will be depleted, and contributions from current workers and taxes on benefits will cover only 74 percent of program costs.31

There are two primary ways that Social Security’s growth relative to the economy can be contained: first, make the program smaller by curtailing benefits relative to contributions, and, second, make the economy larger by adopting policies to promote steady economic growth.

A drop in the CPI can have a significant dollar impact on Social Security’s outgo. In a July 2000 memo, the Social Security Deputy Chief Actuary projected that reducing the COLA by 0.5 percentage points below the CPI would achieve 40 percent of the 1.86 percent of payroll needed in that year (2000) to achieve long-term solvency (Goss, 2000). Because of its potential effect on benefits through the COLA, the CPI is among the factors policymakers are considering as a component in various long-term Social Security solvency packages.

The Macroeconomic Adviser (MA) model’s projections show that lowering the growth in the CPI by half a percentage point would lower total Social Security benefit payments by $56 billion in 2020 ($354 billion cumulatively) and $120 billion in 2028 ($1.06 trillion cumulatively).32

An across-the-board COLA cut, for example, by the CPI minus 0.5 percentage point as illustrated above, often has been included in the discussions about curtailing Social Security benefits (Koitz, 1998).33 The problem with an across-the-board COLA cut, however, is that benefits would not keep up with full inflation, and each subsequent year benefits would fall farther behind.

The C-CPI-U vs. the CPI-W as an Annual Social Security Cost-of-Living Adjustment: What Is the Difference?

The impact of using a C-CPI-U rather than a CPI-W to determine the Social Security COLA can be illustrated by looking at the data for the 2003 COLA. (This is the COLA applied to the January 2004 benefit check.) The average C-CPI-U for the third quarter of 2002 (July–September) was 106.0; it was 108.0 for the same period in 2003. The increase is calculated as:

\[100 \times \frac{108.0 - 106.0}{106.0} = 1.8\%\]

Had the C-CPI-U been used for the Social Security COLA calculation, the COLA would have been 1.8 percent. That is a reduction of 0.3 percentage points (2.1 percent minus 1.8 percent) from the CPI-W.

Replacing the CPI-W with the new C-CPI-U has been included in a number of recent Social Security reform proposals (Ball, 2005). In contrast to cutting the already calculated CPI by some designated amount, the C-CPI-U methodology makes a technical correction that most experts agree moves the CPI closer to a real cost-of-living index (COLI).

At the same, however, some may see such a change as a benefit cut for current beneficiaries, because future benefits will grow more slowly than they would with the CPI-W and, therefore, purchasing power would be reduced relative to the current

31 Ibid.
32 See footnotes 4 and 5.
33 The Congressional Research Service (CRS), in an examination of three Social Security reform proposals, discusses the 1998 Moynihan-Kerrey proposal and its inclusion of an across-the-board one percentage point cut in the CPI.
system. However, proponents of a new measure contend that purchasing power would keep pace with the cost of living in the economy if the C-CPI-U measure were applied broadly throughout the economy. In that case, prices economy-wide would grow more slowly in the future than they have in the past. If that occurs, adjustments to Social Security COLAs can increase more slowly and still keep pace with the overall cost of living. At the same time, benefits may be lower than they would have been using the existing CPI measures.

In this respect, a move to the C-CPI-U is no different from past improvements in the CPI. Beneficiaries are not guaranteed a specific COLA amount or a specific method of measuring inflation. What Social Security promises is that COLA adjustments will allow benefits to keep pace with the cost of living.

Conclusions

The CPI is an important and influential calculation. As the nation’s primary measure of inflation, it serves as an indicator of the effectiveness of government economic policy by providing information about price changes in the nation’s economy affecting government, business, labor, and private citizens.

Today, the CPI calculation is under close scrutiny. Modifying the calculation to make the CPI more closely resemble a cost-of-living adjustment by using the C-CPI-U would not only address concerns about its accuracy, but also those about Social Security solvency and overall budget deficits.

From the perspective of increasing the trust funds and reducing the deficits, instituting use of the more technically correct C-CPI-U would have positive effects. However, from the perspective of individual workers and their families, concerns remain about what is perceived as a “slowed” CPI, particularly for special populations—for example, those older than age 65—and how the CPI handles their diverse market baskets.

Researchers from the BLS, other government agencies, and academia have argued that the current CPI-U and CPI-W calculations overstate both the true cost of living and the specific expenditures the CPI attempts to track. And many are convinced that the C-CPI-U is the best measure of cost-of-living available, even though it is not perfect. C-CPI-U data are issued only at the national level, and the index is subject to regular revision with the final number being released two years after the reference date, a potential problem for programs with automatic indexing provisions like Social Security’s.

The wide-ranging discussions and the research reports best serve to underscore the importance of the CPI and how it is calculated, and the concerns it raises. They also underscore the fact that before any further changes to the CPI are implemented, implications of those changes for all segments of the population must be well understood and widely accepted.

Technical Appendix

Laspeyres Index

The Laspeyres (L) index compares the consumer expenditure of the reference period (base year “0”) with the consumer expenditure of the comparison period (current year “t”) using the base year’s quantities as follows in the case of two commodities,

\[ L = \frac{P_1^t Q_1^0 + P_2^t Q_2^0}{P_1^0 Q_1^0 + P_2^0 Q_2^0} \]

34 If the C-CPI-U is found to be, for example, 0.5 percentage points lower than the currently projected CPI-W, the difference, after 15 years, in Social Security benefits for a new retiree, age 65, with an initial benefit amount of $875 per month, is over $96 monthly and $1,152 annually.

35 Use of the geometric mean in the calculation, for example.
where \( P_1 \) and \( P_2 \) are prices, and \( Q_1 \) and \( Q_2 \) are quantities. Quantities are also referred to as “weights,” but sometimes quantities are not observed; instead, the shares of consumer expenditure on each item are reported. With some algebraic manipulation, the Laspeyres formula can be modified to replace the “quantity weights” by their expenditure shares, more commonly known as “expenditure weights,” hence \( L \) can be written as,

\[
L = (P_1^0 / P_1^0) \left( (P_1^0 Q_1^0 + P_2^0 Q_2^0) / (P_1^0 Q_1^0 + P_2^0 Q_2^0) \right) + (P_2^0 / P_2^0) \left( (P_2^0 Q_2^0 + P_1^0 Q_1^0) / (P_2^0 Q_2^0 + P_1^0 Q_1^0) \right)
\]

Or,

\[
L = RI_1^0 [P_1^0 / P_1^0] + RI_2^0 [P_2^0 / P_2^0]
\]

where \( RI_1^0 \) and \( RI_2^0 \) are shares of consumer expenditure on commodities 1 and 2 in the base year to the total expenditure in the base year, i.e.,

\[
RI_1^0 = P_1^0 Q_1^0 / (P_1^0 Q_1^0 + P_2^0 Q_2^0) \quad \text{and} \quad RI_2^0 = P_2^0 Q_2^0 / (P_1^0 Q_1^0 + P_2^0 Q_2^0).
\]

### Geometric Mean Index

The Laspeyres index \( (L) \) can be modified to show the Geometric Mean Index \( (G) \) as follows:

\[
L = RI_1^0 [P_1^0 / P_1^0] + RI_2^0 [P_2^0 / P_2^0]
\]

\[
G = [P_1^0 / P_1^0] \left( RI_1^0 + [P_2^0 / P_2^0] RI_2^0 \right)
\]

Where weights \( RI_1^0 \) and \( RI_2^0 \) are still based on base-year quantities, but instead of multiplying the price ratio \([P_1^0 / P_1^0]\) linearly by weight (as an arithmetic mean in Laspeyres), price ratios are now raised to the power of weights (e.g., \( X^2 \) square is written as \( X \) raise to power 2 or \( X^2 \)) and multiplied together to give a geometric mean of all prices weighted by base-year quantities. For this reason, this index is called a geometric mean index. This reduces the substitution bias to some extent, because a weighted geometric mean is always less than a weighted arithmetic mean. (For example, an arithmetic mean of 4 and 16 is 10, while a geometric mean is 8.)

### Superlative Index

The superlative index is designed to solve the problem of fixed weights by: (a) revising the basket in every period, and then (b) taking an average of the two expenditure weights, the base year and the current year, instead of basing the index on one fixed base year.

Because the weights are not fixed in the final estimates, there is little possibility of substitution bias. The superlative index formula by Törnqvist is an extension of the geometric mean formula where the weights are replaced by average weights such that

\[
T = [P_1^0 / P_1^0] W_1 * [P_2^0 / P_2^0] W_2
\]

and

\[
W_1 = \frac{1}{2} [RI_1^0 + RI_1^1] \quad \text{and} \quad W_2 = \frac{1}{2} [RI_2^0 + RI_2^1]
\]

Here, \( W_1 \) is an arithmetic average of the base-year weight \( RI_1^0 \) and the current-year weight \( RI_1^1 \), which is simply

\[
= \frac{1}{2} [P_1^0 Q_1^0 / (P_1^0 Q_1^0 + P_2^0 Q_2^0) + P_1^1 Q_1^1 / (P_1^1 Q_1^1 + P_2^1 Q_2^1)]
\]

Averaging the two solves the problem of the base year vs. the current year. Thus, there is no “fixed basket” in the superlative index determination. The basket changes in every period and weights (the share of the item in total consumption) are equal to the arithmetic averages of two consecutive periods.

However, according to the BLS, expenditure data required for the calculation of the C-CPI-U are available only with a time lag of two years. Thus, the C-CPI-U is first issued as an “initial” estimate using the latest available expenditure data at that time and is subject to two subsequent revisions. Since we had complete expenditure data up to 2003, "final" values of the C-CPI-U have been issued for the 12 months of 2003, "interim" values have been issued for the 12 months of 2004, and "initial" value has been issued for January of 2005.

Because of the time lag, only the “final” estimates use the superlative index formula, while both initial and interim estimates use the Laspeyres and the geometric mean index formula. In 2004, with release of the 2003 monthly expenditure data, the interim indexes for 2003 were revised in their final form using the superlative index formula. Meanwhile, 2004 monthly indexes are reported as interim, and January 2005 index as initial. Once the monthly expenditure data for 2004 becomes available in 2006, C-CPI-U indexes for the 12 months of 2004 will be issued in their final form, and 2005 indexes will become interim.

For more flexibility, the superlative indexes are often chained. Also known as “chained index” numbers, an index of period \( t \) is chained to the
index of \((t–1), (t–2), (t–3), \) and so on, all the way to the base year “0.”
For example, an index of year 2002 chained to base year 1999 becomes,

\[
T_{2002}^{\text{chain-base 1999}} = \left(\frac{T_{2002}}{T_{2001}}\right) \times \left(\frac{T_{2001}}{T_{2000}}\right) \times \left(\frac{T_{2000}}{T_{1999}}\right).
\]

**Endnote**
The authors used the MA model to simulate the effect on the federal budget of a change from the current CPI formula to a chained (superlative) formula. The MA model is a dynamic simulation model and takes into account all macro feedback to project federal receipts and expenditures. This methodology reflects the indirect effects of the change in personal income as a result of the change in benefit amounts. Thus, a decline in the CPI not only reduces transfer payments as a share of personal income, it also reduces personal disposable income and, thus, personal consumption.

Macroeconomic simulations can be performed under different monetary policy regimes. For example, if one assumes the non-borrowed reserves are exogenous, the Federal Reserve can change the reserve ratios of the banks and not the interest rates directly. On the other hand, if the federal funds rates are assumed to be exogenous, the Federal Reserve can directly change the interest rates. Which monetary policy the Federal Reserve will follow in the future depends on the economic and political environment of the nation at the time. However, in the present simulation, we have assumed the federal funds rate to be exogenous and have adjusted it to keep the natural rate of unemployment (NAIRU)\(^36\) stable. (So when the economy produces an unemployment rate above the natural rate, the Federal Reserve decreases the federal funds rate and vice versa when the unemployment rate is lower.)

In our simulation, we first lowered the CPI growth (as an exogenous variable) by half a percentage point, and then adjusted the federal funds rate to keep the unemployment rate stable. As a result, the yield on 10-year Treasury notes, which is determined endogenously in the model, declined by less than 1 percentage point in the long run by 2028. Gross private savings first declined and then increased over the long term, but gross savings increased by more than $500 billion by 2028. A slight decline in interest rates stimulated gross private domestic investment, and, hence, real GDP increased a little over 1 percentage point over the baseline by 2028. The real GDP deflator fluctuated only within .2 percent from the baseline.

Over the long term, unemployment may also be a result of extraneous factors usually not reflected in the macroeconomic models. In such cases, more adjustments may be needed in the federal funds rate. Both federal revenue and expenditure (which make up the federal budget) are determined endogenously in the model. Federal revenues are very sensitive to the federal funds rate—a slight increase (decrease) can decrease (increase) federal revenues by a large amount.\(^37\)

Another factor that affects revenues is the average personal tax rate. We have assumed the average tax rate to continue at the current level as in scenario 5 of CBO’s estimates (i.e., no sunset of EGTRRA and JGTRRA after 2010). Thus at current tax rates, with half a percent less CPI growth, federal revenues would increase by $170 billion by 2028, but federal expenditures would decline by $273 billion, and, as a result, federal surpluses would increase by $443 billion. (Model simulation results from authors are available upon request.\(^38\))

\(^{37}\) If we had assumed the monetary regime of non-borrowed reserves as exogenous and had not adjusted the federal funds rate, the natural rate of unemployment would have been slightly higher, real disposable income and gross savings would have been lower, and, hence, real GDP growth would have declined. On the other hand, federal revenue, instead of rising, would have declined by $278 billion, thus raising the federal surplus by only $297 billion by 2028, or $1.9 trillion cumulatively over 2005–2028.

\(^{38}\) The authors wish to thank Ken Matheny and Ben Herzon of Macroeconomic Advisers who provided comments on and discussion about this analytical approach.
Table A: Comparison of MA Model and CBO's Scenario 5

<table>
<thead>
<tr>
<th>As % of GDP</th>
<th>MA Long run Simulation</th>
<th>CBO Scenario 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2028</td>
<td>In 2030</td>
<td></td>
</tr>
<tr>
<td>Fed. Surplus/Deficit</td>
<td>&lt; 1% until 2026; 1.2% in 2028</td>
<td>1.0</td>
</tr>
<tr>
<td>Fed. Expenditure</td>
<td>19.4</td>
<td>20.8</td>
</tr>
<tr>
<td>Fed Tax Revenue</td>
<td>19.3</td>
<td>25 by 2050</td>
</tr>
<tr>
<td>Average Tax Rate</td>
<td>Current law</td>
<td>Current law</td>
</tr>
<tr>
<td>Fed Debt</td>
<td>8.5</td>
<td>na</td>
</tr>
<tr>
<td>Social Security</td>
<td>5.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Medicare</td>
<td>4.3</td>
<td>5.9</td>
</tr>
<tr>
<td>Medicaid</td>
<td>1.6</td>
<td>1.8</td>
</tr>
<tr>
<td>GDP growth</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Real GDP</td>
<td>$20 trillion</td>
<td>$19 trillion</td>
</tr>
</tbody>
</table>

References


Washington University Macroeconomic Model, Macroeconomic Advisers, LLC, St. Louis.