

Does the CPI Overstate Increases in the Cost of Living?

In June 1995, the Senate Finance Committee appointed a panel of economists to review the accuracy of the consumer price index (CPI) and to estimate the extent, if any, to which the CPI overstates increases in the cost of living.

The impetus for expert review of the accuracy of the CPI does not stem from the desire to have a better measure of inflation per se. Rather, the committee realized that a significant proportion of the budget of the federal government is indexed to the CPI, so any significant measurement error has important budgetary implications.

In testimony before the Senate earlier this year, Federal Reserve Chairman Alan Greenspan noted that about 30 percent of federal outlays are indexed to movements in the CPI, as are about 45 percent of tax receipts. Given the importance of indexed programs and taxes in the budget of the federal government, if the annual inflation adjustments in these programs were reduced by just 1 percentage point, the annual level of the deficit would fall by about \$55 billion after five years, while the cumulative deficit reduction over this period would be nearly \$150 billion, Greenspan estimated. The question is, Does the CPI overstate the true rate of inflation by as much as 1 percent a year?

Two years ago, a Dallas Fed

study of known biases in the federal government's various price indexes noted the remarkable lack of hard evidence on the extent of the potential bias in the CPI.¹ This was surprising, given the great confidence with which many economists tend to assert there is "obviously an upward bias in the reported CPI" and probably at least 2 percentage points a year.

The Dallas Fed study concluded: "In view of the paucity of evidence on the various potential biases in the CPI, we are inclined to think that it is better to err on the side of conservatism in guesstimating the size of the overall bias. A figure of less than 1 percent thus strikes us as a plausible estimate of the overall bias. The true figure could be a lot larger or a lot smaller; at present we simply do not know."

In October 1994, the Congressional Budget Office published its own analysis of the problems with the CPI, concluding that "the amount of bias is not known, [but] the existing empirical evidence, which addresses many but not all of the potential areas of mismeasurement, indicates that the CPI has probably grown faster than the cost of living by between one-fifth and four-fifths of a percentage point in recent years."² In view of the recent resurgence of interest in the problems with accurately measuring changes in the cost of living, it is worthwhile to revisit the issues.

The problems that beset the CPI as a measure of the cost of living can be loosely grouped into two categories. The first category is the set of problems associated with substitution behavior on the part of consumers. The second is the set of problems associated with changes in the quality of goods and the introduction of new goods. This article raises three issues relating to these problems.

First, economists' understanding of the extent of the two classes of problem with the CPI is very skewed. To date, researchers have a much better handle on the extent

of the biases due to substitution than on the biases due to quality change and the introduction of new goods. Furthermore, the biases associated with substitution are quantitatively small.

Second, while quality change and the introduction of new goods potentially pose big problems for the CPI, there is very little hard empirical evidence to suggest that they in fact do so. In discussing the potential problems with the CPI, it is often overlooked that the Bureau of Labor Statistics (BLS) has a variety of mechanisms in place to handle both quality change and the arrival of new goods in the marketplace. The question then becomes not whether the CPI overstates inflation because it neglects these developments, but rather how well the procedures used by the BLS perform relative to a more ideal alternative.

The final point: trying to arrive at an estimate of the overall bias in the CPI is like trying to hit a moving target. The BLS regularly updates its procedures in response to perceived problems with the CPI. Thus, problems that were serious in one time period for a particular category of goods may no longer be an issue. It is not clear that in arriving at an estimate of the overall bias researchers can simply add up the various numbers that have been produced by different studies.

Substitution Biases

Three conceptually distinct types of bias fall under the heading of substitution biases: elementary index functional form bias, commodity substitution bias and outlet substitution bias.

Elementary index functional form bias is a type of bias that arises because the CPI does not actually aggregate the prices of individual commodities, but rather is an aggregation of price indexes. This problem relates to the construction of these elementary price indexes. Why the problem arises relates to the esoterica of index

number construction; essentially, it results from consumers' tendency to respond to sale prices by purchasing more of a good that is on sale. BLS economists estimate that this form of bias may have added 0.4 to 0.5 percentage points to the overall rate of inflation between June 1992 and June 1993.³

Commodity substitution bias is the best known and most extensively studied of the potential biases in the CPI. Substitution bias arises because, while the CPI prices a fixed market basket of goods over time, consumers tend to substitute away from goods that become more expensive and toward goods that become less expensive.

As the price of cellular telephones falls relative to the price of stamps, consumers will make more phone calls and write fewer letters. The CPI fails to take this kind of substitution behavior into account, and as a result, tends to overstate inflation. The consensus estimate is that this form of bias adds about 0.2 percentage points to the overall inflation rate each year, although the exact number will tend to be bigger the further we are from the base year and the greater the change in relative prices.

A potential source of bias that has received a lot of attention recently is the so-called *outlet substitution bias*. The idea here is that the process by which the BLS chooses outlets from which to collect price quotes for inclusion in the CPI may have missed the revolution in retailing. Over the past 15 years or so, low-cost, high-volume discount outlets such as Wal-Mart and Sam's Club have grown rapidly, and shoppers have switched from more traditional outlets toward the newer outlets that offer lower prices. One early estimate of the potential size of this bias put it at 0.25 percentage points per year for the food at home and motor fuel components of the CPI.⁴ However, subsequent research has shown that this figure may be the compounded result of a variety of effects.

Quality Adjustment and New Goods

The essence of the quality adjustment problem is as follows. Suppose the BLS has been tracking the price of some specific brand of VCR for inclusion in the CPI. At some date, the chosen variety of VCR disappears from store shelves, and in its place retailers start offering a new, higher priced model with additional features. How much of the difference in the prices of the new and old models should be treated as a price increase, and how much reflects quality improvement in the VCR? In constructing a measure of the change in the cost of living, it is appropriate to exclude that part of the price increase that results from improvements in the quality of the good.

When facing such a problem, BLS field agents have numerous options. If they deem the new and old products to be essentially the same in a well-defined sense, they include the entire price increase in the CPI and do nothing more. The risk here is that some quality improvements are overlooked, imparting an upward bias to the index. If the new and old products are judged to be different, then BLS agents try to adjust for the quality change before including the price in the CPI. There are many ways to make these adjustments.

For example, BLS agents could make an adjustment based on information received from manufacturers on the cost of the new features, as is often done with autos. Each year when the new models are introduced, the BLS agents obtain cost estimates from manufacturers that allow them to subtract out that component of the price increase that stems from new features. Alternatively, the BLS can make an adjustment using a hedonic regression, which relates the price of a good to its characteristics. However, in many cases neither of these methods can be applied, and the BLS simply imputes the price change for the good in question. That is, the price

that gets entered in the CPI is some average of the prices of similar products.

The imputation procedure does not obviously result in a biased estimate of price change. However, if manufacturers systematically tend to time price increases to coincide with the introduction of new models, imputation may introduce price increases that are *too small* into the CPI, resulting on an overall downward bias. During 1992, some 3.5 percent of retail outlet prices collected for inclusion in the CPI resulted in product substitutions. Of these substitutions, 2 percent were considered "comparable" and no quality adjustment was made. About 0.9 percent of the prices were quality-adjusted through the imputation procedure, while the remaining 0.4 percent were directly quality-adjusted (through the use of either hedonic methods or cost information supplied by manufacturers).

For many categories of goods, it is generally accepted that manufacturers tend to time price increases to coincide with the introduction of new varieties. Two prominent examples are autos and apparel. Recent research by the BLS has compared the results of quality-adjusting the apparel price indexes using traditional and hedonic methods. Researchers have long suspected that the CPI understates inflation in the apparel commodities indexes. Evidence supporting this suspicion is shown in Chart 1, which plots the trend in the apparel commodities component of the CPI and the overall CPI since 1980.⁵ It is clear that from 1981 through 1986 the apparel commodities component of the CPI rose at a slower rate than the overall CPI. This observation, coupled with evidence that apparel inflation was no slower than overall inflation, suggested to the BLS that the procedures for calculating its apparel indexes needed revision.

Two recent studies addressed the issue of quality adjustment in the apparel indexes and found that the traditional methods appeared as

likely to *underestimate* price change as they were to *overestimate* price change.⁶ The first study showed that an index for women's suits that employed hedonic regressions to determine the comparability of substitutions and in the case of non-comparable substitutions to make direct quality adjustments grew 0.7 percentage points *slower* than the published index, suggesting, as most economists suspected, an upward bias in the published index. However, a similar index for women's coats and jackets was shown to grow 3.9 percentage points *more* than the official index, suggesting the existence of a downward bias in the published index.

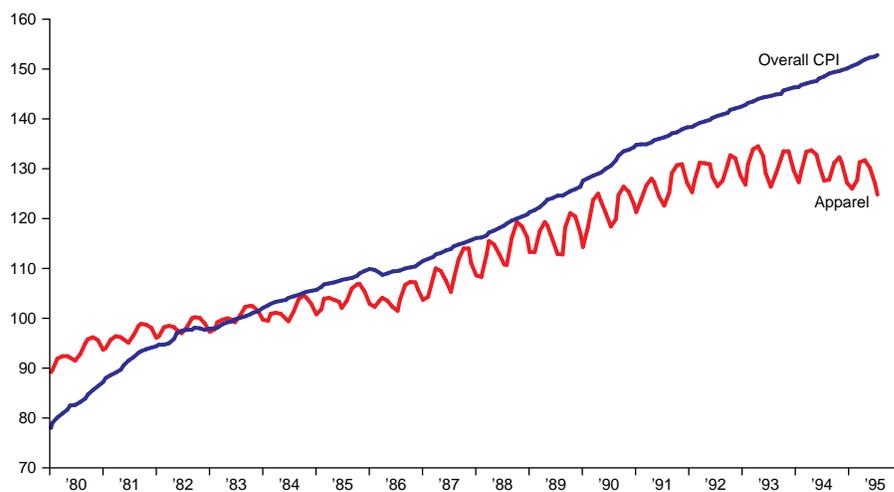
More extensive results are reported in the second study for a broader range of apparel indexes, where it is shown that "While differences are observed between published indexes (those with quality adjustments) and nonhedonic indexes (those without quality adjustments), the results reveal no consistent differences across strata or aggregate level indexes."

What about the problem of new goods? In many ways, the problems posed by the arrival of new goods is similar to that posed by quality change. One way of distinguishing between the two is to classify the quality problem as being the result of some change in a product's characteristics, while the new goods problem is the result of the addition of new characteristics or a rebundling of existing characteristics.⁷ Thus, the invention of the personal computer would be classified as a new goods problem, while improvements in the memory and speed of the personal computer would be classified as a quality problem. There is essentially no empirical evidence on how well the BLS handles the emergence of new goods. Some researchers have made suggestive theoretical calculations that show that the failure to properly account for the introduction of new goods could impart a substantial upward bias to the CPI. But for now, these

Chart 1

The U.S. Consumer Price Index and Apparel Prices, 1980–95

Index, 1982–84 = 100



SOURCE: Bureau of Labor Statistics.

calculations remain speculative.

While it is well-known that the omission of new goods from the consumer price index can cause potentially dramatic overstatement of the rate of inflation, new goods are included in the index through a variety of mechanisms. A recent BLS working paper provides a useful taxonomy of new goods and discusses how the CPI handles each type. This paper distinguishes between replacement items (which are new versions of existing goods that have been, or are about to be, discontinued, such as new model year cars), supplemental items (which are entirely new versions of existing products, such as cereal) and entirely new items (which are not closely related to any existing or previously available item). As a result of changes made in 1978, many new products that emerge are in fact gradually introduced into the CPI.

Calculating the Overall Bias

A hierarchy of evidence is available to address the question of whether the CPI overstates the rate of increase in the cost of living. First, there are those biases that are known to exist and have been quantified. These studies can be

further subdivided between biases for which there have been multiple attempts at quantification (such as the well-known commodity substitution bias) and those for which there have only been one or two studies (such as the bias due to outlet substitution). Then there are those biases that researchers suspect exist but for which they lack quantitative estimates. The primary example here is the problem with accurately measuring changes in the costs of medical care. Even given this classification, we need to distinguish between biases that have been identified and eliminated and biases that have been identified and remain a problem.

Trying to estimate the overall bias in the CPI is like trying to hit a moving target. The BLS has proved to be reasonably diligent in correcting biases in the CPI as soon as their significance becomes evident. Examples include the correction for the treatment of housing and the elimination of the housing depreciation bias. More recently, the BLS has taken steps to alleviate the problems caused by the elementary functional form bias.

One prominent researcher in the theory of price measurement has asserted that the various biases in the CPI are approximately additive.

While in theory the assumption of additivity may be correct, in practice the estimates may be mixing different types of biases. Then there is also the important fact that these estimates of bias come with some sort of standard error.

Nevertheless, there is likely an upward bias in the CPI, and the figure of around 1 percent hinted at by Chairman Greenspan in his testimony earlier this year is as good an estimate as any. The examples of overstatement noted above notwithstanding, it is clear that the bulk of the evidence supports the notion of an upward bias in the index. The BLS is even willing to concede an error of 0.6 percentage points due to substitution biases (see the December 1993 *Monthly Labor Review*). However, absent a comprehensive audit of the CPI (say, along the lines of Robert Gordon's audit of the deflators for producers' durable equipment), there will always be substantial uncertainty surrounding the size of the bias in the CPI. While it is true that most estimates to date have tended toward an upward bias, the standard error, if you will, surrounding these estimates is quite large and possibly of the same order of magnitude as the estimates of the bias itself.

Conclusions

The CPI is the most important measure of inflation the federal government publishes. The widespread use of the CPI to index components of the federal budget means that errors in measuring the CPI have potentially large budgetary implications. The CPI is used to index personal income tax brackets and Social Security and other welfare payments so as to protect taxpayers and Social Security recipients from the pernicious effects of inflation. The idea here is that a taxpayer's liability should not increase just because the price level has increased, if the real purchasing power of his or her income has not gone up also.

On the benefits side, the idea is

that Social Security recipients are entitled to some real amount of purchasing power rather than a nominal amount whose purchasing power is systematically eroded by inflation. However, insofar as the price index used to compensate taxpayers and Social Security recipients for increases in the cost of living overstates the rate at which prices are increasing, taxpayers and Social Security recipients are being overcompensated for inflation and are effectively receiving an additional subsidy from the government. As noted earlier, the potential magnitude of these excess transfers is quite large, and their elimination could go a long way toward eliminating the budget deficit.

Evidence that the CPI overstates the rate of increase in the cost of living is remarkably thin. Researchers do know that, as a result of various types of substitution behavior, the CPI overstates the rate of increase in the CPI by as much as 0.6 percent a year. They have no idea, however, how much quality change and the emergence of new goods adds to this bias. It could be as much as an additional 0.4 percentage points a year, and it could be zero.

What is surprising and often neglected in the debate over the accuracy of the CPI is the fact that the methods employed by the BLS to handle quality change in the CPI seem to be as prone to overcompensate for quality change as they are to undercompensate for quality change, leaving the overall direction of the bias uncertain. In some areas, the BLS freely admits that very little is done to correct for quality change. The prime example is, of course, medical care, where accurate price measurement is fraught with technical and conceptual difficulties. Nonetheless, it is important to keep in mind that just as there are costs to overstating the rate of inflation, so too are there costs to understating it.

—Mark A. Wynne

Notes

- ¹ Mark A. Wynne and Fiona Sigalla, "A Survey of Measurement Biases in Price Indexes," Federal Reserve Bank of Dallas Research Paper, no. 9340, 1993. Also, a version of this paper focusing on the CPI appeared in the Federal Reserve Bank of Dallas *Economic Review*, Second Quarter, 1994.
- ² "Is the Growth of the CPI a Biased Measure of Changes in the Cost of Living?" CBO Papers (Washington D.C.: Congressional Budget Office, October 1994, vii).
- ³ Brent R. Moulton, "Basic Components of the CPI: Estimation of Price Change," *Monthly Labor Review*, December 1993, and Marshall B. Reinsdorf and Brent R. Moulton, "The Construction of Basic Components of Cost of Living Indexes," mimeo, U.S. Department of Labor, May 1994.
- ⁴ Marshall Reinsdorf, "The Effect of Outlet Price Differentials on the U.S. Consumer Price Index," in Murray F. Foss, Marilyn E. Manser and Allan H. Young, eds., *Price Measurements and Their Uses*, NBER Studies in Income and Wealth, vol. 57 (Chicago: University of Chicago Press for National Bureau of Economic Research, 1993).
- ⁵ This chart is adapted from Marshall Reinsdorf, Paul Liegey and Ken Stewart, "New Ways of Handling Quality Change in the U.S. Consumer Price Index," mimeo, U.S. Department of Labor, July 1995.
- ⁶ The relevant studies are Paul Liegey, "Adjusting Apparel Indexes in the CPI for Quality Differences," in Murray F. Foss, Marilyn E. Manser and Allan H. Young, eds., *Price Measurements and Their Uses*, NBER Studies in Income and Wealth, vol. 57 (Chicago: University of Chicago Press for National Bureau of Economic Research, 1993) and "Apparel Price Indexes: Effects of Hedonic Adjustment," *Monthly Labor Review*, May 1994, 38–45.
- ⁷ Dennis Fixler suggests this distinction in "The Consumer Price Index: Underlying Concepts and Caveats," *Monthly Labor Review*, December 1993.