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The Consumer Price Index: Recent Improvements and Prospective Changes

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ABSTRACT

As part of a long running effort to make the CPI a better measure of price change, BLS has made a number of changes in recent years which have affected actual measures of inflation and hence both federal outlays and receipts. This report summarizes those changes, presents estimates of their effect on measured inflation, and explains what other changes are expected for the CPI. This report will be updated as developments warrant.

The Consumer Price Index: Recent Improvements and Prospective Changes

Summary

The Consumer Price Index (CPI), published by the Bureau of Labor Statistics of the Department of Labor (BLS), is probably the most widely used measure of the rate of inflation. Beyond that, it plays a particularly important role in the federal budget. A number of federal government programs are affected by changes in the CPI. On the spending side, social security benefits are adjusted each year so that recipients are insulated from the effects of rising prices. On the revenue side, the personal income tax brackets are adjusted so that when income rises just to keep pace with inflation it is not subject to a higher tax rate.

In December 1996, a special commission established by the Senate Finance Committee reported that the CPI was biased. If that is true, then outlays for social security are rising by more than needed to preserve the purchasing power of benefits. On the revenue side personal income tax brackets are rising more than necessary to avoid "bracket creep."

As part of a long running effort to make the CPI a better measure of price change, the Bureau of Labor Statistics has made a number of changes in recent years which have affected actual measures of inflation and hence both federal outlays and receipts. Between 1995 and 1999, there were ten specific changes in the way the CPI is calculated. Some of them affected narrow categories of goods and services in the index while others had more widespread effects. For 2000, a new effort to adjust for quality changes in audio and video equipment has been introduced.

Both the Council of Economic Advisors and the Congressional Budget Office have published estimates of the effect of these revisions on measured consumer price inflation. The two estimates agree that the cumulative effect of the methodological revisions adopted beginning in 1995 have reduced the annual rate of increase in the CPI by about 0.7 percentage points below what it would have registered in the absence of any change.

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The Consumer Price Index (CPI), published by the Bureau of Labor Statistics of the Department of Labor (BLS), is probably the most widely used measure of the rate of inflation. Beyond that, it plays a particularly important role in the federal budget. A number of federal government programs are affected by changes in the CPI. On the spending side, social security benefits are adjusted each year so that recipients are insulated from the effects of rising prices. On the revenue side, the personal income tax brackets are adjusted so that when income rises just to keep pace with inflation it is not subject to a higher tax rate.[1]

In the recent past, there has been concern in Congress about whether or not the CPI was an accurate measure of the "true" rate of inflation.[2] In December 1996, a special commission established by the Senate Finance Committee reported that the CPI was biased.[3] This commission, chaired by economist Michael Boskin, suggested that the CPI overstated the inflation rate by as much as 1.1% per year. If that were true, social security benefits were rising more than necessary to allow recipients dependent on them to maintain a constant standard of living.

Congress has passed no legislation requiring BLS to change the way it calculates the CPI. However, as part of a long running effort to make the CPI a better measure of price change, BLS has made a number of changes in recent years which have affected actual measures of inflation and hence both federal outlays and receipts. This report summarizes those changes, presents estimates of their effect on measured inflation and explains what other changes are forthcoming.

Methodological Revisions Between 1995 and 2000

Between 1995 and 1999, there were ten specific changes in the way the CPI is calculated. Some of them affected narrow categories of goods and services in the index while others had more widespread effects. This section gives a brief overview of the details of each of these changes. The explanations are given here as much to illustrate some of the difficulties BLS faces in its continuing efforts to make the CPI

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[1]When income rises to keep pace with inflation, but tax brackets are not adjusted, a larger proportion of income falls into a higher tax bracket, and the average tax rate rises even though there has been no change in "real" income. This has been referred to as "bracket creep."

[2]See: CRS Report 97-33 E, *The Consumer Price Index and the "True" Cost of Living*, by Brian W. Cashell.

[3]*Final Report of the Advisory Commission to Study the Consumer Price Index*. Senate Finance Committee Print. December 1996. 67 pp.

a better measure of changes in the cost of living as to chronicle individual methodological improvements.

1995 Changes. Four methodological changes were adopted in January 1995. They involved the pricing of prescription drugs, food prices, and the rental cost of housing.

Prior to 1995, when a prescription drug manufacturer's patent expired and generic substitutes became available, BLS only substituted the generic drug for the brand-name drug (in the CPI) in those stores which discontinued selling the brand-name drug. Because of this practice, the savings accruing to consumers who switched to generic drugs were not fully reflected in the CPI.

Beginning with data for January 1995, when the patent on a prescription drug expires the generic drug may be substituted in the CPI marketbasket whether or not stores continue to sell the brand-name drug. The chances of the generic drug substituting for the brand-name drug in the CPI marketbasket depend on its share of total sales of therapeutically-equivalent drugs. This means that the CPI is much more likely to reflect consumers' substituting cheaper equivalents and is less likely to overstate the effect of rising prices on consumer well-being. If prices were falling, then it would be a case of understating the rate of deflation.[4]

The second methodological change initiated in 1995 concerned prices of food items consumed at home. Two factors created a problem in the calculation of the CPI. First, each year BLS samples prices of new items within detailed categories of goods and services for 20% of the areas in which BLS collects price data. This is referred to as "sample rotation" and it helps the marketbasket account for changing consumer preferences in the short run. Second, the contribution of an individual product to the overall marketbasket depends on its share of total expenditures (price x quantity). When a new product was introduced, through sample rotation, its implicit weight (i.e., quantity) or contribution to the overall index depended, in part, on its price. The lower the price of the substitute item, the higher would be its implicit quantity weight, and vice versa.

When a new item was substituted, and it happened to be on sale, the quantity weight was higher. In subsequent periods, when the product went off sale, the increase in price contributed excessively to the overall measure of inflation. Similarly, if a new product was introduced at a time when its price was temporarily high, due to seasonal factors, for example, its implicit quantity weight was too low and when its price fell in subsequent periods the decline was insufficiently counted in the overall measure. This resulted in an upward bias in the overall index, and it was a particular problem in the measurement of changes in the prices of food purchased for home consumption.

In order to correct for this difficulty, BLS changed the way new items were "rotated" into the population of goods and services whose prices contribute to the

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[4]See: U.S. Department of Labor, Bureau of Labor Statistics. *Measuring Price Change for Medical Care in the CPI.* Summary 97-9, June 1998. 4 pp.

overall CPI. Now BLS collects price data on both new items and the old items they are replacing in the marketbasket for three months before dropping the old items. By overlapping the price samples, the risk of over- or underweighting price changes for a newly introduced item has been reduced. This has been referred to as "seasoning." BLS estimated that this change would reduce the overall CPI by 0.04% per year.[5]

The third change instituted in 1995 affected the way owner-occupied housing costs were measured in the CPI. Rather than measure the cost of actually buying a house in each period, the CPI measures changes in the rental equivalent value of owner-occupied housing.[6] Actually, BLS measures changes in the rental price of houses that are very similar to those houses in the sample that are owner occupied.

However, prior to 1995 the way in which increases in rents were applied to the rental equivalent price of owner-occupied houses caused the CPI to overstate the rate of increase of owner-occupied housing. For example, suppose an owner-occupied house were linked to the average change in the rent of two equivalent houses. If the rent on only one house went up half of the increase would be applied to the price of the owner-occupied house. If in a subsequent period, the rent on the second equivalent house rose as well half of that increase would also have been applied to the owner-occupied house. But this time the increase in price of the owner-occupied house would start from a higher base and a given percentage increase would mean too large an increase in the dollar value of the rental equivalent price of the owner-occupied house. In other words, a compounding effect was introduced which overstated the rise in the rental equivalent price of the owner-occupied house.[7] In 1995, BLS changed the formula used to calculate changes in the price of owner-occupied housing to eliminate this problem.

The fourth change put into place in 1995 also had to do with the measurement of changes in the cost of shelter. Estimates based on monthly surveys of rents tended to underestimate the magnitude of changes in rents. One difficulty in tracking rent changes over short periods of time was that a new tenant may not have been aware that his rent was higher than that of the previous tenant. Estimates based on monthly data also tended to be relatively volatile which could mask actual trends. In order to mitigate these difficulties BLS now bases estimates of change in rents on six-month intervals.[8]

1996 Change. Only one methodological change in the calculation of the CPI was adopted in 1996. That was to extend the so-called seasoning procedure adopted

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[5]Armknecht, Paul A, Brent R. Moulton, and Kenneth J. Stewart. *Improvements to the Food at Home, Shelter, and Prescription Drug Indexes in the U.S. Consumer Price Index.* U.S. Department of Labor, Bureau of Labor Statistics Working Paper 263. February 1995. 23 pp.

[6]BLS began using the "rental equivalent" approach in 1983. See:Gillngham, Robert and Walter Lane. Changing the treatment of shelter costs for homeowners in the CPI. *Monthly Labor Review*, volume 105, number 6, June 1982. pp. 9-14.

[7]Armknecht, Moulton, and Stewart.

[8]Armknecht, Moulton, and Stewart.

in 1995 for food items purchased for home consumption to all goods and services whose prices are measured in the CPI. BLS estimated that in between 1993 and 1994, the effect of this source of bias from all categories of goods and services amounted to 0.24%. The seasoning procedure was extended to all goods and services in June and July 1996.[9]

1997 Change. One methodological change was adopted in 1997. It concerned the way changes in the cost of medical care were counted in the CPI. With the 1997 revision, detailed categories of medical care expenditures were consolidated in a way that made the CPI better able to accommodate changes in the delivery of health care. For example, outpatient and inpatient services were combined so that the index could better account for shifts from in- to outpatient services. Similarly, the price of hospital care was changed to reflect a broader definition. Hospital services are now based on the concept of a "visit." This more flexible approach was felt to be superior in a market where the pace of technological change led to frequent changes in the nature of goods and services whose prices were being collected.[10]

1998 Changes. Two changes to the CPI were introduced in 1998. The first had to do with the way changes in computer prices were estimated. Inflation occurs when consumers pay more this year than they paid last year for the *same* good. Theoretically, a cost-of-living index should not reflect price changes that are associated with changes in the quality of the various goods and services included in the index. As virtually everyone is aware, the pace of technological change has affected computers as much as any product on the market. Quantifying those differences is not always easy.

In 1998, BLS adopted what is known as the "hedonic" approach to measuring quality change in computers. Simply put, hedonics means that instead of just collecting a single price for a given product, analysts attempt to model a product as a bundle of characteristics. In this way price changes may be attributed to changes in one or another of several measurable characteristics of the product. In the case of computers, characteristics would be such features as processor speed and memory. For many goods and services, for example automobiles, quality improvements are associated with higher prices. For computers, prices have been either stable or falling during periods of substantial quality improvements. Adjusting price changes for quality tends to reduce measured rates of price increase. In the case of computers, quality adjustment leads to significant declines in measured price change.[11]

The second change to affect the CPI in 1998 was an update of the entire marketbasket of goods and services whose prices are collected to construct the index. Over time, due to changing tastes and changes in relative prices, among other things,

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[9]See: Moulton, Brent. Bias in the Consumer Price Index: What is the Evidence? *Journal of Economic Perspectives*, volume 10, number 4, Fall 1996. pp. 159-177.

[10]Cardenas, Elaine M. Revision of the CPI Hospital Services Component. *Monthly Labor Review*, volume 119, number 12, December 1996. pp. 40-48.

[11]For a discussion of hedonics, see: Kokoski, Mary F. Quality adjustment of price indexes. *Monthly Labor Review*, volume 116, number 12, December 1993. pp. 34-46.

the mix of goods and services purchased by consumers changes. Every 10 years or so, BLS has updated the marketbasket so that the mix of goods and services in the CPI more closely corresponds to actual consumer purchases.

Consumers insulate themselves somewhat from the effects of inflation by buying less of those goods whose prices are rising faster than average and more of those goods whose prices are rising more slowly than average. Because of these shifts in spending patterns, the prices of the static marketbasket of the CPI tend to rise faster than the prices of what consumers are actually buying. Periodic updating of the marketbasket of the CPI helps minimize this source of bias in measured rates of inflation. Beginning in January 1998, the marketbasket reflects consumer purchasing patterns surveyed in the years 1993, 1994, and 1995.[12]

1999 Changes. Two methodological changes took effect in 1999. One involved the "rotation" of new goods into the index. Sample rotation refers to the fact that the actual goods and services whose prices are collected by BLS change over time. The overall contribution of an item to the index does not change but the individual representative of a price category may vary as purchasing patterns and availability of that item change. It used to be the case that the sample rotation was based on geographic area. Starting in 1999, it is based on expenditure categories. This enables BLS to concentrate on those categories of goods and services that are more subject to change, or more likely to be affected by the introduction of new products.[13]

The second methodological change for 1999 was the introduction of geometric means into the process of calculating the rate of price change for some categories of goods and services. In between marketbasket updates, the CPI is a fixed-weight index and so, in the short run, it doesn't keep up with changes in consumer spending patterns due to changes in relative prices. Thus it tends to overstate the rate of inflation in so far as it affects consumer well being. The introduction of geometric means into the calculation of the CPI will help alleviate this problem. A geometric mean is the square root of the product of two numbers.

In order to illustrate the use of geometric means in the calculation of a price index, consider a simple example involving just two time periods. Two rates of change must be calculated. In the first, expenditure weights from the initial period are used to aggregate all the changes in price. In the second, expenditure weights from the final period are used. Because consumers change what they buy, the first estimate will likely be an overestimate of the "true" rate of inflation (if it is positive), and the second will likely be an underestimate. The geometric mean (that is the square root of the product of the two measures) is a middle ground estimate and given certain conditions can be a better estimate of inflation than either of the other two.

[12]Lane, Walter. Changing the item structure of the Consumer Price Index. *Monthly Labor Review*, volume 119, number 12, December 1996. pp. 18-25.

[13]Congressional Budget Office. *The Economic and Budget Outlook: An Update*. September 1997. pp. 65-66.

The introduction of geometric means into the CPI reduced some of the bias inherent in a fixed-weight price index caused by changing consumer spending patterns.

2000 Changes. The only change that has been announced for the CPI in 2000 is a new effort to adjust for quality change in video and audio equipment. This is part of a continuing project to find ways to account for changes in the quality of the gods and services included in the CPI. In this case the goods involved account for a fairly small part of the overall marketbasket and thus the change is not likely to have a major effect on the numbers.

Estimates of the Effect of Recent Methodological Revisions

Estimates of the effect of these recent revisions are necessarily imprecise, since the old and new methodologies are not simultaneously available to allow a side-by-side comparison. Nevertheless, estimates have been made. Table 1 presents estimates published by the Council of Economic Advisors (CEA) as well as the Congressional Budget Office (CBO).

The two sets of estimates agree that the cumulative effect of the methodological revisions adopted beginning in 1995 have reduced the annual rate of increase in the CPI by about 0.7 percentage points below what it would have registered in the absence of any change.

**Table 1. Recent Methodological Changes in the Consumer Price Index
and Their Estimated Effects**
(in percentage points)

Change in methodology	year introduced	CEA estimate	CBO estimate
Generic prescription drugs	1995	-0.01	
Food at home seasoning	1995	-0.04	
Owners' equivalent rent	1995	-0.10	
Rent composite estimator	1995	0.03	
General seasoning	1996	-0.10	
Hospital services index	1997	-0.06	
Cumulative effect, 1995-1997		-0.28	-0.2 to -0.3
Personal computer hedonics	1998	-0.06	-0.06
Updated marketbasket	1998	-0.15	-0.15
Geometric means	1999	-0.15	-0.14
Rotation by Item	1999	-0.05	-0.10
Cumulative effect, 1995-1999		-0.69	-0.65 to -0.75
Sources: Council of Economic Advisors; Congressional Budget Office.			

The Consumer Price Index Research Series. The Bureau of Labor Statistics (BLS) has estimated a time series showing what the measured rate of inflation would have been if the methodology now used to estimate the current CPI had been in use beginning in 1978. This measure is officially referred to as the *CPI research series using current methods* (CPI-U-RS).[14] Table 2 compares the CPI-U-RS with the consumer price index for all urban consumers (CPI-U), which is the most frequently cited CPI measure.

The average difference between the two measures between December 1978 and December 1998 was 0.45 percentage points. On average, the research series index increased by 0.45 percentage points per year more slowly than did the actual CPI. This is a smaller difference than was estimated by either the CEA or CBO for several reasons. The main reason for the difference is that BLS does not include the effects of updating the marketbasket in 1998 in the research series since that was not a methodological change. The other main reason for the difference is that the CEA and

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[14]This series is not regularly updated. Stewart, Kenneth J. and Stephen B. Reed. Consumer Price Index research series using current methods, 1978-98. Monthly Labor Review, June 1999. pp. 29-38.

CBO estimates are forward looking while the BLS figures show the historical effect of changes in the way the CPI is calculated.

Table 2. Comparing the Actual CPI-U and the Research Series CPI

	percentage change from previous December	
	CPI-U	CPI-U-RS[1]
December 1978	9.0	7.8
December 1979	13.3	10.7
December 1980	12.5	10.7
December 1981	8.9	8.3
December 1982	3.8	5.0
December 1983	3.8	3.7
December 1984	3.9	3.7
December 1985	3.8	3.7
December 1986	1.1	1.0
December 1987	4.4	4.0
December 1988	4.4	3.9
December 1989	4.6	4.2
December 1990	6.1	5.8
December 1991	3.1	2.5
December 1992	2.9	2.6
December 1993	2.7	2.3
December 1994	2.7	2.4
December 1995	2.5	2.3
December 1996	3.3	3.1
December 1997	1.7	1.5
December 1998	1.6	1.4
[1] The CPI-U-RS is not a regularly published statistic. These data were published by the Bureau of Labor Statistics as part of a special study.		
Source: Department of Labor, Bureau of Labor Statistics.		

Future Change in the CPI

In December 1998, BLS announced plans for an additional change in the way the CPI is calculated. Beginning with the release of data for January 2002, the expenditure weights, which were updated in January 1998, will be updated again to reflect spending patterns in 1999 and 2000. Subsequently, the expenditure weights will be updated every two years. This more frequent updating of the composition of the CPI marketbasket should reduce some of the bias the index has had due to long intervals between updates.

This is only the latest in a long series of changes in the CPI. As this report documents, BLS is continually trying to improve the CPI and make it a better measure of changes in the cost of living. Whether or not any future changes in the way the CPI is calculated have significant effects on the actual measure and whether any effects would increase or reduce measured inflation is unknown. But, because the CPI has an important effect on both federal outlays and revenues, congressional interest in continuing efforts to improve it is likely to be high.