

Consumer Price Index research series using current methods, 1978–98

BLS research indicates that the measured rate of inflation would have been lower since 1978 if methods currently used in calculating the Consumer Price Index for All Urban Consumers had been in place from that year to the present

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The Consumer Price Index (CPI) is the most widely used measure of inflation in the United States and affects nearly all Americans. Annual cost-of-living adjustments (COLAs) for Social Security recipients and Federal and military retirees are tied to changes in the CPI, which also is used to determine the annual escalation of Federal income tax brackets, as well as personal exemption and standard deduction amounts. In addition, the CPI is used in the calculation of many key economic indicators that require real- or constant-dollar measures, including estimates of income, earnings, productivity, output, and poverty.

The Bureau of Labor Statistics has made numerous improvements to the CPI over the past quarter-century. While these improvements make the present and future CPI more accurate, *historical* price index series are not adjusted to reflect the improvements.¹ Many researchers, however, would like a historical series that was measured consistently over the entire period. Accordingly, this article presents an estimate of the CPI-U from 1978 to 1998 that incorporates most of the improvements made over that time span into the entire series. The new measure, called the *CPI research series using current methods* (CPI-U-RS), attempts to answer the question, “What would have been the measured rate of inflation from 1978 forward had the methods currently used in calculating the CPI-U been in use since 1978?”²

The CPI-U-RS was constructed by adjusting na-

tional CPI-U index series for methodological improvements, usually at the level of the item stratum, such as new vehicles or residential rent.³ That is, the adjustments were made, not to the aggregate all-items CPI-U directly, but rather to its component indexes. These adjusted series were then aggregated by using the official CPI-U base-period expenditure weights to form the all-items CPI-U-RS and other high-level aggregates.⁴ In this regard, it is important to note that the component indexes were adjusted directly; individual prices were not used to recompute those indexes. For example, as explained later, adjustments were made to the historical values of the CPI-U television index to reflect the estimated impact on that index of hedonic regression-based quality adjustment, had that method been employed prior to its implementation in January 1999. No attempt was made, however, to recompute the television index by applying hedonic regression analysis to the individual television prices collected for the CPI during the 1978–98 period. Such an effort would not have been feasible, in part because the early price data are no longer available.

It is also important to recognize that the CPI-U-RS provides an annual inflation series that adjusts only for specified changes in BLS methodology. No attempt has been made to incorporate research results, such as those on the value of safer, but perhaps less comfortable, air travel, for which there is no corresponding method-

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ological change in the CPI-U. Nevertheless, the CPI-U-RS is expected to be of use to forecasters and other researchers in analyzing the trends and other movements in consumer inflation over the last two decades. Indeed, the measure should help answer the question of the degree to which the measured rate of inflation has been affected by improvements BLS has made.⁵

Over the 21-year period of the study (December 1977 to December 1998), the CPI-U-RS increased 141.2 percent, compared with 163.9 percent for the CPI-U. The figures represent an average annual increase of 4.28 percent for the CPI-U-RS and 4.73 percent for the CPI-U; the average annualized difference between the two measures is thus 0.45 percent. (See chart 1.)

Methodological improvements

A number of significant methodological improvements have been made to the CPI since 1978. The CPI-U-RS differs from the CPI-U in that the CPI-U-RS is adjusted to incorporate estimates of what the measured rate of inflation would have been had those improvements to the CPI-U been made earlier. This section focuses on those methodological improvements that affect the CPI-U-RS and how

the adjustments were derived.

Improvements made to the CPI from 1978 to 1998 and reflected in the CPI-U-RS. Exhibit 1 lists all the improvements made to the CPI since 1978 for which estimates of historical effects were made and included in the CPI-U-RS.

1. *Use of rental equivalence to measure changes in homeowner costs.* In 1983, a major improvement was introduced when the homeownership component of the CPI-U was changed from the cost of the purchase of a home to a flow-of-services approach. Rental equivalence is incorporated into the CPI-U-RS from 1978 to 1982 by first replacing the old weight for homeowner cost in December 1977 (which was based on home purchases, contracted mortgage interest, and so on) by a weight based on the rental equivalence concept. The price change for the new rental equivalence category is then imputed from 1978 to 1982 by changes in the CPI residential rent index. This technique for incorporating rental equivalence into the CPI-U-RS corresponds to how the Bureau created the CPI-U-X1, an experimental consumer price index that employed the rental equivalence treatment from 1967 to 1982.⁶ Thus, the difference between the CPI-U and CPI-U-X1 is also reflected in the CPI-U-RS.

Chart 1. Consumer Price Index for All Urban Consumers (CPI-U) and Consumer Price Index research series using current methods (CPI-U-RS), 1977-98

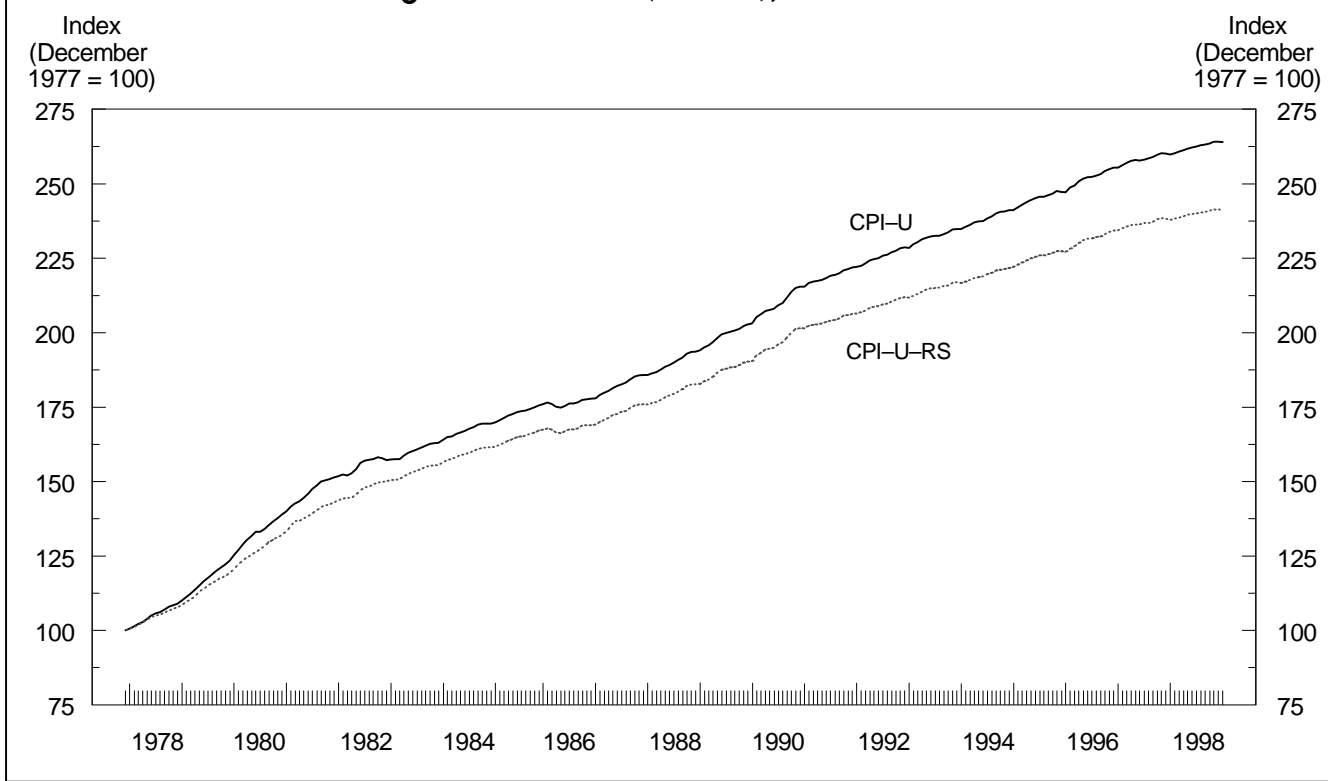


Exhibit 1. Improvements to the Consumer Price Index for All Urban Consumers (CPI-U) since 1978 and their effect on the CPI research series using current methods (CPI-U-RS)¹

Change	Description	Year implemented in CPI-U	CPI-U-RS incorporates estimate of change from—
Use of rental equivalence to measure changes in homeowner costs	Changed homeowners' component from cost of purchase to value of rental services	1983	1978–82
Quality adjustment of used-car prices	Adjusted prices of used cars for differences in quality after changeovers to new models	1987	1978–86
Quality adjustment of sampled housing units to reflect aging of the units	Adjusted rental values in CPI sample to reflect aging	1988	1978–87
Quality adjustment of apparel prices	Used regression models to adjust apparel prices for changes in quality when new clothing lines are introduced	1991	1978–90
Treating shifts between brand-name and generic drugs as price changes	Introduced new procedures that allow generic drugs to be priced when a brand-name drug loses its patent	1995	1978–94
Change in shelter formula to eliminate composite estimator	Replaced composite estimator with a 6-month chain estimator. Underreporting of 1-month rent changes had resulted in missing price changes in residential rent and homeowners' equivalent rent	1995	1978–94
Change in shelter formula to improve rental equivalence estimator	Modified imputation of homeowners' implicit rent to eliminate upward-drift property of previous estimator	1995	1987–94
Elimination of functional form bias for CPI food-at-home categories	Introduced seasoning procedures to eliminate upward bias derived by setting base-period prices of newly initiated items	1995	1978–94
Elimination of functional form bias for other CPI commodity and service categories	Extended food-at-home seasoning procedures to remainder of commodities and services. Base-period prices were left unchanged in most noncomparable substitutions	1996	1978–96
Quality adjustment of personal-computer prices	Used regression models to adjust personal-computer prices for changes in quality	1998	1987–97
Elimination of automobile finance charges	Deemed out of scope of definition of CPI	1998	1978–97
Quality adjustment of television prices	Used regression models to adjust television prices for changes in quality	1999	1978–98
Accounting for consumer substitution within CPI item categories	Introduced a geometric-mean formula that assumes a modest degree of consumer substitution within most CPI item categories	1999	1978–98
Treating mandated pollution control measures as price increases	Adjustments are no longer made to changes in pollution control regulations, which are now viewed as price changes and not quality changes	1999	1978–98

¹ This exhibit generally follows Exhibit 1 in John S. Greenlees and Charles C. Mason, "Overview of the 1998 revision of the Consumer Price Index," *Monthly Labor Review*, December 1996, pp. 3–9.

2. *Quality adjustment of used-car prices.* In 1967, the Bureau began to adjust new-car prices for changes in the quality of the cars. In 1987, the Bureau began adjusting the used-car index for similar changes by applying, to each model in the used-car sample, the percentage of quality adjustment employed when the model was new. A more aggregate version of this same procedure is used to adjust the used-car index of the CPI-U-RS downward from 1978 to 1986, by first estimating the general distribution of model years within the used-car sample in each of those years and then estimating the effect of the quality adjustments applied to new cars of the same model years.⁷

3. *Quality adjustment of sampled housing units to reflect aging.* In 1988, quality adjustments reflecting the aging of the housing stock sample began. The CPI-U-RS incorporates an estimate of the effect of this change by adjusting the residential rent and owners' equivalent rent indexes upward by about 0.3 percent per year from 1978 to 1987.⁸ This figure represents the average of the adjustment factors used in the CPI from 1988 to 1999.⁹

4. *Quality adjustment of apparel prices.* In 1991, the Bureau initiated the use of hedonic models to estimate changes in quality for apparel commodities. Using a BLS study that estimated the effect of this improvement over the last 6 months of 1991, the Bureau adjusted all of the CPI-U-RS apparel commodity indexes from 1978 to 1990 upward by approximately 0.4 percent per year.¹⁰

5. *Treating shifts between brand-name and generic drugs as price changes.* In 1995, a new procedure was introduced that allows a generic drug to be priced when the corresponding brand-name drug loses its patent protection. (The procedure also allows the price of the generic drug to be directly compared with that of the brand-name one.) On the basis of a review of the CPI prescription drug sample from 1993 to 1997, it is estimated that this change reduced the prescription drug index during that period by an average of 0.4 percent per year. Accordingly, the CPI-U-RS prescription drug index is also adjusted downward by varying amounts from 1978 to 1994, depending on the number of generic drugs entering the market each year during that period (relative to the number entering the market from 1993 to 1997).¹¹

6. *Changes in shelter formulas in 1995.* Two changes implemented in January 1995 affected shelter components of the CPI. The first was the elimination of the composite estimation approach that used a weighted average of 1- and 6-month changes in rent to estimate monthly price changes for individual housing units in the CPI rent sample. Evidence indicated that, because some respondents misreported 1-month rent

changes, the composite estimator underestimated price changes; therefore, it was replaced by a 6-month chain estimator in January 1995. This methodological improvement affected both the residential rent and owners' equivalent rent indexes.

The second shelter-related change made in January 1995 affected only the owners' equivalent rent index. The Bureau modified the formula for calculating that index to eliminate an upward-drift tendency the former method had between 1987 and 1995.

The CPI-U-RS is adjusted for these two improvements in the shelter component from 1991 to 1995 by using an experimental Laspeyres consumer price index (called the CPI-U-XL) in place of the CPI-U for both residential rent and owners' equivalent rent.¹² The CPI-U-XL, published for years beginning in 1991, employs the post-1994 estimation formulas for both shelter indexes. Substituting the CPI-U-XL for the CPI-U had the effect of adjusting the residential rent index upward by an average of about 0.1 percent per year during the 1991–95 period. This average effect was also applied to the residential rent index from 1978 to 1990. The average downward adjustment of the owners' equivalent rent index from 1991 to 1995 was 0.6 percent per year, and the effect was used to adjust the owners' equivalent rent component of the CPI-U-RS from 1987 to 1990. From 1978 to 1986, when the owners' equivalent rent index was subject only to the downward bias resulting from the use of composite estimation, it was adjusted *upward* by about 0.1 percent a year for the CPI-U-RS.¹³

7. *Quality adjustment of personal-computer prices.* In 1998, hedonic regression models were first used to adjust personal-computer prices for changes in quality. Estimates based on an analysis of 1998 data indicate that this change has had the effect of lowering the personal-computer index by about 6.5 percent per year. The CPI-U-RS uses this figure to adjust the personal-computer component downward during the period 1987–97.¹⁴

8. *Elimination of automobile finance charges.* Automobile finance charges were dropped from the CPI in 1998 on the basis that they did not reflect a cost of current consumption. The CPI-U-RS eliminates the automobile finance charges index from 1978 to 1997.¹⁵

9. *Quality adjustment of television prices.* Hedonic techniques were used to adjust the television component of the CPI for changes in quality for the first time in 1999. Based on BLS research indicating that the television index would have been approximately 0.1 percent lower per year with the quality adjustments applied from August 1993 to August 1997, the CPI-U-RS estimates the effect of this improvement on the index from 1977 to 1998 by adjusting the index down by that

amount from 1978 to 1998.¹⁶

10. Eliminating functional form bias and accounting for consumer substitution within CPI item categories. The CPI-U-RS uses estimates derived from the experimental CPI using geometric means (CPI-U-XG) to account for both functional form bias and consumer substitution within item categories.

In 1995 and 1996, improvements were made to the CPI to eliminate functional form bias, an upward bias in measured price changes occurring during the period immediately following the introduction of new item samples into the CPI.¹⁷ The new seasoning procedures eliminated the bias for the food-at-home categories in 1995 and for the other CPI categories in mid-1996.¹⁸

While the elimination of functional form bias improved the CPI as a measure of price change for a fixed market basket of goods and services, the estimator was still considered an upper bound to a cost-of-living index because it did not account for consumer substitution—the fact that consumers can, and do, respond to changes in the relative prices of different items. Since January 1999, a geometric-mean formula has been used to calculate most basic indexes in order to address consumer substitution within CPI item categories.¹⁹

The Bureau began publishing the CPI-U-XG in 1997; as with the CPI-U-XL, historical indexes are available only for the years 1991–98. Indexes calculated with the use of geometric means not only address consumer substitution within item categories; they also are free of functional form bias. Therefore, the CPI-U-RS uses estimates derived from the CPI-U-XG to adjust for both functional form bias and consumer substitution within CPI item categories. Specifically, for those CPI-U categories that now use a geometric-mean formula, the CPI-U-RS substitutes price changes from the CPI-U-XG for the period 1991–98. For food-at-home categories, average differences between the CPI-U and CPI-U-XG over the 1991–94 period were used to extrapolate estimates for 1978 to 1990. For other categories that now use the geometric-mean formula, average differences between the same two indexes from January 1991 through May 1996 were used to extrapolate estimates for 1978 to 1990. For those item categories in the CPI-U that continue to use the Laspeyres formula, the CPI-U-RS accounts for the functional form bias present in the CPI-U from 1978 to 1996 by using internal estimates of the bias.²⁰

11. Treating mandated pollution control measures as price increases. In 1999, the Bureau reversed its policy regarding the treatment of pollution control measures designed to improve the environment. From 1967 to 1998, federally mandated improvements in emissions were treated as improvements in quality; starting in 1999, they began to be treated as price increases instead.²¹ The CPI-

U-RS is adjusted upward by removing the environmental quality adjustments made to the motor vehicle and gasoline indexes from 1978 to 1998.

Improvements made to the CPI from 1978 to 1998 and not incorporated into the CPI-U-RS. Several improvements were made to the CPI since 1978, for which no adjustments to the CPI-U-RS were made. Adjustments to the CPI-U-RS were not made if the impact of the improvement on the rate of growth of the index could not be estimated or was believed to be negligible. Improvements of this nature include the updating of CPI expenditure weights and area samples accompanying the CPI revisions of 1978, 1987, and 1998;²² improvements to CPI imputation methods in 1984, 1989, and 1992;²³ improvements in the treatment of seasonal items in 1987;²⁴ an improved treatment of discount airline fares in 1991;²⁵ improved sample augmentation procedures in 1992;²⁶ increased sample sizes for hotels and motels in 1992;²⁷ improvements in the methods for pricing hospital services in 1997;²⁸ a change from area- to item-based sample rotation procedures in 1999;²⁹ revisions to the shelter sample and estimators in 1999;³⁰ and changes to the treatment of utility rebates in 1999.³¹

Limitations of the CPI-U-RS. The CPI-U-RS is limited chiefly in two ways. First, the magnitude of each adjustment made to the CPI-U-RS has a degree of uncertainty surrounding it. Second, some improvements to the CPI-U, for which no adjustments were made to the CPI-U-RS, may nevertheless have affected the rate of inflation, as measured by the CPI-U.

Most adjustments to the CPI-U-RS were based on BLS research that estimated the impact of methodological changes to the CPI over a relatively short period of time, and the effect of a given methodological change (outside the period of study) is assumed to be constant over time. For example, while the price changes for the CPI-U-XG were used to adjust most CPI item categories from 1991 to 1998, the CPI-U-RS was adjusted downward from 1978 to 1990 by the *average* differences between the CPI-U and CPI-U-XG from 1991 to the mid-1990s. Similarly, apparel indexes for the CPI-U-RS from 1978 to 1990 are adjusted on the basis of studies of the effect of the improvement during the last 6 months of 1991. While there is typically a great degree of confidence about the *direction* of the adjustment made to the CPI-U-RS, extrapolations of this type could call into question the *size* of the adjustments.

Similarly, as noted above, a dozen or so methodological improvements have been made to the CPI for which *no* estimate was made for the CPI-U-RS. Other organizations, such as the Congressional Budget Office and the Council of Economic Advisers, have estimated the impact of some of these improvements on the projected rate of inflation for budget forecasts. For example, in 1997, the CPI procedures for pricing hospital services were changed, improving the ability of the

index to reflect changes in the scope and types of payors and treatments. The Congressional Budget Office and the Council of Economic Advisers have estimated that those methodological improvements in the measurement of prices of hospital services will have a modest downward impact on the *future* measured rate of inflation. While it is probable that the measured rate of inflation for hospital services would have been lower had this change been implemented in the CPI earlier, it would be extremely difficult to quantify the effect of the change *retroactively*. CPI data would be of little value for such an exercise, because the 1997 improvements primarily affected the nature of the data collected, not the computational methods applied to those data. Quantification of the effects of improvement would have to be based on knowledge and analysis of past trends in, for example, managed care plans' market penetration, the effectiveness of third-party cost control efforts, cost shifting to privately paying patients, and shifts between inpatient and outpatient treatment for various medical conditions. Now, controversy surrounds some of these trends and their impacts, and a definitive examination of each is beyond the scope of this article. In general, however, the adjustments for inflation that are incorporated into the CPI-U-RS are those for which the Bureau has special expertise or data. The assessment of the impact of other adjustments, such as those for the 1997 improvements in hospital services, is left to other interested parties.

The treatment of expenditure weight updates also is worthy of explanation here. The Bureau does not view the weight updates of 1987 and 1998 as methodological changes; periodic updates have long been a feature of the CPI. Moreover, it is not clear that weighting individual CPI series using the current 1993–95 base period would yield, for example, an improved aggregate measure for the year 1980. Therefore, the CPI-U-RS is not adjusted for the 1987 and 1998 updates. In December 1998, the Bureau announced that, beginning in 2002, expenditure weight updates would occur every 2 years rather than approximately once every decade. No attempt has been made in this article, however, to incorporate the estimated historical impact of biennial updates between 1978 and 1987 and between 1987 and 1998. Such an analysis would face significant hurdles regarding the availability of data and commitment of resources.³²

Results

Over the 21-year period of the study (December 1977 to December 1998), the CPI-U-RS increased 141.2 percent, compared with 163.9 percent for the CPI-U over the same period; the annualized difference between the two measures is approximately 0.45 percent. Table 1 gives the December-to-December percent changes for 1978 through 1998 for the CPI-U and CPI-U-RS for the all-items index and for major CPI groups.

Analysis of results: changes over time. The difference between the all-items indexes of the CPI-U and CPI-U-RS changed markedly over time. From 1978 to 1982, driven largely by the use of rental equivalence in the CPI-U-RS, that index increased about 1 percent per year more slowly, on average, than the CPI-U, although substantial variations occurred from year to year. The differences between the two measures became much smaller after rental equivalence was introduced into the CPI-U in 1983, shrinking to around 0.1 percent per year from 1983 to 1986. The relatively small differences during that period were due in large part to upward adjustments made to the CPI-U-RS housing categories to reflect composite estimation and aging bias. These adjustments partially offset the downward adjustment used to estimate the effect the geometric-mean formula would have had. Since 1986, the difference between the CPI-U and CPI-U-RS at the all-items level has typically remained around 0.3 percent per year to 0.4 percent per year. (See chart 2.)

Analysis of results: quantitative impact of selected adjustments. A large proportion of the difference between the CPI-U and CPI-U-RS can be explained by the rental equivalence adjustment applied from 1978 to 1982 and by the group of adjustments made to reflect changes over time to all CPI formulas.

Rental equivalence was first incorporated into the CPI-U in 1983, and its incorporation into the CPI-U-RS from 1978 to 1982 largely explains the sizable difference between the CPI-U and CPI-U-RS during that period. Indeed, as table 2 shows, when the rental equivalence adjustment alone is applied to the CPI-U from 1978 to 1982, the resulting index increases at a rate similar to that for the CPI-U-RS.

In subsequent years (1983–98), most of the difference between the CPI-U and CPI-U-RS was driven by adjustments that can be described as changes to CPI formulas. Among these changes were the elimination of the composite estimator used to measure the cost of shelter before 1995, the improved estimator for rental equivalence in 1995, the elimination of functional form bias for commodity and service categories in 1995 and 1996, and the implementation of the geometric-mean formula in 1999 to account for consumer substitution within CPI item categories. The importance of the changes from 1983 to 1998 can be seen in table 2.

Over the 21-year period, the remaining adjustments made to the CPI-U-RS were relatively small and largely offsetting. Still, these adjustments had the net effect of making the CPI-U-RS *higher* than it otherwise would have been for most years covered by the study.

Analysis of results: effect on major groups

1. Food and beverages. The difference between the CPI-U and CPI-U-RS for the food-and-beverages group is driven by

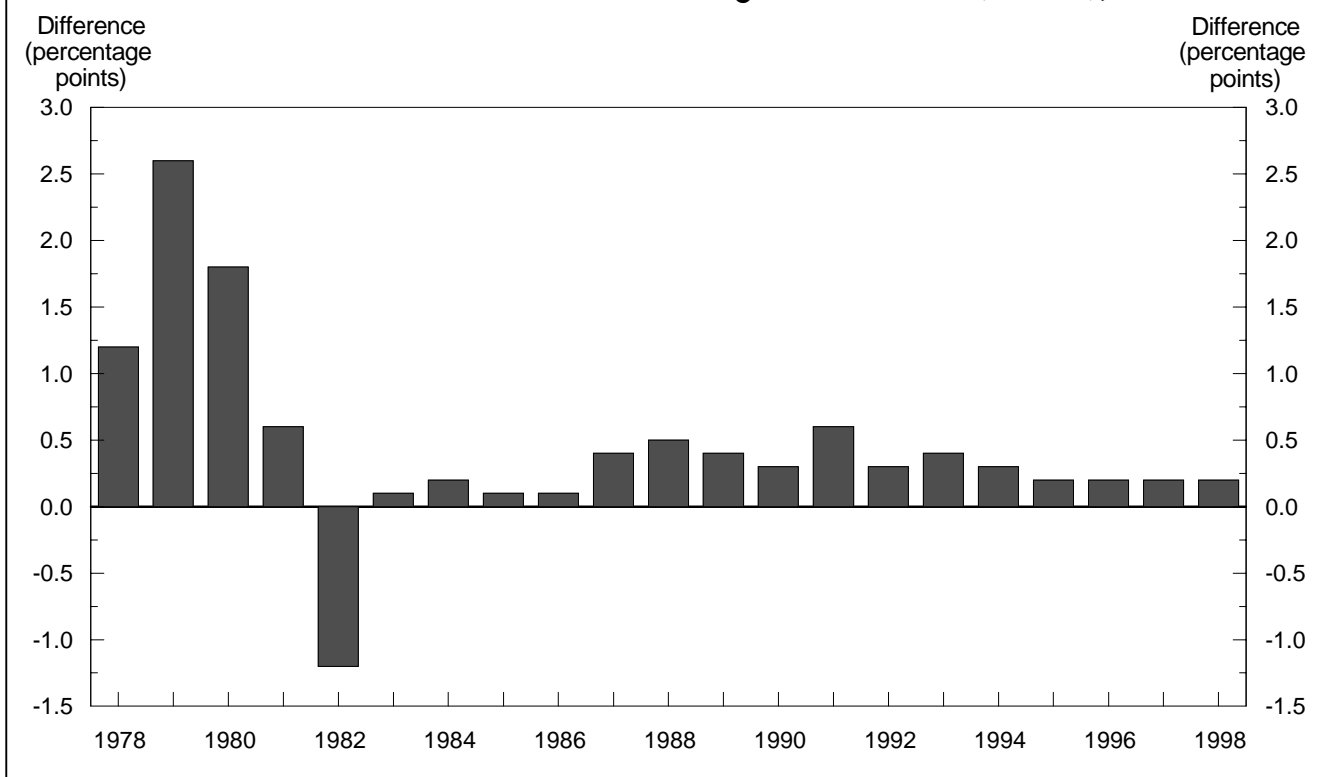
Table 1. CPI for All Urban Consumers (CPI-U) and CPI research series using current methods (CPI-U-RS), all items and major groups, percent changes, December to December, 1978–98

Year	Index	All items	Food and beverages	Housing	Apparel	Transportation	Medical care	Entertainment	Other goods and services	Recreation	Education and Communication
1978	CPI-U	9.0	11.6	10.0	3.1	7.7	8.8	5.7	6.4	—	—
	CPI-U-RS	7.8	11.0	7.4	2.1	7.5	8.8	5.2	6.2	—	—
1979	CPI-U	13.3	10.0	15.2	5.5	18.3	10.1	6.9	7.8	—	—
	CPI-U-RS	10.7	9.5	9.5	4.5	18.5	9.7	6.3	7.5	—	—
1980	CPI-U	12.5	10.1	13.7	6.8	14.6	9.9	9.7	10.1	—	—
	CPI-U-RS	10.7	9.5	9.9	5.8	15.6	10.0	9.0	9.9	—	—
1981	CPI-U	8.9	4.3	10.2	3.5	10.9	12.5	7.2	9.9	—	—
	CPI-U-RS	8.3	3.8	9.8	2.7	10.5	12.2	6.6	9.6	—	—
1982	CPI-U	3.8	3.2	3.6	1.6	1.8	11.0	5.6	12.1	—	—
	CPI-U-RS	5.0	2.7	6.7	.8	2.0	10.8	5.1	11.9	—	—
1983	CPI-U	3.8	2.7	3.5	2.9	3.9	6.4	4.0	7.9	—	—
	CPI-U-RS	3.7	2.1	3.6	1.9	4.2	6.2	3.2	7.7	—	—
1984	CPI-U	3.9	3.8	4.3	2.0	3.1	6.1	4.2	6.0	—	—
	CPI-U-RS	3.7	3.2	4.4	1.0	2.7	5.9	3.7	5.9	—	—
1985	CPI-U	3.8	2.8	4.3	2.8	2.6	6.8	3.1	6.3	—	—
	CPI-U-RS	3.7	2.3	4.4	1.9	2.8	6.5	2.6	6.0	—	—
1986	CPI-U	1.1	3.7	1.7	.9	-5.9	7.7	3.4	5.5	—	—
	CPI-U-RS	1.0	3.3	2.0	.1	-6.2	7.5	2.7	5.3	—	—
1987	CPI-U	4.4	3.5	3.7	4.8	6.1	5.8	4.0	6.1	—	—
	CPI-U-RS	4.0	3.0	3.4	3.8	5.9	5.5	3.4	5.9	—	—
1988	CPI-U	4.4	5.1	4.0	4.7	3.0	6.9	4.6	7.0	—	—
	CPI-U-RS	3.9	4.5	3.6	3.6	2.5	6.6	3.9	6.7	—	—
1989	CPI-U	4.6	5.5	3.9	1.0	4.0	8.5	5.1	8.2	—	—
	CPI-U-RS	4.2	5.0	3.5	-1	3.7	8.2	4.5	7.9	—	—
1990	CPI-U	6.1	5.3	4.5	5.1	10.4	9.6	4.3	7.6	—	—
	CPI-U-RS	5.8	4.6	4.0	4.1	10.6	9.3	3.6	7.4	—	—
1991	CPI-U	3.1	2.5	3.4	3.4	-1.5	7.9	3.9	8.0	—	—
	CPI-U-RS	2.5	2.0	2.6	2.1	-1.5	7.7	3.4	7.8	—	—
1992	CPI-U	2.9	1.6	2.6	1.4	3.0	6.6	2.8	6.5	—	—
	CPI-U-RS	2.6	1.2	2.1	-1	3.2	6.5	2.3	6.3	—	—
1993	CPI-U	2.7	2.7	2.7	.9	2.4	5.4	2.8	2.7	—	—
	CPI-U-RS	2.3	2.1	2.4	-7	2.4	5.1	2.4	2.3	—	—
1994	CPI-U	2.7	2.7	2.2	-1.6	3.8	4.9	2.3	4.2	—	—
	CPI-U-RS	2.4	2.1	1.9	-2.4	4.4	4.8	1.4	3.9	—	—
1995	CPI-U	2.5	2.1	3.0	.1	1.5	3.9	3.3	4.3	—	—
	CPI-U-RS	2.3	1.9	2.8	-1.3	1.3	3.7	2.7	4.2	—	—
1996	CPI-U	3.3	4.2	2.9	-2	4.4	3.0	2.9	3.6	—	—
	CPI-U-RS	3.1	3.8	2.8	-1.0	4.7	2.9	2.0	3.5	—	—
1997	CPI-U	1.7	1.6	2.4	1.0	-1.4	2.8	1.4	5.2	—	—
	CPI-U-RS	1.5	1.5	2.2	.0	-1.5	2.7	.8	5.1	—	—
1998	CPI-U	1.6	2.3	2.3	-7	-1.7	3.4	—	8.8	1.2	.7
	CPI-U-RS	1.4	1.9	2.3	-2.4	-1.7	3.2	—	8.2	.7	3
Dec. 1977–Dec. 1998	CPI-U	163.9	142.5	172.5	62.0	136.5	316.3	¹ 134.3	301.8
	CPI-U-RS	141.2	119.6	143.2	29.1	137.7	299.9	¹ 107.9	282.5
Average annual difference, Dec. 1977–Dec. 1998		.45	.49	.57	1.10	-.03	.20	.62	.25

¹ Entertainment was dropped as a major group in December 1997; number represents percent change from December 1977 through December 1997.

NOTE: Dash indicates not a major group that year. From 1978 to 1998, there were seven major groups in the CPI. In 1998, entertainment was dropped as a major group, and two major groups were added: recreation, and education and communication.

Chart 2. Yearly differences between the Consumer Price Index for All Urban Consumers (CPI-U) and the Consumer Price Index research series using current methods (CPI-U-RS), 1977-98



the geometric-mean adjustments made to the CPI-U-RS; the group was not affected by the other adjustments. The difference between the CPI-U and CPI-U-RS was consistently between 0.5 percent per year and 0.6 percent per year between 1978 and 1994. After 1994, when the food-at-home components of the CPI-U were improved in order to eliminate the functional form bias previously present in them, the average difference between the two measures fell to 0.2 percent per year.

2. Housing. The difference between the CPI-U and the CPI-U-RS in the housing group varies significantly by period. From 1977 to 1982, the difference is explained chiefly by the incorporation into the CPI-U-RS of an estimate for rental equivalence, a method not implemented in the CPI-U until 1983. While the average annual difference between the CPI-U and CPI-U-RS housing measures was 1.9 percent from 1978 to 1982, annual differences were as high as 5.7 percent (in 1979) and as low as -3.1 percent (in 1982).

From 1983 to 1986, the housing group index of the CPI-U-RS was actually rising faster than that of the CPI-U, due to adjustments made to the CPI-U-RS to reflect the elimination of composite estimation and the quality adjustment of shelter units to reflect aging. The annual average difference between the CPI-U and CPI-U-RS from 1983 to 1986 is -0.15 percent per

year. For the remaining years (1987-98), the difference between the CPI-U and CPI-U-RS housing measures was consistently positive, but fairly small, averaging between 0.3 percent per year and 0.4 percent per year.

3. Apparel. From 1978 to 1990, the annual difference between the CPI-U and CPI-U-RS apparel indexes was consistently around 1.0 percent. This substantial gap reflects the large downward adjustment to the CPI-U-RS because of the geometric-mean formula, which has a substantial impact on the apparel category. The effect is partially offset by an upward adjustment of about 0.4 percent per year to reflect an estimate of the retroactive influence of hedonic-based quality adjustments implemented in the CPI-U apparel indexes in 1991. After 1991, with only the geometric-mean adjustment affecting the apparel category of the CPI-U-RS, the average annual difference between the CPI-U and CPI-U-RS apparel indexes was 1.4 percent.

4. Transportation. The annual average difference between the CPI-U and CPI-U-RS transportation components between 1978 and 1998 was near zero, reflecting several changes that roughly offset each other. Specifically, while downward adjustments were made to the CPI-U-RS to incorporate the effects of changes in the quality of used cars and the effects of

the geometric-mean formula, net upward adjustments resulted from the deletion from the CPI-U-RS of the index for automobile finance charges and from an upward adjustment based on the backing out of a prior adjustment for changes in quality for mandated pollution controls made to the CPI-U over the period. While annual changes in the CPI-U and CPI-U-RS transportation measures were usually within one-half percent of each other, the CPI-U-RS transportation measure was a full percentage point *higher* than that of the CPI-U in 1980, a year in which the CPI-U-RS reflected a large upward adjustment to remove the aforesaid previous downward adjustment in the measurement of pollution-related changes in the quality of 1981-model automobiles.

5. Medical care. The average annual difference between the CPI-U and CPI-U-RS for the medical care component was 0.2 percent per year. This relatively small difference primarily reflects the fact that, while a downward adjustment to the CPI-U-RS for medical care commodities was made to reflect the use of geometric means, the geometric-mean formula is not utilized for most medical care services in the calculation of the CPI-U.

6. Entertainment. The annual difference between the CPI-U and CPI-U-RS for the major group of entertainment averaged 0.6 percent from 1978 to 1997, reflecting the downward adjustment made to the CPI-U-RS from the estimate of the likely effect of the geometric-mean formula.

7. Other goods and services. The annual average difference between the CPI-U and CPI-U-RS for the other-goods-and-services component between 1978 and 1998 was 0.25 percent, again reflecting the downward adjustment made to the CPI-U-RS from the estimate of the effect of the geometric-mean formula.

BECAUSE THE CPI-U DOES NOT INCORPORATE methodological changes retroactively, the Bureau of Labor Statistics developed the CPI-U-RS for researchers who are interested in using current and consistent methods of estimating consumer inflation over the 1978–98 period. The CPI-U-RS provides a somewhat different picture of inflation from 1978 to 1998 by including an estimate of most improvements made over time to the CPI back to 1978. Users of CPI data can thus gain a new

Table 2. Estimated effect on annual inflation rate of specific methodological changes, selected periods

Index or type of effect	Average annual rate			
	1978–82	1983–86	1987–97	1998
CPI-U	9.46	3.15	3.50	1.61
Effect of incorporating an estimate of rental equivalence from 1978 to 1982	–.86
Effect of incorporating changes made to CPI formulas	–.28	–.26	–.41	–.23
Effect of all other changes	+.14	+.13	+.06	+.00
CPI-U-RS	8.46	3.02	3.15	1.38

perspective on inflation and on the performance of the U.S. economy between the years 1978 and 1998.

Researchers need to be aware of the limitations of the CPI-U-RS, including the fact that adjustments made to the measure from 1978 forward typically reflect extrapolations of estimates made over later, and much shorter, periods. In addition, the CPI-U-RS is not adjusted for many improvements made to the CPI over the past 21 years, such as the January 1997 change to improve the pricing of hospital services. Nonetheless, for some purposes, the CPI-U-RS can serve as a valuable proxy for what the CPI-U would have been had current (1999) methods been in place from 1978 onward.

It is important to note that the CPI-U-RS is subject to revision. When an improvement is made to the CPI and an effect of that change can be estimated, the CPI-U-RS (unlike the CPI-U) will be revised so that earlier years incorporate that improvement. In addition, if a better method of adjusting the CPI-U-RS for past improvements is found, the CPI-U-RS will be revised to reflect the new technique.

The CPI-U-RS will be updated periodically in the *CPI Detailed Report*. To assist users, all-item indexes for the CPI-U-RS are available on request.³³ In addition, all-item indexes are available for users who would like to link the CPI-U-RS to the CPI-U-X1 for periods prior to 1978.³⁴ □

Notes

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¹ Historical CPI indexes are occasionally revised when data-collection or data-processing errors are discovered. Methodological improvements, however, do not result in revisions to the data.

² Researchers outside the Bureau have attempted to estimate what the CPI would have been had improvements to it been in place earlier. (See, for example, Dean Baker, *Getting Prices Right: A Methodologically Consistent Consumer Price Index, 1953–94* (Washington, DC, Economic Policy Institute, 1996); and Richard Bavier, *Updating the poverty thresholds with expenditure data*, poverty measurement working paper (Bureau of the Census, 1998).) Others, such as the Congressional Budget Office and Council of Economic Advisers, have estimated the effect of recent improvements to the CPI on the projected (future) rate of inflation. General estimates of bias in the CPI relative to

a cost-of-living index have also been made by many groups and individuals, including the Advisory Commission to Study the Consumer Price Index (widely known as the Boskin Commission), the Congressional Budget Office, and the Federal Reserve Board.

³ Because of limitations of available data, adjustments for periods prior to the 1987 revision of the CPI often had to be made at a slightly higher level of aggregation, roughly corresponding to the level of a CPI expenditure class.

⁴ As noted subsequently, CPI expenditure weight updates were not treated as methodological improvements in the construction of the CPI-U-RS.

⁵ The development of such a broader historical research series was one recommendation of the Boskin Commission.

⁶ The CPI-UI-X1 has been used widely as an alternative measure of historical consumer inflation. For a more detailed discussion of rental equivalence, see Robert Gillingham and Walter Lane, "Changing the treatment of shelter costs for homeowners in the CPI," *Monthly Labor Review*, June 1982, pp. 9–14; and "Changing the homeownership component of the Consumer Price Index to rental equivalence," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, January 1983), pp. 1–7.

⁷ For more details on the adjustment of used-car prices for changes in the quality of the cars, see Jeffrey H. Kellar, "New methodology reduces importance of used cars in the revised CPI" *Monthly Labor Review*, December 1988, pp. 34–36.

⁸ Specifically, the monthly price relatives of the rent and owners' equivalent rent indexes were multiplied by 1.003^{1/12}. The result of this adjustment is that the 12-month change in the item category within the CPI-U-RS is 0.3 percent higher than the 12-month change in the CPI-U. Other adjustments set forth in this article can be similarly interpreted.

⁹ For a description of adjustments to reflect the aging of the rental stock, see Walter F. Lane, William C. Randolph, and Stephen A. Berenson, "Adjusting the CPI shelter index to compensate for effect of depreciation," *Monthly Labor Review*, October 1988, pp. 34–37.

¹⁰ For a more detailed description of the improved method used for adjusting apparel prices for changes in quality, see Paul R. Liegey, Jr., "Apparel price indexes: effects of hedonic adjustment," *Monthly Labor Review*, May 1994, pp. 38–45.

¹¹ For more details, see "Improvements to CPI procedures: prescription drugs," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, October 1994), p. 4.

¹² The CPI-U-XL was calculated from 1991 to 1997 in order to give researchers an opportunity to compare differences between a Laspeyres type of index and an experimental CPI that used geometric means (CPI-U-XG), holding constant other changes in CPI methods during that period.

¹³ For more information on the 1995 shelter changes, see Paul A. Armknecht, 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*, working paper 263 (Bureau of Labor Statistics, February 1995); and "Improvements in estimating the shelter indexes in the CPI," *Consumer Price Index Detailed Report*, October 1994, pp. 5–6.

¹⁴ See "Using a hedonic model in the CPI to adjust personal computer prices for changes in quality," *Consumer Price Index Detailed Report*, June 1997, p. 18. From 1987 to 1997, personal computers were included in the CPI item category called "information-processing equipment" (IPE). The adjustments made to the CPI-U-RS reflect an estimate each year of the number of personal-computer prices in the IPE sample during that time.

¹⁵ See Walter Lane, "Changing the item structure of the Consumer Price Index," *Monthly Labor Review*, December 1996, pp. 18–25.

¹⁶ See Brent R. Moulton, Timothy J. LaFleur, and Karin E. Moses, *Research on Improved Quality Adjustment in the CPI: The Case of Televisions*, paper presented at the Fourth Meeting of the International Working Group on Price Indices, Washington, DC, Apr. 22–24, 1999.

¹⁷ See, for example, Marshall Reinsdorf, *Price dispersion, seller sub-*

stitution, and the U.S. CPI, working paper 252 (Bureau of Labor Statistics, March 1994).

¹⁸ A brief description of the improved procedures for the food-at-home categories of the CPI can be found in "Improving CPI sample rotation procedures," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, October 1994), pp. 7–8. A discussion of the extension of this methodology to other commodities and services can be found in "Extending the improvement in CPI sample rotation procedures," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, June 1996), pp. 9–10. A change to eliminate a similar functional form bias resulting from certain item substitutions can be found in "Improving CPI item substitution procedures," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, July 1996), pp. 8–9.

¹⁹ The geometric-mean formula will be used within item categories that make up 61 percent of total consumer spending in the CPI-U; the Laspeyres formula will continue to be used in the remaining categories. (See Kenneth V. Dalton, John S. Greenlees, and Kenneth J. Stewart, "Incorporating a geometric mean formula in the Consumer Price Index," *Monthly Labor Review*, October 1998, pp. 3–7.)

²⁰ Brent R. Moulton, Karin Moses, and Claire McAnaw Gallagher, "Formula bias in the CPI: Estimated impact of seasoning," undated internal memorandum.

²¹ See "The treatment of mandated pollution control measures in the CPI," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, September 1998), pp. 4–7. The author of the piece, Dennis Fixler, notes that the CPI is a subindex of a cost-of-living index in that the CPI is defined to include only market transactions, although it is conditional on nonmarket factors. Accordingly, changes in the quality of these factors—such as the environment—are generally deemed outside of the scope of the CPI.

²² See Greenlees and Mason for a description of improvements made with the 1998 and previous CPI revisions.

²³ See, for example, "Improvements in CPI procedures," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, March 1990, August 1992), pp. 3–4 each issue.

²⁴ *Handbook of Methods* (Bureau of Labor Statistics, April 1997), chapter 17, pp. 187–88.

²⁵ Internal BLS memo from Walter F. Lane to Stephen G. Wright, Nov. 20, 1991, on "New Pricing Guidelines for Airline Fares."

²⁶ See "Improvements in CPI procedures: sample augmentation," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, February 1992), p. 3.

²⁷ See "Improvements to CPI procedures: lodging while out of town," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, March 1992), p. 4.

²⁸ See Elaine M. Cardenas, "Revision of the CPI hospital services component," *Monthly Labor Review*, December 1996, pp. 40–48.

²⁹ Robert Cage, "New methodology for selecting outlet samples," *Monthly Labor Review*, December 1996, pp. 49–61.

³⁰ Frank Ptacek and Robert M. Baskin, "Revision of the CPI housing sample and estimators," *Monthly Labor Review*, December 1996, pp. 31–39.

³¹ "Changes to the treatment of utility rebates," *Consumer Price Index Detailed Report* (Bureau of Labor Statistics, July 1998), p. 5.

³² In a December 1998 announcement, the Bureau estimated that a hypothetical 1989 update would have reduced the CPI's subsequent growth rate, but that later updates would have had smaller or countervailing effects. The Bureau suggested that more frequent updates would have a small upward effect on the index in some future years and a small downward effect in other years.

³³ Call (202) 606–7000.

³⁴ The CPI-U-X1 was an experimental measure of the all-items index using an estimate of rental equivalence from 1967 through 1982.