

Planned Change In The Consumer Price Index Formula

**Bureau of Labor Statistics
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PLANNED CHANGE IN THE CONSUMER PRICE INDEX FORMULA

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The Bureau of Labor Statistics announced today its decision to use a new formula for calculating the basic components of the Consumer Price Index for all Urban Consumers (CPI-U) and the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). This change will become effective with data for January 1999.

The new formula, the geometric mean estimator, will be used in index categories that comprise approximately 61 percent of total consumer spending represented by the CPI-U. The remaining index categories, which are shown in the attached table, will continue to be calculated as they are currently. Based upon BLS research, it is expected that planned use of the new formula will reduce the annual rate of increase in the CPI by approximately 0.2 percentage point per year.

The research that BLS has conducted over the past few years strongly suggests that the use of the geometric mean estimator at the basic level of index construction in the CPI will produce a measure that more accurately reflects the impact that changing prices have on the average U.S. household.

The following presents a summary of the factors that led BLS to consider use of the new formula, the empirical research that BLS conducted in evaluating the new formula, and the specific decisions BLS has reached for using it in the CPI. A more detailed description of the analysis underlying the decisions will be released later this year.

The possibility of using the geometric mean formula to calculate basic indexes in the CPI was first raised by BLS researchers in 1993. One initial motivation for this research was the problem of functional form bias (sometimes referred to as "formula bias" or "elementary index bias") then present in the CPI. The functional form bias occurred because of technical problems involved 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 suffer from this problem. Functional form bias in the CPI was eliminated in a series of steps, beginning in January 1995 and ending in July 1996, using an approach that did not involve the use of the geometric mean formula. BLS, however, continued research on the formula and development of an experimental geometric mean index, in part due to a recognition that the formula offered a means of reflecting consumer substitution behavior.

In December 1996, the Advisory Commission to Study the Consumer Price Index, commonly known as the Boskin Commission, recommended the use of the geometric mean formula for the aggregation of prices within all item categories in the CPI. This recommendation was based upon the belief that a geometric mean formula would help to correct what the Commission called "substitution bias." The CPI currently is constructed using a set of constant, or fixed, implicit quantity weights. Thus the index does not reflect the fact that consumers can and do, to some degree, insulate themselves from the impact of higher prices by adjusting their spending to favor relatively lower-priced goods or services. Consequently, the current CPI, when compared with a measure that reflects this substitution effect, tends to overstate the rate of price increase consumers experience.

In contrast to the fixed quantity weights of the current CPI formula, the geometric mean estimator employs a set of fixed expenditure proportions as weights to be used in averaging the prices of individual items within a CPI basic index. Fixing the relative expenditure proportions rather than the relative quantities implies that consumers can alter the quantities of goods and services they buy, albeit within the narrow range of a CPI category, when the

relative prices of those goods and services change. It is, in part, this property of the geometric mean estimator that led to the Boskin Commission recommendation of its use in the CPI.

The CPI is constructed as an aggregation of basic indexes computed for approximately 200 item categories, such as "ice cream and related products," in each of 38 geographic areas. Within each of these index components, or strata, prices for specific items in a sample of outlets (stores) are combined to produce a basic index. As noted above, the geometric mean formula will be used only to average prices within the item-area strata. Consequently, the use of the formula will address only the issue of consumer substitution within strata.

Substitution can take several forms corresponding to the types of item- and outlet-specific prices used to construct the basic indexes:

- Substitution among brands of products, for example, between brands of ice cream;
- Substitution among product sizes, for example, between pint and quart packages of ice cream;
- Substitution among outlets, for example, between a brand of ice cream sold at two different stores;

- Substitution across time, for example, between purchasing ice cream during the first or second week of the month;
- Substitution among types of items within the category, for example, between ice cream and frozen yogurt;
- Substitution among specific items in different index categories, for example, between ice cream and cupcakes.

Thus, in response to an increase in the price charged by a store for a certain brand of ice cream, a consumer could respond by redistributing purchases along any of several dimensions represented by other priced items in the category: to another brand of ice cream whose price had not risen, to a larger package of ice cream with a smaller price per ounce, to ice cream at a different store where ice cream is on sale, or to a brand of frozen yogurt. The consumer also could respond by postponing the ice cream purchase until a later date. (Prices for CPI items are collected throughout the month and then averaged.)

Finally, the consumer could substitute from the ice cream brand to a specific alternative dessert item, such as cupcakes or apples, that is in another CPI category. This latter form of substitution, although across CPI

categories, would still have the effect of reducing the quantity consumed of the higher-priced ice cream brand relative to the quantities of other items within the ice cream stratum. Like the other forms of substitution, this is implicitly addressed by use of the geometric mean formula. Note, however, that *overall* substitution across categories, such as between ice cream products in general and apples in general, is *not* addressed by the geometric mean formula. The geometric mean formula will not be used to combine the basic indexes in the CPI, like those for ice cream products and apples, into the overall index. In the same way, the use of the geometric mean formula within categories does not address the issue of whether consumers can, or do, respond to a general increase in the price of ice cream products by, for example, forgoing dessert.

It should also be noted that the formula is only allowing for a degree of substitution by consumers as a group. While the formula implicitly assumes that at least some customers will change their purchasing patterns when items' relative prices change, it is not inconsistent with some individual consumers continuing to purchase their favorite products even when they become relatively more expensive.

In April 1997, BLS began issuing an experimental CPI that used the geometric mean estimator in the calculation of all basic components of the index. This experimental index was issued to provide users with a quantitative estimate of the impact that use of a geometric mean formula at the lowest level of index construction would have on the performance of the CPI. At that time, it was stated that BLS would continue research on the question of using a geometric mean estimator in the CPI. This research would entail a thorough review of the theoretical literature concerning different index number formulas, a review of the practices of other countries and the justifications for their choices of formula, and a systematic and comprehensive analysis of available data to evaluate the appropriateness of using the geometric mean formula in the construction of each basic component of the CPI.

One of the principal objectives of the BLS research on geometric means was to determine, for each of the basic index categories that comprise the CPI, the extent to which consumers can be expected to alter their spending when relative prices change. Three types of evidence were examined in this effort: (1) highly detailed supermarket scanner data on prices charged for, and quantities sold of, a limited number of individual item categories; (2)

measures of the extent of substitution at index calculation levels above the basic level, which can be viewed as providing indirect evidence concerning the likelihood of substitution behavior within item categories; and (3) estimates of the magnitude and prevalence of the substitution effect derived from a survey of the relevant empirical literature. For a variety of reasons, this evidence did not provide definitive support concerning the existence and magnitude of the substitution effect in each of the basic index categories. For example, although analysis of the detailed data on prices and quantities strongly indicated the existence of a significant substitution effect, the analysis was possible for only a few item categories because of limited data availability.

Taken in its entirety, however, the evidence unambiguously supported the proposition that consumers can, and do, alter their purchasing behavior in response to changes in the array of prices that they confront in the market place. The geometric mean estimator, as was stated earlier, can better reflect the effects of such changes in consumer spending than can the current CPI formula. Use of the geometric mean estimator at the basic level of index calculation in the CPI thus can be expected to produce an overall CPI that better reflects the impact that changing

prices have on the average consumer. Consequently, BLS plans to use the geometric mean estimator in most CPI basic indexes, beginning with data for January 1999.

The basic indexes that will continue to be calculated as they are now represent important exceptions to this general rule. The rationales for these exceptions are presented below.

Selected Shelter Services. The total residential housing stock changes slowly. Thus, consumers as a group cannot freely alter their purchases of housing services in response to changes in the relative prices of different rental units. Consequently, the item categories of residential rent, owner's equivalent rent, and housing at school will not employ the geometric mean estimator. As of December 1997, these three categories together had a relative importance of 27.315 percent in the CPI-U and 25.500 percent in the CPI-W.

Selected Utilities and Government Charges. The services in these categories are provided primarily by governments or by regulated monopolies. Although CPI pricing samples within a basic index may include different service providers, in most cases consumers can substitute between these providers only by moving into a different service area. The BLS analysis of the substitution effect

above the basic index level supports the continued use of the current formula in the utilities sector. Additionally, estimated demand elasticities obtained from the economics literature mentioned before are low, at least in the short run, and thus argue for maintaining the current approach. These six categories had a total relative importance of 7.067 percent in the CPI-U and 7.347 percent in the CPI-W, as of December 1997. (These relative importance totals include the prorated weight of two unpublished indexes, unsampled motor vehicle fees and unsampled video and audio, whose movements will be imputed by a mixture of geometric-mean and arithmetic-mean indexes.)

Selected Medical Care Services. The decision to retain the current formula for professional and hospital medical care services is based largely on the results of the survey of demand elasticities in the economics literature. The relatively large elasticities for some prescription drugs contrast with low elasticities for hospital and professional services. Insurance firms and health plans, acting as agents for consumers, may be more sensitive to relative price changes than are consumers themselves, who pay only a share of the cost directly. It is, nonetheless, difficult to justify the proposition that consumers are highly responsive to relative prices in their

direct purchases of health care services. The six excluded medical care categories (along with corresponding unpublished health insurance indexes) had a total relative importance of 4.159 percent in the CPI-U and 3.484 percent in the CPI-W, as of December 1997.

These exclusions leave three major groups of the CPI—Food and beverages, Apparel, and Other goods and services—that will use the geometric mean formula exclusively in the calculation of basic indexes. The other major groups each will have one or more excepted categories. Within the Transportation group, State and local registration, license, and motor vehicle property tax charges will continue to use the current formula. Within the Recreation group, the Cable television index will continue to be calculated as it now is, as will the Telephone services local charges index within the Education and communication group. The Housing group will have six important exceptions to use of the geometric mean estimator, three within Shelter and three within Fuels and utilities. Within the Medical care group, the Medical care commodities indexes will employ the geometric mean formula, while most indexes for Medical care services will continue to use the current formula.

It is important to note that, in addition to the evidence described above, the BLS considered other factors in reaching its decisions on the use of the geometric mean estimator. Two of these additional considerations are worthy of mention. First, the geometric mean estimator does not suffer from the persistent bias that affected the current formula before special, corrective procedures were implemented in 1995 and 1996. Use of the geometric mean estimator as outlined above obviates the need to use these special procedures in all but the several basic indexes that will continue to use the current formula. Largely eliminating the need for special procedures will, for the most part, make unnecessary the continued monitoring of how well they are achieving their intended objective. Second, index calculation formulas often are evaluated with respect to how well they satisfy certain performance criteria, often referred to as tests. Within the context of the list of tests generally imposed on price indexes, the geometric mean formula performs at least as well as the Laspeyres index.

The geometric mean estimator will be introduced in both the CPI-U and the CPI-W effective with data for January 1999, in accord with the past practice of introducing methodological changes at the beginning of a

calendar year. BLS will continue to publish "overlap" CPI-U and CPI-W series using the current calculation method for the first six months of 1999. These indexes will not be published regularly for months subsequent to June 1999, but will be available upon request.

The experimental CPI-U-XG, using the geometric mean estimator in the calculation of all basic indexes, issued since April 1997, will be calculated through data for December 1998. Users of this series are reminded that the implementation of the geometric mean formula in 1999 will not apply to all basic indexes. Therefore, the movements of the CPI-U-XG relative to the CPI-U during 1998 may not be indicative of the future impact of the geometric mean formula in the CPI.

Components Retaining the Arithmetic Mean (Laspeyres) Formula

1. Selected shelter services:

- | | | |
|------------------------------|---|---------------------------------------|
| A) Rent of primary residence | B) Owners' equivalent rent of primary residence | C) Housing at school, excluding board |
|------------------------------|---|---------------------------------------|

2. Selected utilities and government charges:

- | | | |
|--------------------------------|--|--------------------------------------|
| A) Electricity | C) Residential water and sewerage maintenance | E) Telephone services, local charges |
| B) Utility natural gas service | D) State and local registration, license, and motor vehicle property tax | F) Cable television |

3. Selected medical care services:

- | | | |
|-------------------------|--|------------------------------------|
| A) Physicians' services | C) Eyeglasses and eye care | E) Hospital services |
| B) Dental services | D) Services by other medical professionals | F) Nursing homes and adult daycare |