

Chapter 17.

The Consumer Price Index (Updated 06/2007)

The Consumer Price Index (CPI) is a measure of the average change over time in the prices of consumer items—goods and services that people buy for day-to-day living. The CPI is a complex construct that combines economic theory with sampling and other statistical techniques and uses data from several surveys to produce a timely and precise measure of average price change for the consumption sector of the American economy. Production of the CPI requires the skills of many professionals, including economists, statisticians, computer scientists, data collectors, and others. The CPI’s surveys rely on the voluntary cooperation of many people and establishments throughout the country who, without compulsion or compensation, supply data to the Government’s data collection staff.

Part I. Overview of the CPI

Three CPI series. The Bureau of Labor Statistics (BLS; the Bureau) publishes CPI data every month. The three main CPI series are:

- CPI for All Urban Consumers (CPI-U)
- Chained CPI for All Urban Consumers (C-CPI-U)
- CPI for Urban Wage Earners and Clerical Workers (CPI-W)

The *CPI for All Urban Consumers*, or *CPI-U*, which BLS began publishing in January 1978, represents the buying habits of the residents of urban or metropolitan areas in the United States. The *CPI for Urban Wage Earners and Clerical Workers*, or *CPI-W*, the oldest of the series, covers a subset of the urban population.¹ The prices used for producing these two series are the same. The CPI-U and CPI-W

¹ Specifically, the all-urban population consists of all urban households in Metropolitan Statistical Areas (MSAs) and in urban places of 2,500 inhabitants or more. Nonfarm consumers living in rural areas within MSAs are included, but the index excludes rural nonmetropolitan consumers and the military and the institutional population. The urban wage earner and clerical worker population consists of consumer units with clerical workers, sales workers, craftworkers, operatives, service workers, or laborers. More than one-half of the consumer unit’s income has to be earned from the above occupations, and at least one of the members must be employed for 37 weeks or more in an eligible occupation.

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differ only in the consumer spending weights used to combine, or average together, basic indexes.²

The newest CPI series, the *Chained CPI for All Urban Consumers* (or *C-CPI-U*), also represents the urban population as a whole. BLS began publishing this series in August 2002 with data beginning in January 2000. The prices used in the C-CPI-U are the same as those used to produce the CPI-U and the CPI-W, but the C-CPI-U uses a different formula and different weights to combine basic indexes. The formula used in the C-CPI-U accounts for consumers' ability to achieve the same standard of living from alternative sets of consumer goods and services. This formula requires consumer spending data that are not immediately available. Consequently, the C-CPI-U, unlike the other two series, is published first in preliminary form and is subject to two subsequent scheduled revisions. (See below for more details.)

CPI populations. A consumer price index measures the price-change experience of a particular group called its *target population*. The CPI uses two target populations for its main series:

- All Urban Consumers (the “U” population)
- Urban Wage Earners and Clerical Workers (the “W” population)

Both the CPI-U and the C-CPI-U target the U-population. The U-population, which was about 87 percent of the U.S. population in the 1990 census, covers households in all areas of the United States except people living in rural non-metropolitan areas, in farm households, on military installations, in religious communities, and in institutions such as prisons and mental hospitals.

The W-population, the target of the CPI-W, is a subset of the U-population. The W-population consists of all U-population households for whom 50 percent or more of household income comes from wages and clerical workers' earnings. This group's share of the population of the United States has diminished over the years. In 1990, the W-population was about 32 percent of the total U.S. population. The W-population excludes households of professional and salaried workers, part-time workers, the self-employed, and the unemployed, along with households with no one in the labor force, such as those of retirees. The CPI began using the current W-population effective with the CPI for January 1964, when the population was expanded to include nonfamily (single-person and unrelated-individuals) households.

² Until 1982, BLS maintained separate (but overlapping) samples of outlets and specific items for the W- and U-populations. Given little variance in the movements between the CPI-U and CPI-W and facing budget cuts, BLS dropped the separate samples for the W-population. The CPI-U converted to rental equivalence effective with the indexes for January 1983; the CPI-W moved to rental equivalence 2 years later. Since January 1985, the movements of all CPI-W basic indexes have been identical to those of their CPI-U counterparts.

Indexes for other populations. It is possible, although difficult, to construct consumer price indexes for other subsets of the U.S. population, such as the elderly or the poor. BLS has produced experimental indexes for some of these groups. (See the discussion below for details.)

CPI Concepts and Scope

Concepts

The CPI provides an estimate of the price change between any two periods. The percent change between the CPIs for two periods indicates the degree to which prices changed between them. The CPI follows the prices of a sample of items in various categories of consumer spending—such as food, clothing, shelter, and medical services—that people buy for day-to-day living. The monthly movement in the CPI derives from weighted averages of the *price changes* of the items in its sample. A sample item's price change is the ratio of its price at the current time to its price in a previous time. A sample item's weight in this average is the share of total consumer spending that it represents. The algebraic formulas used for this averaging are called *index number formulas*.³

A unifying framework for dealing with practical questions that arise in construction of the CPI is provided by the concept of the cost-of-living index (COLI).⁴ As it pertains to the CPI, the COLI for the current month is based on the answer to the following question: “*What is the cost, at this month's market prices, of achieving the standard of living actually attained in the base period?*” This cost is a hypothetical expenditure—the lowest expenditure level necessary at this month's prices to achieve the base-period's living standard. The ratio of this hypothetical cost to the actual cost of the base-period consumption basket in the base period is the COLI. Unfortunately, because the cost of achieving a living standard cannot be observed directly, in operational terms a COLI can only be approximated. Although the CPI cannot be said to equal a cost-of-living index, the concept of the COLI provides the CPI's measurement objective⁵ and the standard by which we define any bias in the CPI. BLS long has said that it operates within a cost-of-living framework in

³ For a review of index number formulas, their properties, and their relationship to economic theory, see W.E. Diewert, “Index Numbers,” in J. Eatwell, M. Malgare, and P. Newman, eds., *The New Palgrave: A Dictionary of Economics*, vol. 2 (London, The MacMillan Press, 1987), pp. 767-80.

⁴ For more information on the cost-of-living index concept, see the technical references at the end of this chapter.

⁵ See “Updated Response To The Recommendations Of The Advisory Commission To Study The Consumer Price Index,” prepared in response to a letter from Jim Saxton, Chairman of the Joint Economic Committee, to Katharine Abraham, Commissioner of the Bureau of Labor Statistics, dated Jan. 28, 1997. Also published as “Measurement issues in the consumer price index,” *Statistical Journal of the United Nations*, ECE 15 (ISO Press, 1998), pp. 1-36. Available on the Internet at <http://stats.bls.gov/cpi/cpi0698a.htm>.

producing the CPI.⁶ That framework has guided, and will continue to guide, operational decisions about the construction of the index.

Because the COLI is not directly observable, the CPI employs index number formulas that offer approximations to the measurement objective. The CPI-U and the CPI-W use a Laspeyres formula to average the price changes across categories of items. It is sometimes said that the Laspeyres formula provides an “upper bound” on the COLI. The C-CPI-U uses a Tornqvist formula to average across the categories. This formula belongs to a class of formulas called superlative because, under certain assumptions, they can provide close approximations to a COLI. Since 1999, the CPI program has used the geometric mean formula to average price change within most item categories. Under certain assumptions that are likely to be true within most categories, an index based on the geometric mean formula will be closer to a COLI than will a Laspeyres index.

Scope

The cost of maintaining a standard of living is affected by phenomena that go beyond the traditional domain of a consumer price index—changes in the cost of consumer goods and services. The broadest form of a COLI, which is called an *unconditional* COLI, would reflect changes in nonprice factors such as crime rates, weather conditions, and health status. The objective of the CPI, by contrast, is to provide an approximation to a *conditional* COLI that includes only the prices of market goods and services or government-provided goods for which explicit user charges are assessed. Free goods, characteristics of the environment (such as air and water quality), the value of leisure time, and items that governments provide at no cost are not in scope, although they undeniably can have a major impact on the cost of living as broadly defined.

Excluded goods and services. The CPI covers the consumption sector of the U.S. economy. Consequently, it excludes investment items, such as stocks, bonds, real estate, and business expenses. Life insurance also is excluded for this reason, although health, household, and vehicle insurance are in scope. Employer-provided in-kind benefits are viewed as part of income. Purchases of houses, antiques, and collectibles are viewed as investment expenditures and therefore excluded. Gambling losses, fines, cash gifts to individuals or charities, and child support and alimony payments also are out of scope. Changes in interest costs or interest rates are now excluded from the CPI scope, although some were in the CPI for many years. Finally, for practical reasons, the CPI excludes illegal goods and services and the value of home-produced items other than owners’ equivalent rent.

⁶ On the use of a cost-of-living index as a conceptual framework for practical decisionmaking in putting together a price index, see Robert Gillingham, “A Conceptual Framework for the Revised Consumer Price Index,” *1974 Proceedings of the American Statistical Association, Business and Economic Statistics Section*, pp. 46-52.

Taxes. Both the CPI and the conditional COLI measure changes in expenditures—including the effect of changes in sales taxes and similar taxes that are part of the final price of consumer products—needed to achieve the base-period standard of living. Neither the CPI nor the COLI, however, measures the change in before-tax income required to maintain the base-period living standard. For this reason, neither the COLI nor the CPI is affected by changes in income and other direct taxes. For certain purposes, one might want to define price indexes that include, rather than exclude, income taxes.⁷ The CPI does include the effects of changes in sales taxes and other indirect taxes. As noted above, however, these are included as part of the price of consumer products. No attempt is made to reflect changes in the quantity or quality of government services paid for through taxes.

Government-provided and -subsidized items. The CPI treats as price changes any changes to fees that the government charges for items, such as admission to a national park. The CPI also counts the price of subsidized items that are available to the general public. For example, governments may subsidize local transit operation. If the subsidy is cut and the fare raised, the CPI will reflect this price increase. On the other hand, the CPI does not reflect changes to means-tested (dependent on the recipient’s income) subsidies, such as Food Stamps or Section 8 housing allowances. Changes in such subsidies are treated as changes to the recipient’s income and, therefore, out of scope.

CPI Structure and Publication

Calculation of price indexes

In the CPI, the urban portion of the United States is divided into 38 geographic areas called *index areas*, and the set of all goods and services purchased by consumers is divided into 211 categories called *item strata*. This results in 8,018 (38 x 211) item-area combinations.

The CPI is calculated in two stages. The first stage is the calculation of *basic indexes*, which show the average price change of the items *within* each of the 8,018 CPI item-area combinations.⁸ For example, the electricity index for the Boston CPI area is a basic index. The weights for the first stage come from the sampling frame for the category in the area. At

⁷ One could develop a COLI or a Laspeyres index along these lines. Such an index (sometimes called a *tax-and-price index*) would provide an answer to a different question (along the lines of “*At current prices, what is the least before-tax income needed to buy . . .*”) from the one that is relevant to the CPI. It would be appropriate for different uses. For a research measure of a consumption index inclusive of income taxes and Social Security contributions, see Robert Gillingham and John Greenlees, “The Impact of Direct Taxes on the Cost of Living,” *Journal of Political Economy*, August 1987, pp. 775-96.

⁸ This is a slight simplification. In all but 6 of the 38 areas, the prices of the items in many of the item strata are observed bimonthly. As a result, in any given month, the number of item-area combinations tracked is slightly below 6,000.

the second stage, *aggregate indexes* are produced by averaging *across* subsets of the 8,018 CPI item-area combinations. The aggregate indexes are the higher-level indexes; for example, the all-items index for Boston is an average of all of the area's 211 basic indexes. Similarly, the aggregate index for electricity is an average of the basic indexes for electricity in each of the 38 index areas. The U.S. city average—all-items CPI is an average of all basic indexes. The weights for the second stage are derived from reported expenditures from the Consumer Expenditure Survey (CE).

CPI publication

Indexes. Each month's index value displays the average change in the prices of consumer goods and services since a *base period*, which currently is 1982-84 for most indexes. For example, the CPI-U for March 2002 was 178.8. One interpretation of this is that a representative set of consumer items that cost \$100 in 1982-84 would have cost \$178.80 in March 2002.

Percent change. Rather than emphasizing the level of the index in comparison to the base period, the monthly CPI release stresses the CPI's percent change from the previous month and from the previous year. The most commonly reported monthly percent change is the 1-month *seasonally adjusted* change. Continuing the example, the March 2002 CPI was 178.8 and the February 2002 CPI was 177.8, so the CPI increased 0.6 percent (not seasonally adjusted) from February to March of 2002. The annual percent change in the CPI from March 2001 to March 2002 was 1.5 percent.⁹

CPI area and item indexes. BLS publishes a large number of additional CPI index series. Appendix 1 shows the major publication tables. For the U-population areas—the broadest geographic coverage—*detailed item indexes* for most categories of consumer spending are published every month. Also every month, BLS publishes all-items indexes, along with a limited set of detailed indexes, for the three largest metropolitan areas and for the major geographic areas. In addition, detailed food, energy, and shelter indexes are published monthly for all CPI publication areas. Bimonthly or semiannually, all-items indexes for selected metropolitan areas are published along with the limited set of detailed indexes.

The primary reason for publishing CPI item-area detail indexes is to aid in analysis of movements in the national all-items CPI. Decisions on which detailed indexes to publish depend, in part, on the reliability of the estimates.¹⁰ CPI area indexes and CPI item detail indexes use only a portion of the CPI sample; this makes them subject to substantially greater sampling error than the national CPI. **For this reason, BLS strongly urges users to consider the U.S. all-items CPI for use in escalator clauses.**

⁹ Annual CPI changes usually are reported on an unadjusted basis.

¹⁰ Steven Grandits, "Publication strategy for the 1998 revised Consumer Price Index," *Monthly Labor Review*, December 1996, pp. 26-30, available online at <http://stats.bls.gov/opus/mlr/1996/12/art4full.pdf>.

CPI area indexes. BLS calculates and publishes separate area indexes for:

- Four geographic regions (Northeast, Midwest, South, and West), sometimes called *census regions*
- Three population size classes (large metropolitan areas, small metropolitan areas,¹¹ and nonmetropolitan urban places)
- Selected region-size classes (regions cross-classified by population size—for example, large metropolitan areas in the Northeast)
- Selected metropolitan areas

Comparing the CPI for an area to the U.S. CPI or to the CPI for another area gives an indication of differences among the areas' rates of price change. In other words, such a comparison indicates whether—over time—prices of items that consumers in one area tend to buy have risen more or less rapidly than the prices of items that consumers in another area tend to buy. **It does not indicate whether the average level of prices in an area is higher or lower than the average level in another area.**

CPI item indexes. BLS classifies the CPI market basket of consumer goods and services into a hierarchy of categories. The top levels of the item category hierarchy consist of:

- The eight *major groups*
- Other *groups*
- *Expenditure classes*
- *Item strata*

For the U.S. CPI, BLS publishes all levels down to item strata. BLS publishes less item detail for the CPI area indexes.

Special aggregations. BLS also calculates and publishes indexes for special aggregations, such as energy items, that cut across the above classification scheme. The series *All items less food and energy* sometimes is said to measure the core rate of inflation. Food and energy are two of the most volatile components of the CPI. For this reason, many analysts regard the measure of core inflation as more useful for their purposes.

The C-CPI-U. The Chained CPI-U, BLS's newest index series, uses a superlative index formula, which reflects consumers' behavior in response to changes in relative prices. Unfortunately, this requires current expenditure data, and expenditure data become available only after a significant

¹¹ Prior to January 1998, the CPI published data for medium and small metropolitan areas, which have been combined to form a single class.

lag. Consequently, C-CPI-U index values, unlike the values of the CPI-U and CPI-W, are not final when first published. To mitigate the difficulties arising from this delay, BLS issues two preliminary estimates of the C-CPI-U. The “initial” values come out every month concurrent with the CPI-U and the CPI-W. The following February, “interim” values replace the initial values for all 12 months of the previous year. One year later, the interim values are replaced with the final C-CPI-U.¹² For example, in February 2005, with the January 2005 release of the CPI-U, the CPI-W, and the initial C-CPI-U, BLS published interim C-CPI-U indexes for the 12 months of 2004, and final C-CPI-U index values for 2003.

Seasonally adjusted indexes and percent changes. In addition to the originally computed indexes and percent changes, which are called *unadjusted indexes* and *unadjusted percent changes*, BLS calculates and publishes *seasonally adjusted series*. The unadjusted numbers reflect the change in price resulting from all causes, including normal seasonal price movement due to regular changes—resulting, for example, from weather, harvests, the school year, production cycles, model changeovers, holidays, or sales—that recur every year. For economic analysis and for other purposes, it is useful to remove the estimated seasonal effects from the original indexes and percent changes. To produce the *seasonally adjusted indexes* and *percent changes*, BLS uses *seasonal adjustment techniques* that remove these effects. BLS seasonally adjusts only those CPI series that pass certain statistical criteria and for which there is an economic rationale for observed seasonality. For example, while the unadjusted CPI rose 0.6 percent from February to March 2002, the seasonally adjusted 1-month percent change in the CPI during that time was 0.3 percent. Seasonally adjusted indexes are subject to annual revision and therefore are not recommended for use in escalation contracts. Seasonal adjustment is done only at the national level for the U.S. city average CPI-U and CPI-W. Presently, the C-CPI-U does not have sufficient historical data to permit calculation of stable seasonal factors.

Average prices. For some food, beverage, and energy items, the CPI samples contain enough observations of unique items to make possible the computation and publication of meaningful average retail prices. A list of published average prices is shown in appendix 3.

Correction policy. The CPI, unlike many other statistical series, does not rely on respondents to transmit data to the national office. CPI data collectors collect almost all CPI data, so that routine revisions to account for late-arriving data are not necessary. Virtually all data are received in time for the

¹² The first release of C-CPI-U data took place on Aug. 16, 2002. At that time, final data for the 12 months of 2000, interim data for the 12 months of 2001, and initial data for the first 7 months of 2002 were issued.

calculation of indexes for the appropriate month. In rare cases, however, when we discover that we made an error collecting or compiling information, we issue corrections to the CPI series in accordance with BLS policy and CPI practices.

Corrections to the CPI-U and CPI-W. These series are final when issued. The CPI-U and CPI-W are commonly used in escalation agreements and to adjust pensions and tax brackets; consequently, revisions can be costly for the users of these indexes. For this reason, there is a presumption in BLS policy and practice against revisions to the CPI that extend back over lengthy periods. When a mistake is discovered, CPI staff evaluates the error in the context of BLS guidelines for issuing corrections to previously published CPI data.

Corrections to the C-CPI-U. As noted above, C-CPI-U indexes are not final when first issued. They are routinely revised, and are not final until the publication of data for the second January after initial publication. If the CPI-U and CPI-W series are corrected, the C-CPI-U series will be corrected as well. Corrected C-CPI-U indexes will be issued for all series affected by the error, as far back as the past 5 years.

How to interpret the CPI

Movements of the indexes from one month to another usually are expressed as percent changes rather than changes in index points. The level of the index (relative to its base period) affects index point changes, but it does not affect percent changes. The example below shows how to compute percent changes:

Index point change

CPI	178.8
Less CPI for previous period	176.2
Equals index point change	2.6

Percent change

Index point difference	2.6
Divided by the previous index	176.2
Equals	0.015
Results multiplied by 100.0	0.015 * 100
Equals percent change	1.5

Percent changes for periods other than 1 year usually are expressed as annualized percentages. Annualized percent changes indicate what the change would be if the CPI continued to change at the same rate each month over a 12-month period. These are calculated using the standard formula for compound growth:

$$PC_{annual} = \left[\left(IX_{t+m} / IX_t \right)^{12/m} - 1 \right] * 100$$

where

IX_t is the index in month t ,

I_{t+m} is the index m months after month t , and

PC_{annual} is the annualized percent change.

Uses of the CPI

The CPI affects virtually all Americans because of the many ways in which it is used. Its major uses are:

- *As an economic indicator.* As the most widely used measure of inflation, the CPI is a major indicator of the effectiveness of Government economic policy. The President, the Congress, and the Federal Reserve Board use the movement of the CPI to help formulate and monitor the effect of fiscal and monetary policies. Business executives, labor leaders, and other private citizens also use the index as a guide in making economic decisions.

- *As a means of adjusting income payments.* The index directly affects the income of almost 80 million people. Social Security¹³ benefits and military and Federal Civil Service pension payments are all indexed by the CPI. The Food Stamp program uses the CPI for food at home, and changes in the CPI affect the cost of school lunches for children. In the private sector, many collective bargaining agreements tie automatic wage increases to the CPI. Some private firms and individuals use the index to keep rents, alimony, and child support payments in line with changing prices.

- *As a means of preventing inflation-induced tax changes.* The Federal income tax rules, and those of many States as well, use the CPI to adjust tax brackets, the standard deduction, and other monetary values in the tax code. This prevents inflation from automatically increasing taxes, a phenomenon called *bracket creep*.

- *As a deflator of other economic series.* Other statistical programs use the CPI or its components to adjust for price changes and produce inflation-free versions of their series. Examples of CPI-adjusted series include components of the U.S. Department of Commerce National Income and Product Accounts (such as gross domestic product and personal consumption expenditures) and retail sales measures and the BLS hourly and weekly earnings series.

Limitations of the index

The CPI covers a wide variety of items that all urban consumers purchase, but—because most individuals concentrate spending on a relatively small fraction of the total number of items available in the market—it contains items that a given individual does not purchase. The CPI must represent a composite consumer, and it does not necessarily represent the price-change experience of any one individual, household, or family. Similarly, the CPI may not be applicable to all

questions about price movements for all population groups.

As noted above, CPI indexes cannot be used to determine relative living costs. The CPIs for various geographic areas of the United States do not indicate the differences in price level among them. The change in the CPI for an individual area measures the degree to which prices have changed over time within that particular area. It does not show whether prices or living costs are higher or lower in that area relative to another area or to the United States as a whole. Comparing indexes between one area and another indicates which area has experienced more rapid price change—not which area has a higher price level or higher living costs.

Sampling and nonsampling error. The CPI is estimated from a sample of consumer purchases; it is not a complete measure of price change. Consequently, the index results may deviate slightly from those that would be obtained if all consumer transactions were covered. This is called *sampling error*. These estimating or sampling errors are statistical limitations of the index.

A different kind of error in the CPI can occur when, for example, a respondent provides BLS field representatives with inaccurate or incomplete information. This is called *nonsampling error*. BLS attempts to minimize these errors by obtaining prices through personal observation whenever possible, and by correcting errors immediately upon discovery. The field representatives, technicians, and commodity specialists who collect, process, and analyze the data are trained to watch for deviations in reported prices that might be due to errors.

A fuller discussion of the varieties and sources of possible error in the index is presented in part III of this chapter, “Precision of CPI Estimates.”

Experimental indexes

Population subgroups. The CPI program also calculates and publishes some indexes on an experimental basis only. For example, the program provides experimental indexes separately for demographic subgroups, such as the elderly or the poor. Comparing indexes for such subgroups does not indicate whether the prices they pay are higher or lower than the prices other groups pay; this comparison indicates only whether prices of their items have risen faster or slower than those for other groups. Indexes for subgroups of the population are, in some ways, more difficult to construct than indexes for the whole. In particular, making sure that samples refer to only part of the population may be difficult or impractical. Moreover, making subgroup indexes as precise as the national CPI would require that the sample sizes be as large.

The Experimental CPI for Americans 62 Years of Age and Older (CPI-E). BLS periodically issues a report on its experimental index for the elderly. This index, sometimes referred to as the CPI for the elderly or *CPI-E*, is calculated

¹³ Specific information on the Social Security use of the CPI can be found on the Social Security Administration Web site at www.ssa.gov/OACT/COLA/colaseries.html.

monthly and is available on request. It should be emphasized that the CPI-E is merely a reweighting of the CPI basic indexes using expenditure weights from households headed by someone 62 years of age or older. There is no attempt to recalculate the basic indexes themselves so that they represent the retail outlets and consumption items of older consumers.¹⁴

The CPI for the poor. A 1996 BLS research paper¹⁵ presented price indexes for various definitions of the poor population. There is no regular attempt to keep this series up to date. Like the CPI-E, the indexes in the paper were estimated by reweighting basic indexes, with no refashioning of those basic indexes to correspond to the purchasing and consumption patterns of the target populations.

CPI research series. Over the years, BLS has made many improvements to the CPI. When BLS changes its methods, it always announces them in advance and, if possible, estimates the impact the change would have had in recent periods. BLS does not, however, revise previously published CPI data to reflect the new methods. This practice means that the movement of the CPI over time reflects not only price change over time but also changes to CPI methods. To assist users who wish to use the CPI over long periods, BLS publishes the CPI-U Research Series Using Current Methods (CPI-U-RS). It provides estimates, for the period since 1977, of what the CPI would have been had the most current methods been in effect. Each time there are new methods introduced into the CPI, the CPI-U-RS is revised from 1978 forward.¹⁶

History of the CPI, 1919 to 2003

The CPI was initiated during World War I, when rapid increases in prices, particularly in shipbuilding centers, made such an index essential for calculating cost-of-living adjustments in wages. To provide appropriate weighting patterns for the index, so that it would reflect the relative importance of goods and services purchased by consumers, studies of family expenditures were conducted in 92 industrial centers from 1917 to 1919. Periodic collection of prices was started and, in 1919, BLS began publication of separate indexes for 32 cities. Regular publication of a national index, the U.S. city average, began in 1921, and indexes were estimated back to 1913.¹⁷

¹⁴ For more information, see *Consumer Price Index Detailed Report*, February 2000, pp. 5-7.

¹⁵ Thesia Garner, David Johnson, and Mary Kokoski, "An experimental Consumer Price index for the poor," *Monthly Labor Review*, September 1996, pp. 32-42.

¹⁶ Kenneth J. Stewart and Stephen B. Reed, "CPI research series using current methods, 1978-1998," *Monthly Labor Review*, June 1999, pp. 29-38.

¹⁷ Collection of food prices back to 1890 had been initiated in 1903. During the course of the 1917-19 expenditure survey, retail prices for other items were collected in 19 cities for December of each year back to 1914 and in 13 other cities back to December 1917 only.

Since its inception, the CPI has been comprehensively revised on six occasions to implement updated samples and weights, expanded coverage, and enhanced methodologies. For example, the 1998 revision, the most recent one, introduced more timely consumer spending weights; updated geographic and housing samples; a revised item classification structure; a new housing index estimation system; computer-assisted data collection; and a new Telephone Point-of-Purchase Survey. BLS also has made important improvements to the CPI beyond the major revision processes, an example being the introduction of the geometric mean formula in January 1999. Table 1, on the following pages, provides a chronology of revisions and improvements to the CPI, and appendix 3 displays historical changes in base period, population coverage, and other index characteristics.

The improvements introduced over the years have reflected not only BLS's own experience and research, but also the criticisms and investigations of outsiders. Notably, in undertaking the 1940 comprehensive revision of the CPI, BLS acted on recommendations made by an Advisory Committee appointed by the American Statistical Association. Major studies were conducted during World War II by the President's Committee on the Cost of Living¹⁸ and in 1951 by the House Committee on Education and Labor.¹⁹

The 1961 report of the Price Statistics Review Committee (sometimes called the "Stigler Committee") provided impetus for subsequent changes in many aspects of the CPI, including the sampling of outlets and items, the treatment of quality changes in consumer durables, and the role of cost-of-living theory.²⁰ Recent studies include the 1996 report of the Advisory Commission to Study the Consumer Price Index (the "Boskin Commission")²¹ and the 2002 report *At What Price? Conceptualizing and Measuring Cost-of-Living and Price Indexes* by a National Research Council panel of the National Academy of Sciences.²² A continuing flow of articles in professional journals and books also has contributed to the assessment of the CPI's quality and of the ways in which it might be improved. For a list of published papers, consult the Technical References at the end of this chapter.

Retail prices of food and wholesale prices of other items were used to estimate price change from 1914 back to 1913.

¹⁸ *Report of The President's Committee on the Cost of Living* (Washington, Office of Economic Stabilization, 1945).

¹⁹ *Consumers' Price Index, Report of a Special Subcommittee of the Committee on Education and Labor*, U.S. Congress, House of Representatives, 82/1, Subcommittee Report No. 2 (Washington, U.S. Government Printing Office, 1951).

²⁰ *Government Price Statistics, Hearing before the subcommittee on Economic Statistics, U.S. Congress, Joint Economic Committee, 871. Part 1* (Washington, U.S. Government Printing Office, Jan. 24, 1961).

²¹ Committee on Finance, United States Senate, *Final Report of the Advisory Commission to Study the Consumer Price Index* (The Boskin Commission Report) (Washington, U.S. Government Printing Office, December 1996).

²² Charles Schultze and Christopher Mackie, eds. *At What Price?: Conceptualizing and Measuring Cost-of Living and Price Indexes* (Washington, National Academy Press, 2002).

Table 1. **Chronology of changes in the Consumer Price Index**

<p>The Consumer Price Index to 1940</p>
<ul style="list-style-type: none"> • Began publication of separate indexes for 32 cities (1919) Collected prices in central cities periodically. • Developed weights from a study that BLS conducted in 1917-19 of family expenditures in 92 industrial centers Reflected the relative importance of goods and services purchased by consumers. • Collected prices for major groups: Food, clothing, rent, fuels, house furnishings, and miscellaneous • Limited pricing to items selected in advance to represent their categories • Began regular publication of a national index, the U.S. city average (1921): Based index on an unweighted average of the city indexes. Estimated U.S. city average back to 1913, using food prices only.
<p>The 1940 CPI revision: the first comprehensive revision</p>
<ul style="list-style-type: none"> • Used weights based on 1934-36 study of consumer expenditures • Collected prices in the 34 largest cities • Implemented a weighted average of cities for the U.S. city average CPI
<p>Improvements made between the 1940 and 1953 revisions</p>
<ul style="list-style-type: none"> • During World War II: Discontinued the pricing of unavailable items, such as new cars and household appliances Increased the weight of other items, including automobile repair and public transportation • In 1951: Adjusted weights in seven cities using 1947 and 1949 survey of consumer expenditures Adjusted weights for the 1950 census Adjusted rent index to remove “new unit bias” caused by rent control Added new items to the list of covered items, including frozen foods and televisions
<p>The 1953 CPI revision: the second comprehensive revision</p>
<ul style="list-style-type: none"> • Used weights from a 1950 expenditure survey conducted in central cities and attached urbanized areas • Refined the target population to include urban wage earner and clerical worker families • Added a sample of medium and small cities • Updated the list of items that the index covered, adding restaurant meals • Added new sources of price data • Improved pricing and calculation methods

Table 1. **Chronology of changes in the Consumer Price Index—Continued**

<p>The 1964 CPI revision: the third comprehensive revision</p> <ul style="list-style-type: none"> • Based weights on 1960-61 expenditure patterns in metropolitan areas • Added single-person households to target population: urban wage earner and clerical worker households • Extended pricing to the suburbs of sampled metropolitan areas • Updated the sample of cities, goods and services, and retail stores and service establishments
<p>Improvements made between the 1964 and 1978 revisions</p> <ul style="list-style-type: none"> • Made quality adjustments for new vehicles at model changeover • Improved treatment of seasonal items
<p>The 1978 CPI revision: the fourth comprehensive revision</p> <ul style="list-style-type: none"> • Added a new Consumer Price Index: the CPI for All Urban Consumers, or the CPI-U • Renamed the older CPI as the CPI for Urban Wage Earners and Clerical Workers, or the CPI-W • Used weights from a 1972-73 survey of consumer expenditures and the 1970 census • Expanded the sample to 85 areas • Increased minimum pricing frequency from quarterly to bimonthly • Implemented monthly pricing in the five largest areas • Introduced probability sampling methods at all stages of CPI sampling: Used probability selection methods to select the CPI sample items within stores Eliminated the list of eligible items as virtually all consumer items became eligible for pricing • Introduced checklists that define each category of spending • Developed estimates of the CPI's sampling error and optimal sample allocation to minimize that error
<p>Improvements made between the 1978 and 1987 revisions</p> <ul style="list-style-type: none"> • Began outlet and item sample rotation (1981): Began systematic replacement of outlets and their item samples between major revisions Implemented new Point-of-Purchase Survey (POPS) Selected retail outlets with probability proportional to consumer spending therein Eliminated reliance on outdated secondary-source sampling frames Began rotating outlet and item samples every 5 years Began rotating one-fifth of the CPI pricing areas each year • Introduced rental equivalence concept (January 1983 for the CPI-U; January 1985 for the CPI-W): Introduced the flow-of-services method, which removes the investment component from homeowner indexes Discontinued the asset-price approach, which treated the purchase of a home as a consumer good

Table 1. **Chronology of changes in the Consumer Price Index—Continued**

<p>The 1987 CPI revision: the fifth comprehensive revision</p> <ul style="list-style-type: none"> • Used weights from the 1982-84 Consumer Expenditure Survey and the 1980 census • Updated samples of items, outlets, and areas • Redesigned the CPI housing survey • Improved sampling, data collection, data processing, and statistical estimation methods • Initiated more efficient sample design and sample allocation • Introduced techniques to make CPI production and calculation more efficient
<p>Improvements made between the 1987 and 1998 revisions</p> <ul style="list-style-type: none"> • Improved the housing estimator to account for the aging of the sample housing units • Improved the handling of new models of vehicles and other goods • Implemented new sample procedures to prevent overweighting items whose prices are likely to rise • Improved seasonal adjustment methods • Initiated a single hospital services item stratum with a treatment-oriented item definition: Discontinued pricing of the inputs to the index for hospital services
<p>The 1998 CPI revision: the sixth comprehensive revision</p> <ul style="list-style-type: none"> • Weights from the 1993-95 Consumer Expenditure Survey and the 1990 census • Updated geographic and housing samples • Extensively revised item classification system • Implemented new housing index estimation system • Used computer-assisted data collection • Added the Telephone Point-of-Purchase Survey (TPOPS): Allows rotation of outlet and item samples by item category and geographic area, rather than by area alone
<p>Improvements since the 1998 revision</p> <ul style="list-style-type: none"> • Initiated a new housing survey based on the 1990 census (January 1999): Estimated price change for owners' equivalent rent directly from rents • Began using a geometric mean formula for most basic indexes (January 1999): Mitigates lower-level substitution bias Reflects shifts in consumer spending within item categories as relative prices change • Published the CPI-U Research Series Featured backcastings of all CPI method changes to 1978 Provided revision in cases of methodology change

Table 1. **Chronology of changes in the Consumer Price Index—Continued**

Improvements since the 1998 revision—Continued
<ul style="list-style-type: none"> • Extended the use of hedonic regression to estimate the value of items changing in quality • Directed replacement of sample items in the personal computer and other categories, to keep samples current • Implemented 4-year outlet rotation to replace the 5-year scheme • Began within-outlet item rotation for prescription drugs and other item categories • Implemented biennial weight updates (January 2002): Separated weight updates from major revisions to keep weights as current as possible (Weights used in 2002-2003 were based on the 1999-2000 Consumer Expenditure Survey; weights used in 2004-05 were based on the 2001-02 Consumer Expenditure Survey; weights used in 2006-07 were based on the 2003-04 Consumer Expenditure Survey.) Increased sample size of the Consumer Expenditure Survey, so that CPI weights can be based on just 2 years of data Specified that future weight updates be done in January of even-numbered years, using data from expenditure surveys 2 and 3 years previous • Added the Chained Consumer Price Index for All Urban Consumers (C-CPI-U) (August 2002): Uses more advanced “superlative” index formula (the Tornqvist formula) Corrects upper-level substitution bias • Began computer-assisted data collection for the Commodities and Services Survey (2002–2003) • Expanded collection of price data to all business days of the month (Before 2004, prices were collected the first 18 business days of the month for the first 10 months of the year and the first 15 business days for November and December.) • Began publishing indexes to three decimal places (Jan. 2007)

Part II. Construction of the CPI

Sampling: Areas, Items, and Outlets

The smallest geographic areas in which pricing is done for the CPI are called primary sampling units (PSUs). Within these areas, sales outlets are chosen where people shop and live. The selected nonshelter outlets are matched to a sample of items that these consumers buy. Appendix 4 shows the names of the 87 PSUs selected for the 1998 revision CPI-U and the counties contained therein. Of these PSUs, 36 were not in the previous PSU sample. Prices from these were introduced into CPI index calculation with the release of the January 1998 index. Appendix 4 also gives the percentage of the CPI-U population represented by each PSU (as of 1990), and indicates whether items priced bimonthly (see below) are priced in odd- or even-numbered months, or both.

Area Sample²³

For the purpose of selecting the 1998 CPI PSU sample, the entire United States was divided into PSUs. First, BLS used the U.S. Office of Management and Budget's (OMB's) definition of Metropolitan Areas (MAs)²⁴ to divide the country into metropolitan and nonmetropolitan areas. The PSUs within the metropolitan area are, with five exceptions, OMB-defined MAs.²⁵ In the nonmetropolitan areas, BLS defined the PSU boundaries. In general, a PSU is delineated by county borders (with some exceptions in New England) and can comprise several counties.

Each PSU was first classified by its size. All PSUs with populations larger than 1.5 million were declared to be self-representing and given the size class of A.²⁶ The remaining non-self-representing PSUs, metropolitan and nonmetropolitan, are called B and C PSUs, respectively.²⁷ (To avoid

²³ A more detailed description of the 1998 revision area sample selection is contained in Janet Williams, Eugene F. Brown, and Gary R. Zion, "The Challenge of Redesigning the Consumer Price Index Sample," *1993 Proceedings of the American Statistical Association*, Business and Economic Statistics Section, pp. 200-205; and Janet L. Williams, "The redesign of the CPI geographic sample," *Monthly Labor Review*, December 1996, pp. 10-17. Available on the Internet at www.bls.gov/opub/mlr/1996/12/art2full.pdf.

²⁴ MAs are Metropolitan Statistical Areas (MSAs), Primary Metropolitan Statistical Areas (PMSAs), or Consolidated Metropolitan Statistical Areas (CMSAs). For more information, see the Statistical Policy Office of the U.S. Office of Management and Budget, Attachments to OMB Bulletin No. 93-05, *Metropolitan Areas 1992*, Lists I-IV.

²⁵ The five PSU exceptions are the Los Angeles suburbs PSU, the three PSUs that together form the New York-Northern New Jersey-Long Island CMSA, and the Washington, DC, PSU.

²⁶ Anchorage and Honolulu are A PSUs with smaller populations.

²⁷ When planning began for the 1998 revision of the CPI, one potential change envisioned was the publication of a Consumer Price

confusion, it is important to recognize the distinction between the naming conventions for PSUs and those for CPI size-class indexes. In general, prices collected in B PSUs are used to compute the B/C CPI indexes, and prices in C PSUs are used in the computation of the D CPI indexes. The exceptions are the Anchorage and Honolulu metropolitan areas, which are A PSUs but included in the B/C size-class indexes.)

The second classification variable for PSUs is census region. The next phase of the area selection was to stratify (group) PSUs in each region-size class—for example, South B—into strata (groups) of similar PSUs based on their scores on several factors (called stratifying variables). Each A PSU is in a stratum by itself—thus the name self-representing. Selection of the stratifying variables was based on linear regression modeling of price change (sequentially finding sums of a constant and a constant times each of a subset of 1990 census and geographic PSU variables that best explain CPI price change over different periods). The variables (called geographic variables) used in all stratifications except that for the South B PSUs were percent urban, the normalized latitude and longitude of the PSU's geographic center, and normalized longitude squared. In the stratification of the South B PSUs, percent urban and variables used in the 1987 revision—namely, mean interest and dividend income per consumer unit (CU), mean CU wage and salary income, percent housing units (HUs) heated by electricity, percent HUs heated by fuel oil, percent owner-occupied HUs, percent black CUs, and percent CUs with retired person—were used. The program employed to do the stratifications was a modified version of the Friedman-Rubin clustering algorithm, which puts PSUs in the same strata based on their similarities on the stratification variables, while keeping the population sizes of the strata approximately equal.

A program was used to select one PSU per stratum so that the selected PSUs are well-distributed over the States and there are many 1988-sample PSUs among the newly selected ones.²⁸ Prices from the 36 newly selected non-1988-sample PSUs were introduced into CPI index calculations in 1998.

Index for the total U.S. population (called the CPI-T). To accommodate this expanded CPI, a larger number of PSUs was selected to cover the population living in rural areas outside the metropolitan area.

²⁸ In case a CPI-T was judged too costly, a selection was made from nonmetropolitan PSUs that would have their urban parts included in the CPI-U. Candidate PSUs had to contain some urban population. From these candidates, a probability (proportional to the urban population of their stratum) sample for the CPI-U was selected in each region except the Northeast. Long after the selection of the PSUs, a decision was made not to publish a CPI-T because of its increased cost. At that time, 18 of the previously selected PSUs were dropped from the CPI sample and designated as "Consumer Expenditure Survey only" PSUs. (See chapter 16.)

Since 1998, indexes have been published monthly for the New York, Los Angeles, and Chicago Consolidated Metropolitan Statistical Areas (CMSAs). Indexes for the Washington-Baltimore CMSA, along with the next 10 largest A PSUs (not including those contained in the aforementioned CMSAs) containing between 1.27 and 2.89 percent of the CPI-U population, are published bimonthly. In January and July, semiannual indexes are published for the 12 smallest A PSUs. Indexes also are published for the U.S. total as well as for region and size class totals, with the exception of the D indexes in the Northeast and West. Beginning in 2002, semiannual indexes have been published for Phoenix.

Replicates, which are used in variance calculation, are assigned to each A PSU based on population, with each A PSU having either two or four replicates. B and C PSUs are paired in each region, with each pair containing a PSU on the even and odd monthly pricing cycles, except for single PSU pairs in the region-size classes in which the number of PSUs is not a multiple of 4. Publication of a region-size class requires at least four PSUs (two replicates). The allocation of replicates is provided in the next section, along with the allocation of replicate panels.²⁹

Item and Outlet Samples

Commodities and services other than shelter

Item structure and sampling. The CPI item structure has four levels of classification. The 8 major groups are made up of 70 expenditure classes (ECs), which in turn are divided into 211 item strata. Major groups and ECs do not figure directly in CPI sample selection, although ECs are used in smoothing item stratum expenditure estimates during composite estimation. Within each item stratum, one or more substrata, called entry-level items (ELIs), are defined. There are a total of 305 ELIs, which are the ultimate sampling units for items as selected by the BLS national office. They represent the level of item definition from which data collectors begin item sampling within each sample outlet. (See appendix 5 for a complete list of consumer ECs, item strata, and ELIs.)

To enable the CPI to reflect changes in the marketplace, new item and outlet samples are selected each year, on a rotating basis, for approximately 25 percent of the item strata in each PSU. Each year, four regional item universes are tabulated from the 2 most recent years of CE data. Independent samples of ELIs are selected from the corresponding regional item universe for each item stratum PSU-replicate scheduled for rotation that year. Within each sample PSU-replicate, each item sample is based on a systematic probability-proportional-to-size (PPS) sampling procedure, in which each ELI has a probability of

selection proportional to the CPI-U population expenditures for the region for the ELI within its stratum.

Item and outlet sample design. The CPI uses two separate sample designs, one for rent and owners' equivalent rent, and one for all other commodities and services. The methodology used to determine the commodities and services item and outlet sample design is presented here in brief. The design for the rent and owners' equivalent rent indexes is described later.

The primary objective of the Commodities and Services (C&S) sample design is to determine an allocation of individual item and outlet selections, by item stratum and by PSU, replicate, and POPS category (see below), that minimizes the sampling variance of price change measured by the all-cities C&S CPI, subject to certain budgetary and sample share constraints. Models are used to project the sampling variance and data collection costs in terms of the decision variables for the sample design. For these models, all commodities and services item strata are grouped into 13 major groups:

1. Food at home—nonmeat staples
2. Food at home—meat, poultry, fish
3. Food at home—fruits and vegetables
4. Other food at home, plus beverages (alcoholic and nonalcoholic)
5. Food away from home
6. Fuels and utilities
7. Household furnishings and operations
8. Apparel and upkeep
9. Transportation less motor fuel
10. Motor fuel
11. Medical care
12. Education and communication
13. Recreation and other commodities and services

In brief, the C&S sample allocation methodology is as follows: First, a variance function that projects the variance of price change as a function of the above variables for the commodity and service components is modeled. Second, a cost function that predicts the total annual cost of the commodity and service components of the CPI is formulated. Third, values for all coefficients of the two functions, including estimates of outlet sample overlap, are estimated. Fourth, nonlinear programming techniques are used to determine approximately optimal sizes for the item and outlet samples needed to minimize the CPI variance under varying assumptions of annual price change subject to cost constraints.

The variance and cost functions for the CPI are modeled for 15 PSU groups:

PSU group name

1. New York City
2. New York City suburbs
3. Los Angeles City
4. Los Angeles suburbs
5. Chicago

²⁹ For the A PSUs, the number of replicate panels is the same as the number of replicates. Each non-self-representing PSU is allocated one replicate panel.

6. Philadelphia and San Francisco
7. Detroit and Boston
8. Other large self-representing PSUs
9. Small self-representing PSUs
10. Medium-sized PSUs, Census Region 1
11. Medium-sized PSUs, Census Region 2
12. Medium-sized PSUs, Census Region 3
13. Medium-sized PSUs, Census Region 4
14. Small PSUs, Census Regions 1-4
15. Anchorage and Honolulu

A detailed discussion of the sample allocation methodology is provided in appendix 6. The allocation is resolved with each C&S sample rotation, which occurs twice each year, and allocations change as sample frames are refreshed and rotated. For ongoing pricing, predicted outlet visits total 26,400 each month, with prices collected for 85,000 items.

Outlet and price surveys. BLS field representatives collect prices monthly for food at home, energy, and selected other commodity and service item strata in all PSUs. Items that are priced monthly typically are those with more volatile and variable price movement. The list of commodities and services priced monthly in all PSUs is given in table 2 below. Prices also are collected monthly for all commodity and service item strata in the three largest publication areas—New

Table 2. CPI items priced monthly everywhere

All food at home items
Housing at school, excluding board
Other lodging away from home, including hotels and motels
Tenants' and household insurance
Fuel oil
Propane, kerosene, and firewood
Electricity
Utility (piped) gas service
Used cars and trucks (secondary source)
Gasoline (all types)
Other motor fuels
Tires
Vehicle accessories other than tires
State and local registration, license, and motor vehicle property tax
Parking and tolls
Newspapers and magazines
Recreational books
Postage
Delivery services
Landline telephone services, local charges
Landline telephone services, long-distance charges
Wireless telephone services
Cigarettes
Tobacco products other than cigarettes

York, Los Angeles, and Chicago. Prices are collected bimonthly for the C&S item strata not cited in table 2 in the remaining PSUs, which are assigned to either even- or odd-numbered months for pricing.

Telephone Point-of-Purchase Survey (TPOPS). The U.S. Census Bureau conducts the TPOPS for BLS. The survey furnishes data on retail outlets from which metropolitan and urban nonmetropolitan households purchased defined groups of commodities and services to be priced in the CPI. Commodities and services are grouped into sampling categories, called POPS categories, based on ELIs as defined in the CPI classification structure. Some POPS categories consist of only one ELI, while others consist of multiple ELIs. ELIs are combined into a single POPS category when the commodities or services generally are sold in the same outlets. Currently, there are 214 POPS categories. (Categories are listed in appendix 7.)

TPOPS uses random-digit dialing technology to select households for participation in the survey. Within each PSU, banks of telephone numbers containing at least some residential numbers are identified. Among these identified banks, numbers are then randomly dialed. Inevitably, some of the dialed numbers such as nonworking, ring-no-answer, cellular, business, and FAX machine telephone numbers are ineligible for TPOPS interviewing. Some numbers belong to ineligible households, such as military households.

Eligible respondents include all civilian, noninstitutional persons residing in regular residences, boarding houses, student or worker housing, mobile home parks, and permanent-type living quarters in hotels and motels, as well as staff residing in institutions. Not all of the eligible telephone numbers are productive, however, as respondent refusals are unavoidable. Approximately 25 percent of the numbers that are called for the first time result in a productive TPOPS interview.

BLS specifies a target number of completed TPOPS interviews for each PSU. In the small and medium-sized PSUs, that target number is 110 completed interviews. For most of the self-representing PSUs, the target number of completed interviews ranges from 200 to 400. In New York City and Chicago, the target number of completed interviews is 460. In Los Angeles, the specified goal is 500.

Upon first contact and after determining the eligibility and willingness of the household, a Census Bureau interviewer asks a variety of administrative and demographic questions. One of these is how many people are part of that particular CU. A CU consists of all members of a particular housing unit or other type of living quarters who are 1) related by blood, marriage, adoption, or some other legal arrangement, such as foster children, or 2) unrelated but financially dependent upon each other for major living expenses, those for housing or food. Demographic and socioeconomic information also is elicited. This information allows BLS to monitor how well the selected CUs represent the overall population, as well as to analyze the shopping patterns of various segments of the population.

Any given responsive CU is called once a quarter for four successive quarters. Each time, the interviewer administers the survey to the original respondent, if possible. During each interview, the respondent is asked whether the CU had expenditures for a set of POPS categories over a duration of time called a “recall period.” Recall periods are POPS-category-specific and vary from 1 week to 5 years. The recall period for a specific POPS category is defined to produce a sufficient, but not excessive, number of outlets for sampling purposes. For instance, because CUs tend to purchase gasoline frequently, a 1-week recall period is used. In contrast, people tend to purchase cars and funeral services infrequently; therefore a 5-year recall period is assigned. If the respondent reports expenditures for a particular POPS category, the interviewer prompts the respondent for the outlet name, location, and amount spent. At the end of each quarter of interviewing, the Census Bureau sends the TPOPS outlet frame data to BLS for processing. BLS processes TPOPS data two quarters at a time. The primary objective of BLS processing of TPOPS data is to select a sample of outlets at which specific items ultimately will be priced for inclusion in the CPI. The expenditure amounts reported in TPOPS are used as outlet selection probabilities.

TPOPS employs a quarterly rotating-panel sample design. On a quarterly basis, every PSU is assigned 1 of 16 TPOPS questionnaires. Each questionnaire consists of up to 16 POPS categories. In a particular quarter and for a particular PSU, the selected TPOPS respondents are asked about expenditures made for some or all of the POPS categories on the assigned questionnaire. During each subsequent quarter of TPOPS interviewing, the given PSU is administered a different questionnaire until each of the 16 questionnaires has been administered. It takes 4 years of quarterly interviewing to rotate through all 16 questionnaires. After the 4 years, the cycle for the PSU starts over again. In this manner, all TPOPS samples are refreshed once every 4 years. This practice is repeated for each PSU. The quarterly pattern of assigned POPS categories varies from PSU to PSU in a strategic fashion to ensure that every POPS group is assigned to at least a few PSUs each quarter.

Outlet sampling procedures. The design for TPOPS provides for the rotation of approximately one-quarter of the items in each sample PSU during the course of each year. With each rotation, item samples and outlet samples are selected for the designated items and corresponding POPS categories.

In self-representing PSUs, sample households for each TPOPS rotation are divided into two or more independent groups. This process defines two or more frames of outlets per category-PSU for outlet selection. The principal purpose of constructing these independent groups, or replicate panels, is variance estimation. A single subset of independently selected ELIs and outlets for all item strata within a PSU is called a replicate. The number of replicates per PSU group and the number of PSUs in each PSU group are given in table 3.

Table 3 . Construction of replicate panels

<i>PSU group</i>	<i>Number of PSUs</i>	<i>Number of replicate panels</i>
1. New York City	1	4
2. New York City suburbs	2	4
3. Los Angeles City	1	4
4. Los Angeles suburbs	1	2
5. Chicago	1	4
6. Philadelphia and San Francisco	2	4 (2 each)
7. Detroit and Boston	2	4 (2 each)
8. Other large self-representing PSUs	7	14 (2 each)
9. Small self-representing PSUs	12	24 (2 each)
10. Medium-sized PSUs, Census Region 1	8	8
11. Medium-sized PSUs, Census Region 2	10	10
12. Medium-sized PSUs, Census Region 3	22	22
13. Medium-sized PSUs, Census Region 4	6	6
14. Small PSUs, Census Regions 1-4	10	10
15. Anchorage and Honolulu	2	4 (2 each)

Reported expenditures for each outlet within the frame for each POPS category and PSU-replicate are edited prior to sample selection. Sometimes, a purchase is reported for an outlet but the amount of expenditures is not reported; to ensure a chance of selection for the outlet in those cases, the mean expenditure for outlets for the POPS category-PSU replicate is assigned to the outlet. Large expenditure totals for an outlet are edited, in some cases, to be no greater than 25 percent of the total expenditure reported for the POPS category-PSU-replicate. In cases in which there are more than 20 outlets reported for a POPS category-PSU-replicate, the largest reported expenditures are trimmed to be no greater than 10 percent of the total reported for that POPS category-PSU-replicate.

Outlet samples are selected independently for each PSU, replicate, and POPS category using a systematic PPS sampling procedure. Each outlet in a frame has a probability of selection proportional to the total expenditures reported for the outlet in the POPS category in the TPOPS survey. In each PSU-replicate, all ELIs selected in the item sampling process are assigned for pricing to each sample outlet selected from the frame for the corresponding POPS categories. When multiple selections of a sample outlet occur, a commensurate increase is made in the number of quotes priced for the outlet.

Outlet sampling procedures for commodities and services not included in the TPOPS. Some commodity and service items are excluded from the TPOPS, either because existing sampling frames are adequate or because it became apparent that the TPOPS would not yield an adequate sampling frame. (See appendix 8.) For each of these items (non-POPS), BLS either constructs the sampling frame or acquires it from an-

other source. Each non-POPS item has its own sample design. The frames consist of all outlets providing the commodity or service in each sample area. A measure of size is associated with each outlet on the sampling frame. Ideally, this measure is the amount of revenue generated by the outlet from the item for the CPI-U population in the sample area. Whenever revenue is not available, an alternative measure of size, such as employment, number of customers, or sales volume, is substituted. All samples are selected using systematic sampling techniques with probability proportional to the measure of size.

The source of the sampling frame, the definition of the sampling unit, the measure of size employed, the final pricing unit, and the number of designated outlets and quotes for each non-POPS item are presented in appendix 8.

Merging item and outlet samples. Item and outlet samples, which are selected independently, must be merged before data collection. A concordance that maps ELIs to POPS categories allows each sampled ELI to be assigned for price collection to the outlet sample selected for the POPS category that contains it. The number of price quotes for an ELI in each outlet thus equals the number of times the ELI was selected for pricing in the PSU-replicate during the item sampling process. The item-outlet sample merge determines the number of price quotes assigned for collection in each sample outlet. In the outlet sampling process, outlets with large expenditure reports may be selected more than once from the frame for a given POPS category. An outlet also may be selected from the frame for more than one POPS category. If an outlet is selected multiple times for a given POPS category, the same multiple of price quotes is assigned for collection for each sample ELI matching the category. If an outlet is selected for more than one POPS category, price quotes are assigned for collection for all ELIs selected in each category.

Selection procedures within outlets. A BLS field representative visits each selected outlet. For each ELI assigned to the outlet for price collection, the field representative uses a multistage probability selection technique to select a specific item from among all the items the outlet sells that fall within the ELI definition. The field representative first identifies all of the items included in the ELI definition and offered for sale by the outlet. When there is a large number of items in the ELI, the representative groups them by common characteristics, such as brand, size, or type of packaging. With the assistance of the respondent for the outlet, the field representative assigns probabilities of selection to each group.

The probabilities of selection are proportional to the sales of the items included in each group. The field representative may use any of four procedures for determining the proportion of sales. In order of preference, they are listed below:

1. Obtaining the proportions directly from a respondent;
2. Ranking the groups by importance of sales as indi-

cated by the respondent, and then obtaining the proportions directly or using assigned proportions;

3. Using shelf space to estimate the proportions, where applicable; and
4. Using equal probability.

After assigning probabilities of selection, the field representative uses a random-number table to select one group. The field representative then identifies all items included in the selected group, forms groups of those items based on the in-common characteristics, assigns probabilities to each group, and uses a random number table to select one. The field representative repeats this process through successive stages until reaching a unique item. The field representative describes the selected unique item on a checklist for the ELI. Checklists contain the descriptive characteristics necessary to identify the item among all items defined within the ELI.

These selection procedures ensure that there is an objective and efficient probability sampling of CPI items other than shelter. They also allow broad definitions of ELIs, so that the same unique item need not be priced everywhere. The wide variety of specific items greatly reduces the within-item component of variance, reduces the correlation of price movement between areas, and allows a substantial reduction in the number of quotes required to achieve a given variance. Another important benefit from the broader ELIs is a significantly higher likelihood of finding a priceable item within the definition of the ELI in the sample outlet.

This selection process is completed during the visit to the outlet to obtain the price for the selected item. Subsequently, personal visits or telephone calls are made, either monthly or bimonthly, to ascertain that the item is still sold and to obtain its current price.

Computer-assisted data collection for commodities and services. A new computer-assisted data collection (CADC) system was used in the C&S beginning in September 2002. The data collection instrument is composed of two main modules. The interactive electronic checklists of item specifications allow the data collector to identify the same item upon returning to an outlet, to substitute a similar item, or to initiate a new item for pricing. Each ELI is subdivided into clusters, with each cluster having its own set of specifications. Checklists contain descriptive information about items, including features of the items themselves and components of the item that might affect the price. A checklist can be a straightforward list of specifications, or it can be fairly complex, with hierarchical dependencies among specifications and complicated mathematical formulas. The interactive electronic checklist enforces rules regarding patterns of specifications that may be necessary to identify an item. The checklist also prevents inconsistencies.

The other module of the C&S CADC collection instrument comprises some screens that make up the pricing form and various functions pertaining to the task of data collec-

tion. For instance, some screens enable the economic assistant (EA) to organize his or her work at the level of the outlet or the quote, while some allow review of collected data or information about the outlet and respondent. An EA selects an action, such as substituting a new item for one that is unavailable (only options that are appropriate for that action are offered in the collection instrument). The pricing screens allow the EA to enter the price of the item as well as relevant information about it, such as quantity, size, unit of size, sales tax, and seasonality; the EA also can see the previous price and other data relevant to the quote.

Electronic data collection improves data quality in part by activating important rules at the moment the data are being collected. For instance, a suspiciously large price change can be noted immediately, rather than after data have been sent to Washington and examined by commodity analysts. The collection instrument contains more than 100 edits, which either warn the EAs about some important aspect of a quote or prevent them from entering invalid information.

CPI data collection is scheduled in terms of business days (that is, weekdays excluding holidays). Before 2004, data collection covered three pricing periods, each comprising 6 business days in most months and 5 days in November and December. Consequently, the last scheduled data collection was usually the 18th business day of the month. Beginning with data for January 2004, the three pricing periods now are of variable length and end on the last business day of the month.

Shelter

The CPI housing unit sample is the source of the data on residential rents used to calculate changes in rents for the rent of primary residence (rent) index. The housing survey also uses these rent data in calculating changes in the rental value of owned homes for the owners' equivalent rent of primary residence (REQ) index. These two shelter indexes account for over 28 percent of the total CPI weight as of December 2003.

Stratification. Research indicates that location (geography) is the most important variable in determining rent change; that is, it accounts for most of the variance. Once geography is taken into account, only rent level is significant in predicting rent change.

Geographic software allowed stratification by geography for the 1999 housing sample. The geographic stratification accomplishes five goals:

1. It helps ensure sample coverage for the major characteristics (geography and rent level) that are correlated with rent change.

2. The geographic nature of the strata and the neighborhoods within the strata allows correlation of renter-occupied units with owner-occupied units. This correlation of renter-occupied units in the neighborhood with the owner-occupied units in the same neighborhood is the basis for measuring the REQ index.

3. Housing units constructed after 1990 can be located and assigned to the existing geographic strata. (See *New construction augmentation*, below.)

4. By meeting goals 1 through 3, stratification should lead to a reduction in the sampling variance of the rent and REQ indexes.

5. The stratification structure allows the rotation of housing samples on a rolling basis, thereby distributing the introduction of future census samples over an extended period.

The 1999 Housing Sample is a stratified cluster sample, which represents housing units built before 1990. Housing units built after 1989 are handled through the New Construction survey. (See *New construction augmentation*, below.) Using data from the 1990 census, staff of the BLS Price Statistical Methods Division (PSMD) divided the PSUs into geographic neighborhoods (segments). The segments are small contiguous groups of census blocks (sectors). The segments contain at least 50 housing units in the larger PSUs and at least 30 housing units in the smaller PSUs. These segments are stratified by geographic location within the PSU. Six geographic strata were formed in each PSU. Once geography was taken into account, only rent level was found to be significant in predicting rent change. Thus, the stratification boundaries were determined using information about population, housing expenditure, and median rent levels.

To create the two central strata for each PSU, PSMD staff found the smallest square in the central part of the PSU containing one-third of the housing expenditure for the PSU. Staff then split the square into two parts, either by latitude or by longitude, in a way that maximized the difference in median rent levels between them. These parts became strata 1 and 2. The four noncentral strata were determined iteratively in a similar fashion: the noncentral part of the PSU was split into two parts, either by latitude or by longitude, in a way that maximized the difference in median rent level between them. Within each half a second split was made, perpendicular to the first. This determined the four noncentral strata.

Thus, rent levels and housing expenditure data were used to determine the geographic strata boundaries. The resulting strata, however, are purely geographic divisions of the PSU. In summary, two of the strata correspond roughly to the most densely populated part of the PSU, and the other four strata correspond to surrounding suburban areas.³⁰ The PSMD staff then selected segments in the strata to represent housing units constructed before 1990 as described below.

Weighting during segment sample selection. In the 1999 Housing Sample, segments were selected with probability proportional to size, the size measure being estimated expenditures. In the segment selection process, the segments are

³⁰ For more details see Eugene F. Brown and William H. Johnson, "Comparison of Stratification Designs for the Housing Sample of the Consumer Price Index," *1994 Proceedings of the American Statistical Association*.

ordered within each stratum by county and then by segment rent level within county. Because the segment selection is systematic, this guarantees that not all high-rent or low-rent segments are chosen.

Each segment, s , was assigned a probability of selection p within the stratum S , which is the ratio of the cost of housing in the segment TC_s relative to the cost of housing in the stratum. Therefore,

$$P_s = TC_s / \sum_{s \in S} TC_s$$

where S = stratum, and

TC_s is defined below.

Each segment also has a weight, W_s , which is the reciprocal of the probability of selection. Therefore,

$$W_s = 1/P_s$$

The total cost of housing in the segment, TC_s , is the cost of rented housing in the segment, RC_s , plus the cost of owned housing in the segment, OC_s . The RC_s is the number of rented housing units in the segment, R_s , times the average rent value within the segment, RR_s . The OC_s is the number of owned housing units in the segment, O_s , times an estimated average owner equivalent rent value within the segment, IR_s . This gives segments with higher-valued units (higher rent levels) a higher probability of selection and a lower segment weight.

$$TC_s = RC_s + OC_s = R_s * RR_s + O_s * IR_s$$

The estimated average owner equivalent rent value, IR_s , was determined by a nonlinear regression of the 1990 census owner value within census blocks on the 1990 census average rent value within the corresponding census block.

The following is the nonlinear (exponential) regression that was used:

$$y = b_0 * (1 - \exp(-b_1 * x)) + \varepsilon$$

$$z = y - \varepsilon$$

where y = average rent;
 x = average owner value; and
 z = average implicit rent.

The actual regression coefficients (b_0 and b_1) were determined uniquely within each PSU.

Because rents are not volatile, the housing sample is divided into panels; one panel is priced each month and each panel is priced twice a year. For example, panel 1 is priced in January and July, panel 2 in February and August, and so on through panel 6. The segments within the strata are assigned to these panels. These assignments are made such that each panel has a representative subsample of the PSU. Because each panel is representative of the entire sample and there is never an off-cycle month for the housing survey, a panel of data provides sufficient information for

monthly publication of the rent and REQ indexes. Segments were selected within the PSUs in multiples of 36, so that each combination of stratum and panel had the same sample size.

New construction augmentation. The augmentation of the housing sample with newly constructed housing units is not part of the segment sample selection process, but it is included here because these housing units fit neatly into the geographic stratification of the housing sample. The Census Bureau supplies to BLS a sample of address records from building permits, representing housing units built after 1989. BLS calls this list of address records the New Construction sample. BLS expects to receive about 1,000 address records per year from the Census Bureau, of which 20 percent will yield usable renter-occupied units after they have gone through the screening process. (See *Screening*, below.) Once BLS receives the New Construction sample, it assigns each address record to 1 of the 6 geographic strata based on the address's zip code. BLS then allocates the New Construction sample into segments using the Census Bureau sample design and zip code. There are some areas that do not issue building permits and thus are not covered by the sample received from the Census Bureau. The Census Bureau gives BLS a file that indicates which areas do not issue building permits. In these areas, renter-occupied housing units built after 1989 are eligible to be in the housing sample.

About 10,000 segments were selected in the PSUs. The 1999 Housing Sample is designed to consist of approximately 50,000 rental units. PSMD staff computed sampling rates for each segment, so that the sample design would be realized after the listing, sampling, and screening processes described below were completed. These sampling rates were used during the listing process to select the addresses to be screened for use in the housing sample.

Sample allocation to PSUs and strata. BLS allocated the sample to PSUs based on the estimated total housing expenditure in each PSU. The estimated total housing PSU expenditure is the sum of the total cost of housing, defined above, across all segments and strata.

$$PSU \text{ expenditure} = \sum_{s=1}^6 \sum_{s \in S} TC_s$$

There are six strata within each PSU and six collection panels. It was desired that the segment sample size be equal within each stratum and collection panel. It was also desired that there be at least two segments per stratum per collection panel. Thus, the segments were allocated in blocks of 36 segments with a minimum of 72 segments per PSU. For PSUs with multiple replicates, it was desired to have at least 36 segments per replicate and an equal sample size in each replicate. It was determined that a minimum of 108 segments was needed to support publication in areas that were published semiannually and that a minimum of 180 segments was needed for areas that are published bimonthly. The one exception was Baltimore, which received 108 segments but is published bimonthly as part

of the Washington-Baltimore CMSA. As the sample size was previously about 10,000 segments and the budget for housing data collection was comparable, multiples of 36 segments were chosen so that the total would be near 10,000 segments.

In some segments, the number of renters was so small that BLS did not expect to find at least 4 renters by sampling 50 housing units in the segments. So, additional segments were selected that were similar to these segments with relatively few renters. The additional segments are called “helper segments.” Any segment with fewer than 8 percent of housing units reported as renter in the 1990 census was assigned a helper segment. If a segment had fewer than 4 percent of housing units reported as renter in the 1990 census, only the helper segment would be visited, because the expected number of renters found would be less than 2. There were 9,720 regular segments chosen and 1,870 helper segments. There were 955 segments with fewer than 4 percent renters that were not sent out for initiation. That left a total of 10,635 segments to be visited for the housing sample.

Sample selection within strata. BLS took a systematic PPS sample of segments within each stratum. The segments were ordered prior to sample selection. The counties within each stratum were ordered using Peano ordering; then, within counties, the segments were ordered by composite rent level, according to the formula:

$$CR_s = \frac{R_s * RR_s + O_s * IR_s}{R_s + O_s}$$

The goal in taking a systematic sample of the ordered segments is to obtain a sample with good coverage of both geography and rent levels. The measure of size used for segments was the total cost of housing, TC_s .

The final selection of the sample took place in the field. The process consisted of listing the housing units in the segment, selecting a sample of housing units to be screened, and then screening those units to determine the in-scope units. For the 1999 Housing Sample, this process used CADC. A key element of the 1999 Housing Sample was the conversion of all data collection and transmission to electronic systems. There are two Housing CADC instruments, listing and collection, that handle electronic data collection.

Listing/sampling. Listing is the process of recording the addresses of all housing units in a segment. The segments are the outputs of the sample selection process. The listing of the sampled segments is a highly labor-intensive portion of the Housing Sample preparation activities. Once a segment has been listed, the sampling rate mentioned above is applied to the listed addresses using a sampling algorithm to select the addresses for the next stage of the process, *Screening*.

The CADC listing/sampling (listing) instrument. The use of portable computers for these activities resulted in substantial savings, because CADC consolidates listing and

data capture into one operation. The CADC listing instrument was designed to make listing as easy as possible for the field staff. Selected segment information was electronically transmitted to the field, and the field staff was assigned to list these segments. When the field staff selects a street name from the sector boundary data, street names are automatically entered. The first street number is entered and is then automatically incremented (or decremented) as specified by the field staff. As the street numbers change, the street names are copied to each line as the field staff lists the addresses within the segment. When the staff member moves to another street, he or she can select the next street name from the sector boundary data and proceed. In areas where the street numbers are not clearly marked or do not exist, the staff member must enter a description of the property. A computerized phrase builder has been designed to reduce the amount of typing required of the field staff as they enter these descriptions.

Using the CADC listing instrument, the computer and the field staff together determined if the collected listing data conformed to the expected results. If the listing data were acceptable, the sampling algorithm was applied to the listing data by the computer. The result of the sampling was a set of addresses that have been selected for screening. All of the listing/sampling data were electronically transmitted to the housing database in Washington, DC.

If time permits, the field staff may choose to screen/initiate the selected addresses. The CADC listing instrument generates screening/initiation schedules using data that were collected during listing/sampling. These screening/initiation schedules are passed to the collection instrument, so that field staff can screen and initiate in-scope addresses while in the segment. If time does not permit, the screening/initiation process carries over to the next month—that is, it takes one or more collection periods to successfully initiate all the housing units.

Collection. The field staff receives housing units to screen/initiate, either from the listing instrument or from the Washington database, as specified in the *Listing/sampling (listing) instrument* section above. Collection includes the *screening* of the selected housing units to determine if the units are in scope for the housing sample. If a unit is in scope, it is initiated. *Initiation* is the initial collection of rent data, which consists of the rent paid and the specific housing services that are associated with the unit and the rent paid. These data are the basis for all calculations of rent change that occurs during the life of the unit in the housing sample. After initiation, the housing unit is priced on panel every 6 months. Pricing is very similar to the initiation process, but some previous answers are provided. The collection of the housing data, and particularly the rent data, is independent. That is, the field staff collects the data without giving the respondent the previous answer. Previous answers for some nonrent data are provided, so that the field staff can confirm certain changes with the respondent. In-

herent in all of the structured housing questionnaires (screening, initiation, and pricing) are various flow determinations (skip patterns), such that the answer to one question determines the next question that must be asked/answered.

The CADC instrument. The CADC instrument receives the screening/initiation schedules electronically. The field staff obtains answers to various (screening) questions (through observation and through direct questioning of eligible respondents) that determine whether an address is in scope for the housing sample. The screening criteria consist of tenure (whether the unit is renter or owner occupied) and other criteria, such as not being in public housing projects, being built before 1990, being a primary residence, and the tenant not being a relative of the landlord.

With the computer, the skip patterns can be very efficient. Because the computer has stored all of the previously collected data, automated logic checks remove all redundant question patterns, thereby reducing the field staff's work and the respondent's burden. Automated data checking ensures that only correct data types are collected, other automated logic checks ensure that collected data are consistent, and the instrument informs the field staff if any required data have not been collected. These data checks are being performed at the time of collection, so errors and inconsistencies can be corrected while the respondent is present. The result is that the data that are sent to Washington are as accurate as possible. The collection instrument also automatically determines appropriate "scope status"—permanently out of scope, temporarily out of scope, incomplete, or complete and in scope.

If the housing unit is found to be out of scope for some reason that is not likely to change, the collection instrument assigns a scope status of "permanently out of scope" and the unit is never visited again. (An example of this would be units in public housing projects.) If the housing unit is found to be out of scope for some reason that might change, its status is "temporarily out of scope," and another screening/initiation attempt is made after a specified waiting period. (An example of this might be when the unit is not the primary residence for the current tenant, but may become the primary residence for some future tenant.) If the screening was incomplete, the housing unit is assigned a scope status that results in another screening/initiation attempt in 6 months. Selected addresses that pass the screening criteria are considered in scope for the housing sample and are eligible for the next stage of the process, *initiation*.

Initiation. The CADC instrument automatically flows into the initiation portion of the instrument when the instrument has determined that the screening is complete and the housing unit is in scope. As mentioned above, the collection instrument handles the skip patterns, the automated data and consistency checks, the schedule completion checks, and the final initiation status. The screening and initiation data are then electronically transmitted to the housing database in Washington.

Pricing. The field staff receives, electronically, the housing units to price from the Washington database. The CADC collection instrument automatically flows into the pricing portion of the instrument and, as mentioned above, the collection instrument handles the skip patterns, the automated data and consistency checks, the schedule completion checks, and the final schedule status. The pricing data are electronically transmitted to Washington, where they are reviewed and corrected as necessary.

These data, along with the initiation or pricing data from 6 months earlier, are used in the housing price relative calculation (PRC) described below. Occasionally situations occur during pricing that affect the unit's scope status and, on a scheduled but infrequent basis, additional questions are asked to ensure that the housing units are still in scope for the housing sample. If changes occur, the units are treated as indicated in *Screening*, above, based on their new scope status.

Augmentation. As mentioned above, the 1999 Housing Sample was designed to produce roughly 50,000 rental units. Mainly due to an inability to locate renters in heavily owner-occupied areas, the actual yield initially was roughly 25,000. A two-stage augmentation effort was begun in March of 1999 to increase the sample size within certain segments.

With certain exceptions, each segment in the sample was supposed to produce roughly five rental units. Segments that yielded four or more rental units were not considered as candidates for augmentation. The first stage of augmentation dealt with segments that had initially produced two or three rental units. In these segments, the sample of housing units was doubled, with the expectation that an additional two or three rental units would be found after screening. The second stage of augmentation dealt with those segments that had initially produced no rental units or one rental unit. BLS economic assistants in the field who were familiar with the segments were asked to provide information to help determine whether it would be worthwhile to augment these segments or whether such an effort would prove fruitless. By March 2000, the augmentation effort had added approximately 10,000 rental units to the housing sample.

Estimation of Price Change in the CPI

As stated above, the CPI is calculated in two stages. In the first stage, *basic indexes* are calculated for each of the 8,018 CPI item-area combinations. For example, the electricity index for the Boston CPI area is a basic index. The weights for the first stage come from the sampling frame for the category in the area. Then, at the second stage, *aggregate indexes* are produced by averaging *across* subsets of the 8,018 CPI item-area combinations. The aggregate indexes are the higher-level indexes; for example, the all-items index for Boston is the average of all its 211 basic indexes. Similarly, the aggregate index for electricity is the average of the basic indexes for electricity in each of the 38 index areas. The U.S. city average—all-items CPI is the grand average of all basic in-

Table 4. Item categories using the Laspeyres formula

<p>1. Selected shelter services (rent of primary residence; owners' equivalent rent of primary residence; and housing at school, excluding board)</p> <p>2. Selected utilities and government charges (electricity; residential water and sewerage maintenance; landline telephone services, local charges; utility (piped) gas service; State and local registration, license, and motor vehicle property tax)</p> <p>3. Selected medical care services (physicians' services; hospital services; dental services; services by other medical professionals; and nursing homes and adult daycare.)</p>

dexes. For the CPI-U and CPI-W, the weights for the second stage are the base-period expenditures on the item category/areas from the CE. For the C-CPI-U, weights for the second stage represent base- and current-period expenditures from the CE.

Estimation of price change for commodities and services other than shelter

As discussed above, the C&S is the CPI's primary source of price change data. Of the 209 C&S item strata, 185 are *priced* strata. The other 24 C&S strata, all of which have very small weights, are—for a variety of reasons—*unsampled* or truncated from pricing. The price movements of unsampled strata are imputed from related priced strata.

For most priced C&S strata, the C&S is the *primary* source, meaning that information on price change comes from samples that the survey maintains. A few C&S strata, including those for airline fares, intercity train fares, and used vehicles, use *secondary* sources of data on prices for their samples.

Price relatives. Each month, the processing of the C&S data yields a set of *price relatives* (a price relative is a measure of short-term price change) for all of the monthly and on-cycle bimonthly basic indexes. The PRC uses an index number formula to obtain an average price change for the items in each basic index's sample. Prior to January 1999, all CPI price relatives used a modified Laspeyres index number formula. This is a ratio of a weighted arithmetic mean of prices in the current period to the same average of the same items' prices in the previous period, with estimated quantities of the items purchased in its sampling period serving as weights. In January 1999, the PRC for most of the item strata converted to the geometric mean index formula, which is a weighted geometric mean of price ratios (an item's current price divided by its previous price) with weights equal to expenditures on the items in their sampling periods. (Calculations for 13 strata—including the two shelter strata—continue to use the Laspeyres formula; see table 4).³¹ BLS will continue to evaluate the appropriateness of the formula used in the calculation of basic or elementary item indexes and, on an an-

nual basis, may change or adjust the formula for constructing these indexes. For example, effective with the release of January 2004 data, the geometric mean formula replaced the Laspeyres arithmetic mean formula in the calculation of the basic indexes both for cable and satellite television and radio services and for eyeglasses and eye care.

Since January 1999, most item strata have used an expenditure-share-weighted geometric average ${}_{a,i}R^G_{[t;t-1]}$. The other strata use the Laspeyres formula average, ${}_{a,i}R^L_{[t;t-1]}$, which all strata used prior to 1999. The Laspeyres is a base-period-quantity-weighted arithmetic average. Every month the C&S system computes price relatives for each area-item combination (a,i) using these formulas:

$${}_{a,i}R^G_{[t;t-1]} = \prod_{j \in a,i} \left(\frac{P_{j,t}}{P_{j,t-1}} \right)^{\left(\frac{W_{j,POPS}}{\sum_{k \in a,i} W_{k,POPS}} \right)}$$

$${}_{a,i}R^L_{[t;t-1]} = \frac{\sum_{j \in a,i} (W_{j,POPS} / P_{j,POPS}) P_{j,t}}{\sum_{j \in a,i} (W_{j,POPS} / P_{j,POPS}) P_{j,t-1}}$$

where

${}_{a,i}R^G_{[t;t-1]}$ and ${}_{a,i}R^L_{[t;t-1]}$, are, respectively, the geometric and Laspeyres price relatives for area-item combination, a,i , from the previous period, $t-1$ (either 1 month or 2 months ago), to the current month, t ;

$P_{j,t}$ is the price of the j th observed item in month t for area-item combination a,i ;

$P_{j,t-1}$ is the price of the *same item* in time $t-1$;

$P_{j,POPS}$ is an estimate of the item j 's price in the sampling period when its POPS was conducted; and

$W_{j,POPS}$ is item j 's weight in the POPS, which is defined in detail below.

The product in the geometric mean formula and sums in the Laspeyres formula are taken over all usable quotes in area-item combination a,i . It is important that the price of

³¹ See "Planned Change in the Consumer Price Index Formula," <http://stats.bls.gov/cpi/epigm02.htm>.

each quote be collected (or estimated) in both months in order to measure price change.

Quote weights. For each individual quote, the weight $W_{j,POPS}$ is computed as:

$$W_{j,POPS} = \alpha E f g b / M B$$

where

α is the proportion of the total dollar volume of sales for the ELI relative to the entire POPS category within the outlet (called the outlet's *percent of POPS* for the ELI);

E is an estimate of the total daily expenditure for the POPS category in the PSU half-sample by people in the U-population (called the *basic weight*);

f is a *duplication factor* that accounts for any special subsampling of outlets and quotes;

g is a *geographic factor* used to account for differences in the index area's coverage when the CPI is changing from an area design based on an old decennial census to a design based on a more recent census;

b is the number of times the ELI was selected to represent the item stratum, divided by the total selections for the item stratum, in the PSU half-sample;

M is the number of quotes with usable prices in both months $t-1$ and t for the ELI-PSU half-sample; and

B is the proportion of the item stratum's expenditure accounted for by the ELI in the region.

POPS-period prices. In the Laspeyres formula, the item expenditure weight is divided by an estimate of the item's price in the sampling period to convert the expenditure into an estimated quantity. An item's POPS period occurred sometime before its outlet's initiation, so that one cannot observe its POPS price directly. It is estimated from the item's price at the time the sample was initiated and the best estimates of price change for the period from the POPS period to the initiation period:

$$P_{j,POPS} = P_{j,0} / [IX_{j,0} / IX_{j,POPS}]$$

where

$P_{j,0}$ is the price of the j th item at time 0 (when it was initiated or chosen for the sample);

$IX_{j,0}$ is the value of the price index most appropriate for the j th item in period 0, the time it was initiated; and

$IX_{j,POPS}$ is the value of the same price index in the POPS period (period *POPS*).

Item replacement and quality adjustment

One of the more difficult problems faced in compiling a price index is the accurate measurement and treatment of quality change due to changing product specifications and consumption patterns. The concept of the CPI requires a measurement through time of the cost of purchasing an unchanging, constant-quality set of goods and services. In reality,

products disappear, products are replaced with new versions, and new products emerge.

When the data collector finds that he or she can no longer obtain a price for an item in the CPI sample (most commonly because the outlet permanently stops selling it), the data collector uses the *CPI replacement* procedure to find a new item. As explained above in the section on CPI item and outlet samples, each item stratum consists of one or more ELIs. CPI staff economists, called commodity analysts, in Washington have developed checklists that define further subdivisions of each ELI. When seeking a replacement in a retail outlet, the data collector first uses the checklist for the ELI to find the item the outlet sells that is "closest" to the previously priced one. Then the data collector describes the replacement item on the checklist, capturing its important specifications. The commodity analyst assigned to the ELI reviews all replacements and selects one of three methods to adjust for quality change and to account for the change in item specifications.

The following example describes the most common type of quality adjustment problem. Assume that in period t a data collector tries to collect the price for item j in its assigned outlet and is not able to do so because the outlet no longer sells the item. A price for item j was collected in period $t-1$. Following the procedure, the data collector finds a replacement and collects a price for it. The replacement becomes the *new version* (version $v+1$) of item j . The decision as to how the CPI treats the replacement is made by the commodity analyst assigned to the ELI to which item j belongs. The commodity analyst has the descriptions of the two versions of item j . In addition, he or she has the $t-1$ price, $P_{j,t-1}^v$, for the earlier version (version v) and the period t price, $P_{j,t}^{v+1}$, of the replacement version $v+1$. The following table displays the price information available to the commodity analyst.

Item version	Period $t-1$ price	Period t price
Old version v	$P_{j,t-1}^v$	
Replacement version $v+1$		$P_{j,t}^{v+1}$

To use the item in index calculation for period t , we need an estimate of $P_{j,t-1}^{v+1}$, the price of the replacement version, $v+1$, in period $t-1$, or we need an estimate of $P_{j,t}^v$, the price of the earlier version, v , in period t . If there is no accepted way of estimating either $P_{j,t-1}^{v+1}$ or $P_{j,t}^v$, the observation for item j is left out of index calculation for period t , meaning that the observation is treated as a nonresponse handled by imputation (see below).

The commodity analyst chooses one of three methods to handle the replacement:

- 1) Direct comparison;
- 2) Direct quality adjustment; or
- 3) Imputation.

Direct comparison. If the new and old items are essentially the same, the commodity analyst deems them directly comparable, and the price comparison between the items is used in the index. In this case, it is assumed that no quality difference exists.

Direct quality adjustment. The most explicit method for dealing with a replacement item is to estimate the value of the differences. The estimate of this value is called a quality adjustment amount $QA_{j,t-1}$. In this case:

$$P_{j,t-1}^{v+1} = P_{j,t-1}^v + QA_{j,t-1}$$

Chief sources of direct quality adjustment information are manufacturers' cost data and hedonic regression.

Imputation. Imputation is a procedure for handling missing information. The CPI uses imputation for a number of cases, including refusals, inability to collect data for some other reason (the item may be out of season), and the inability to make a satisfactory estimate of the quality change. Substitute items that can be neither directly compared nor quality adjusted are called *noncomparable*. For noncomparable substitutions, an estimate of constant-quality price change is made by imputation. There are two imputation methods: *Cell-relative* imputation and *class-mean* imputation.

Cell-relative imputation. If there is no reason to believe that price change for an item is different from those for the other items in its cell or basic index, the *cell-relative* method is the appropriate way to impute. This method is used for missing values because in that case we have no knowledge about the observation. For noncomparable substitutions, the cell-relative method is prevalent for food and service items. The price change between the old item and the noncomparable new item is assumed to be the same as the average price change of all similar items in 1 month for the same geographic area—that is, the same as the average price change for the cell for that item strata and index area.

In this method, which is sometimes referred to as “linking,” the item is effectively left out of the calculation for 1 month; the cell relative is computed without the observation. The price relative (either $R_{ai,t,t-1}^L$ or $R_{ai,t,t-1}^G$) is computed with one less usable quote. The variable M in the quote weight formula adjusts the weights of other quotes.

When there is a new version of the item that is not comparable to the previous version, a price for the new version ($P_{j,t}^{v+1}$) is available. That price is not used in the calculations for period t but, in the subsequent period $P_{j,t}^{v+1}$ is used as the previous price. If, on the other hand, the reason for the imputation was that the item was temporarily missing (meaning that no price was collected), a period- t price must be estimated for use in period $t+1$. For this purpose, the cell relative is used:

$$P_{j,t}^v = R_{ai,t,t-1} * P_{j,t-1}^v$$

Although this value is not used in the calculations for the current period t , $P_{j,t}^v$ is used in the subsequent period's PRC as the $t-1$ price.

Class-mean imputation. The C&S uses class-mean imputation for many noncomparable replacements, primarily in the item strata for vehicles, for other durables including high-tech items, and for apparel. The logic behind the class-mean procedure is that, for many items, price change is closely associated with the annual or periodic introduction of new lines or models. For example, at the introduction of new model year vehicles, there are often price increases while, later in the model year, there are commonly price decreases. The CPI uses the quality adjustment method as frequently as possible to handle item replacements that occur when vehicle product lines are updated. Class-mean imputation is employed in the remaining replacement situations. In those cases the CPI estimates price change from the price changes of other observations that are going through item replacement at the same time and were either quality adjusted directly or were judged directly comparable. For class-mean imputation, the CPI estimates $P_{j,t}^v$, which is an estimate of the current (t) price for the old version (v), and uses this estimated current price in the calculation of the price relative for period t . The estimated current-period price is the previous-period ($t-1$) price of the old version times a specially constructed price relative for the class.

$$P_{j,t}^v = P_{j,t-1}^v * R_{[t,t-1]}^c$$

$R_{[t,t-1]}^c$ is computed with either the geometric mean or Laspeyres formula over the subset of observations in the stratum to which item j belongs. The subset is the class of interest—that is, all the comparable and quality-adjusted replacement observations in the cell (item stratum by index area).

Estimation of price change for shelter

The rent and REQ indexes measure the change in the cost of shelter for renters and owners, respectively. Price change data for these two indexes come from the CPI Housing survey. Each month, BLS field representatives gather information from renter units on the rent for the current and previous months and on what services are provided.

Rent. The rent estimates used in the CPI are “contract rents.” They are the payment for all services the landlord provides in exchange for the rent. For example, if the landlord provides electricity, it is part of the contract rent. The CPI item expenditure weights also include the full contract rent payment. The CPI rents are calculated as the amounts the tenants pay their landlords plus any rent reductions tenants receive for performing services for the landlord (sometimes called “rent as pay”) plus any subsidy payment paid to the landlord. Reductions for any other reasons are not considered part of the rent.

Rental equivalence (REQ). The REQ approach to measuring price change for owner-occupied housing started in the CPI-U in January 1983 and the CPI-W in January 1985. The REQ index is designed to measure the change in the rental value of owner-occupied housing. In essence, REQ measures the change in the amount a homeowner would pay to rent, or would earn from renting, his or her home in a competitive market. It is a measure of the change in the price of the shelter service provided by owner-occupied housing.

PRC for Housing. The housing and the C&S systems do not directly calculate indexes. Instead, they produce price relatives, and the index estimation system then uses the price relatives for basic index calculation. Price relatives are ratios of price change from the previous month ($t-1$) to the current month (t), and basic index calculation updates the last month's indexes ($t-1$) to the current month (t).

Weighting during the PRC. The renter and owner costs of housing in the segment (see *Weighting during segment sample selection*, above) become the basis of the renter and owner weights used by the PRC for the segment.

To derive the total renter weight in the segment (RW_s), the segment weight (W_s) must be adjusted by the proportion of renter cost in the segment (RA_s) and the probability of a particular renter in the segment being selected for the sample (RP_s).

The proportion of renter cost in the segment (RA_s) is the renter cost (RC_s) divided by the total cost (TC_s).

$$RA_s = RC_s / TC_s$$

The probability of a particular renter in the segment being selected for the sample (RP_s) is the number of sampled housing units in the segment (SU_s) divided by the total number of housing units in the segment (HU_s).

$$RP_s = SU_s / HU_s$$

The total renter weight for the segment (RW_s), therefore, is the segment weight (W_s) times the renter cost proportion (RA_s) adjusted by the proportion of renters sampled (RP_s).

$$RW_s = W_s * \frac{RA_s}{RP_s} = W_s * \frac{RC_s}{TC_s} * \frac{HU_s}{SU_s}$$

To derive the total owner weight in the segment (OW_s), the segment weight (W_s) must be adjusted by the proportion of owner cost in the segment (OA_s) and the proportion of renters in the segment selected for the sample (RP_s). Because owners are not sampled, renters are reweighted to represent owners, and the RP_s is used in both derivations.

The proportion of owner cost (OA_s) is the owner cost (OC_s) divided by the total cost (TC_s).

$$OA_s = OC_s / TC_s$$

The total owner weight for the segment (OW_s), therefore, is the segment weight (W_s) times the owner cost proportion (OA_s) adjusted by the proportion of renters sampled (RP_s).

$$OW_s = W_s * \frac{OA_s}{RP_s} = W_s * \frac{OC_s}{TC_s} * \frac{HU_s}{SU_s}$$

The rent and REQ estimators. The rent estimator uses the change in the "economic rent," which is basically the "contract rent" adjusted for any changes in the quality of the housing unit. The REQ estimator uses the change in the "pure rent," which excludes the cost of any utilities included in the rent contract.

The 6-month chained estimator. For the rent index, the current month's index is derived by applying the sixth root of the 6-month rent change to the index for the previous month. For the REQ index, the current month's index is derived by applying the sixth root of the 6-month REQ change to the index for the previous month.

The rent estimator uses the change in the "economic rent." Because of the panel structure used in the housing sample, the 6-month change in rent is based on sampled, renter-occupied units that have usable 6-month rent changes. The sum of the current (t) economic rents for each usable unit within a segment, weighted by the renter weight for that segment, is divided by the sum of the economic rents charged 6 months earlier ($t-6$) for each usable unit within a segment, weighted by the renter weight for that segment. This ratio is used to represent the 6-month change in rent for all renter-occupied units in the segment.

In a parallel calculation, the sum of the current (t) pure rents for sampled, renter-occupied units within a segment, weighted by the owner weights, is divided by the sum of the weighted pure rents 6 months earlier (time $t-6$). This ratio is used to represent the 6-month change in the REQ index for all owner-occupied units in the segment.

The functions of the PRC have been designed to make use of the parallel rent and REQ computations. In general, the PRC aggregates the weighted rents for the units (i) in the Index Area (a) for the current period (t) and for 6 months earlier (time $t-6$), and then computes the price relatives:

$$REL_{t-6,t,a} = \frac{\sum_{i \in a} W_s * R_{i,t}}{\sum_{i \in a} W_s * R_{i,t-6}}$$

When the PRC is run for rent, economic rents (ER_i) and renter weights (RW_s) are used:

$$REL_{t-6,t,a}^{RENT} = \frac{\sum_{i \in A} RW_s * ER_{i,t}}{\sum_{i \in A} RW_s * ER_{i,t-6}}$$

When the PRC is run for REQ, pure rents (PR_i) and owner weights (OW_s) are used. That is,

$$REL_{t-6,t,a}^{REQ} = \frac{\sum_{i \in A} OW_s * PR_{i,t}}{\sum_{i \in A} OW_s * PR_{i,t-6}}$$

The index estimation system needs a 1-month price relative, not a 6-month price relative; therefore, the 6th root of the $REL_{t-6,t,a}$ is derived:

$$REL_{t-1,t,a} = \sqrt[6]{REL_{t-6,t,a}}$$

and then passed to the index estimation system for basic index computation for the rent and REQ item strata.

Vacancy imputation. Vacant units that were previously occupied by renters are used in the calculation of $R_{i,t-1}$ and $R_{i,t-6}$. The vacancy imputation process incorporates several assumptions about the unobserved rents of vacant units. It is assumed that rents tend to change at a different rate for units that become vacant (and are, therefore, in the process of changing tenants) than for other units. The vacancy imputation model assumes that, after an initial lease period, expected rents change at a steady rate until the old tenant moves out of the unit. When there is a change in occupant or a unit becomes vacant, the rent is assumed to jump at some rate, referred to as the “jump rate.” In markets with generally rising rents, this jump rate is usually greater than the average rate of change for occupied units. BLS estimates the jump rate based on nonvacant sample units in the PSU that have had a change in tenant between $t-6$ and t . Rent changes for nonvacant units without a tenant change are used to calculate the average continuous rate of change. These values are used to impute rents for vacant units for periods t and $t-1$ from their rent in $t-6$.³² The imputed rents, $r_{i,t}$ and $r_{i,t-1}$, of the i th vacant rental unit in t and $t-1$ are:

$$r_{i,t-1} = r_{i,t-6} J^{5/6} \text{ and } r_{i,t} = r_{i,t-6} J \text{ if the unit was not vacant in } t-6$$

$$r_{i,t-1} = r_{i,t-6} C^5 \text{ and } r_{i,t} = r_{i,t-6} C^6 \text{ if the unit was vacant in } t-6$$

³² For more information on vacancy imputation, see J.P. Sommers and J.D. Rivers, “Vacancy Imputation Methodology for Rents in the CPI,” 1983 *Proceedings of the American Statistical Association*, Business and Economic Statistics Section.

where J is the 6-month jump rate calculated for the PSU, and C is the 1-month steady rate of change.

The imputation of vacant rents ensures that the unobserved rent change that occurs when a unit becomes vacant is reflected in the final rent index. The 6-month rent-change estimates capture these changes once the units become occupied; however, the changes are missed in 1-month rent-change estimates without vacancy imputation.

Ageing adjustment. The ageing adjustment accounts for the small loss in quality as housing units age (or depreciate) between interviews. The ageing adjustment factors can be thought of as $1/(1-d)$ where d is the monthly rate of physical depreciation. BLS computes factors for each housing unit with regression-based formulas. The formulas account for the age of the unit and a number of structural characteristics.³³ The ageing adjustment procedure was introduced into the CPI in 1988.

Quality adjustment. Quality adjustments made to the cost of rental housing are used in the rent and REQ indexes. In addition to collecting the rent charged, BLS also collects a description of major services and facilities provided by the landlord. If the services and facilities differ between two collection periods for which rents are compared, the rent for the current period is adjusted to reflect the differences in services between the periods. For instance, if the owner no longer provides a certain utility, BLS calculates an estimate of the value of that utility and adds it to the current rent in order to have an adjusted rent value. This adjusted rent is the current cost of the same set of services provided for the previous rent.

To make quality adjustments in costs of utilities, BLS uses data from the U.S. Department of Energy’s Residential Energy Consumption Survey to develop formulas to estimate utility use for various types and sizes of housing, in various climates, with different types of heating and air-conditioning, hot water, and so on. Prices for utilities come from the CPI average price program. A similar, simpler formula is used to estimate water and sewer costs.

Using data calculated yearly from the ageing adjustment regressions, quality adjustments for major structural changes (that is, the number of bedrooms, bathrooms, or other rooms and central air-conditioning) have been made since February 1989.³⁴

³³ For further information, 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.

³⁴ For additional information on quality adjustments in housing, see Steven W. Henderson and Stephen A. Berenson, “Quality adjustments for structural changes in CPI housing sample,” *Monthly Labor Review*, November 1990, pp. 40-42.

Special pricing and estimation procedures for medical care

Although third parties—mainly government agencies and employers—pay much of the cost of medical care on behalf of consumers, the medical care component of the CPI covers only that part of healthcare commodities, services, and health insurance premiums that consumers pay for “out of pocket.”³⁵

Medical insurance premiums constitute the largest part of consumers’ out-of-pocket spending for medical care. To date, BLS has not been satisfied with its attempts to price medical insurance directly.³⁶ Unlike those on other forms of consumer insurance in the CPI, the data needed from insurers to hold the quality of the insurance policies constant is so extensive and so closely held that BLS has not been able to construct a constant-quality health insurance index. Consequently, the CPI has employed an indirect method for pricing health insurance. As described below, the CPI allocates most of consumers’ out-of-pocket expenditures on health insurance premiums to the weights for other healthcare services and commodities, placing the small remainder, which covers the insurance companies’ costs and their profits, in an unpublished CPI health insurance stratum.

Use of the indirect method for pricing health insurance has two important effects on the CPI. First, the relative shares of the weights for each of the other CPI medical care item strata are significantly increased, because they include their portions of the reallocated consumer expenditure for health insurance premiums.³⁷ Second, the CPI approach to measuring price change for medical care items reflects the fact that these items are—for the most part—paid for by insurance companies and, therefore, the approach must take account of insurance arrangements such as type of reimbursement method.

Medical care items and their prices. The movement of CPI medical care indexes is based on the average change in the prices of a sample of items selected to represent them. The items are, for example, a prescription for a specific medicine or a visit of a specified duration to a doctor or a hospital. These are inputs to medical treatments addressing a specific medical condition.³⁸ The CPI data collectors, following CPI

sampling procedures, select the sample items by working with respondents in pharmacies, doctors’ offices, hospitals, and other outlets that provide medical care.

CPI defines the transaction price for medical care items as all payments or expected payments received from eligible payers, including both the patient and appropriate insurers.³⁹ In most cases, the field staff is able to collect transaction prices; if the respondent is unable or unwilling to provide transaction prices, the field staff codes the hospitals as refusals.

CPI medical care indexes. The CPI medical care aggregate index covers medical care commodities, which consist of prescription and over-the-counter (OTC) drugs and supplies, and medical care services, which include professional services, hospital services, and medical insurance.

Medical care commodities has a smaller weight in the CPI than medical care services. One reason for this is that medical commodity items that are commonly sold with a medical service are included in the service stratum. Eyeglasses, for example, are in the eye care stratum, because they often are sold as part of an eye examination.

The professional medical services expenditure category serves as the umbrella for a series of stratum indexes: Physicians’ services, dental care, eye care, and services by other medical professionals. The hospital and related services category includes item strata for hospital services and nursing home services. Medical insurance, whose weight share is reduced due to indirect pricing, is the remainder of the medical care services category. Details on the more difficult pricing issues associated with these item strata follow:

Prescription drugs. In response to technological change and the complex marketing of prescription drugs, the CPI program has developed a series of techniques to show the effects of such trends. Field staff uses special procedures to handle the expiration of a drug’s patent protection and the subsequent introduction of equivalent generic drugs, a prescription drug’s conversion to OTC status, and the stream of new pharmaceutical products into the marketplace.

Brand vs. generic. Since 1995 a method allowing generic versions of prescription drugs coming off patent to have a chance for inclusion in the CPI has been in place. Six months after the expiration of the patent for a particular prescription drug, the CPI field agent (data collector) disaggregates among all the FDA-designated therapeutically equivalent versions of the medicine, including the brand name, that are available

³⁵ As a consequence, the medical care portion of the CPI is much smaller than its portion of the National Accounts.

³⁶ At the time of this writing, efforts were underway in conjunction with the Producer Price Index program to test-price health insurance directly. For a description of an earlier effort, see Ina Kay Ford and Phil Sturm, “Test of the direct pricing of health insurance policies,” appendix to “CPI revision provides more accuracy in the medical care component,” *Monthly Labor Review*, April 1988, pp. 25-26.

³⁷ See U.S. Bureau of Labor Statistics, “Direct Pricing of Health Insurance in the Consumer Price Index,” Paper presented at the Sixth Meeting of the International Working Group on Price Indices, Canberra, Australia, April 2001.

In that study, the share of the CPI weight for health insurance under direct health insurance pricing was 2.7 percent—compared with 0.3 percent under indirect insurance pricing. At the same time, the shares of the other medical care items were commensurately smaller (for example, for hospitals, 0.4 percent versus 1.4 percent).

³⁸ A recent National Academy of Sciences panel that reviewed CPI practices suggested that BLS should experiment with using selected medical conditions as the CPI items. Under that approach, the CPI would follow the movement to new treatments—such as drug therapy replacing surgery—and, to the extent possible, show any price changes. See Charles L. Schultze and Christopher Mackie, eds., *At What Price? Conceptualizing and Measuring Cost-of-Living and Price Indexes* (Washington, National Academy Press, 2002), pp. 178-90.

³⁹ Elaine M. Cardenas, “The CPI for hospital services: concepts and procedures,” *Monthly Labor Review*, July 1996, pp. 38-39.

in each outlet in which the original drug is priced. This process allows the newer generics an opportunity to build sales in the individual pharmacy over a 6-month period, and then, through disaggregation—a probability-proportional-to-size statistical technique—the generic versions of the drug have a one-time chance for selection in proportion to sales volume at the particular outlet. Should a generic drug be selected, any price change that occurred from brand to generic is reflected in the index.

Prescription vs. over-the-counter. When a drug in the CPI's prescription sample loses its prescription status and can be sold as an OTC drug, the CPI retains the item as part of the prescription drug sample while using its OTC price. Thus, the prescription drug index series shows any price change that occurs as the result of drugs changing status from prescription to OTC. The OTC version of the drug remains in the prescription drug sample until it rotates out during the next rotation scheduled for that item, generally slated for 2 years after the original prescription drug was brought into the sample at initiation. At future sample rotations, the OTC item is eligible for initiation in the nonprescription drug stratum and ineligible in the prescription drug stratum. Similarly, should a drug in the nonprescription sample change its status (that is, from OTC to prescription), the CPI would show the resulting price change, if any, in the nonprescription drugs and supplies index.

Accelerated item rotation for prescription drugs. With the acceleration of drug introductions into the market for pharmaceuticals, BLS needs to ensure that it picks up new items in the CPI sample in a timely fashion. In August 2001, the CPI implemented a process called “within-outlet item rotation” for prescription drugs. BLS now rotates prescription drug quotes within existing outlets (retail pharmacies) approximately once every 2 years, in addition to rotating the outlets and the items within the outlets every 4 years. This accelerated pattern of both item and outlet sample rotation keeps the array of prescription drugs priced in the index representative of those purchased by consumers. (Within-outlet item rotation, which is distinguished from outlet rotation in that it involves the updating of individual items within an outlet between outlet rotation periods, is being expanded to other items, starting in 2003. Within-outlet item rotation is designed to enhance the timeliness and representativeness of the item samples in categories where the array of items consumed is thought to be changing rapidly.)

Physicians' services. This item stratum covers services that are performed and billed by private-practice medical doctors. This includes all medical professionals with a doctor of medicine (MD) degree except for ophthalmologists, whose services are priced in the eye care stratum. It also includes osteopaths (they are not MDs, but often have hospital privileges). House, office, clinic, and hospital visits are included so long as the bill comes from the physician.⁴⁰ At initiation of a quote for physicians' services, the CPI data collector

first establishes the practitioner's specialty and then disaggregates to an appropriate service. The data collector describes the characteristics of the selected visit and any related procedures using a CPI checklist specific to the medical specialty. Common Procedural Terminology (CPT) codes are used to help describe the item precisely; this description remains fixed for the 4 years during which the CPI program follows its price, unless either the selected combination of services changes or a CPT code definition is modified. Transaction prices in the physicians' services index may include Medicare B payments as well as those fees that the doctor expects to receive directly from the patient or from private insurance.

Services by other medical professionals. This stratum covers services performed and billed by medical practitioners who are not medical doctors (lack an MD degree) and are not covered in the dental stratum or the eye care stratum. Included here are chiropractic and physical therapy, podiatry, audiology (including hearing aids), acupuncture, nursing, nutritional counseling, occupational therapy, and psychology and psychotherapy.

Hospital services. Items in the hospital services stratum cover the hospital portion of a medical treatment, including inpatient and outpatient services. The pricing unit is the hospital visit, defined by a date of admission and a date of discharge as documented on a hospital bill and usually associated with a specific diagnosis or medical condition.⁴¹ At initiation, the CPI data collector works with the respondent to select a hospital bill based on revenues generated by eligible payers. The data collector refers to the bill to describe the item in terms of the bundle of goods and services consumed during a timeframe or visit for the purpose of bringing the patient to the physical (or mental) state required for discharge from the hospital. The form that the hospital visit takes as the pricing unit is that of its reimbursement method, the method used by the insurer to pay the hospital for the services. There are several possible types of reimbursement that insurers may write into their contracts with providers: fee-for-service, diagnosis-related group, per diem, case rate, admission rate, package, ambulatory patient group, service units, and capitation. With the exceptions of fee-for-service and fee schedule, each type of reimbursement reflects either a lump-sum payment based on the diagnosis or type of procedure performed or a flat fee per unit of service.

Current procedures for selecting hospital services to price in the CPI involve the following basic steps:

⁴⁰ Ina Kay Ford and Daniel B. Ginsburg, “Medical Care in the CPI,” in E. Berndt and D. Cutler, eds., *Medical Care Output and Productivity*, NBER Research Studies in Income and Wealth (Chicago, University of Chicago Press, 2001), p. 215.

⁴¹ At this time, neither the pricing of total treatment paths nor the measurement of patient outcomes is available for the CPI, given the structure of the medical care component and the difficulty of evaluating the results of treatments.

- Disaggregation by setting to reflect the relative proportions of inpatient services versus outpatient services at the individual hospital outlet level;
- Disaggregation by payer (for example, self-pay or insurance company);
- Selection of hospital bills based on selected payers, when the hospital administration will provide them;
- Request for the type of reimbursement method and the actual or estimated payment for the described hospital visit, based on the terms of the contract between the provider and the insurer; and
- Description of the hospital visit, including a bundle of procedures, services, equipment use, supplies, and materials typically associated with the hospital event or episode, as defined by both the bill and the contract (the visit).

Monthly pricing and bimonthly pricing consist of updating the reimbursement method and amount based on the contract between provider and insurer, and maintaining current discounts and—for those fee-for-service reimbursements based on the hospital chargemaster with applied discounts—list prices.

Quality adjustment. Not all factors affecting the quality of medical care services can be accounted for in the list of descriptors for the priced item. Many factors contributing to the quality of a medical care event (for example, a hospital visit, a dental appointment) are somewhat intangible and not easily measured. In particular, improved technologies and procedures sometimes can lead to quality changes that BLS cannot measure.

There are, however, certain types of changes in medical care items for which the BLS can quantify a quality difference and adjust for it. For example, suppose the item that the CPI is following is a limited visit to a physician's office for treatment of a sore throat. If the physician changes the service so that a throat culture is always included in the cost of the visit, BLS would not reflect the addition of the throat culture as a price increase. In this case, the item description would make the change in service clear to the medical care analyst so that BLS could treat it as a different unique service. If the physician identifies the cost of the office visit with the throat culture for the previous month, a price change in the cost of the office visit with a throat culture can be reflected from the previous month.

Health insurance. As noted above, the CPI employs an indirect method to measure price change for health insurance.⁴² This indirect approach decomposes medical insurance into three parts:

- Changes in the prices of medical care items covered by health insurance policies;
- Changes in the cost of administering the policies; and
- Changes in the cost of maintaining reserves and, as appropriate, profits.

Most of the expenditure for health insurance goes for the first item—the part that reflects insurers' payments for medical treatment. The CPI program allocates this part of health insurance spending to the medical care indexes for those treatments in proportion to claims paid out for them.⁴³ The remaining weight for the other two parts of insurance is for the overhead of the insurers; this is all that remains in the unpublished CPI health insurance index. Note that it is only consumer-paid insurance that is in scope; out-of-scope or ineligible health insurance receipts include those from employers, Medicare Part A (funded through payroll taxes), Medicaid, TriCare (coverage for military families), and workers' compensation.

Price movement over time for the unpublished health insurance indexes in the CPI is determined by the movements of the other medical care strata, adjusted by changes in the retained-earnings ratio (see below). This process yields a measure of price change for insurance of constant coverage and utilization. That is, changes in benefit coverage and utilization levels generally are offset by compensating premium charges and thus do not significantly affect retention rates. Implicit in the process is the assumption that the level of service from the individual carriers is strictly a function of the benefits paid. Other changes in the amount of service provided for policyholders, such as more convenient claims handling, affect the movement of the index even though, strictly speaking, they should be removed; still, the effects are probably small.

Retained-earnings ratio. BLS obtains calendar year data for premium income, benefit payments, and retained earnings. For each year, the ratio of retained earnings to benefit payments is calculated, yielding a retained-earnings ratio. Next, the latest year's ratio is divided by the previous year's ratio to obtain the relative of change in the ratios. Finally, this annual relative of change is converted to a monthly relative (by taking its 12th root) so that the CPI can reflect the change month by month over the calendar year. Because it is not feasible to obtain the monthly change in price caused by changing retention margins, spreading the annual change evenly over the year is preferable to reflecting the entire annual change in 1 month.

⁴² For a full discussion of health insurance in the CPI, see Dennis Fixler, "The treatment of the price of health insurance in the CPI," Unpublished paper (Bureau of Labor Statistics, 1996).

⁴³ Ford and Ginsburg, "Medical Care in the CPI," p. 216.

Special pricing for other items

New vehicles. Prices for new cars and trucks selected for inclusion in the CPI pose a special problem because the manufacturer's suggested retail (sticker) price is not the transaction price for most new vehicles. Most automotive dealers offer customers concessions on the sticker price or, for models that are in high demand, the dealers charge an additional markup beyond the sticker price. When pricing new vehicles, BLS economic assistants obtain separately all of the components of the sticker price. This includes the base price and the prices for options, dealer preparation, transportation, and so forth. In addition, they obtain from the dealer the average rebate, concession, and/or markup during the preceding 30 days. This enables BLS to estimate the true transaction price.

Quality adjustment also is common in the calculation of the new vehicles index. The most frequently cited example of direct quality adjustment in the CPI deals with the annual model changeover for new cars and trucks. Each year, price adjustments are made to account for the quality differences between the old and the new models. In some cases, the adjustments are based on the previous model's retail price for optional equipment. In other cases, the quality adjustments must be derived from production cost data supplied by the manufacturers. These data are adjusted by estimated manufacturer and retailer markup rates to derive retail values for the quality changes.

Adjustments for quality change in the CPI new car index include structural and engineering changes that affect safety, reliability, performance, durability, economy, carrying capacity, maneuverability, comfort, and convenience. Since 1999, quality adjustments have not been made for changes associated with pollution control mandates.⁴⁴

The derivation of production-cost-based quality adjustments for new cars is carried out in association with the BLS Producer Price Index and International Price programs. The adjustments exclude changes in style or appearance, such as chrome trim, unless these features have been offered as options and purchased by customers. Also, new technology sometimes results in better quality at the same or reduced cost. Usually, no satisfactory value can be developed for such a change. In such cases, the quality change is ignored, and prices are compared directly.

In addition to quality adjustments for physical changes to cars and trucks, adjustments are made for changes in the warranty coverage provided by auto manufacturers when sufficient data are available to derive estimates of their values.

Vehicle leasing. The vehicle leasing index was first published in January 2002. The prices used in the index are monthly lease payments. As with new vehicles, the agreed-upon purchase price of the vehicle must be estimated. BLS

economic assistants collect the base price and the prices for options, dealer preparation, transportation, and so forth. Also, any rebate(s) available are included, along with the largest estimated concession or discount the dealer would allow for the leased vehicle on the day of pricing. Then, the lease terms are applied to obtain the residual value, depreciation amount, rent charge, and total monthly lease payment. During the annual model changeover, the quality adjustments developed for the CPI new car index also are used in the CPI vehicle leasing index.

Used cars and trucks. Models that are from 2 to 6 years old are priced in the used car and truck index. Data on used vehicle prices are obtained from a secondary source. Once a year, each sample vehicle is updated by 1 model year to maintain the same vehicle age. The sample prices are adjusted for quality change using the same information used for quality adjustment in the new vehicle index. This is done by figuring the percentage that the quality adjustments represent of the price of the vehicle when it was new. The quality adjustments are then assumed to depreciate at the same rate as the car as a whole.

Apparel. The special characteristics of apparel marketing have historically caused a number of problems in the maintenance of a constant-quality market basket of apparel in the CPI. Many apparel items are seasonal and subject to frequent style changes. In addition, heated competition in the marketing of apparel commodities has led to increasingly rapid turnover of styles available in retail outlets. Until recently, these factors meant that, when new styles replaced old ones, many substitutions were deemed not comparable. Marketing practices for apparel generally entail introducing such goods at high regular prices and marking them down to lower sale prices throughout their shelf life. The inability to compare prices at the time the new goods are introduced (when price changes are normally passed along to the consumer) precludes capturing any pure price change that accompanies the style changes. As a result, during the early to mid-1980s, it is likely that apparel indexes understated price change.

Research undertaken to correct this problem delineates the critical apparel quality characteristics to hold constant in the substitution process. When an outlet discontinues an apparel item, the BLS field representative follows the CPI substitution procedures to find the closest substitute that the outlet offers for sale. The procedure ensures that as many as possible of the critical quality characteristics of the substitute are the same as those of the discontinued item. For those characteristics that are not the same, CPI apparel experts estimate the value of the difference and directly adjust the price to account for them.

Hedonic regression modeling is the technique used to determine the importance of the various quality characteristics that add value to a particular good. In this approach, an item can be viewed as a collection of characteristics that,

⁴⁴ See Bureau of Labor Statistics, "Treatment of Mandated Pollution Control Measures in the CPI," at www.bls.gov/cpi/cpitreat.htm.

taken together, provide satisfaction or value to the consumer. In other words, a woman's suit can be considered an aggregation of its components, such as a jacket and skirt or pants, each of which contributes to the value of the suit in the eyes of the consumer. In addition, certain aspects of the suit, such as its fiber content and its construction, add or subtract value from the consumer's standpoint. Hedonic regression modeling is a tool that allows the researcher to estimate which factors are the most important price-determining characteristics of these goods. In the CPI, this research has resulted in better data collection documents and procedures for pricing apparel commodities. By noting the most important quality characteristics on the data collection document, the field agents who collect data for the CPI can try to hold constant these important characteristics even when other details change. This improvement in the collection documents has resulted in a remarkable increase in the number of comparable substitutions chosen for apparel commodities.

As additional research led to further improvements in the modeling process, steps were taken to further reduce the number of substitute items deemed not comparable with the old items. Tests on the data collected for apparel goods determined that direct quality adjustments could be made using the estimates of the values of the different components of the apparel items. If, for example, a two-piece man's suit that had been priced is no longer available because three-piece-style suits replaced all the two-piece suits, the value of the vest can be added to the price of the old two-piece suit and the quality-adjusted price of the old suit compared directly with the price of the new three-piece suit. Alternatively, if fiber percentages vary between two items, quality adjustment can account for the quality difference to permit comparison of the prices of the two goods. Other differences that have been shown to be statistically significant also can be factored out to permit constant-quality price comparisons of apparel items. This critical change allows another incremental step forward in decreasing the number of substitutions that cannot be compared because of differences in quality characteristics. While this change has its greatest impact in apparel, because apparel had been plagued with low comparability rates, this same research is underway in other areas of the CPI, so that marginal improvements in comparability in other areas can be expected in the next few years.

The hedonic approach to quality adjustment used for apparel is in contrast to the approach used for new cars, which is based on manufacturers' costs. While estimates of the value of the quality change for new cars are based on the manufacturers' cost differentials adjusted for retail markups, the quality adjustments in apparel are based on the average consumer's valuation of the change as well as on the manufacturers' costs to produce the goods. This valuation is what the hedonic modeling technique—based on the prices paid by consumers for the goods for which the CPI collects prices—implicitly estimates. As this research continues, BLS expects to make further improvements in the quality adjustment process.

Utility (piped) gas service. To measure a constant consumption amount for the CPI's utility (piped) gas service index, the data collector initiates a fixed level of energy or heat consumption for each observation. The fixed consumption amount is selected in Washington, based on household bill expenditure data as reported in the CE. Subsequently, when the observation is priced each month, field staff collects the cost of that fixed amount. This amount is defined as a fixed number of therms (a therm is 100,000 British Thermal Units, or BTUs). When the surveyed outlet delivers and bills its residential customers by the number of therms consumed, the CPI uses the current price per therm to determine the prices of that outlet's observations. But, when piped gas is delivered and billed by volume (for example, cubic feet), the CPI program must adjust each quote to account for the fact that the volume of gas needed to produce a constant amount of energy or BTUs varies depending on the quality of gas (BTUs/CF). In this case, the amount of gas priced each month is adjusted based on the heat value of gas delivered by the outlet, as follows:

$$\text{Current adjusted consumption} = \text{original consumption} * \frac{\text{original heat value}}{\text{current heat value}}$$

This adjustment ensures that a constant amount of energy is being priced from month to month for the utility (piped) gas service index.

Special pricing for seasonal items

Seasonal items are those commodities and services that are available only at certain times of the year rather than year round. Down parkas, snow skis, and fresh tangelos are examples of seasonal items. Special procedures are employed when selecting and pricing items generally available only part of the year to ensure that they are appropriately represented in the sample and that price changes are correctly included in the calculation of the CPI. In particular, the procedures prevent substituting away from a seasonal item when it is out of season.

Although seasonal items can exist in any ELI, some ELIs include an especially large percentage of such items and, consequently, receive special treatment. These seasonal ELIs include most apparel items, fresh fruit, indoor plants and cut flowers, fans and air-conditioners, some sports and recreational equipment, and admission to sporting events. The designation of an ELI as seasonal or nonseasonal is made at the regional level, using the four geographic census regions in the CPI design. Some items that exhibit a seasonal selling pattern in the Northeast region, for example, may be sold year round in the South. In practice, though, nearly all ELIs designated seasonal are seasonal in all four regions.

After the samples for these seasonal ELIs are selected following the normal sample selection procedures, the number of quotes is doubled to ensure that, despite the seasonal disappearance of a substantial number of quotes, a large enough number of in-season quotes remains to calculate the index.

The quotes in these ELIs are paired; that is, for each original quote that is selected, a second quote in the same ELI and outlet is initiated and priced 6 months later. In the fresh fruit ELIs, one quote of each pair is designated January-June, and the other quote is designated July-December. In all other seasonal ELIs, one quote of each pair is designated fall/winter, and one quote is designated spring/summer. The fall/winter and spring/summer designations are used for the nonfood quotes because these are the distinctions that are most commonly used by the retailing industry to categorize seasonal merchandise. These seasonal designations are used to help establish the specific items eligible for each quote, so that year-round items and items from each season are initiated in their proper proportions.

For every specific commodity and service priced in the CPI, including year-round items, BLS field representatives collect—at the time when they initiate the item and every time they must find a substitute for it—its in-season months. These data become a part of the item description and are updated if there is a change. Field representatives attempt to price every item in each period during which it is designated for collection, even during those months when the item may be out of its indicated season. If the item is available, the price is collected and used in the calculation of the CPI. A common practice in marketing seasonal items, particularly seasonal clothing, is to mark down prices to clear the merchandise from the stores as the end of each season approaches. During the period when a seasonal item is unavailable, its price is imputed following standard imputation procedures. When an item returns at the beginning of its season several months later, the price is directly compared with the item's last price, as it has been imputed forward. This completes the circle in a sense: having followed the price of the item down to clearance price levels, BLS then follows the price back up to regular (or at least higher) prices the following season. Keep in mind that, in this context, the “following” season means the same season the next year, that is, the following fall/winter season for the fall/winter sample, and the following spring/summer season for the spring/summer sample.

When an item becomes permanently unavailable, the standard procedure is to substitute the most similar item sold in the outlet. In the case of a year-round item not in a seasonal ELI, this process takes place as soon as the item is permanently unavailable. For items in seasonal ELIs and seasonal items in ELIs that are not designated seasonal, however, the period during which a substitution can take place is restricted to those months when a full selection of appropriate seasonal merchandise is available.

These special initiation, pricing, and substitution procedures are intended to ensure that an adequate sample of items is available every month, and that the correct balance of seasonal and year-round items is maintained. As a result, the estimates of price movement for the ELIs that include seasonal items correctly reflect price changes not just for items available year round but for the entire universe of items included in those ELIs.

Other price adjustments and procedures

Bonus merchandise adjustments. Sometimes, products are offered with free merchandise included with the purchase of the original item. Such “bonus” items may provide additional satisfaction to consumers, and BLS will, therefore, make adjustments to the purchase price to take into consideration the value of the bonus merchandise. The adjustment made depends on the type of merchandise offered and the perceived value of the bonus to the consumer. If the bonus merchandise consists of more of the same item, the adjustment is reflected in the price of the item. For example, if a manufacturer offers 2 ounces of toothpaste “free with the purchase of the regular 6-ounce tube,” the item's price is adjusted to reflect a decrease in the price per ounce. When the bonus is removed, the price per ounce returns to its prior level, and a price increase is recorded. In this instance, the value to the consumer is assumed to be one-third greater during the bonus period. If the bonus merchandise consists of an item that has some significant value to the consumer, and the item is of a different genre, an adjustment is made to account for the value of the free item when it is feasible to do so. Bonuses that are contingent on an additional unrelated purchase, such as a free can of soup when purchasing a whole chicken from the poultry case, are ignored.

Cents-off coupons. In order for a coupon to be used to reduce the reported price of an item, the coupon must be either attached to the item, attached to the product's display shelf, dispensed by machines attached to the product's display shelf, located at promotional displays, or distributed to all shoppers by product representatives standing in the immediate vicinity of the display shelf. All other coupons presented by customers as purchase reductions at the time of payment are ineligible.

Concessions. A concession is a deduction of a specific amount from the proposed selling price for the item. The usual CPI practice is to subtract from the proposed selling price the average concession for the priced item over the past 30 days.

Different-day pricing. For a subset of items, if the selected priced item is not available for sale at the time of collection, prices from up to 7 days prior to the actual day of collection are eligible. The item must have been offered for sale during the previous 7 days and the most recently available price is reported. The list of items eligible generally are those for which specific items may not be available every day, such as a specific type of fresh fish.

Discounts. A discount price is a reduced price that is available only to certain customers in a specific outlet. If the discount is available only during the period of price collection, such as that for a grocery-card discounted item, the discount is included only if 50 percent or more of sales for

the affected item are discounted. If the discount is in effect for more than one collection period and the discount applies to 5 percent or more of the dollar sales of the item in the outlet, a probability selection is made to determine if the discount should be collected. For example, if the regular cash price accounts for 84 percent of sales, senior citizens' discounts account for 10 percent and employee discounts account for 6 percent of sales, a one-time probability-based selection is made among the three options to determine which price to report.

Manufacturers' rebates. When product manufacturers offer customers cash rebates at the time of purchase for purchases of items priced in the CPI, these rebates are reflected in the index as price reductions. When a rebate is offered for a priced new vehicle, it is the estimated average rebate over the past 30 days that is subtracted from the vehicle's reported price. For vehicle leasing, it is the rebate in effect as of the day the collected price is obtained. For mail-in rebate offers, the price of the affected item is reported without subtracting the amount of the rebate. An attempt is made to determine the proportion of customers who take advantage of the rebate, and, prior to use in the index, the reported price is then adjusted accordingly.

Membership retail outlets. Outlets that require a membership fee to be paid in order to be able to shop at the outlet are eligible for pricing in the CPI. If the actual price paid for products varies with the level of membership, a specific membership is selected and the reported prices reflect that membership level.

Quantity discounts. Many items in the CPI are sold both individually and in quantity. When consumers are able to purchase an amount greater than a single unit at a discounted price, the first multiple-unit price is reported for use in the CPI. For example, if the 12-ounce can of corn being priced can be purchased at 25 cents for a single can, three cans for 69 cents, or five cans for \$1, the price used in the CPI is the per ounce price of the three cans.

Shoppers' cards. If a priced outlet issues a card offering a "card discount" on selected products purchased by cardholders, such discounts are treated as "temporary discounts" and processed as follows. The discount is included only if 50 percent or more of sales for the affected item during the collection period are subject to the card discount.

Special-day prices. If a selected outlet has different prices for priced items based on the day of the week when a purchase is made, a selection is made between special-day and regular-day purchases, based on revenue. If the "special day" is selected, the price collected is for the most recent special-day price.

Utility refunds. Sometimes, public utility commissions require that utilities such as telephone, piped gas, or electricity

companies make rebates to their customers. These rebates may arise from a number of different causes. For example, a utility may be permitted to use a new rate schedule temporarily until a final determination is made. If the final rates set by the commission are lower than the temporary ones, the difference must be refunded for consumption during the period. Such refunds do not reflect the actual current-period prices (what new customers would pay) for utility services. Thus, the CPI disregards any refund for past excess charges when they appear on residential bills as a separate refund credit that is subtracted from charges for the current billing period's usage. This procedure reduces month-to-month volatility of utility indexes and ensures that they reflect current prices and price trends more accurately. The utility indexes do include current-period credits that are based on current consumption, such as purchased gas adjustment and fuel adjustments.

Unit-priced food items. When food items that are sold on a unit basis but lack a labeled weight are being priced, two items are weighed to permit calculation of an average weight for the item. This helps to reduce the variability in size that occurs among individual, loose items and is not overly burdensome for the data collection process. For example, if the item being priced is Red Delicious apples and the price is 50 cents each, the BLS field staff reports the price of one apple and the combined weight of two apples taken from the produce rack. In computing the price per ounce, the combined weight is divided by 2 and the 50-cent price of the Red Delicious apple is divided by this average weight.

Container deposits. BLS collects information on container deposits for a variety of nonalcoholic and alcoholic beverages to reflect the influence of changes in deposit legislation on price change. Consumers who purchase throw-away containers are considered to be purchasing both the product itself and the convenience of throwing the container away. When a local jurisdiction enacts deposit legislation and no longer allows stores to sell throwaway containers, those consumers who were previously purchasing throwaway containers may experience a change in the price of this convenience. The price of the same-sized container of product plus its deposit establishes an upper bound for the price change, because the consumer could retain the former convenience by now purchasing returnables and simply throwing them away. In similar fashion, information about deposits and the status of legislation can be used to estimate price change when a container bill is repealed. Changes due to the enactment or repeal of container bills are shown in data for the month in which the legislation becomes effective.

Sales taxes. The CPI includes all applicable taxes paid by consumers for services and products purchased. Many prices for services and products used to calculate the CPI are collected with taxes included because this is the manner in which they are sold. Examples are tires and cigarettes. Other prices are collected excluding applicable taxes, with those taxes

subsequently added in the Washington office. The tax rates for these items are determined from secondary sources based on the State, county, and local tax structure governing the sale of the service or product at the point of purchase.

Index Calculation

As stated earlier, the CPI is actually calculated in two stages. The sections above describe the first stage of that calculation—how the CPI calculates the *basic* or *elementary indexes*, which show the average price change of the items in each of the 8,018 CPI item-area combinations.

The section below describes the second stage of calculation—how the *aggregate indexes* are produced by averaging *across* the 8,018 CPI item-area combinations.

Estimation of upper-level price change

Aggregation of elementary CPI data into published indexes requires three ingredients: Elementary indexes, elementary expenditures to use as aggregation weights, and a price index number formula that uses the expenditures to aggregate the sample of elementary indexes into a published index.

1. Input elementary price indexes. The CPI-U, CPI-W, and all three versions of the C-CPI-U (initial, interim, and final) are constructed using the same combination of Laspeyres and geometric mean elementary indexes. There is one exception to this general rule. The final version of the C-CPI-U contains a slightly different method of imputing off-cycle elementary index values for elementary item-area combinations priced on a bimonthly schedule. In the CPI-U, CPI-W, and the initial and interim versions of the C-CPI-U, off-cycle bimonthly elementary indexes are set equal to the previous-month index value. In contrast, off-cycle indexes used in final C-CPI-U aggregation are set equal to the geometric mean of the indexes for the adjacent months (see equation below).

2. Input elementary expenditure weights. To aggregate elementary indexes into published indexes, an aggregation

weight for each elementary item-area combination is required. The function of the aggregation weight is to assign each elementary index a relative importance or contribution in the resulting aggregate index. (See appendix 9.) The aggregation weight corresponds to consumer tastes and preferences and resulting expenditure choices among the 211 elementary items in the 38 elementary areas comprising the CPI sample, for a specified time period.

a. CPI-U and CPI-W. In the CPI-U and CPI-W, aggregation weights (AW) are defined as:

$${}_{i,a,p}AW_{\beta} = \frac{{}_{i,a,p}\widehat{P}_{\alpha}\widehat{Q}_{\beta}}{100}$$

where ${}_{i,a,p}\widehat{P}_{\alpha}$ is the estimated price of item (*i*) purchased in area (*a*) by population (*p*) in period (α), and ${}_{i,a,p}\widehat{Q}_{\beta}$ is the estimated quantity of item (*i*) purchased in area (*a*) by population (*p*) in period (β). Period (α) is the base period of the corresponding elementary item-area index. For example, the “Sports equipment” (ITEM = RC02) in Seattle (AREA = A423) index has a base period of α = June 1985. CPI elementary indexes have varying base periods. Most published indexes have an index base period of α = 1982-84.

Time period (β) corresponds to the reference period of the expenditures used to derive the implicit quantity weights needed for Laspeyres aggregation. As of 2005, the CPI-U and CPI-W had an expenditure reference period of β = 2001-02. Historically, the CPI expenditure reference period has been updated approximately every 10 years (table 5). In 2002, BLS instituted a biennial rotation schedule for updating the expenditure reference period. Effective with the January 2004 index, the expenditure reference period changed from β = 1999-2000 to β = 2001-02; effective with the January 2006 index, it was updated again to 2003-04; and so forth. It is worth noting that a change in the expenditure reference period results in a change in the implicit quantity (*Q*) assigned to each elementary index, but not the implicit price component (*P*) of the aggregation weight (*AW*) of each elementary index.

Imputation of Off-Cycle Indexes, C-CPI-U estimation

$${}_{i,a,p}IX_{[\alpha,t]} = \left({}_{i,a,p}IX_{[\alpha,t-1]} * {}_{i,a,p}IX_{[\alpha,t+1]} \right)^{1/2}$$

where

p = population (Note: C-CPI-U is produced for the urban population only.)

a = CPI elementary area

i = CPI elementary item

t = year and month

α = base-period reference month

${}_{i,a}IX_{[0;t]}$ = index of price change for elementary item (*i*) in area (*a*) from base period (0) to month (*t*)

TABLE 5. Expenditure reference periods in the CPI

Expenditure reference period	Month introduced	Terminal month
1917-19	1919	Dec. 1924
Avg. 1917-19 and 1934-36	Jan. 1925	Dec. 1929
1934-36	Jan. 1930	Dec. 1949
1947-49	Jan. 1950	Dec. 1952
1950	Jan. 1953	Dec. 1963
1960-61	Jan. 1964	Dec. 1977
1972-73	Jan. 1978	Dec. 1986
1982-84	Jan. 1987	Dec. 1997
1993-95	Jan. 1998	Dec. 2001
1999-2000	Jan. 2002	Dec. 2003
2001-02	Jan. 2004	Dec. 2005
2003-04	Jan. 2006	Dec. 2007

Note that, prior to January 1953, previously published indexes often were revised retroactively based on more recent consumer expenditure data.

Aggregation weights for the CPI-U and CPI-W are derived from estimates of household expenditures collected in the CE. Despite an increase in the CE sample size in 1999, expenditure estimates at the elementary item-area level would be unreliable due to sampling error without the use of statistical smoothing procedures. BLS uses two basic techniques to minimize the variance associated with each elementary item-area base-period expenditure estimate. First, data are pooled over an extended period in order to build the expenditure estimates on an adequate sample size. The current reference period (β) uses 24 months of data.⁴⁵ Second, elementary item-area expenditures are averaged, or composite estimated, with item-regional expenditures.⁴⁶ This has the effect of lowering the variance of each elementary item-area expenditure at the cost of biasing it toward the expenditure patterns observed in the larger geographical area. This process is summarized in the following equations.

The estimated expenditure ${}_{i,a,p}(\hat{P}\hat{Q})_{\beta}$ for item (i) in area (a) for population (p) in reference period (β) is derived from a weighted average of the item's relative importance in the elementary area (a) and its relative importance in its corresponding region-size classification (m), for each year encompassing reference period (β). The weight (δ) assigned to the region-size class (m) and the weight ($1-\delta$) assigned to the elementary area (a) are a function of the variance in each area and the covariance of each measure.⁴⁷ The resulting average share (\hat{s}) is then multiplied by the sum of all expenditures in the elementary area in the corresponding year, to obtain a revised item expenditure. In a process called "rak-

ing," the revised item expenditures are adjusted by a factor such that, once summed, they equal the unadjusted expenditures at the region-size class (m) expenditure class (e) level. Annual item-area expenditures (β_n) have a lower bound of one cent (\$0.01). The raked item expenditures in each year of reference period (β) are then averaged to obtain the estimated expenditure in (β). Finally, the estimated expenditure is adjusted by the corresponding item-area index to obtain the aggregation weight: an expenditure value with an implicit price of time period (α) and implicit quantity of time period (β).

b. Initial C-CPI-U and interim C-CPI-U. Because the initial version of the C-CPI-U is published simultaneously with the CPI-U, it uses expenditure data from the same expenditure reference period (β) as the CPI-U aggregation weights. Unlike those in the CPI-U, however, the expenditures are not adjusted forward to a December pivot month and rebased so that the implicit price corresponds to the corresponding item-area index base period. Rather, the estimated expenditure weights with implicit prices of time period (β) and implicit quantities of time period (β) are used as aggregation weights.

The interim version of each monthly C-CPI-U index is published in February of the ensuing year. Hence, if the ensuing year is one in which the weight is updated, then the interim version of each monthly C-CPI-U is based on more contemporaneous expenditures than its initial version. For example, 2002 initial indexes produced in 2002 used $\beta = 1999-2000$. Interim indexes for 2002 were produced in 2003 and likewise used $\beta = 1999-2000$. Initial indexes for 2003 also used $\beta = 1999-2000$. However, 2003 interim indexes produced in 2004—a weight-update year—were constructed using $\beta = 2001-02$.

c. Final C-CPI-U. For the final C-CPI-U, which uses the Tornqvist index for upper-level aggregation in a monthly chained construct, monthly expenditure estimates for each elementary item-area combination are required as aggregation weights. These are derived from the same CE data as the CPI-U aggregation weights. Like the biennial data used for CPI-U aggregation, adequacy of the underlying sample size from which the expenditure weights are estimated is an issue for C-CPI-U aggregation. To minimize the variance of the elementary item-area monthly expenditures, a ratio-allocation procedure is adopted to estimate each item-area monthly

⁴⁵ Prior to 2002, the expenditure reference period was based on 36 months of data (for example, $\beta=1993-95$ from 1998 to 2001 and $\beta=1982-84$ from 1987 to 1997).

⁴⁶ Elementary areas are grouped into region-by-city-size classifications for the purpose of composite estimation. There are four regions (Northeast, Midwest, South, and West) and two city-size classifica-

tions (A-sized cities and non-A-sized cities) for a total of eight region-by-city-size classifications.

⁴⁷ For more information on composite estimation, see Michael P. Cohen and John P. Sommers, "Evaluation of the Methods of Composite Estimation of Cost Weights for the CPI," *1984 Proceedings of the American Statistical Association*, Business and Economic Statistics Section, pp. 466-71.

Estimation of CPI-U Elementary Aggregation Weights

Expenditure on item (i) in area (a) by population (p) in year (β_n)

$${}_{i,a,p}(PQ)_{\beta_n}$$

Total expenditures in area (a) by population (p) in year (β_n)

$$\sum_{i,a \in a,p}^i {}_{i,a,p}(PQ)_{\beta_n}$$

Share of total expenditures for item (i) in area (a) for population (p) in year (β_n)

$${}_{i,a,p}S_{\beta_n} = \frac{{}_{i,a,p}(PQ)_{\beta_n}}{\sum_{i,a \in a,p}^i {}_{i,a,p}(PQ)_{\beta_n}}$$

Expenditure on item (i) in major area (m) by population (p) in year (β_n)

$${}_{i,m,p}(PQ)_{\beta_n} = \sum_{i,a \in m,p}^{i,a} {}_{i,a,p}(PQ)_{\beta_n}$$

Total expenditures in major area (m) by population (p) in year (β_n)

$$\sum_{i,m \in m,p}^i {}_{i,m,p}(PQ)_{\beta_n}$$

Share of total expenditures for item (i) in area (m) for population (p) in year (β_n)

$${}_{i,m,p}S_{\beta_n} = \frac{{}_{i,m,p}(PQ)_{\beta_n}}{\sum_{i,m \in m,p}^i {}_{i,m,p}(PQ)_{\beta_n}}$$

Composite-estimated share of total expenditures for item (i) in area (a) for population (p) in year (β_n)

$${}_{i,a,p}\hat{S}_{\beta_n} = \delta({}_{i,m,p}S_{\beta_n}) + (1 - \delta)({}_{i,a,p}S_{\beta_n})$$

Estimated expenditure on item (i) in area (a) by population (p) in year (β_n)

$${}_{i,a,p}(\tilde{P}\tilde{Q})_{\beta_n} = \left(\sum_{i,a \in a,p}^i {}_{i,a,p}(PQ)_{\beta_n} \right) * {}_{i,a,p}\hat{S}_{\beta_n}$$

Raked expenditure on item (i) in area (a) by population (p) in year (β_n)

$${}_{i,a,p}(\hat{P}\hat{Q})_{\beta_n} = {}_{i,a,p}(\tilde{P}\tilde{Q})_{\beta_n} * \frac{\sum_{i,a \in e,m}^{i,a} {}_{i,a,p}(PQ)_{\beta_n}}{\sum_{i,a \in e,m}^i {}_{i,a,p}(\tilde{P}\tilde{Q})_{\beta_n}}$$

Estimated expenditure in expenditure reference period (β)

$${}_{i,a,p}(\hat{P}\hat{Q})_{\beta} = \frac{1}{N} \left(\sum_{n=1}^N {}_{i,a,p}(\hat{P}\hat{Q})_{\beta_n} \right)$$

Cost weight in pivot month (v)

$${}_{i,a,p}(\hat{P}_v\hat{Q}_\beta) = {}_{i,a,p}(\hat{P}\hat{Q})_{\beta} * \left(\frac{{}_{i,a,p}IX_{\alpha,v}}{{}_{i,a,p}IX_{\alpha,\beta}} \right)$$

Aggregation weight

$${}_{i,a,p}(\hat{P}_\alpha\hat{Q}_\beta) = \frac{{}_{i,a,p}(\hat{P}_v\hat{Q}_\beta)}{{}_{i,a,p}IX_{\alpha,v}}$$

where

- p = population (urban or urban wage earner)
- a = CPI elementary area
- i = CPI elementary item
- e = expenditure class
- m = One of eight CPI major areas, defined by region-and-city-size classification. Regions are Northeast, Midwest, South, and West; city-size types are self-representing and non-self-representing.
- P = price
- Q = quantity
- N = number of years in the CPI-U expenditure reference period (NOTE: currently $N=2$.)
- β_n = year belonging to expenditure reference period β (NOTE: $n=1$ is 1999 and $n=2$ is 2000 in the current CPI-U expenditure reference period.)
- δ = weight assigned to major area (m), where $0 \leq \delta \leq 1$
- α = lower-level index base period
- v = year and month, usually December, prior to the month when expenditure weights from reference period β are first used in the CPI
- ${}_{i,a,p}S_{\beta_n}$ = estimated expenditures (PQ) for item (i) in area (a) for population (p) as a percent of total CPI expenditures in area (a) in period β_n
- ${}_{i,a}IX_{\alpha,\beta}$ = lower-level index of price change from index base period (α) to expenditure reference period (β) for item (i) in area (a)
- ${}_{i,a}IX_{\alpha,v}$ = lower-level index of price change from index base period (α) to pivot-month (v) for item (i) in area (a)

expenditure from U.S. monthly item expenditures (see equation below).

The monthly expenditure for an item in an elementary area is derived in two steps: First, the monthly expenditure for the item is summed across all 38 areas to obtain a U.S. monthly item expenditure; second, the U.S. monthly item expenditure is allocated among all 38 elementary areas according to each area's relative expenditure share for the item during the current and preceding 11 months. Note that ${}_{i,A}(PQ)_t = {}_{i,A}(\hat{P}\hat{Q})_t$.

The estimated monthly item-area expenditures have a lower bound of 1/12th of a penny (\$0.000833), and when summed over the calendar year, they have a lower bound

(\$01) equivalent to that of the annual data in the CPI-U expenditure reference period data.

3. Aggregation formula. The Laspeyres price index is used to aggregate elementary indexes into published CPI-U and CPI-W indexes. The Laspeyres index uses estimated quantities from the predetermined expenditure reference period (β) to weight each elementary item-area index. These quantity weights remain fixed for a 2-year period, and then are replaced each January in each even year when the aggregation weights are updated. In a Laspeyres aggregation, consumer substitution between items is assumed to be zero. The aggregate index for any given month is computed as a

Estimation of monthly expenditures at the elementary level

Estimated monthly expenditures

$${}_{i,a,p}(\hat{P}\hat{Q})_t = \sum_{i,a \in i,A} {}_{i,a,p}(PQ)_t * \left(\frac{\sum_{t \in T} \sum_{i,a,p} (PQ)_t}{\sum_{i,a \in A} \sum_{t \in T} (PQ)_t} \right)$$

where

- p = population (NOTE: C-CPI-U is produced for the urban population only.)
- a = CPI elementary area
- i = CPI elementary item
- A = all CPI elementary areas ("U.S. city average")
- P = price
- Q = quantity
- t = month
- T = time period covering month (t) and 11 months prior to month (t)

quantity-weighted average of the current month index divided by the index value in the index base period. (See the equation for long-term price change below.) Month-to-month price change is then calculated as a ratio of the long-term monthly indexes (see equation below).

In contrast, the C-CPI-U is built by chaining together indexes of one-month price changes. For the final C-CPI-U index, each monthly index is computed using the Tornqvist formula with monthly weights from both the current and the previous month. Consumer substitution behavior is not assumed by the Tornqvist formula; rather, it is implicitly accounted for by use of current- and base-month expenditures. An index of 1-month price change is calculated and then multiplied by the index value for the previous month to obtain the current-month index value. See the equations on the following page.

For the initial and interim C-CPI-U indexes, the geometric mean index formula is used first to calculate a month-to-month index of price change. This monthly index is then multiplied by an adjustment factor (λ) that represents the historically observed difference between Tornqvist and geometric mean upper-level aggregation of CPI elementary indexes.⁴⁸ (See equations below.) The function of the adjust-

ment factor is to more closely align the geometric mean month-to-month index, computed with lagged expenditure weights for the base period (β), to a Tornqvist month-to-month index, computed with contemporaneous monthly expenditures ($t-1$ and t).

Finally, the adjusted geometric mean month-to-month index is multiplied by the previous-month C-CPI-U index value to obtain the current-month C-CPI-U index value. (Equations are shown on the following page.) Note that each interim month-to-month index is chained onto an interim long-term index value, with the exception of the January index, which is chained onto the previous year December index, which is in final C-CPI-U form. Each initial month-to-month index is chained onto an initial long-term index value, with the exception of the January index, which is chained onto the previous year's December index, which is in interim C-CPI-U form.

⁴⁸ The set of data available to compute the adjustment factor is limited to all periods for which the final C-CPI-U has been computed. In 2004, for example, final C-CPI-U indexes were available only for the 36 months of 2000-2002. Because of a lack of sufficient time-series data, the adjustment factor to date for initial and interim C-CPI-U indexes has been set equal to $\lambda = 1$. As additional data become available, the optimal value of λ will be evaluated, and its value will be subject to change periodically.

CPI-U and CPI-W upper-level aggregation formula

Long-term price change

$$I_{I,A,p} IX_{[z;t]}^L = I_{I,A,p} IX_{[z;v]}^L * \frac{\sum_{i,a \in I,A} i_{i,a,p} AW_{\beta} * i_{i,a,p} IX_{[\alpha;t]}^{LorG}}{\sum_{i,a \in I,A} i_{i,a,p} AW_{\beta} * i_{i,a,p} IX_{[\alpha;v]}^{LorG}}$$

Month-to-month price change

$$I_{I,A,p} IX_{[t-1;t]}^L = \frac{I_{I,A,p} IX_{[z;t]}^L}{I_{I,A,p} IX_{[z;t-1]}^L}$$

where

- A = all elementary areas ("U.S. city average")
- a = CPI elementary area
- p = population (the C-CPI-U is calculated for the U-population only.)
- i = CPI elementary item
- I = all elementary items ("all-items")
- t = month
- z = base period of the aggregate index (NOTE: the U.S. city average—all-items CPI-U index has a base period of $z=1982-84$.)
- α = base period of the elementary index (i) in area (a)
- v = year and month, usually December, prior to the month when expenditure weights from reference period (β) are first used in the CPI
- $i_{i,a,p} IX_{[\alpha;t]}$ = lower-level index of price change from period (α) to month (t) for item (i) in area (a)
- $i_{i,a,p} IX_{[\alpha;v]}$ = lower-level index of price change from period (α) to pivot-month (v) for item (i) in area (a)
- $i_{i,a,p} AW_{\beta}$ = aggregation weight from reference period (β) for item (i) in area (a)
- $I_{I,A,p} IX_{[z;v]}^L$ = aggregate-level CPI-U index of price change from period (z) to pivot-month (v) for aggregate item (I) in aggregate area (A) for population (p)

Final C-CPI-U upper-level aggregation formula

Long-term price change

$$I,A,p IX_{[z;t]}^T = I,A,p IX_{[z;t-1]}^T * I,A,p IX_{[t-1;t]}^T$$

Month-to-month price change

$$I,A,p IX_{[t-1;t]}^T = \prod_{i,a \in I,A} \left(\frac{i,a IX_{[\alpha;t]}^{LorG}}{i,a IX_{[\alpha;t-1]}^{LorG}} \right)^{\frac{i,a,p S_{t-1} + i,a,p S_t}{2}}$$

where

p	=	population (Note: the C-CPI-U is calculated for the urban consumer population only.)
a	=	CPI elementary area
A	=	aggregate area
i	=	CPI elementary item
I	=	aggregate item
z	=	base period of the aggregate index (NOTE: the U.S. city average—all-items C-CPI-U index has a base period of z=December 1999.)
α	=	base period of the elementary index (i) in area (a)
t	=	month
$i,a IX_{[\alpha;t]}$	=	lower-level index of price change from period (α) to month (t) for item (i) in area (a)
$i,a IX_{[\alpha;t-1]}$	=	lower-level index of price change from period (α) to month ($t-1$) for item (i) in area (a)
$i,a S_t$	=	expenditure in month (t) for item (i) in area (a) as percent of total expenditures in month (t) for aggregate item (I) in aggregate area (A)
$i,a S_{t-1}$	=	expenditure in month ($t-1$) for item (i) in area (a) as percent of total expenditures in month ($t-1$) for aggregate item (I) in aggregate area (A)
$I,A IX_{[z;t]}^T$	=	aggregate-level C-CPI-U Tornqvst index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A)

Initial and interim C-CPI-U upper-level aggregation formula

Initial C-CPI-U

Long-term price change

$$I,A,p IX_{[z;y,t]}^{Gi} = I,A,p IX_{[z;y-1,12]}^{Gr} * \prod_{n=1}^t I,A,p IX_{[y,n-1;y,n]}^{Gi}$$

Interim C-CPI-U

Long-term price change

$$I,A,p IX_{[z;y,t]}^{Gr} = I,A,p IX_{[z;y-1,12]}^T * \prod_{n=1}^t I,A,p IX_{[y,n-1;y,n]}^{Gr}$$

Initial C-CPI-U

Month-to-month price change

$$I,A,p IX_{[t-1;t]}^{Gi} = \lambda \prod_{i,a \in I,A} \left(\frac{i,a IX_{[\alpha;t]}^{LorG}}{i,a IX_{[\alpha;t-1]}^{LorG}} \right)^{i,a,p S_\beta}$$

Interim C-CPI-U

Month-to-month price change

$$I,A,p IX_{[t-1;t]}^{Gr} = \lambda \prod_{i,a \in I,A} \left(\frac{i,a IX_{[\alpha;t]}^{LorG}}{i,a IX_{[\alpha;t-1]}^{LorG}} \right)^{i,a,p S_\beta}$$

where

p	=	population (Note: the C-CPI-U is calculated for the urban consumer population only.)
a	=	CPI elementary area
A	=	all elementary areas ("U.S. city average")
i	=	CPI elementary item
I	=	all elementary items ("all-items")
t	=	month
y	=	year
λ	=	adjustment factor (Note: $\lambda = 1$.)
z	=	base period of the aggregate index (NOTE: the All-Items, U.S. City Average C-CPI-U index has a base-period of z=December 1999.)
α	=	base period of the elementary index (i) in area (a)
$i,a IX_{[\alpha;t]}$	=	lower-level index of price change from period (α) to month (t) for item (i) in area (a)
$i,a IX_{[\alpha;t-1]}$	=	lower-level index of price change from period (α) to month ($t-1$) for item (i) in area (a)
$i,a S_\beta$	=	expenditure in reference period (β) for item (i) in area (a) as percent of total expenditures in reference period (β) for aggregate item (I) in aggregate area (A)
$IX_{[z;t]}^T$	=	aggregate-level C-CPI-U Tornqvst index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A)
$I,A,p IX_{[z;y-1,12]}^{Gr}$	=	aggregate-level C-CPI-U interim index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A) (Gr= geometric mean, interim indexes; Gi=geometric mean, initial indexes.)

Calculation of seasonally adjusted indexes

Seasonal adjustment. Seasonal adjustment removes the estimated effect of changes that normally occur at the same time every year (such as price movements resulting from changing climatic conditions, production cycles, model changeovers, holidays, sales, etc.). CPI series are selected for seasonal adjustment if they pass certain statistical criteria and if there is an economic rationale for the observed seasonality. Seasonal factors used in computing the seasonally adjusted indexes are derived using X-12-ARIMA seasonal adjustment software. X-12-ARIMA, developed by the Census Bureau, is an extension of the X-11 variant of the Census Method II Seasonal Adjustment methodology, which allows the use of regression-ARIMA models for more sophisticated time-series analysis. In some cases, intervention analysis seasonal adjustment is carried out using X-12-ARIMA to derive more accurate seasonal factors. Consumer price indexes may be adjusted directly or aggregatively depending on the level of aggregation of the index and the behavior of the component series.⁴⁹

Intervention analysis seasonal adjustment. Some index series show erratic behavior due to nonseasonal economic events (called interventions) or methodology changes. These events, which can be one-time occurrences or recurring events that happen at infrequent and irregular intervals, adversely affect the estimate of the seasonal component of the series.

Intervention analysis seasonal adjustment allows nonseasonal economic phenomena, such as outliers and level shifts, to be factored out of indexes before calculation of seasonal adjustment factors. (An *outlier* is an extreme value for a particular month. A *level shift* is a change or shift in the price level of a CPI series caused by an event, such as an excise tax increase or oil embargo, occurring over 1 or more months.) An index series whose underlying trend has experienced a sharp and permanent shift will generate distorted results when adjusted using the standard X-12-ARIMA procedure. X-12-ARIMA's regression techniques are used to model the distortions and account for them as part of the seasonal adjustment process. The result is an adjustment based on a representation of the series with the seasonal pattern emphasized. Intervention analysis seasonal adjustment also makes it possible to account for seasonal shifts, resulting in a better seasonal adjustment in the periods before and after the shift occurred. Not all CPI series are adjusted using intervention analysis seasonal adjustment techniques. However, for affected series, the resulting seasonal factors better represent the true seasonal pattern than factors calculated without these techniques. These seasonal factors are applied to the original unadjusted series. Level

shifts and outliers, removed in calculating the seasonal factors, remain in the resulting seasonally adjusted series.

In recent years, BLS has used intervention analysis seasonal adjustment for various indexes—gasoline, fuel oil, new vehicles, women's and girls' apparel, educational books and supplies, electricity, utility (piped) gas service, water and sewerage maintenance, nonalcoholic beverages and beverage materials, and whiskey at home. Series are adjusted using intervention analysis techniques when interventions are clearly identified. After a number of years, series may revert to adjustment using standard methods. In addition, for some series, intervention analysis is used and the resulting series does not show a clear and stable seasonal pattern. In these cases, the series is not seasonally adjusted.

Direct and aggregative adjustment. Each year BLS seasonally adjusts eligible lower-level CPI index series directly with the X-12-ARIMA software using unadjusted indexes for the latest 5 to 8 calendar years. CPI index series are adjusted using the multiplicative model.

Most high-level index series are adjusted by the aggregative method, which is more appropriate for broad categories whose component indexes show strongly different seasonal patterns. Under the aggregative method, direct adjustment is first applied to indexes at lower levels of detail, and thereafter the adjusted detail is aggregated to yield the higher-level seasonally adjusted indexes. If intervention analysis is indicated, it will be used in adjusting selected lower-level indexes prior to aggregation. For series that have not been selected for seasonal adjustment, the original, unadjusted data are used in the aggregation process.

Revision. The seasonal factors are updated annually. Each year in February, BLS recalculates and publishes revised seasonally adjusted indexes for the previous 5 years. Seasonally adjusted indexes become final in the last and 5th year of revision. Seasonal factors for the past year are used to generate seasonally adjusted indexes for the current year starting with the release of the January CPI.

Calculation of annual and semiannual average indexes

CPI annual average indexes use 12 successive months of CPI values as:

$$I_{12av} = \sum_{t=1}^{12} I_{t,0} / 12$$

Semiannual average indexes are computed for the first half of the year (January to June) and for the second half of the year (July to December) using 6 successive months of CPI values as:

$$I_{6av} = \sum_{t=1}^6 I_{t,0} / 6$$

⁴⁹ J.A. Buszuwski and S. Scott, "On the Use of Intervention Analysis in Seasonal Adjustment," 1988 *Proceedings of the American Statistical Association*, Business and Economics Section.

where the value of each monthly index is real or interpolated, depending on availability.⁵⁰

For bimonthly indexes, the intermediate indexes are calculated using a geometric mean of the values in the months adjacent to the one being estimated.

Average prices

Average prices are estimated from CPI data for selected food and beverage items, utility (piped) gas, electricity, gasoline, automotive diesel fuel, and fuel oil #2 to support the research and analytic needs of CPI data users (see appendix 2). Food average prices are published without tax, while the other average prices are published with tax included.

For each food and beverage item, the average price for a specified unit (for instance, pound or gallon) is published monthly for the U.S. city average and for the four regions—Northeast, Midwest, South, and West. Metric-equivalent sizes are shown as well.

Average prices for utility (piped) gas, electricity, and gasoline are published monthly for the U.S. city average, the 4 regions, the 3 population size classes, 10 region/size-class cross-classifications, and the 14 largest local index areas. For utility (piped) gas, average prices per therm, per 40 therms, and per 100 therms are published. For electricity, average prices per kilowatt-hour (kwh) and per 500 kwh are published. For gasoline, the average price per gallon is published. Average prices for commonly available grades of gasoline are published as well as the average price across all grades.

⁵⁰ To be published, a semiannual average must have at least two noninterpolated index values with sufficient samples. An annual average must have at least four noninterpolated index values with sufficient samples.

Average prices per gallon for automotive diesel fuel and fuel oil #2 are published monthly for the U.S. city average, the 4 regions, the 3 population size classes, and 10 of 12 region/size-class cross-classifications.

Price quotes for 40 therms and 100 therms of utility (piped) gas and for 500 kwh of electricity are collected in sample outlets for use in the average price programs only. Since they are for specified consumption amounts, they are not used in the CPI. All other price quotes used for average price estimation are regular CPI data.

With the exception of the 40 therms, 100 therms, and 500 kwh price quotes, all eligible prices are converted to a price per normalized quantity. These prices are then used to estimate a price for a defined fixed quantity. For example, prices for a variety of package sizes for flour are converted to prices per ounce. An average price per ounce of flour is then estimated and multiplied by 16 to yield a price per pound, the published quantity.

The average price for collection period t is estimated as:

$$\bar{P}_t = \frac{\sum W_{it} P_{it} / P_{ib}}{\sum W_{it} / P_{ib}}$$

where W_{it} is a quote-level expenditure weight of items used in the average price estimation for the ELI/PSU/replicate. Dividing the expenditure weight by the base price, P_{ib} , for a given quote yields an implicit estimate of quantity. Thus, the average price is, conceptually, a weighted average of prices, P_{it} , where the weights are quantity amounts. Imputed prices are used in estimating average prices.

Part III. Precision of CPI Estimates

An important advantage of probability sampling methods is that a measure of the sampling error of survey estimates can be computed directly from the sample data. The CPI sample design accommodates error estimation by making two or more selections (replications) of items and outlets within an index area. Therefore, two or more samples of quotes in each self-representing PSU and one in each non-self-representing PSU are available. With this structure, which reflects all stages of the sample design, variance estimation techniques using replicated samples can be used.

Sources of Error

We divide the total error into two sources: *sampling error* and *nonsampling error*. Sampling error is the uncertainty in the CPI caused by the fact that a sample of retail prices is used to compute the CPI, instead of using the complete universe of retail prices. The sampling variance attributable to the estimation of expenditure weights (see chapter 16 for more detail on consumer expenditure weights) is directly incorporated in the variance estimates computed for the CPI, due to the fact that these expenditures are independently estimated for each replicate. Nonsampling error is the rest of the error, and will be discussed at the end of this section. Incorrect information given by survey respondents and data processing errors are examples of nonsampling error.

BLS constantly tries to reduce error in the CPI. Variance and sampling error are reduced by using samples of retail prices and samples of consumer expenditures that are as large as possible, given resource constraints. The Bureau has developed a model that optimizes, on a 2-year basis, the allocation of resources. The model indicates the number of prices that should be observed in each geographic area and each item category to minimize the variance of the U.S. city average all-items index. The Bureau reduces nonsampling error through a series of computerized and professional data reviews, as well as through continuous survey process improvements and theoretical research.

Sample Design

Starting in 1978 the CPI's sample design has accommodated variance estimation by using two or more independent samples of items and outlets in each geographic area. This allows two or more statistically independent estimates of the index to be made. The independent samples are called *replicates*, and the set of all observed prices is called the *full sample*.

As discussed above, BLS calculates CPI indexes for 38

geographic areas across the United States. The 38 areas consist of 31 *self-representing* areas and 7 *non-self-representing* areas. Self-representing areas are large metropolitan areas, such as the Boston metropolitan area, the St. Louis metropolitan area, and the San Francisco metropolitan area. Non-self-representing areas are collections of smaller metropolitan areas. For example, one non-self-representing area is a collection of 32 small metropolitan areas in the Northeast region (Buffalo, Hartford, Syracuse, Burlington, and others) of which 8 have been randomly selected to represent the entire set. Within each of the 38 areas, price data are collected for 211 item categories called *item strata*. Together the 211 item strata cover all consumer purchases.

Multiplying the number of areas by the number of item strata gives 8,018 (= 38 x 211) different area-item combinations for which price indexes need to be calculated. Separate price indexes are calculated for each one of these 8,018 area-item combinations. After calculating all 8,018 of these *basic-level* indexes, the indexes are then aggregated to form *higher-level* indexes, using expenditure estimates from the CE as their weights.

CPI variances are primarily computed with a stratified random groups method, for 1-, 2-, 6- and 12-month percent changes. From 1978 to 1998, the BLS computed CPI variances by using a first-order Taylor approximation of the ratio of cost weights. This methodology was replaced, beginning in January 1998, by the stratified random groups method, in which variances are computed separately for certain subsets of areas and items, and then those individual variances are combined to produce the variance of the entire area-item combination. Subsets of items are formed by the intersection of the item category with each of the eight major groups.

Variance Estimation Using Replicates

Let $IX(A,I,f,t)$ denote the index value for area= A , item category= I , in month= t , where f indicates that it is the full-sample value, and let $IX(A,I,f,t-k)$ denote the value of the same index in month= $t-k$. The upper-case letter A denotes a *set* of areas, such as the Northeast or Midwest region of the country, and the upper-case letter I denotes a *set* of item strata, such as *all items* or *all items less food and energy*, or even a single item stratum. Also let $IX(A,I,r,t)$ and $IX(A,I,r,t-k)$ be the corresponding index values for replicate= r . Most areas have two replicates, but some have more. Then, the full-sample k -month percent change between months $t-k$ and t is computed by dividing $IX(A,I,f,t)$ by $IX(A,I,f,t-k)$, subtracting 1, and multiplying by 100:

$$PC(A, I, f, t, t-k) = \left(\frac{IX(A, I, f, t)}{IX(A, I, f, t-k)} - 1 \right) * 100$$

Every index has an aggregation weight, $AGGWT(A, I, f)$ or $AGGWT(A, I, r)$, associated with it, which is used to combine the index with other indexes to produce indexes for larger geographic areas and larger item categories. For example, the aggregation weights are used to combine all 8,018 basic-level indexes into higher-level indexes such as the U.S. city average—all-items index. The product of an index and its weight is called a *cost weight*.

$$CW(A, I, f, t) = IX(A, I, f, t) * AGGWT(A, I, f, t)$$

A cost weight is an estimate of the total cost in area= A for consumption of item category I in month t . A replicate cost weight would be indexed with r instead of f . Because the aggregation weights are not indexed by time (except across pivot months; see bridging section below), the percent change formula above is equivalent to

$$PC(A, I, f, t, t-k) = \left(\frac{CW(A, I, f, t)}{CW(A, I, f, t-k)} - 1 \right) * 100$$

which is equivalent to

$$PC(A, I, f, t, t-k) = \left(\frac{\sum_{a \in A} \sum_{i \in I} CW(a, i, f, t)}{\sum_{a \in A} \sum_{i \in I} CW(a, i, f, t-k)} - 1 \right) * 100$$

because cost weights are additive from the lowest item-area level up to the highest U.S. city average—all-items level. The lower-case letter a denotes one of the 38 basic-level areas included in area= A , and the lower-case letter i denotes one of the 211 item categories. (Note: Item aggregation I can be as small as one item stratum or may comprise one or more major groups.)

For the stratified random groups method, a replicate percent change is defined as follows: At each item-area replicate level, the individual full sample cost weight, $CW(a, i, f, \bullet)$, is subtracted from the full sample cost weight $CW(A, I, f, \bullet)$, and a replicate cost weight, $CW(a, i, r, \bullet)$, is added back in. The replicate percent change for area= a , item subset= i , replicate= r between months $t-k$ and t is then computed as follows:

$$PC_s(a, i, r, t, t-k) = \left(\frac{CW(A, I, f, t) - CW(a, i, f, t) + CW(a, i, r, t)}{CW(A, I, f, t-k) - CW(a, i, f, t-k) + CW(a, i, r, t-k)} - 1 \right) * 100$$

for self-representing areas. For non-self-representing areas, another replicate percent change for area= a , item category= I , replicate= r between months $t-k$ and t is computed as:

$$PC_n(a, I, r, t, t-k) = \left(\frac{CW(A, I, f, t) - CW(a, I, f, t) + CW(a, I, r, t)}{CW(A, I, f, t-k) - CW(a, I, f, t-k) + CW(a, I, r, t-k)} - 1 \right) * 100$$

$$CW(A, I, \bullet, \bullet) = \sum_{a \in A} \sum_{i \in I} CW(a, i, \bullet, \bullet)$$

The symbol $\alpha \in A$ means that the sum is over all basic-level areas within area= A , and the symbol $i \in I$ means that the sum is over major groups within item category= I .

The variance is computed with the following stratified random groups variance estimation formula:

$$V[PC(A, I, f, t, t-k)] = \sum_{i \in I} \sum_{a \in A \cap S} \frac{1}{R_a(R_a - 1)} \sum_{r=1}^{R_a} (PC_s(a, i, r, t, t-k) - PC(A, I, f, t, t-k))^2 + \sum_{a \in A \cap N} \frac{1}{R_a(R_a - 1)} \sum_{r=1}^{R_a} (PC_n(a, I, r, t, t-k) - PC(A, I, f, t, t-k))^2$$

where S and N are the sets of all self-representing and non-self-representing areas in the CPI's geographic sample, respectively; and $A \cap S$ and $A \cap N$ are the sets of all self-representing and non-self-representing areas within area= A . The number R_a is the number of replicates in area= a .

When the item category I no longer spans more than one major group, the above formula reduces to:

$$V[PC(A, I, f, t, t-k)] = \sum_{a \in A} \frac{1}{R_a(R_a - 1)} \sum_{r=1}^{R_a} (PC(a, I, r, t, t-k) - PC(A, I, f, t, t-k))^2$$

Variance Estimation Without Replicates

BLS computes index series for 85 special (SRC) item categories, which are below the item stratum level and thus do not have accompanying replicate index values. (CE weights are produced only down to the item-stratum level in each index area.) The stratified random groups methodology requires a replicate structure. So, for these SRC items (such as *butter* or *pork* or *new cars*), an alternative variance estimation method is needed. Given the availability—at the regional and higher-area levels—of *independent* estimates for these SRC items, the jackknife variance estimation methodology can be employed. Each area full sample cost weight can be subtracted from the all-area full sample cost weight to provide a jackknife replicate estimate. By taking the ratio of these replicate cost weight estimates at times t and $t-k$, subtracting one, and multiplying by 100, one obtains the required jackknife replicate percent change value. (For the U.S. city average special item estimates, there are 38 independent index areas, and so 38 jackknife replicate estimates to work with.)

The full-sample percent change is computed as before (except that item category= I here is smaller even than an item stratum):

$$PC(A, I, f, t, t-k) = \left(\frac{CW(A, I, f, t)}{CW(A, I, f, t-k)} - 1 \right) * 100$$

The jackknife replicate percent change is computed as follows:

$$PC(A-a, I, r, t, t-k) = \left(\frac{CW(A, I, f, t) - CW(a, I, f, t)}{CW(A, I, f, t-k) - CW(a, I, f, t-k)} - 1 \right) * 100$$

Then the variance for the k-month percent change is computed in the usual jackknife form:

$$V[PC(A,I,f,t,t-k)] = \frac{N_A - 1}{N_A} \sum_{a \in A} (PC(A-a,I,r,t,t-k) - PC(A,I,f,t,t-k))^2$$

Bridging Across Pivot Months

Every 2 years, BLS updates its set of aggregation index weights based on CE data collected from the $t-2$ and $t-3$ years. In January 2004, BLS replaced its old set of aggregation weights with a new 2-year set of weights from expenditure data collected in 2001-02. In January 2006, this set of weights was replaced by an updated set of weights from expenditure data collected in 2003-04, and so on.

Whenever the variance estimates cross the pivot month (as they do in December 2003 and December 2005), a bridging factor has to be introduced into any variance calculation that crosses the pivot month between t and $t-k$ months (including month $t-k$, but not including month t). The bridging factor is then applied directly to the individual ratio of cost weights, for both full-sample and replicate values, inside each percent change calculation. Thus, in its most general form,

$$PC(\bullet,\bullet,\bullet,t,t-k) = \left(\frac{CW(\bullet,\bullet,\bullet,t) * CW(\bullet,\bullet,\bullet,old)}{CW(\bullet,\bullet,\bullet,t-k) * CW(\bullet,\bullet,\bullet,new)} - 1 \right) * 100$$

for every combination of *area* and *item*, and for full-sample and replicate values, with the bridging factor defaulting to 1 whenever not applicable.

The bridging factor, $CW(\bullet,\bullet,\bullet,old) / CW(\bullet,\bullet,\bullet,new)$, essentially allows the *old* aggregation weight in the bridge's numerator to cancel out the *old* aggregation weight in the $t-k$ cost weight, while the *new* aggregation weight in the bridge's denominator cancels out the *new* aggregation weight in the t cost weight, leaving $IX(\bullet,\bullet,\bullet,t) / IX(\bullet,\bullet,\bullet,t-k)$ free to move this level's percent change without disruption. Note that $IX(\bullet,\bullet,\bullet,old) / IX(\bullet,\bullet,\bullet,new) = 1$ at all times.

Nonsampling Error

CPI estimates are subject to nonsampling error as well as sampling error. Surveys involve many operations, all of which are potential sources of nonsampling error. The errors arise from the survey process regardless of whether the data are collected from the entire universe or from a sample of the population. The most general categories of nonsampling error are coverage error, nonresponse error, response error, processing error, and estimation error.

Coverage error in an estimate results from the omission of part of the target population (undercoverage) or the inclusion of units from outside of the target population (overcoverage). Coverage errors result from the omission of cities, households, outlets, and items that are part of the target populations from the relevant sampling frames or from

their double-counting or improper inclusion in the frames. A potential source of coverage error is the time lag between the TPOPS and the initiation of price collection for commodities and services at sampled outlets. Because of the time lag, the products offered by the outlet at the time pricing is initiated may not coincide with the set from which the TPOPS respondents were purchasing.

Nonresponse error results when data are not collected for some sampled units because of the failure to interview households or outlets. This can occur when selected households and outlets cannot be contacted or refuse to participate in the survey. Nonresponse rates during monthly pricing for the CPI C&S and housing surveys are shown in tables 6 and 7.

Table 6. Response rates for commodities and services for the CPI-U, U.S. city average, by major group, 2006

Commodities and services	Eligible	Collected	Percent collected	Used in estimation	Percent in estimation
Outlets	318,461	306,540	96.3	294,015	92.3
Total quotes	1,109,172	942,255	85.0	918,869	82.8
Food	422,311	387,205	91.7	381,437	90.3
Housing (less shelter)	174,780	156,881	89.8	152,789	87.4
Apparel	142,341	75,618	53.1	70,835	49.8
Transportation	132,282	122,137	92.3	119,474	90.3
Medical care	48,183	38,623	80.2	37,504	77.8
Recreation	79,261	67,622	85.3	64,787	81.7
Education and communication	64,475	51,974	80.6	50,604	78.5
Other goods and services	45,539	42,195	92.7	41,439	91.0

Table 7. Response rates for housing for the CPI-U, U.S. city average, 2006

Housing (Shelter)	Eligible	Collected, data reported	Collected, found vacant	No data at collection or other	Used in estimation
Number of total units	64,370	46,985	6,463	10,922	53,448
Percent of eligible units	100.0	73.0	10.0	17.0	83.0

Response error results from the collection and use in estimation of incorrect, inconsistent, or incomplete data. Response error may arise because of the collection of data from inappropriate respondents, respondent memory or recall errors, deliberate distortion of responses, interviewer effects, misrecording of responses, pricing of wrong items, misunderstanding or misapplication of data collection procedures, or misunderstanding of the survey needs and/or lack of cooperation from respondents. The pricing methodology in the commodities and services component of the CPI allows the previous period's price to be available at the time of

collection. This dependent pricing methodology is believed to reduce response variance for measuring change, but may cause response bias and lag. The housing component of the CPI employs an independent pricing methodology specifically to avoid potential response bias.

Processing error arises from incorrect editing, coding, and data transfer. Price data are collected by CADC. With CADC, processing error is minimized. Automated data checking ensures that only correct data types are collected; other automated logic checks remove all redundant question patterns, and the instrument informs the field staff when not all required data have been collected. In both systems, errors also can result from software problems in the computer processing that cause correctly entered data to be lost. Computer screening and professional review of the data provide checks on processing accuracy. Occasional studies of these processing errors in the CPI have shown them to be extremely small.

Estimation error results when the survey process does not accurately measure what is intended. Such errors may be conceptual or procedural in nature, arising from a misunderstanding of the underlying survey measurement concepts or a misapplication of rules and procedures.

Substitutions and adjustments for quality change in the items priced for the CPI are possible sources of estimation error due to procedural difficulties. Ideally, CPI data collection forms and procedures would yield all information necessary to determine or explain price and quality differences for all items defined within an ELI. Because such perfect information is not available, BLS economists supplement directly collected data with secondary data. Estimation error will result if the BLS adjustment process, which may require significant judgment or lack key data, is misapplied, or if it consistently overestimates or underestimates quality change for particular kinds of items.

The effect of the aging of housing units is an example of potential estimation error, which is similar to the issue of quality change in commodities and services. Until 1988, BLS did not adjust for the slow depreciation of houses and apartments over time. BLS research indicates that annual changes for the residential rent and owners' equivalent rent indexes would have been 0.1 to 0.2 percent larger if some type of aging adjustment had been included.

The total nonsampling error of the CPI results from errors in the type of data collected, the methods of collection, the

data processing routines, and the estimation processes. The cumulative nonsampling error can be much greater than the sampling error.

Response Rates

Response rates are calculated for the CPI at the data collection phase and at the index estimation phase for ongoing pricing. The response rate at the data collection phase is the number of responding sample units divided by the sum of (1) the number of eligible sample units and (2) the number of sample units with eligibility not determined. A sample unit is eligible if it belongs to the defined target population and responses should be collected from the unit for one or more items. The response rate at estimation is defined as the number of sample units used in estimation divided by the sum of (1) the number of eligible sample units and (2) the number of sample units with eligibility not determined.

Commodities and services items (any except rent and owners' equivalent rent) are further broken down into outlets and quotes. An "outlet" is a generic term used by the CPI to describe places where prices are collected. A "quote" is a specific item to be priced in a specific outlet. There may be from 1 to more than 50 quotes priced in an outlet. Table 6 shows the relatively low percentages of quotes reported collected and used in estimation for apparel. Low rates for these items largely can be attributed to the design of the apparel sample. Because apparel items are commonly in stores only at certain times of the year, most of the apparel sample is doubled, with each half of the sample designated for pricing during part of the year. Thus, at any particular time of the year many apparel quotes, although eligible, are designated out of season, and prices are not collected. For further information, see the section above on seasonal items.

The response rates for housing (shelter) shown in table 7 include categories for renters only. Owners are out of scope for the CPI housing sample. A unit qualifies as renter if its tenure status is known either by previous knowledge or is collected in the current interview period. The response rates at the data collection phase for housing (shelter) are separated into three categories. If usable information is obtained, the unit is designated eligible and data reported. If the assigned unit is located but is unoccupied, the unit is designated eligible, found vacant. In instances where the unit is eligible but no data are available (for example refusals), the unit is designated eligible, other. The response rates at the estimation phase are units that are used in either rent or REQ.

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Appendix 1. Characteristics of the Consumer Price Index, 1890 to date

Date	Survey providing expenditure weight		Base period	Census providing population weights	Number of areas included	Family composition	Earnings of chief earner	Source and amount of family income	Length of employment	Economic level, length of residence, nativity, and race	Title(s)
	Group weights	Item weights									
1890 ¹ ...	None	1901	Varied	None	Varied	Two or more persons.	Salaried worker earning \$1,200 or less during year. No limitation on wage earners.	No limitation	No limitation	No limitation	
1919 Feb. 1921	1917-19	1917-19	1913		² 32	Minimum of husband, wife, and one child who was not a boarder or lodger. No boarders nor more than three lodgers present.	Salaried worker earning \$2,000 or less. No limitation on wage earners.	At least 75 percent from principal earner or others who contributed to earnings to family fund.		No slum or charity families; white only; in area entire year and in United States 5 years or more; no non-English speaking families.	Cost-of-living.
Sept. 1935... Dec. 1935 ⁴ ... Aug. 1940 ⁵ ...	1934-36	⁶ 1934-36	1923-35 1935-39	³ Average 1920-30 1930	⁷ 33	Two or more persons. Not more than two boarders or lodgers, or guests for more than 26 guest-weeks.	At least \$300. Salaried worker earning less than \$2,000 during year or less than \$200 during any month. No upper limitation on wage earners.	At least \$500. Less than one-fourth interest, dividends, royalties, speculative gains, rents, gifts, or income in rent in payment of services. Less than 3 months' free rent. No subsidiary clerical worker earning \$2,000 or over.	At least 1,008 hours spread over 36 weeks	No relief families, either on direct or work relief; white only, except where black population was significant part of total; in area 9 months or more.	Indexes of the cost of living of wage earners and lower-salaried workers in large cities.
May 1941 ⁸ ... July 1943 Sept. 1945				⁹ 1940	34						Consumer's Price Index for Moderate Income Families in Large Cities.
Jan. 1951 ¹⁰ ...	1947-49	¹¹ 1934-36		1950		Two or more persons.	No limitation. (Family income not in excess of \$10,000.)	Family income under \$10,000 after taxes in the survey year. No minimum income limit, except that families with no income from wage or salaries were excluded.	Family head must have been employed at least 26 weeks.	No exclusion for receipt of relief as such, but only families with wage or salary earnings included. No length of residence, nativity or racial limitations.	
Jan. 1953 ¹² ..	¹³ 1950	¹³ 1950	¹⁴ 1947-49		46				No specific requirement, but major portion of income of family head must be from employment as wage earner or salaried clerical worker.		Shorttitle: Consumer Price Index Complete name: Index of Change in Prices of Goods and Services Purchased by City Wage-Earner and Clerical-Worker Families to Maintain Their Level of Living.

See footnotes at end of table.

Appendix 1. Characteristics of the Consumer Price Index, 1890 to date—Continued

Date	Survey providing expenditure weight		Base period	Census providing population weights	Number of areas included	Family composition	Earnings of chief earner	Source and amount of family income	Length of employment	Economic level, length of residence, nativity, and race	Title(s)
	Group weights	Item weights									
Jan. 1962 Jan. 1964 ¹⁶	¹⁷ 1960-61	¹⁷ 1960-61	¹⁵ 1957-59	1960	50	Families of two or more persons and single workers; at least one full-time wage earner.	No limitation	More than half of combined family income from wage-earner or clerical-worker occupation.	A minimum of 37 weeks for at least 1 family member.	No restrictions other than the wage-earners and clerical-worker definition.	Consumer Price Index for Urban Wage Earners Clerical Workers.
Jan. 1966 ¹⁸ Jan. 1971 ¹⁹ Jan. 1978 ²⁰	²¹ 1972-73	²² 1974	1967	1970	85	Same as above for earner and clerical-worker index. No limitation for urban consumer index.		Same as above wage-earner and clerical-worker index. No limitation for urban consumer index.	Same as above for wage-earner and clerical-worker index. No employment required for urban consumer index.	Same as above for wage-earner and clerical-worker index. No limitation for urban consumer index. ²³	1) Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). 2) Consumer Price Index for All Urban Consumers (CPI-U).
Jan. 1983 ²⁴ Jan. 1985 ²⁵ Jan. 1987 ²⁶	²⁷ 1982-84	²⁸ 1985-89		1980	91	CPI-U CPI-W Similar to above except student residing in college-regulated housing are treated as separate family units					
Jan. Jan. 1988 Jan. 1998 ³⁰ Jan. 2002 ³³	³¹ 1993-95 ³⁴ 1999-00	³² 1992-96 ³⁵ 1997-01	²⁹ 1982-84	1990							
July 2002 ³⁶	1999-00		Dec. 1999			Same as CPI-U population					Chained Consumer Price Index for All Urban Consumers (C-CPI-U)

- ¹Food price indexes only.
- ²For 19 cities, data were available back to December 1914 and, for 13 cities, back to 1917. For the United States, data were available back to the 1913 annual average.
- ³Indexes between 1918 and 1929 were recomputed retroactively with population weights based on the average of the 1920 and 1930 censuses.
- ⁴Index published in December 1935 for July 15, 1935; indexes also were calculated on the 1913 = 100 base.
- ⁵Indexes between 1925 and 1929 were recomputed retroactively with group weights based on the average of 1917-19 and 1934-36; indexes between March 15, 1930, and March 15, 1940, were recomputed retroactively using 1934-36 group weights.
- ⁶During World War II, weights were adjusted to account for rationing and shortages.
- ⁷Data for 51 to 56 cities included in the food index.
- ⁸Index published in May 1941 for March 14, 1941. Food indexes were based on 51 cities.
- ⁹The 1940 census data were supplemented by ration book registration data.
- ¹⁰Index published in March 1951 for January 1951.
- ¹¹Indexes between January 1950 and January 1951 were revised retroactively for all items and group indexes. Indexes for rent and all items were corrected for the new-unit bias from 1940. Old series also published through 1952.
- ¹²Item weights were revised for only the seven cities for which 1947-49 expenditure data were available. Index published in February and January 1953. Linked to old series as of December 1952. Old series also published for a 6-month overlap period.
- ¹³Data were adjusted to 1952 for weight derivation.
- ¹⁴Indexes also were calculated on the base of 1935-39 = 100 through December 1957.
- ¹⁵Index published in February for January 1962. Indexes also were calculated on bases of 1947-49 = 100 and 1939 = 100.
- ¹⁶Index published March 3 for January 1964. Linked to old series as of December 1963. Old series also published for a 6-month overlap period.
- ¹⁷Data were adjusted to December 1963 for weight derivation.
- ¹⁸Index published in February for January 1966. Linked to old series as of December 1965.
- ¹⁹Index published in February for January 1971. Indexes were also calculated on the 1957-59 = 100 base.
- ²⁰Index published in February for January 1978. Linked to old series as of December 1977. Old series also published for a 6-month overlap period.
- ²¹Data were adjusted to December 1977 for weight derivation.
- ²²Item weights based on Points of Purchase Survey in 1974.
- ²³Coverage was expanded to include wage earners and clerical workers in the entire nonfarm parts of the metropolitan areas in addition to those living within the urbanized areas of the metropolitan areas and urban places of 2,500 or more inhabitants.
- ²⁴Changed homeowners' costs from asset approach to flow-of-service approach (rental equivalence).
- ²⁵Changed homeowners' costs from asset approach to flow-of-service approach (rental equivalence).
- ²⁶Index published in February for January 1987. Linked to old series as of December 1986. Old series also published for a 6-month overlap period.
- ²⁷Data were adjusted to December 1986 for weight derivation.
- ²⁸Item weights based on Continuing Point of Purchase Survey (CPOPS) from 1985-89; first "rolling revision."
- ²⁹Index published in February for January 1988. Indexes also calculated on the 1967 = 100 base.
- ³⁰Index published in February for January 1989. Linked to old series as of December 1997. Old series also published for a 6-month overlap period.
- ³¹Data adjusted to December 1997 for weight derivation.
- ³²At time of revision the CPOPS covered 1992-96. The revised TPOPS began being introduced in 1998.
- ³³Index published in February for January 2002. Linked to old series as of December 2001. Old series also published for a 6-month overlap period.
- ³⁴Data were adjusted to December 2001 for weight deviation.
- ³⁵TPOPS on 4-year rotation at the time of expenditure weight update largely reflected data from 1997 forward.
- ³⁶New, supplemental index. First issued in preliminary form (initial); subject to revision in February (interim) and again the following February (final). Elementary indexes aggregated using an adjusted geometric mean for the initial and interim versions, and a Tornqvist formula for the final version. Data calculated for 2000 forward.

Appendix 2. List of published indexes

CPI-U and CPI-W Indexes Published at the U.S. City Average (National) Level

All items

Food and beverages

Food

Food at home

Cereals and bakery products

Cereals and cereal products

Flour and prepared flour mixes

Breakfast cereal

Rice, pasta, cornmeal

Rice *

Bakery products

Bread

White bread *

Bread other than white *

Fresh biscuits, rolls, muffins

Cakes, cupcakes, and cookies

Cookies *

Fresh cakes and cupcakes *

Other bakery products

Fresh sweetrolls, coffeecakes, doughnuts *

Crackers, bread, and cracker products *

Frozen and refrigerated bakery products, pies, tarts, turnovers *

Meats, poultry, fish, and eggs

Meats, poultry, and fish

Meats

Beef and veal

Uncooked ground beef

Uncooked beef roasts

Uncooked beef steaks

Uncooked other beef and veal

Pork

Bacon, breakfast sausage, and related products

Bacon and related products *

Breakfast sausage and related products

Ham

Ham, excluding canned *

Pork chops

Other pork including roasts and picnics

Other meats

Frankfurters *

Lunchmeats *

Lamb and organ meats *

Lamb and mutton *

Poultry

Chicken

Fresh whole chicken *

Fresh and frozen chicken parts *

Other poultry including turkey

Appendix 2. List of published indexes—Continued

- Fish and seafood
 - Fresh fish and seafood
 - Processed fish and seafood
 - Canned fish and seafood *
 - Frozen fish and seafood *
- Eggs
- Dairy and related products
 - Milk
 - Fresh whole milk *
 - Fresh milk other than whole *
 - Cheese and related products
 - Ice cream and related products
 - Other dairy and related products
- Fruits and vegetables
 - Fresh fruits and vegetables
 - Fresh fruits
 - Apples
 - Bananas
 - Citrus fruits
 - Oranges, including tangerines *
 - Other fresh fruits
 - Fresh vegetables
 - Potatoes
 - Lettuce
 - Tomatoes
 - Other fresh vegetables
 - Processed fruits and vegetables
 - Canned fruits and vegetables
 - Canned fruits *
 - Canned vegetables *
 - Frozen fruits and vegetables
 - Frozen vegetables *
 - Other processed fruits and vegetables including dried
 - Dried beans, peas, and lentils *
- Nonalcoholic beverages and beverage materials
 - Juices and nonalcoholic drinks
 - Carbonated drinks
 - Frozen noncarbonated juices and drinks
 - Nonfrozen noncarbonated juices and drinks
 - Beverage materials including coffee and tea
 - Coffee
 - Roasted coffee *
 - Instant and freeze-dried coffee *
 - Other beverage materials including tea
- Other food at home
 - Sugar and sweets
 - Sugar and artificial sweeteners
 - Candy and chewing gum
 - Other sweets
 - Fats and oils
 - Butter and margarine
 - Butter *
 - Margarine *

Appendix 2. List of published indexes—Continued

- Salad dressing
- Other fats and oils including peanut butter
 - Peanut butter *
- Other foods
 - Soups
 - Frozen and freeze-dried prepared foods
 - Snacks
 - Spices, seasonings, condiments, sauces
 - Salt and other seasonings and spices *
 - Olives, pickles, relishes *
 - Sauces and gravies *
 - Other condiments *
 - Baby food
 - Other miscellaneous foods
- Food away from home
 - Full service meals and snacks
 - Limited service meals and snacks
 - Food at employee sites and schools
 - Food from vending machines and mobile vendors
 - Other food away from home
- Alcoholic beverages
 - Alcoholic beverages at home
 - Beer, ale, and other malt beverages at home
 - Distilled spirits at home
 - Whiskey at home *
 - Distilled spirits, excluding whiskey, at home *
 - Wine at home
 - Alcoholic beverages away from home
 - Beer, ale, and other malt beverages away from home *
 - Wine away from home *
 - Distilled spirits away from home *
- Housing
 - Shelter
 - Rent of primary residence
 - Lodging away from home
 - Housing at school, excluding board
 - Other lodging away from home including hotels and motels
 - Owners' equivalent rent of primary residence
 - Tenants' and household insurance
- Fuels and utilities
 - Household energy
 - Fuel oil and other fuels
 - Fuel oil
 - Propane, kerosene, and firewood
 - Gas (piped) and electricity
 - Electricity
 - Utility (piped) gas service
 - Water and sewer and trash collection services
 - Water and sewerage maintenance
 - Garbage and trash collection
- Household furnishings and operations
 - Window and floor coverings and other linens

Appendix 2. List of published indexes—Continued

- Floor coverings
- Window coverings
- Other linens
- Furniture and bedding
 - Bedroom furniture
 - Living room, kitchen, and dining room furniture
 - Other furniture
- Appliances
 - Major appliances
 - Laundry equipment *
 - Other appliances
- Other household equipment and furnishings
 - Clocks, lamps, and decorator items
 - Indoor plants and flowers
 - Dishes and flatware
 - Nonelectric cookware and tableware
- Tools, hardware, outdoor equipment and supplies
 - Tools, hardware and supplies
 - Outdoor equipment and supplies
- Housekeeping supplies
 - Household cleaning products
 - Household paper products
 - Miscellaneous household products
- Household operations
 - Domestic services
 - Gardening and lawncare services
 - Moving, storage, freight expense
 - Repair of household items
- Apparel
 - Men's and boys' apparel
 - Men's apparel
 - Men's suits, sport coats, and outerwear
 - Men's furnishings
 - Men's shirts and sweaters
 - Men's pants and shorts
 - Boys' apparel
 - Women's and girls' apparel
 - Women's apparel
 - Women's outerwear
 - Women's dresses
 - Women's suits and separates
 - Women's underwear, nightwear, sportswear, and accessories
 - Girls' apparel
- Footwear
 - Men's footwear
 - Boys' and girls' footwear
 - Women's footwear
- Infants' and toddlers' apparel
- Jewelry and watches
 - Watches
 - Jewelry

Appendix 2. List of published indexes—Continued

Transportation

Private transportation

New and used motor vehicles

New vehicles

New cars and trucks *

New cars *

New trucks *

Used cars and trucks

Leased cars and trucks

Car and truck rental

Motor fuel

Gasoline (all types)

Gasoline, unleaded regular *

Gasoline, unleaded midgrade *

Gasoline, unleaded premium *

Other motor fuels

Motor vehicle parts and equipment

Tires

Vehicle accessories other than tires

Vehicle parts and equipment other than tires *

Motor oil, coolant, and fluids *

Motor vehicle maintenance and repair

Motor vehicle body work

Motor vehicle maintenance and servicing

Motor vehicle repair

Motor vehicle insurance

Motor vehicle fees

State and local registration and license

Parking and other fees

Parking fees and tolls *

Automobile service clubs *

Public transportation

Airline fare

Other intercity transportation

Ship fare *

Intracity transportation

Medical care

Medical care commodities

Prescription drugs

Nonprescription drugs and medical supplies

Internal and respiratory over-the-counter drugs

Nonprescription medical equipment and supplies

Medical care services

Professional services

Physicians' services

Dental services

Eyeglasses and eye care

Services by other medical professionals

Hospital and related services

Hospital services

Inpatient hospital services *

Outpatient hospital services *

Nursing homes and adult daycare

Appendix 2. List of published indexes—Continued

Recreation

Video and audio

- Televisions

- Cable and satellite television and radio service

- Other video equipment

- Video cassettes, discs, and other media including rental

 - Video cassettes and discs, blank and prerecorded *

 - Rental of video tapes, and discs *

- Audio equipment

- Audio discs, tapes, and other media

Pets, pet products and services

- Pets and pet products

 - Pet food *

 - Purchase of pets, pet supplies, accessories *

- Pet services including veterinary

 - Pet services *

 - Veterinarian services *

Sporting goods

- Sports vehicles including bicycles

- Sports equipment

Photography

- Photographic equipment and supplies

 - Film and photographic supplies *

 - Photographic equipment *

- Photographers and film processing

 - Photographer fees *

 - Film processing *

Other recreational goods

- Toys

 - Toys, games, hobbies, and playground equipment *

- Sewing machines, fabric, and supplies

- Music instruments and accessories

Recreation services

- Club membership dues and fees for participant sports

- Admissions

 - Admission to movies, theaters, and concerts *

 - Admission to sporting events *

- Fees for lessons or instructions

Recreational reading materials

- Newspapers and magazines

- Recreational books

Education and communication

Education

- Educational books and supplies

 - College textbooks *

- Tuition, other school fees, and childcare

 - College tuition and fees

 - Elementary and high school tuition and fees

 - Childcare and nursery school

 - Technical and business school tuition and fees

Communication

- Postage and delivery services

Appendix 2. List of published indexes—Continued

Postage

Delivery services

Information and information processing

Telephone services

Land-line telephone services, local charges

Land-line telephone services, long-distance charges

Land-line interstate toll calls *

Land-line intrastate toll calls *

Wireless telephone services

Information technology, hardware, and services

Personal computers and peripheral equipment

Computer software and accessories

Internet services and electronic information providers

Telephone hardware, calculators, and other consumer information items

Other goods and services

Tobacco and smoking products

Cigarettes

Tobacco products other than cigarettes

Personal care

Personal care products

Hair, dental, shaving, and miscellaneous personal care products

Cosmetics, perfume, bath, nail preparations and implements

Personal care services

Haircuts and other personal care services

Miscellaneous personal services

Legal services

Funeral expenses

Laundry and drycleaning services

Apparel services other than laundry and drycleaning

Financial services

Checking account and other bank services *

Tax return preparation and other accounting fees *

Miscellaneous personal goods

Stationery, stationery supplies, gift wrap *

Special aggregate indexes

All items—old base

All items less energy

All items less food

All items less food and energy

All items less medical care

All items less shelter

Apparel less footwear

Commodities

Commodities less food

Commodities less food and beverages

Commodities less food and energy commodities

Domestically produced farm food

Durables

Energy

Energy commodities

Appendix 2. List of published indexes—Continued

Nondurables
Nondurables less food
Nondurables less food and apparel
Nondurables less food and beverages
Nondurables less food, beverages, and apparel
Other services
Rent of shelter
Services
Services less energy services
Services less medical care services
Services less rent of shelter
Transportation services
Utilities and public transportation
Purchasing power of the consumer dollar
Purchasing power of the consumer dollar—old base

* Special index based on a substantially smaller sample.

C-CPI-U Indexes Published at the U.S. City Average (National) Level

(The C-CPI-U is issued for national averages only, and employs a December 1999 = 100 reference base.)

All items

- Food and beverages
 - Food
 - Food at home
 - Food away from home
 - Alcoholic beverages

Housing

- Shelter
- Fuels and utilities
- Household furnishings and operations

Apparel

Transportation

- Private transportation
- Public transportation

Medical care

- Medical care commodities
- Medical care services

Recreation

Education and communication

- Education
- Communication

Other goods and services

Appendix 2. List of published indexes—Continued

Special aggregate indexes

Services

Commodities

Durables

Nondurables

All items less food and energy

Energy

CPI-U and CPI-W Indexes Published at the Regional and National City Size-class Levels

All items

Food and beverages

Food

Food at home

Food away from home

Alcoholic beverages

Housing

Shelter

Rent of primary residence

Owners' equivalent rent of primary residence

Fuels and utilities

Household energy

Gas (piped) and electricity

Electricity

Utility (piped) gas service

Household furnishings and operations

Apparel

Transportation

Private transportation

New and used motor vehicles

New vehicles

New cars and trucks *

New cars *

Used cars and trucks

Motor fuel

Gasoline (all types)

Gasoline, unleaded regular *

Gasoline, unleaded midgrade *

Gasoline, unleaded premium *

Medical care

Medical care commodities

Medical care services

Professional services

Recreation

Education and communication

Other goods and services

Appendix 2. List of published indexes—Continued

Special aggregate indexes

- All items—old base
- All items less energy
- All items less food
- All items less food and energy
- All items less medical care
- All items less shelter
- Commodities
- Commodities less food
- Commodities less food and beverages
- Commodities less food and energy commodities
- Durables
- Energy
- Energy commodities
- Nondurables
- Nondurables less food
- Nondurables less food and apparel
- Nondurables less food and beverages
- Nondurables less food, beverages, and apparel
- Services
- Services less energy services
- Services less medical care services
- Rent of shelter
- Transportation services
- Other services
- Services less rent of shelter

* Special index based on a substantially smaller sample.

CPI-U and CPI-W Indexes Published at the Regional and City Size-class Levels

- All items
 - Food and beverages
 - Food
 - Food at home
 - Food away from home
 - Alcoholic beverages
 - Housing
 - Shelter
 - Rent of primary residence
 - Apparel
 - Transportation
 - Private transportation
 - Motor fuel
 - Gasoline (all types)
 - Gasoline, unleaded regular *
 - Gasoline, unleaded midgrade *
 - Gasoline, unleaded premium *

Appendix 2. List of published indexes—Continued

Medical care

Recreation

Education and communication

Other goods and services

Special aggregate indexes

All items—old base

All items less energy

All items less food and energy

All items less medical care

All items less shelter

Commodities

Commodities less food

Commodities less food and beverages

Durables

Energy

Nondurables

Nondurables less food

Nondurables less food and beverages

Services

Services less rent of shelter

Services less medical care services

* Special index based on a substantially smaller sample.

Appendix 3. Items for which average prices are published

Item	United States	Region	Population size class	Area
Energy				
Utility (piped) gas—40 therms	X	X	X	X
Utility (piped) gas—100 therms	X	X	X	X
Utility (piped) gas per therm	X	X	X	X
Fuel oil #2 per gallon (3.785 liters)	X	X	X	
Electricity per 500 KWH	X	X	X	X
Electricity per KWH	X	X	X	X
Gasoline, all types, per gallon (3.785 liters)	X	X	X	X
Gasoline, unleaded regular, per gallon (3.785 liters)	X	X	X	X
Gasoline, unleaded midgrade, per gallon (3.785 liters)	X	X	X	X
Gasoline, unleaded premium, per gallon (3.785 liters)	X	X	X	X
Automotive diesel fuel, per gallon (3.785 liters)	X	X	X	
Cereals and bakery products				
Flour, white, all purpose, per lb. (453.6 gm)	X	X		
Rice, white, long grain, uncooked, per lb. (453.6 gm)	X	X		
Spaghetti and macaroni, per lb. (453.6 gm)	X	X		
Bread, white, pan, per lb. (453.6 gm)	X	X		
Bread, French, per lb. (453.6 gm)	X	X		
Bread, whole wheat, pan, per lb. (453.6 gm)	X	X		
Cookies, chocolate chip, per lb. (453.6 gm)	X	X		
Crackers, soda, salted, per lb. (453.6 gm)	X	X		
Beef and veal				
Ground chuck, 100% beef, per lb. (453.6 gm)	X	X		
Ground beef, 100% beef, per lb. (453.6 gm)	X	X		
Ground beef, lean and extra lean, per lb. (453.6 gm)	X	X		
All uncooked ground beef, per lb. (453.6 gm)	X	X		
Chuck roast, USDA Choice, bone-in, per lb. (453.6 gm)	X	X		
Chuck roast, graded and ungraded, excluding USDA Prime and Choice, per lb. (453.6 gm)	X	X		
Chuck roast, USDA Choice, boneless, per lb. (453.6 gm)	X	X		
Round roast, USDA Choice, boneless, per lb. (453.6 gm)	X	X		
Round roast, graded and ungraded, excluding USDA Prime and Choice, per lb. (453.6 gm)	X	X		
Rib roast, USDA Choice, bone-in, per lb. (453.6 gm)	X	X		
All uncooked beef roasts, per lb. (453.6 gm)	X	X		
Steak, T-Bone, USDA Choice, bone-in, per lb. (453.6 gm)	X	X		
Steak, rib eye, USDA Choice, boneless, per lb. (453.6 gm)	X	X		
Steak, round, USDA Choice, boneless, per lb. (453.6 gm)	X	X		
Steak, round, graded and ungraded, excluding USDA Prime and Choice, per lb. (453.6 gm)	X	X		
Steak, sirloin, USDA Choice, bone-in, per lb. (453.6 gm)	X	X		
Steak, sirloin, graded and ungraded, excluding USDA Prime and Choice, per lb. (453.6 gm)	X	X		
Steak, sirloin, USDA Choice, boneless, per lb. (453.6 gm)	X	X		
Short ribs, any primal source, bone-in, per lb. (453.6 gm)	X	X		
Beef for stew, boneless, per lb. (453.6 gm)	X	X		
All uncooked beef steaks, per lb. (453.6 gm)	X	X		
All uncooked other beef (excluding veal), per lb. (453.6 gm)	X	X		
Pork and other meats				
Bacon, sliced, per lb. (453.6 gm)	X	X		
Chops, center cut, bone-in, per lb. (453.6 gm)	X	X		
Chops, boneless, per lb. (453.6 gm)	X	X		
All pork chops, per lb. (453.6 gm)	X	X		
Ham, rump or shank half, bone-in, smoked, per lb. (453.6 gm)	X	X		
Ham, boneless, excluding canned, per lb. (453.6 gm)	X	X		
All ham (excluding canned ham and luncheon slices), per lb. (453.6 gm)	X	X		
Ham, canned, 3 or 5 lbs, per lb. (453.6 gm)	X	X		
Shoulder picnic, bone-in, smoked, per lb. (453.6 gm)	X	X		
All other pork (excluding canned ham and luncheon slices), per lb. (453.6 gm)	X	X		
Sausage, fresh, loose, per lb. (453.6 gm)	X	X		
Frankfurters, all meat or all beef, per lb. (453.6 gm)	X	X		
Bologna, all beef or mixed, per lb. (453.6 gm)	X	X		
Lamb and mutton, bone-in, per lb. (453.6 gm)	X	X		

Appendix 3. Items for which average prices are published—Continued

Item	United States	Region	Population size class	Area
Poultry, fish and eggs				
Chicken, fresh, whole, per lb. (453.6 gm)	X	X		
Chicken breast, bone-in, per lb. (453.6 gm)	X	X		
Chicken legs, bone-in, per lb. (453.6 gm)	X	X		
Turkey, frozen, whole, per lb. (453.6 gm)	X	X		
Tuna, light, chunk, per lb. (453.6 gm)	X	X		
Eggs, Grade A, large, per doz.	X	X		
Eggs, Grade AA, large, per doz.	X	X		
Dairy products				
Milk, fresh, whole, fortified, per 1/2 gal. (1.9 lit)	X	X		
Milk, fresh, whole, fortified, per gal. (3.8 lit)	X	X		
Milk, fresh, low fat, per 1/2 gal. (1.9 lit)	X	X		
Milk, fresh, low fat, per gal. (3.8 lit)	X	X		
Butter, salted, grade AA, stick, per lb. (453.6 gm)	X	X		
American processed cheese, per lb. (453.6 gm)	X	X		
Cheddar cheese, natural, per lb. (453.6 gm)	X	X		
Ice cream, prepackaged, bulk, regular, per 1/2 gal. (1.9 lit)	X	X		
Yogurt, natural, fruit flavored, per 8 oz. (226.8 gm)	X	X		
Fresh fruits and vegetables				
Apples, Red Delicious, per lb. (453.6 gm)	X	X		
Bananas, per lb. (453.6 gm)	X	X		
Oranges, Navel, per lb. (453.6 gm)	X	X		
Oranges, Valencia, per lb. (453.6 gm)	X	X		
Cherries, per lb. (453.6 gm)	X	X		
Grapefruit, per lb. (453.6 gm)	X	X		
Grapes, Thompson, Seedless, per lb. (453.6 gm)	X	X		
Lemons, per lb. (453.6 gm)	X	X		
Peaches, per lb. (453.6 gm)	X	X		
Pears, Anjou, per lb. (453.6 gm)	X	X		
Strawberries, dry pint, per 12 oz. (340.2 gm)	X	X		
Potatoes, white, per lb. (453.6 gm)	X	X		
Lettuce, iceberg, per lb. (453.6 gm)	X	X		
Tomatoes, field grown, per lb. (453.6 gm)	X	X		
Broccoli, per lb. (453.6 gm)	X	X		
Cabbage, per lb. (453.6 gm)	X	X		
Carrots, short trimmed and topped, per lb. (453.6 gm)	X	X		
Celery, per lb. (453.6 gm)	X	X		
Corn on the cob, per lb. (453.6 gm)	X	X		
Cucumbers, per lb. (453.6 gm)	X	X		
Onions, dry yellow, per lb. (453.6 gm)	X	X		
Peppers, sweet, per lb. (453.6 gm)	X	X		
Processed fruits and vegetables				
Apple sauce, any variety, all sizes, per lb. (453.6 gm)	X	X		
Orange juice, frozen concentrate, 12 oz. can, per 16 oz. (473.2 ml)	X	X		
Peaches, canned, any variety, all sizes, per lb. (453.6 gm)	X	X		
Beans, dried, any type, all sizes, per lb. (453.6 gm)	X	X		
Corn, canned, any style, all sizes, per lb. (453.6 gm)	X	X		
Potatoes, frozen, french fried, per lb. (453.6 gm)	X	X		
Tomatoes, canned, whole, per lb. (453.6 gm)	X	X		
Tomatoes, canned, any type, all sizes, per lb. (453.6 gm)	X	X		
Other food items				
Sugar, white, all sizes, per lb. (453.6 gm)	X	X		
Sugar, white, 33-80 oz. pkg, per lb. (453.6 gm)	X	X		
Margarine, stick, per lb. (453.6 gm)	X	X		
Margarine, soft, tubs, per lb. (453.6 gm)	X	X		
Shortening, vegetable oil blends, per lb. (453.6 gm)	X	X		
Peanut butter, creamy, all sizes, per lb. (453.6 gm)	X	X		
Cola, nondiet, cans, 72 oz. 6 pk., per 16 oz. (473.2 ml)				
{Deposit may be included in price.}	X	X		
Cola, nondiet, per 2 liters (67.6 oz) {Deposit may be included in price.}	X	X		
Coffee, 100%, ground roast, all sizes, per lb. (453.6 gm)	X	X		
Coffee, 100%, ground roast, 13.1-20 oz. can, per lb. (453.6 gm)	X	X		

Appendix 3. Items for which average prices are published—Continued

Item	United States	Region	Population size class	Area
Coffee, instant, plain, regular, all sizes, per lb. (453.6 gm)	X	X		
Potato chips, per 16 oz. (453.6 gm)	X	X		
Alcoholic beverages				
Malt beverages, all types, all sizes, any origin, per 16 oz. (473.2 ml)	X	X		
Vodka, all types, all sizes, any origin, per 1 liter (33.8 oz)	X	X		
Wine, red and white table, all sizes, any origin, per 1 liter (33.8 oz.)	X	X		

Appendix 4. Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2006 (2003-2004 Weights)

(Percent of all items)

Item and group	U.S. city average	
	CPI-U	CPI-W
Expenditure category		
All items	100.000	100.000
Food and beverages	14.992	16.475
Food	13.885	15.457
Food at home	7.896	9.244
Cereals and bakery products	1.103	1.285
Cereals and cereal products .....	.359	.440
Flour and prepared flour mixes .....	.046	.054
Breakfast cereal .....	.199	.237
Rice, pasta, cornmeal .....	.114	.148
Bakery products .....	.744	.845
Bread .....	.221	.246
Fresh biscuits, rolls, muffins .....	.103	.109
Cakes, cupcakes, and cookies .....	.206	.245
Other bakery products .....	.214	.246
Meats, poultry, fish, and eggs	2.112	2.623
Meats, poultry, and fish	2.013	2.503
Meats	1.305	1.660
Beef and veal .....	.628	.808
Uncooked ground beef .....	.232	.319
Uncooked beef roasts .....	.105	.129
Uncooked beef steaks .....	.239	.294
Uncooked other beef and veal .....	.052	.066
Pork .....	.414	.527
Bacon, breakfast sausage, and related products .....	.132	.169
Ham .....	.094	.112
Pork chops .....	.081	.117
Other pork including roasts and picnics .....	.106	.129
Other meats .....	.263	.325
Poultry .....	.371	.468
Chicken .....	.297	.385
Other poultry including turkey .....	.073	.082
Fish and seafood .....	.337	.375
Fresh fish and seafood .....	.208	.232
Processed fish and seafood .....	.129	.144
Eggs .....	.099	.121
Dairy and related products .....	.821	.928
Milk .....	.293	.358
Cheese and related products .....	.253	.271
Ice cream and related products .....	.142	.157
Other dairy and related products .....	.133	.143
Fruits and vegetables	1.211	1.332
Fresh fruits and vegetables .....	.963	1.052
Fresh fruits .....	.493	.533
Apples .....	.086	.100
Bananas .....	.073	.085
Citrus fruits .....	.094	.107
Other fresh fruits .....	.239	.241
Fresh vegetables .....	.470	.520
Potatoes .....	.077	.092
Lettuce .....	.062	.069
Tomatoes .....	.092	.109
Other fresh vegetables .....	.239	.250
Processed fruits and vegetables .....	.248	.279
Canned fruits and vegetables .....	.129	.142
Frozen fruits and vegetables .....	.077	.087
Other processed fruits and vegetables including dried .....	.042	.051
Nonalcoholic beverages and beverage materials .....	.906	1.082
Juices and nonalcoholic drinks .....	.602	.754
Carbonated drinks .....	.325	.432
Frozen noncarbonated juices and drinks .....	.017	.020
Nonfrozen noncarbonated juices and drinks .....	.260	.303
Beverage materials including coffee and tea .....	.304	.328
Coffee .....	.100	.103
Other beverage materials including tea .....	.204	.225

Appendix 4. Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2006 (2003-2004 Weights)-Continued

(Percent of all items)

Item and group	U.S. city average	
	CPI-U	CPI-W
Expenditure category		
Other food at home	1.743	1.993
Sugar and sweets .....	.302	.337
Sugar and artificial sweeteners .....	.056	.069
Candy and chewing gum .....	.194	.207
Other sweets .....	.052	.061
Fats and oils .....	.227	.283
Butter and margarine .....	.068	.081
Salad dressing .....	.062	.080
Other fats and oils including peanut butter .....	.097	.122
Other foods	1.214	1.373
Soups .....	.086	.092
Frozen and freeze dried prepared foods .....	.247	.280
Snacks .....	.268	.288
Spices, seasonings, condiments, sauces .....	.215	.244
Baby food .....	.071	.100
Other miscellaneous foods .....	.327	.368
Food away from home	5.989	6.213
Full service meals and snacks	2.615	2.164
Limited service meals and snacks	2.711	3.238
Food at employee sites and schools .....	.257	.332
Food from vending machines and mobile vendors .....	.126	.201
Other food away from home .....	.281	.279
Alcoholic beverages	1.107	1.018
Alcoholic beverages at home .....	.708	.717
Beer, ale, and other malt beverages at home .....	.332	.457
Distilled spirits at home .....	.123	.114
Wine at home .....	.253	.146
Alcoholic beverages away from home .....	.399	.301
Housing	42.691	40.463
Shelter	32.776	30.570
Rent of primary residence	5.930	8.021
Lodging away from home	2.648	1.430
Housing at school, excluding board .....	.154	.075
Other lodging away from home including hotels and motels	2.493	1.356
Owners' equivalent rent of primary residence	23.830	20.776
Tenants' and household insurance .....	.369	.342
Fuels and utilities	5.264	5.779
Household energy	4.368	4.842
Fuel oil and other fuels .....	.338	.346
Fuel oil .....	.231	.227
Propane, kerosene, and firewood .....	.107	.119
Gas (piped) and electricity	4.029	4.496
Electricity	2.750	3.099
Utility (piped) gas service	1.280	1.397
Water and sewer and trash collection services .....	.897	.937
Water and sewerage maintenance .....	.669	.711
Garbage and trash collection .....	.228	.226
Household furnishings and operations	4.651	4.114
Window and floor coverings and other linens .....	.350	.281
Floor coverings .....	.051	.046
Window coverings .....	.097	.069
Other linens .....	.203	.165
Furniture and bedding .....	.981	.856
Bedroom furniture .....	.324	.290
Living room, kitchen, and dining room furniture .....	.458	.401
Other furniture .....	.193	.153
Unsampled furniture .....	.006	.013
Appliances .....	.334	.381
Major appliances .....	.193	.218
Other appliances .....	.134	.153
Unsampled appliances .....	.007	.010
Other household equipment and furnishings .....	.585	.491
Clocks, lamps, and decorator items .....	.318	.252
Indoor plants and flowers .....	.100	.079
Dishes and flatware .....	.075	.068
Nonelectric cookware and tableware .....	.091	.092

Appendix 4. Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2006 (2003-2004 Weights)-Continued

(Percent of all items)

Item and group	U.S. city average	
	CPI-U	CPI-W
Expenditure category		
Tools, hardware, outdoor equipment and supplies .....	.756	.791
Tools, hardware and supplies .....	.206	.292
Outdoor equipment and supplies .....	.365	.319
Unsampled tools, hardware, outdoor equipment and supplies .....	.185	.179
Housekeeping supplies .....	.853	.946
Household cleaning products .....	.372	.461
Household paper products .....	.211	.231
Miscellaneous household products .....	.270	.254
Household operations .....	.792	.368
Domestic services .....	.252	.079
Gardening and lawn care services .....	.256	.113
Moving, storage, freight expense .....	.079	.051
Repair of household items .....	.128	.080
Unsampled household operations .....	.077	.045
Apparel	3.726	4.041
Men's and boys' apparel .....	.885	.954
Men's apparel .....	.698	.706
Men's suits, sport coats, and outerwear .....	.136	.121
Men's furnishings .....	.175	.176
Men's shirts and sweaters .....	.198	.184
Men's pants and shorts .....	.173	.207
Unsampled men's apparel .....	.017	.018
Boys' apparel .....	.186	.247
Women's and girls' apparel	1.590	1.680
Women's apparel	1.353	1.388
Women's outerwear .....	.113	.121
Women's dresses .....	.139	.218
Women's suits and separates .....	.723	.706
Women's underwear, nightwear, sportswear and accessories .....	.352	.318
Unsampled women's apparel .....	.026	.024
Girls' apparel .....	.237	.292
Footwear .....	.749	.954
Men's footwear .....	.228	.311
Boys' and girls' footwear .....	.162	.236
Women's footwear .....	.359	.407
Infants' and toddlers' apparel .....	.177	.235
Jewelry and watches .....	.325	.218
Watches .....	.046	.045
Jewelry .....	.279	.173
Transportation	17.249	19.515
Private transportation	16.188	18.793
New and used motor vehicles	7.581	8.626
New vehicles	4.982	5.210
Used cars and trucks	1.716	2.675
Leased cars and trucks .....	.596	.540
Car and truck rental .....	.090	.056
Unsampled new and used motor vehicles .....	.195	.145
Motor fuel	4.347	5.441
Gasoline (all types)	4.303	5.388
Other motor fuels .....	.044	.053
Motor vehicle parts and equipment .....	.370	.444
Tires .....	.219	.238
Vehicle accessories other than tires .....	.151	.206
Motor vehicle maintenance and repair	1.145	1.145
Motor vehicle body work .....	.086	.064
Motor vehicle maintenance and servicing .....	.425	.423
Motor vehicle repair .....	.612	.631
Unsampled service policies .....	.022	.027
Motor vehicle insurance	2.261	2.678
Motor vehicle fees .....	.484	.458
State and local registration and license .....	.311	.321
Parking and other fees .....	.161	.132
Unsampled motor vehicle fees .....	.012	.004
Public transportation	1.060	.723
Airline fare .....	.649	.387
Other intercity transportation .....	.163	.075
Intracity transportation .....	.246	.257
Unsampled public transportation .....	.003	.004

Appendix 4. Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2006 (2003-2004 Weights)-Continued

(Percent of all items)

Item and group	U.S. city average	
	CPI-U	CPI-W
Expenditure category		
Medical care	6.281	5.228
Medical care commodities	1.446	1.135
Prescription drugs	1.018	.775
Prescription drugs	1.006	.767
Unsampled rent or repair of medical equipment .....	.011	.007
Nonprescription drugs and medical supplies .....	.428	.360
Internal and respiratory over-the-counter drugs .....	.294	.265
Nonprescription medical equipment and supplies .....	.135	.094
Medical care services	4.834	4.094
Professional services	2.817	2.338
Physicians' services	1.616	1.404
Dental services .....	.721	.584
Eyeglasses and eye care .....	.225	.181
Services by other medical professionals .....	.255	.169
Hospital and related services	1.630	1.378
Hospital services	1.542	1.344
Nursing homes and adult daycare .....	.089	.034
Health insurance .....	.386	.378
Recreation	5.552	5.022
Video and audio	1.719	1.867
Televisions .....	.124	.123
Cable and satellite television and radio service	1.145	1.263
Other video equipment .....	.040	.042
Video cassettes, discs, and other media including rental .....	.173	.214
Audio equipment .....	.074	.070
Audio discs, tapes and other media .....	.090	.101
Unsampled video and audio .....	.075	.055
Pets, pet products and services .....	.646	.640
Pets and pet products .....	.377	.418
Pet services including veterinary .....	.269	.222
Sporting goods .....	.674	.529
Sports vehicles including bicycles .....	.401	.272
Sports equipment .....	.264	.250
Unsampled sporting goods .....	.009	.007
Photography .....	.168	.147
Photographic equipment and supplies .....	.080	.068
Photographers and film processing .....	.086	.077
Unsampled photography .....	.002	.002
Other recreational goods .....	.381	.366
Toys .....	.245	.269
Sewing machines, fabric and supplies .....	.071	.052
Music instruments and accessories .....	.049	.033
Unsampled recreation commodities .....	.017	.013
Recreation services	1.651	1.248
Club membership dues and fees for participant sports .....	.504	.312
Admissions .....	.706	.608
Fees for lessons or instructions .....	.217	.139
Unsampled recreation services .....	.223	.189
Recreational reading materials .....	.312	.224
Newspapers and magazines .....	.184	.142
Recreational books .....	.127	.082
Unsampled recreational reading materials .....	.001	.000
Education and communication	6.034	5.605
Education	3.076	2.329
Educational books and supplies .....	.204	.208
Tuition, other school fees, and childcare	2.872	2.121
College tuition and fees	1.524	.970
Elementary and high school tuition and fees .....	.408	.272
Child care and nursery school .....	.735	.759
Technical and business school tuition and fees .....	.067	.033
Unsampled tuition, other school fees, and childcare .....	.137	.087
Communication	2.958	3.276
Postage and delivery services .....	.189	.152

Appendix 4. Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2006 (2003-2004 Weights)-Continued

(Percent of all items)

Item and group	U.S. city average	
	CPI-U	CPI-W
Expenditure category		
Postage .....	.174	.140
Delivery services .....	.015	.012
Information and information processing	2.769	3.124
Telephone services	2.225	2.633
Land-line telephone services, local charges .....	.746	.859
Land-line telephone services, long distance charges .....	.685	.807
Wireless telephone services .....	.795	.967
Information technology, hardware and services .....	.543	.492
Personal computers and peripheral equipment .....	.203	.178
Computer software and accessories .....	.037	.026
Internet services and electronic information providers .....	.245	.239
Telephone hardware, calculators, and other consumer information items .....	.051	.039
Unsampled information and information processing .....	.008	.009
Other goods and services	3.476	3.652
Tobacco and smoking products .....	.712	1.139
Cigarettes .....	.662	1.073
Tobacco products other than cigarettes .....	.046	.061
Unsampled tobacco and smoking products .....	.004	.004
Personal care	2.764	2.513
Personal care products .....	.708	.771
Hair, dental, shaving, and miscellaneous personal care products .....	.368	.421
Cosmetics, perfume, bath, nail preparations and implements .....	.336	.345
Unsampled personal care products .....	.005	.005
Personal care services .....	.677	.618
Haircuts and other personal care services .....	.677	.618
Miscellaneous personal services	1.188	.962
Legal services .....	.304	.257
Funeral expenses .....	.191	.124
Laundry and dry cleaning services .....	.285	.282
Apparel services other than laundry and dry cleaning .....	.034	.025
Financial services .....	.186	.147
Care of invalids and elderly at home .....	.106	.005
Unsampled items .....	.082	.122
Miscellaneous personal goods .....	.192	.162
Special aggregate indexes		
All items	100.000	100.000
Commodities	40.305	44.175
Commodities less food and beverages	25.313	27.700
Nondurables less food and beverages	14.191	15.699
Nondurables less food, beverages, and apparel	10.465	11.658
Durables	11.122	12.001
Services	59.695	55.825
Rent of shelter	32.407	30.227
Transportation services	5.638	5.600
Other services	10.730	9.761
All items less food	86.115	84.543
All items less shelter	67.224	69.430
All items less medical care	93.719	94.772
Commodities less food	26.420	28.718
Nondurables less food	15.299	16.717
Nondurables less food and apparel	11.572	12.676
Nondurables	29.183	32.174
Apparel less footwear	2.977	3.087
Services less rent of shelter	27.288	25.598
Services less medical care services	54.861	51.732
Energy	8.715	10.282
All items less energy	91.285	89.718
All items less food and energy	77.401	74.261
Commodities less food and energy commodities	21.735	22.932
Energy commodities	4.685	5.786
Services less energy services	55.666	51.329
Domestically produced farm food	6.580	7.702
Utilities and public transportation	9.356	10.051

Appendix 5. Sample areas, population weights, and pricing cycles

PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)		PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)	
			Odd	Even				Odd	Even
	Northeast region				<i>B110</i>	<i>Burlington, VT MSA</i> Chittenden (part), Franklin (part), Grand Isle (part)	0.74		X
	New York-Northern New Jersey-Long Island, NY-NJ-CT-PA CMSA:				<i>B112</i>	Sharon, PA MSA Mercer	.67		X
A109	New York City Bronx, Kings, New York, Queens, Richmond	3.39	X	X	<i>B114</i>	Johnstown, PA MSA Cambria, Somerset	.95	X	
A110	New York-Connecticut Suburbs NY portion: Dutchess, Nassau, Orange, Putnam, Rockland, Suffolk, Westchester CT portion: Fairfield, Litchfield (part), Middlesex (part), New Haven (part)	2.74	X	X	<i>B116</i>	Springfield, MA MSA Franklin (part), Hampden (part), Hampshire (part)	1.12	X	
						Midwest region			
					<i>A207</i>	Chicago-Gary-Kenosha, IL-IN-WI CMSA IL portion: Cook, DeKalb, DuPage, Grundy, Kane, Kankakee, Kendall, Lake, McHenry, Will IN portion: Lake, Porter WI portion: Kenosha	3.81	X	X
A111	New Jersey-Pennsylvania Suburbs NJ portion: Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union, Warren PA portion: Pike	2.83	X	X	<i>A208</i>	Detroit-Ann Arbor-Flint, MI CMSA Genesee, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, Wayne	2.40		X
A102	Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD CMSA NJ portion: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Salem DE portion: New Castle MD portion: Cecil PA portion: Bucks, Chester, Delaware, Montgomery, Philadelphia	2.73		X	<i>A209</i>	St. Louis, MO-IL MSA IL portion: Clinton, Jersey, Madison, Monroe, St. Clair MO portion: Franklin, Jefferson, Lincoln, St. Charles, St. Louis, Warren, St. Louis city	1.15		X
A103	Boston-Brockton-Nashua, MA-NH-ME-CT CMSA CT portion: Windham (part) MA portion: Bristol (part), Essex, Hampden (part), Middlesex, Norfolk, Plymouth, Suffolk, Worcester (part) ME portion: York (part) NH portion: Hillsborough (part), Merrimack (part), Rockingham (part), Strafford (part)	2.52	X		<i>A210</i>	Cleveland-Akron, OH CMSA Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Summit	1.32	X	
A104	Pittsburgh, PA MSA Allegheny, Beaver, Butler, Fayette, Washington, Westmoreland	1.11		X	<i>A211</i>	Minneapolis-St. Paul, MN-WI MSA MN portion: Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, Wright WI portion: Pierce, St. Croix	1.18	X	
B102	Reading, PA MSA Berks	.83	X		<i>A212</i>	Milwaukee-Racine, WI CMSA Milwaukee, Ozaukee, Racine, Washington, Waukesha	.74	X	
B104	Syracuse, NY MSA Cayuga, Madison, Onondaga, Oswego	.87	X		<i>A213</i>	Cincinnati-Hamilton, OH-KY-IN CMSA IN portion: Dearborn, Ohio KY portion: Boone, Campbell, Gallatin, Grant, Kenton, Pendleton OH portion: Brown, Butler, Clermont, Hamilton, Warren	.84	X	
B106	Buffalo-Niagara Falls, NY MSA Erie, Niagara	.68		X	<i>A214</i>	Kansas City, MO-KS MSA KS portion: Johnson, Leavenworth, Miami, Wyandotte MO Portion: Cass, Clay, Clinton, Jackson, Lafayette, Platte, Ray	.73		X
B108	Hartford, CT MSA Hartford (part), Litchfield (part), Middlesex (part), New London (part), Tolland (part), Windham (part)	.83		X					

Appendix 5. Sample areas, population weights, and pricing cycles—Continued

PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)		PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)	
			Odd	Even				Odd	Even
B218	Wausau, WI MSA Marathon	0.71		X		Carroll, Harford, Howard, Queen Anne's, Baltimore city			
B220	Dayton-Springfield, OH MSA Clark, Greene, Miami, Montgomery	.84		X	A316	Dallas-Fort Worth, TX CMSA Collin, Dallas, Denton, Ellis, Henderson, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant	1.87	X	
B222	Evansville-Henderson, IN-KY MSA IN portion: Posey, Vanderburgh, Warrick KY portion: Henderson	.77		X	A318	Houston-Galveston-Brazoria, TX CMSA Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller	1.73		X
B224	Columbus, OH MSA Delaware, Fairfield, Franklin, Licking, Madison, Pickaway	.71	X		A319	Atlanta, GA MSA Barrow, Bartow, Carroll, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Newton, Paulding, Pickens, Rockdale, Spalding, Walton	1.37		X
B226	Saginaw-Bay City-Midland, MI MSA Bay, Midland, Saginaw	.87	X		A320	Miami-Fort Lauderdale, FL CMSA Broward, Dade	1.48		X
B228	Elkhart-Goshen, IN MSA Elkhart	.81	X		A321	Tampa-St. Petersburg-Clearwater, FL MSA Hernando, Hillsborough, Pasco, Pinellas	.96	X	
B230	Decatur, IL MSA Macon	.87	X		B338	Chattanooga, TN-GA MSA GA portion: Catoosa, Dade, Walker TN portion: Hamilton	0.81	X	
B232	Youngstown-Warren, OH MSA Columbiana, Mahoning, Trumbull	.72		X	B340	Florence, SC MSA Florence	.74		X
B234	Madison, WI MSA Dane	.88		X	B342	Albany, GA MSA Dougherty, Lee	.84		X
B236	Lincoln, NE MSA Lancaster	.88	X		B344	Norfolk-Virginia Beach-Newport News, VA-NC MSA NC portion: Currituck VA portion: Gloucester, Isle of Wight, James City, Mathews, York, Chesapeake city Hampton city, Newport News city, Norfolk city, Poquoson city, Portsmouth city, Suffolk city, Virginia Beach city, Williamsburg city	.85		X
C212	Faribault-Northfield, MN Urban parts of: Rice	.61		X	B346	Pine Bluff, AR MSA Jefferson	.81		X
C216	Chanute-Iola, KS Urban parts of: Allen, Neosho Housing only in urban parts of: Bourbon, Crawford	.78	X		B348	Raleigh-Durham-Chapel Hill, NC MSA Chatham, Durham, Franklin, Johnstown, Orange, Wake	.82		X
C218	Brookings-Madison, SD Urban parts of: Brookings, Lake, Moody	.46		X	B350	Richmond-Petersburg, VA MSA Charles City, Chesterfield, Dinwiddie, Goochland, Hanover, Henrico, New Kent, Powhatan, Prince George, Colonial Heights city, Hopewell city, Petersburg city, Richmond city	.89		X
C222	Mount Vernon, IL Urban parts of: Jefferson Housing only in urban parts of: Marion South region Washington-Baltimore, DC-MD- VA-WV CMSA:	.90	X		B352	Beaumont-Port Arthur, TX MSA Hardin, Jefferson, Orange	.92		X
A312	Washington, DC-MD-VA-WV DC portion: District of Columbia MD portion: Calvert, Charles, Frederick, Montgomery, Prince George's, Washington VA portion: Arlington, Clarke, Culpeper, Fairfax, Fauquier, King George, Loudoun, Prince William, Spotsylvania, Stafford, Warren, Alexandria city, Fairfax city, Falls Church city, Fredericksburg city, Manassas city, Manassas Park city WV portion: Berkeley, Jefferson	2.01	X		B354	Brownsville-Harlingen-San Benito, TX MSA Cameron	.75	X	
A313	Baltimore, MD PMSA Anne Arundel, Baltimore,	1.10	X						

Appendix 5. Sample areas, population weights, and pricing cycles—Continued

PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)		PSU	Sample areas and counties	Percent of index population	Pricing cycle (months)	
			Odd	Even				Odd	Even
B356	Florence, AL MSA Colbert, Lauderdale	0.81	X			PMSA Los Angeles			
B358	Greenville-Spartanburg-Anderson, SC MSA Anderson, Cherokee, Greenville, Pickens, Spartanburg	.92	X		A420	Los Angeles Suburbs, CA Orange, Riverside, San Bernardino, Ventura	2.62	X	X
B360	Fort Myers-Cape Coral, FL MSA Lee	.74	X		A422	San Francisco-Oakland-San Jose, CA CMSA Alameda, Contra Costa, Marin, Napa, Santa Clara, Santa Cruz, San Francisco, San Mateo, Solano, Sonoma	2.89		X
B362	Birmingham, AL MSA Blount, Jefferson, St. Clair, Shelby	.89	X		A423	Seattle-Tacoma-Bremerton, WA CMSA Island, King, Kitsap, Pierce, Snohomish, Thurston	1.37		X
B364	Melbourne-Titusville-Palm Bay, FL MSA Brevard	.79	X		A424	San Diego, CA MSA San Diego	1.16	X	
B366	Lafayette, LA MSA Acadia, Lafayette, St. Landry, St. Martin	.90	X		A425	Portland-Salem, OR-WA CMSA OR portion: Clackamas, Columbia, Marion, Multnomah, Polk, Washington, Yamhill WA portion: Clark	.83	X	
B368	Ocala, FL MSA Marion	.74	X		A426	Honolulu, HI MSA Honolulu	.39	X	
B370	Gainesville, FL MSA Alachua	.78		X	A427	Anchorage, AK MSA Anchorage	.10		X
B372	Amarillo, TX MSA Potter, Randall	.85		X	A429	Phoenix-Mesa, AZ MSA Maricopa, Pinal	1.04	X	
B374	San Antonio, TX MSA Bexar, Comal, Guadalupe, Wilson	.90	X		A433	Denver-Boulder-Greeley, CO CMSA Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson, Weld	.92	X	
B376	Oklahoma City, OK MSA Canadian, Cleveland, Logan, McClain, Oklahoma, Pottawattamie	.87		X	B482	Chico-Paradise, CA MSA Butte	.99		X
B378	Baton Rouge, LA MSA East Baton Rouge, Livingston, West Baton Rouge	.91	X		B484	Provo-Orem, UT MSA Utah	1.01		X
B380	Odessa-Midland, TX MSA Ector, Midland	.80		X	B486	Modesto, CA MSA Stanislaus	1.01	X	
C328	Arcadia-Wauchula, FL Urban parts of: De Soto, Hardee Housing only in urban parts of: Glades, Hendry, Highlands	.93		X	B488	Boise City, ID MSA Ada, Canyon	.84	X	
C332	Morristown-Jefferson City, TN Urban parts of: Hamblen, Jefferson	.65	X		B490	Las Vegas, NV-AZ MSA AZ portion: Mohave NV portion: Clark, Nye	.94		X
C334	Picayune-Poplarville, MS Urban parts of: Pearl River Housing only in urban parts of: Lamar, Marion	1.15		X	B492	Yuma, AZ MSA Yuma	.83	X	
C344	Statesboro-Waynesboro-Millennium-Sylvania, GA Urban parts of: Bulloch, Burke, Jenkins, Screven West region Los Angeles-Riverside-Orange County, CA CMSA:	.72	X		C450	Bend-Redmond, OR Urban parts of: Deschutes	.91		X
A419	Los Angeles-Long Beach, CA	4.10	X	X	C456	Pullman-Colfax, WA Urban parts of: Whitman	.91	X	

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items

F MAJOR GROUP: FOOD AND BEVERAGES

CEREALS AND BAKERY PRODUCTS

FA Cereals and cereal products

FA01	<i>Flour and prepared flour mixes</i>
FA011	FLOUR AND PREPARED FLOUR MIXES
FA02	<i>Breakfast cereal</i>
FA021	BREAKFAST CEREAL
FA03	<i>Rice, pasta, cornmeal</i>
FA031	RICE, PASTA, CORNMEAL

FB Bakery products

FB01	<i>Bread</i>
FB011	BREAD
FB02	<i>Fresh biscuits, rolls, muffins</i>
FB021	FRESH BISCUITS, ROLLS, AND MUFFINS
FB03	<i>Cakes, cupcakes, and cookies</i>
FB031	CAKES AND CUPCAKES (EXCLUDING FROZEN)
FB032	COOKIES
FB04	<i>Other bakery products</i>
FB041	CRACKERS AND BREAD & CRACKER PRODUCTS
FB042	SWEETROLLS, COFFEE CAKE & DOUGHNUTS (EXCLUDING FROZEN)
FB043	FROZEN BAKERY PRODUCTS & FROZEN/REFRIGERATED DOUGHS & BATTERS
FB044	PIES, TARTS, TURNOVERS (EXCLUDING FROZEN)

MEATS, POULTRY, FISH, AND EGGS

FC Beef and veal

FC01	<i>Uncooked ground beef</i>
FC011	UNCOOKED GROUND BEEF
FC02	<i>Uncooked beef roasts</i>
FC021	UNCOOKED BEEF ROASTS
FC03	<i>Uncooked beef steaks</i>
FC031	UNCOOKED BEEF STEAKS
FC04	<i>Uncooked other beef and veal</i>
FC041	OTHER UNCOOKED BEEF AND VEAL

FD Pork

FD01	<i>Bacon, breakfast sausage, and related products</i>
FD011	BACON, BREAKFAST SAUSAGE, AND RELATED PRODUCTS
FD02	<i>Ham</i>
FD021	HAM
FD03	<i>Pork chops</i>
FD031	PORK CHOPS
FD04	<i>Other pork including roasts and picnics</i>
FD041	OTHER PORK INCLUDING ROASTS AND PICNICS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

FE Other meats

FE01 Other meats
FE011 FRANKFURTERS
FE012 LUNCHMEATS
FE013 LAMB, ORGAN MEATS, AND GAME

FF Poultry

FF01 Chicken
FF011 CHICKEN
FF02 Other poultry including turkey
FF021 OTHER POULTRY INCLUDING TURKEY

FG Fish and seafood

FG01 Fresh fish and seafood
FG011 FRESH FISH AND SEAFOOD
FG02 Processed fish and seafood
FG021 PROCESSED FISH AND SEAFOOD

FH Eggs

FH01 Eggs
FH011 EGGS

DAIRY AND RELATED PRODUCTS

FJ Dairy and related products

FJ01 Milk
FJ011 MILK
FJ02 Cheese and related products
FJ021 CHEESE AND RELATED PRODUCTS
FJ03 Ice cream and related products
FJ031 ICE CREAM AND RELATED PRODUCTS
FJ04 Other dairy and related products
FJ041 OTHER DAIRY AND RELATED PRODUCTS

FRUITS AND VEGETABLES

FK Fresh fruits

FK01 Apples
FK011 APPLES
FK02 Bananas
FK021 BANANAS
FK03 Citrus fruits
FK031 CITRUS FRUITS
FK04 Other fresh fruits
FK041 OTHER FRESH FRUITS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

FL Fresh vegetables

<i>FL01</i>	<i>Potatoes</i>
FL011	POTATOES
<i>FL02</i>	<i>Lettuce</i>
FL021	LETTUCE
<i>FL03</i>	<i>Tomatoes</i>
FL031	TOMATOES
<i>FL04</i>	<i>Other fresh vegetables</i>
FL041	OTHER FRESH VEGETABLES INCLUDING FRESH HERBS

FM Processed fruits and vegetables

<i>FM01</i>	<i>Canned fruits and vegetables</i>
FM011	CANNED FRUITS AND VEGETABLES
<i>FM02</i>	<i>Frozen fruits and vegetables</i>
FM021	FROZEN FRUITS AND VEGETABLES
<i>FM03</i>	<i>Other processed fruits and vegetables including dried</i>
FM031	OTHER PROCESSED FRUITS AND VEGETABLES INCLUDING DRIED

NONALCOHOLIC BEVERAGES AND BEVERAGE MATERIALS

FN Juices and nonalcoholic drinks

<i>FN01</i>	<i>Carbonated drinks</i>
FN011	CARBONATED DRINKS
<i>FN02</i>	<i>Frozen noncarbonated juices and drinks</i>
FN021	FROZEN NONCARBONATED JUICES AND DRINKS
<i>FN03</i>	<i>Nonfrozen noncarbonated juices and drinks</i>
FN031	NONFROZEN NONCARBONATED JUICES AND DRINKS

FP Beverage materials including coffee and tea

<i>FP01</i>	<i>Coffee</i>
FP011	COFFEE
<i>FP02</i>	<i>Other beverage materials including tea</i>
FP021	TEA
FP022	OTHER BEVERAGE MATERIALS

OTHER FOOD AT HOME

FR Sugar and sweets

<i>FR01</i>	<i>Sugar and artificial sweeteners</i>
FR011	SUGAR AND ARTIFICIAL SWEETENERS
<i>FR02</i>	<i>Candy and chewing gum</i>
FR021	CANDY AND CHEWING GUM
<i>FR03</i>	<i>Other sweets</i>
FR031	OTHER SWEETS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

FS Fats and oils

<i>FS01</i>	<i>Butter and margarine</i>
FS011	BUTTER AND MARGARINE
<i>FS02</i>	<i>Salad dressing</i>
FS021	SALAD DRESSING
<i>FS03</i>	<i>Other fats and oils including peanut butter</i>
FS031	PEANUT BUTTER
FS032	OTHER FATS AND OILS

FT Other foods

<i>FT01</i>	<i>Soups</i>
FT011	SOUPS
<i>FT02</i>	<i>Frozen and freeze dried prepared foods</i>
FT021	FROZEN AND FREEZE DRIED PREPARED FOODS
<i>FT03</i>	<i>Snacks</i>
FT031	SNACKS
<i>FT04</i>	<i>Spices, seasonings, condiments, sauces</i>
FT041	SALT AND OTHER SEASONINGS AND SPICES
FT042	OLIVES, PICKLES, RELISHES
FT043	SAUCES AND GRAVIES
FT044	OTHER CONDIMENTS (EXCLUDING OLIVES, PICKLES, AND RELISHES)
<i>FT05</i>	<i>Baby food</i>
FT051	BABY FOOD
<i>FT06</i>	<i>Other miscellaneous foods</i>
FT061	PREPARED SALADS
FT062	OTHER MISCELLANEOUS FOODS

FOOD AWAY FROM HOME

FV Food away from home

<i>FV01</i>	<i>Full service meals and snacks</i>
FV011	FULL SERVICE MEALS AND SNACKS
<i>FV02</i>	<i>Limited service meals and snacks</i>
FV021	LIMITED SERVICE MEALS AND SNACKS
<i>FV03</i>	<i>Food at employee sites and schools</i>
FV031	FOOD AT EMPLOYEE SITES AND SCHOOLS
<i>FV04</i>	<i>Food from vending machines and mobile vendors</i>
FV041	FOOD FROM VENDING MACHINES AND MOBILE VENDORS
<i>FV05</i>	<i>Other food away from home</i>
FV051	BOARD, CATERED EVENTS, AND OTHER FOOD AWAY FROM HOME

ALCOHOLIC BEVERAGES

FW Alcoholic beverages at home

<i>FW01</i>	<i>Beer, ale, and other malt beverages at home</i>
FW011	BEER, ALE AND OTHER MALT BEVERAGES AT HOME

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

FW02 *Distilled spirits at home*
FW021 DISTILLED SPIRITS AT HOME
FW03 *Wine at home*
FW031 WINE AT HOME

FX Alcoholic beverages away from home

FX01 *Alcoholic beverages away from home*
FX011 ALCOHOLIC BEVERAGES AWAY FROM HOME

H MAJOR GROUP: HOUSING

SHELTER

HA Rent of primary residence

HA01 *Rent of primary residence*
HA011 RENT OF PRIMARY RESIDENCE

HB Lodging away from home

HB01 *Housing at school, excluding board*
HB011 HOUSING AT SCHOOL, EXCLUDING BOARD
HB02 *Other lodging away from home including hotels and motels*
HB021 RENTAL OF LODGING AWAY FROM HOME

HC Owners' equivalent rent of primary residence

HC01 *Owners' equivalent rent of primary residence*
HC011 OWNERS' EQUIVALENT RENT OF PRIMARY RESIDENCE

HD Tenants' and household insurance

HD01 *Tenants' and household insurance*
HD011 TENANTS' AND HOUSEHOLD INSURANCE

FUELS AND UTILITIES

HE Fuel oil and other fuels

HE01 *Fuel oil*
HE011 FUEL OIL
HE02 *Propane, kerosene, and firewood*
HE021 PROPANE, KEROSENE, AND FIREWOOD

HF Gas (piped) and electricity

HF01 *Electricity*
HF011 ELECTRICITY
HF02 *Utility (piped) gas service*

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

HF021 UTILITY (PIPED) GAS SERVICE

HG Water and sewer and trash collection services

HG01 *Water and sewerage maintenance*
HG011 RESIDENTIAL WATER AND SEWERAGE SERVICE
HG02 *Garbage and trash collection*
HG021 GARBAGE AND TRASH COLLECTION

HOUSEHOLD FURNISHINGS AND OPERATIONS

HH Window and floor coverings and other linens

HH01 *Floor coverings*
HH011 FLOOR COVERINGS
HH02 *Window coverings*
HH021 CURTAINS AND DRAPES
HH022 WINDOW COVERINGS
HH03 *Other linens*
HH031 BATHROOM LINENS
HH032 BEDROOM LINENS
HH033 KITCHEN & DINING ROOM LINENS

HJ Furniture and bedding

HJ01 *Bedroom furniture*
HJ011 MATTRESS & SPRINGS
HJ012 BEDROOM FURNITURE OTHER THAN MATTRESS & SPRINGS
HJ02 *Living room, kitchen, and dining room furniture*
HJ021 SOFAS, SLIPCOVERS, & DECORATIVE PILLOWS
HJ022 LIVING ROOM CHAIRS
HJ023 LIVING ROOM TABLES
HJ024 KITCHEN & DINING ROOM FURNITURE
HJ03 *Other furniture*
HJ031 INFANTS' FURNITURE
HJ032 OUTDOOR FURNITURE
HJ033 OCCASIONAL FURNITURE
HJ09 *Unsampled furniture*
HJ090 RENTAL OF FURNITURE

HK Appliances

HK01 *Major appliances*
HK011 REFRIGERATORS & HOME FREEZERS
HK012 WASHERS & DRYERS
HK013 STOVES AND OVENS EXCLUDING MICROWAVE OVENS
HK014 MICROWAVE OVENS
HK02 *Other appliances*
HK021 FLOOR CLEANING EQUIPMENT
HK022 SMALL ELECTRIC KITCHEN APPLIANCES
HK023 OTHER ELECTRIC APPLIANCES
HK09 *Unsampled appliances*
HK090 PORTABLE DISHWASHERS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

HL Other household equipment and furnishings

<i>HL01</i>	<i>Clocks, lamps, and decorator items</i>
HL011	LAMPS & LIGHTING FIXTURES
HL012	HOUSEHOLD DECORATIVE ITEMS & CLOCKS
<i>HL02</i>	<i>Indoor plants and flowers</i>
HL021	INDOOR PLANTS & FRESH CUT FLOWERS
<i>HL03</i>	<i>Dishes and flatware</i>
HL031	DISHES
HL032	FLATWARE
<i>HL04</i>	<i>Nonelectric cookware and tableware</i>
HL041	NONELECTRIC COOKINGWARE
HL042	TABLEWARE & NONELECTRIC KITCHENWARE

HM Tools, hardware, outdoor equipment and supplies

<i>HM01</i>	<i>Tools, hardware and supplies</i>
HM011	PAINT, WALLPAPER TOOLS & SUPPLIES
HM012	POWER TOOLS
HM013	MISCELLANEOUS HARDWARE, SUPPLIES & EQUIPMENT
HM014	NONPOWERED HAND TOOLS
<i>HM02</i>	<i>Outdoor equipment and supplies</i>
HM021	POWERED LAWN & GARDEN EQUIPMENT AND OTHER OUTDOOR ITEMS
HM022	LAWN & GARDEN SUPPLIES & INSECTICIDES
<i>HM09</i>	<i>Unsampled tools, hardware, outdoor equipment and supplies</i>
HM090	UNSAMPLED ITEMS

HN Housekeeping supplies

<i>HN01</i>	<i>Household cleaning products</i>
HN011	LAUNDRY & CLEANING PRODUCTS
HN012	LAUNDRY & CLEANING EQUIPMENT
<i>HN02</i>	<i>Household paper products</i>
HN021	HOUSEHOLD PAPER PRODUCTS
<i>HN03</i>	<i>Miscellaneous household products</i>
HN031	MISCELLANEOUS HOUSEHOLD PRODUCTS

HP Household operations

<i>HP01</i>	<i>Domestic services</i>
HP011	DOMESTIC SERVICES
<i>HP02</i>	<i>Gardening and lawncare services</i>
HP021	GARDENING AND LAWNCARE SERVICES
<i>HP03</i>	<i>Moving, storage, freight expense</i>
HP031	MOVING, STORAGE, FREIGHT EXPENSE
<i>HP04</i>	<i>Repair of household items</i>
HP041	APPLIANCE REPAIR
HP042	REUPHOLSTERY OF FURNITURE
HP043	INSIDE HOME MAINTENANCE AND REPAIR SERVICES
<i>HP09</i>	<i>Unsampled household operations</i>
HP090	UNSAMPLED ITEMS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

A MAJOR GROUP: APPAREL
APPAREL COMMODITIES

MEN'S AND BOYS' APPAREL

AA Men's apparel

AA01	<i>Men's suits, sport coats, and outerwear</i>
AA011	MEN'S SUITS
AA012	MEN'S SPORT COATS AND TAILORED JACKETS
AA013	MEN'S OUTERWEAR
AA02	<i>Men's furnishings</i>
AA021	MEN'S UNDERWEAR, HOSIERY AND NIGHTWEAR
AA022	MEN'S ACCESSORIES
AA023	MEN'S ACTIVE SPORTSWEAR
AA03	<i>Men's shirts and sweaters</i>
AA031	MEN'S SHIRTS
AA032	MEN'S SWEATERS AND VESTS
AA04	<i>Men's pants and shorts</i>
AA041	MEN'S PANTS AND SHORTS
AA09	<i>Unsampled men's apparel</i>
AA090	UNSAMPLED ITEMS

AB Boys' apparel

AB01	<i>Boys' apparel</i>
AB011	BOYS' OUTERWEAR
AB012	BOYS' SHIRTS AND SWEATERS
AB013	BOYS' UNDERWEAR, NIGHTWEAR, HOSIERY AND ACCESSORIES
AB014	BOYS' SUITS, SPORT COATS, AND PANTS
AB015	BOYS' ACTIVE SPORTSWEAR
AB09	<i>Unsampled boys' apparel</i>
AB090	UNSAMPLED ITEMS

WOMEN'S AND GIRLS' APPAREL

AC Women's apparel

AC01	<i>Women's outerwear</i>
AC011	WOMEN'S OUTERWEAR
AC02	<i>Women's dresses</i>
AC021	WOMEN'S DRESSES
AC03	<i>Women's suits and separates</i>
AC031	WOMEN'S TOPS
AC032	WOMEN'S SKIRTS, PANTS, AND SHORTS
AC033	WOMEN'S SUITS AND SUIT COMPONENTS
AC04	<i>Women's underwear, nightwear, sportswear and accessories</i>
AC041	WOMEN'S UNDERWEAR AND NIGHTWEAR

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

AC042	WOMEN'S HOSIERY AND ACCESSORIES
AC043	WOMEN'S ACTIVE SPORTSWEAR
AC09	<i>Unsampled women's apparel</i>
AC090	UNSAMPLED ITEMS

AD **Girls' apparel**

AD01	<i>Girls' apparel</i>
AD011	GIRLS' OUTERWEAR
AD012	GIRLS' DRESSES
AD013	GIRLS' TOPS
AD014	GIRLS' SKIRTS AND PANTS
AD015	GIRLS' ACTIVE SPORTSWEAR
AD016	GIRLS' UNDERWEAR, NIGHTWEAR, HOSIERY AND ACCESSORIES
AD09	<i>Unsampled girls' apparel</i>
AD090	UNSAMPLED ITEMS

AE **Footwear**

AE01	<i>Men's footwear</i>
AE011	MEN'S FOOTWEAR
AE02	<i>Boys' and girls' footwear</i>
AE021	BOYS' FOOTWEAR
AE022	GIRLS' FOOTWEAR
AE03	<i>Women's footwear</i>
AE031	WOMEN'S FOOTWEAR

AF **Infants' and toddlers' apparel**

AF01	<i>Infants' and toddlers' apparel</i>
AF011	INFANTS' AND TODDLERS' OUTERWEAR, PLAY AND DRESSWEAR, AND SLEEPWEAR
AF012	INFANTS' AND TODDLERS' UNDERWEAR AND DIAPERS

AG **Jewelry and watches**

AG01	<i>Watches</i>
AG011	WATCHES
AG02	<i>Jewelry</i>
AG021	JEWELRY

T **MAJOR GROUP: TRANSPORTATION**

PRIVATE TRANSPORTATION

TA **New and used motor vehicles**

TA01	<i>New vehicles</i>
TA011	NEW CARS & TRUCKS
TA012	NEW MOTORCYCLES
TA02	<i>Used cars and trucks</i>
TA021	USED CARS & TRUCKS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

TA03	<i>Leased cars and trucks</i>
TA031	LEASED CARS & TRUCKS
TA04	<i>Car and truck rental</i>
TA041	AUTOMOBILE AND TRUCK RENTAL
TA09	<i>Unsampled new and used motor vehicles</i>
TA090	UNSAMPLED ITEMS

TB Motor fuel

TB01	<i>Gasoline (all-types)</i>
TB011	REGULAR UNLEADED GASOLINE
TB012	MID-GRADE UNLEADED GASOLINE
TB013	PREMIUM UNLEADED GASOLINE
TB02	<i>Other motor fuels</i>
TB021	AUTOMOTIVE DIESEL FUEL
TB022	ALTERNATIVE MOTOR FUELS

TC Motor vehicle parts and equipment

TC01	<i>Tires</i>
TC011	TIRES
TC02	<i>Vehicle accessories other than tires</i>
TC021	VEHICLE PARTS & EQUIPMENT OTHER THAN TIRES
TC022	MOTOR OIL, COOLANT & FLUIDS

TD Motor vehicle maintenance and repair

TD01	<i>Motor vehicle body work</i>
TD011	MOTOR VEHICLE BODY WORK
TD02	<i>Motor vehicle maintenance and servicing</i>
TD021	MOTOR VEHICLE MAINTENANCE & SERVICING
TD03	<i>Motor vehicle repair</i>
TD031	MOTOR VEHICLE REPAIR
TD09	<i>Unsampled vehicle maintenance and repair</i>
TD090	UNSAMPLED SERVICE POLICIES

TE Motor vehicle insurance

TE01	<i>Motor vehicle insurance</i>
TE011	MOTOR VEHICLE INSURANCE

TF Motor vehicle fees

TF01	<i>State and local registration, license, and motor vehicle property tax</i>
TF011	STATE VEHICLE REGISTRATION, DRIVER'S LICENSE, AND MOTOR VEHICLE PROPERTY TAX
TF012	LOCAL VEHICLE REGISTRATION
TF03	<i>Parking and other fees</i>
TF031	PARKING FEES AND TOLLS
TF032	AUTOMOBILE SERVICE CLUBS
TF09	<i>Unsampled motor vehicle fees</i>
TF090	UNSAMPLED ITEMS

PUBLIC TRANSPORTATION

TG Public transportation

TG01	<i>Airline fare</i>
TG011	AIRLINE FARES
TG02	<i>Other intercity transportation</i>
TG021	INTERCITY BUS FARES
TG022	INTERCITY TRAIN FARES
TG023	SHIP FARES
TG03	<i>Intracity transportation</i>
TG031	INTRACITY MASS TRANSIT
TG032	TAXI FARE
TG033	CAR AND VAN POOLS
TG09	<i>Unsampled public transportation</i>
TG090	UNSAMPLED ITEMS

M MAJOR GROUP: MEDICAL CARE

MEDICAL CARE COMMODITIES

MA Prescription drugs

MA01	<i>Prescription drugs</i>
MA011	PRESCRIPTION
MA09	<i>Unsampled rent or repair of medical equipment</i>
MA090	UNSAMPLED ITEMS

MB Nonprescription drugs and medical supplies

MB01	<i>Internal and respiratory over-the-counter drugs</i>
MB011	INTERNAL AND RESPIRATORY OVER-THE-COUNTER DRUGS
MB02	<i>Nonprescription medical equipment and supplies</i>
MB021	TOPICALS AND DRESSINGS
MB022	MEDICAL EQUIPMENT FOR GENERAL USE
MB023	SUPPORTIVE AND CONVALESCENT MEDICAL EQUIPMENT

MEDICAL CARE SERVICES

MC Professional services

MC01	<i>Physicians' services</i>
MC011	PHYSICIANS' SERVICES
MC02	<i>Dental services</i>
MC021	DENTAL SERVICES
MC03	<i>Eyeglasses and eye care</i>
MC031	EYEGLASSES AND EYE CARE
MC04	<i>Services by other medical professionals</i>
MC041	SERVICES BY OTHER MEDICAL PROFESSIONALS

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

MD Hospital and related services

<i>MD01</i>	<i>Hospital services</i>
MD011	HOSPITAL SERVICES
<i>MD02</i>	<i>Nursing homes and adult daycare</i>
MD021	NURSING AND CONVALESCENT HOME CARE
MD022	ADULT DAY CARE

ME Health insurance

<i>ME01</i>	<i>Commercial health insurance</i>
ME011	COMMERCIAL HEALTH INSURANCE, RETAINED EARNINGS
<i>ME02</i>	<i>Blue Cross/Blue Shield</i>
ME021	BLUE CROSS/BLUE SHIELD HEALTH INSURANCE, RETAINED EARNINGS
<i>ME03</i>	<i>Health maintenance plans</i>
ME031	HEALTH MAINTENANCE PLANS, RETAINED EARNINGS
<i>ME04</i>	<i>Medicare and other health insurance</i>
ME041	MEDICARE & COMMERCIAL MEDICARE SUPPLEMENTS, RETAINED EARNINGS

R MAJOR GROUP: RECREATION

RA Video and audio

<i>RA01</i>	<i>Televisions</i>
RA011	TELEVISIONS
<i>RA02</i>	<i>Cable and satellite television and radio service</i>
RA021	CABLE AND SATELLITE TELEVISION AND RADIO SERVICE
<i>RA03</i>	<i>Other video equipment</i>
RA031	OTHER VIDEO EQUIPMENT
<i>RA04</i>	<i>Video cassettes, discs, and other media including rental</i>
RA041	VIDEO CASSETTES AND DISCS, BLANK AND PRERECORDED
RA042	RENTAL OF VIDEO TAPES AND DISCS
<i>RA05</i>	<i>Audio equipment</i>
RA051	AUDIO COMPONENTS, RADIOS, TAPE RECORDERS/PLAYERS, AND OTHER AUDIO EQUIPMENT
<i>RA06</i>	<i>Audio discs, tapes and other media</i>
RA061	AUDIO DISCS & TAPES, PRERECORDED & BLANK
<i>RA09</i>	<i>Unsampled video and audio</i>
RA090	UNSAMPLED ITEMS

RB Pets, pet products and services

<i>RB01</i>	<i>Pets and pet products</i>
RB011	PET FOOD
RB012	PURCHASE OF PETS, PET SUPPLIES, ACCESSORIES
<i>RB02</i>	<i>Pet services including veterinary</i>
RB021	PET SERVICES
RB022	VETERINARIAN SERVICES

RC Sporting goods

<i>RC01</i>	<i>Sports vehicles including bicycles</i>
RC011	OUTBOARD MOTORS & POWERED SPORTS VEHICLES
RC012	UNPOWERED BOATS & TRAILERS
RC013	BICYCLES & ACCESSORIES

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

<i>RC02</i>	<i>Sports equipment</i>
RC021	GENERAL SPORTS EQUIPMENT EXCLUDING WATER
RC022	WATER SPORTS EQUIPMENT
RC023	HUNTING, FISHING, & CAMPING EQUIPMENT
<i>RC09</i>	<i>Unsampled sporting goods</i>
RC090	UNSAMPLED ITEMS
RD	Photography
<i>RD01</i>	<i>Photographic equipment and supplies</i>
RD011	FILM AND PHOTOGRAPHIC SUPPLIES
RD012	PHOTOGRAPHIC EQUIPMENT
<i>RD02</i>	<i>Photographers and film processing</i>
RD021	PHOTOGRAPHER FEES
RD022	FILM PROCESSING
<i>RD09</i>	<i>Unsampled photography</i>
RD090	UNSAMPLED RENT AND REPAIR OF PHOTOGRAPHIC EQUIPMENT
RE	Other recreational goods
<i>RE01</i>	<i>Toys and games</i>
RE011	TOYS, GAMES, HOBBIES, & PLAYGROUND EQUIPMENT
RE012	VIDEO GAME HARDWARE, SOFTWARE & ACCESSORIES
<i>RE02</i>	<i>Sewing machines, fabric and supplies</i>
RE021	SEWING ITEMS
<i>RE03</i>	<i>Music instruments and accessories</i>
RE031	MUSIC INSTRUMENTS & ACCESSORIES
<i>RE09</i>	<i>Unsampled recreation services</i>
RE090	UNSAMPLED ITEMS
RF	Recreation services
<i>RF01</i>	<i>Club membership dues and fees for participant sports</i>
RF011	CLUB MEMBERSHIP DUES AND FEES FOR PARTICIPANT SPORTS
<i>RF02</i>	<i>Admissions</i>
RF021	ADMISSION TO MOVIES, THEATERS, CONCERTS AND OTHER REOCCURRING EVENTS
RF022	ADMISSION TO SPORTING EVENTS
<i>RF03</i>	<i>Fees for lessons or instructions</i>
RF031	FEES FOR LESSONS OR INSTRUCTIONS
<i>RF09</i>	<i>Unsampled recreation services</i>
RF090	UNSAMPLED ITEMS
RG	Recreational reading materials
<i>RG01</i>	<i>Newspapers and magazines</i>
RG011	SINGLE-COPY NEWSPAPERS AND MAGAZINES
RG012	NEWSPAPER AND MAGAZINE SUBSCRIPTIONS
<i>RG02</i>	<i>Recreational books</i>
RG021	BOOKS PURCHASED THROUGH BOOK CLUBS
RG022	BOOKS NOT PURCHASED THROUGH BOOK CLUBS
<i>RG09</i>	<i>Unsampled recreational reading materials</i>
RG090	UNSAMPLED ITEMS

E MAJOR GROUP: EDUCATION AND COMMUNICATION

EDUCATION

EA Educational books and supplies

- EA01 Educational books and supplies*
- EA011 COLLEGE TEXTBOOKS
- EA012 ELEMENTARY AND HIGH SCHOOL BOOKS AND SUPPLIES
- EA013 ENCYCLOPEDIAS AND OTHER SETS OF REFERENCE BOOKS
- EA09 Unsampld educational books and supplies*
- EA090 UNSAMPLED ITEMS

EB Tuition, other school fees, and childcare

- EB01 College tuition and fees*
- EB011 COLLEGE TUITION AND FIXED FEES
- EB02 Elementary and high school tuition and fees*
- EB021 ELEMENTARY AND HIGH SCHOOL TUITION AND FIXED FEES
- EB03 Child care and nursery school*
- EB031 DAY CARE AND NURSERY SCHOOL
- EB04 Technical and business school tuition and fees*
- EB041 TECHNICAL AND BUSINESS SCHOOL TUITION AND FIXED FEES
- EB09 Unsampld tuition, other school fees, and childcare*
- EB090 UNSAMPLED ITEMS

COMMUNICATION

EC Postage and delivery services

- EC01 Postage*
- EC011 POSTAGE
- EC02 Delivery services*
- EC021 DELIVERY SERVICES

Information and information processing

ED Telephone services

- ED01 Land-line telephone services, local charges*
- ED011 LAND-LINE TELEPHONE SERVICES, LOCAL CHARGES
- ED02 Land-line telephone services, long-distance charges*
- ED021 LAND-LINE LONG DISTANCE TELEPHONE SERVICES
- ED03 Wireless telephone services*
- ED031 WIRELESS TELEPHONE SERVICES

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

EE Information technology, hardware, and services

<i>EE01</i>	<i>Personal computers and peripheral equipment</i>
EE011	PERSONAL COMPUTERS & PERIPHERAL EQUIPMENT
<i>EE02</i>	<i>Computer software and accessories</i>
EE021	COMPUTER SOFTWARE & ACCESSORIES
<i>EE03</i>	<i>Internet services and electronic information providers</i>
EE031	INTERNET SERVICES AND ELECTRONIC INFORMATION PROVIDERS
<i>EE04</i>	<i>Telephone hardware, calculators, and other consumer information items</i>
EE041	TELEPHONE, PERIPHERAL EQUIPMENT & ACCESSORIES
EE042	CALCULATORS, TYPEWRITERS, & OTHER INFORMATION PROCESSING EQUIPMENT
<i>EE09</i>	<i>Unsampled information and information processing</i>
EE090	UNSAMPLED ITEMS

G MAJOR GROUP: OTHER GOODS AND SERVICES

GA Tobacco and smoking products

<i>GA01</i>	<i>Cigarettes</i>
GA011	CIGARETTES
<i>GA02</i>	<i>Tobacco products other than cigarettes</i>
GA021	TOBACCO PRODUCTS OTHER THAN CIGARETTES
<i>GA09</i>	<i>Unsampled tobacco and smoking products</i>
GA090	UNSAMPLED ITEMS

GB Personal care products

<i>GB01</i>	<i>Hair, dental, shaving, and miscellaneous personal care products</i>
GB011	PRODUCTS AND NONELECTRIC ARTICLES FOR THE HAIR
GB012	DENTAL & SHAVING PRODUCTS, INCLUDING NONELECTRIC ARTICLES
GB013	DEODORANT/SUNTAN PREPARATIONS, SANITARY/FOOTCARE PRODUCTS
GB014	ELECTRIC PERSONAL CARE APPLIANCES
<i>GB02</i>	<i>Cosmetics, perfume, bath, nail preparations and implements</i>
GB021	COSMETICS, PERFUME, BATH, NAIL PREPARATIONS & IMPLEMENTS
<i>GB09</i>	<i>Unsampled personal care products</i>
GB090	WOMEN'S HAIR PIECES/WIGS & RENT/REPAIR PERS. CARE APPLS

GC Personal care services

<i>GC01</i>	<i>Haircuts and other personal care services</i>
GC011	HAIRCUTS AND OTHER PERSONAL CARE SERVICES

GD Miscellaneous personal services

<i>GD01</i>	<i>Legal services</i>
GD011	LEGAL SERVICES
<i>GD02</i>	<i>Funeral expenses</i>
GD021	FUNERAL EXPENSES
<i>GD03</i>	<i>Laundry and dry cleaning services</i>
GD031	LAUNDRY AND DRY CLEANING SERVICES

CPI Appendix 6. Major groups, expenditure classes, item strata, and entry level items—Continued

<i>GD04</i>	<i>Apparel services other than laundry and dry cleaning</i>
GD041	SHOE REPAIR AND OTHER SHOE SERVICES
GD042	CLOTHING ALTERATIONS, RENTALS, AND REPAIRS
GD043	WATCH AND JEWELRY REPAIR
<i>GD05</i>	<i>Financial services</i>
GD051	CHECKING ACCOUNTS AND OTHER BANK SERVICES
GD052	TAX RETURN PREPARATION AND OTHER ACCOUNTING FEES
<i>GD06</i>	<i>Care of invalids and elderly at home</i>
GD061	CARE OF INVALIDS, ELDERLY AND CONVALESCENTS IN THE HOME
<i>GD09</i>	<i>Unsampled items</i>
GD090	UNSAMPLED ITEMS

GE Miscellaneous personal goods

<i>GE01</i>	<i>Miscellaneous personal goods</i>
GE011	STATIONERY, STATIONERY SUPPLIES, AND GIFT WRAP
GE012	LUGGAGE
GE013	INFANTS' EQUIPMENT

Appendix 7. Sample Allocation Methodology for Commodities and Services

Introduction

The primary objective of the Commodities and Services (C&S) sample design is to determine values for all sample design variables that minimize the sampling variance of 6-month price change for the C&S portion of the Consumer Price Index (CPI). The sample design variables are the number of entry level items (ELIs) to select in each item stratum and the number of outlets to select per Telephone Point-of-Purchase Survey (TPOPS) category-replicate panel in each Primary Sampling Unit (PSU). To that end, the variance of price change for the C&S portion of the CPI and the total annual cost of data collection and processing are modeled as functions of the design variables. These models allow the sample design problem to be expressed as one of minimizing the total variance of price change, subject to various cost and sample allocation constraints. Within this framework, nonlinear programming methods are used to solve the problem for optimal values of the sample design variables.

Certain simplifying assumptions are made to render the problem tractable and operationally more manageable. The number of PSUs, the number of replicate panels per PSU, and the classification of ELIs into item strata have been determined in previous work (Williams et al., 1993; Lane, 1996). Item strata are divided into 13 item groups for the design: 4 food at home groups (nonmeat staples; meat, poultry, and fish; fruits and vegetables; and other food at home and alcoholic and nonalcoholic beverages); food away from home; household furnishings and operations; fuels and utilities; apparel; transportation less motor fuel; motor fuel; medical care; education and communications; and recreation and other commodities and services. The 87 PSUs are divided into 15 groups according to size and number of replicate panels. (See table 7.) It is assumed that the same item and outlet sample sizes will apply to all PSUs within the same PSU group. This reduces the allocation problem to one of determining the number of ELI selections per replicate panel by PSU group and item group $\{K_{ij}, i = 1, \dots, 15, j = 1, \dots, 13\}$, $i =$ PSU group, $j =$ item group, and the number of outlet selections per TPOPS category per replicate by PSU group and item group $\{M_{ij}, i = 1, \dots, 15, j = 1, \dots, 13\}$. These are the design variables.

Let σ_{Total}^2 be the total price change variance for the C&S portion of the CPI, and let C_{Total} be the total annual cost of data collection. Then, the sample design problem can be expressed as one of minimizing σ_{Total}^2 subject to the following cost and sample allocation constraints:

Table 7. PSU Groups for C&S Design

PSU Group	Name	PSU Group	Name
1	New York City	10	Non-self-representing PSUs, Census Region 1
2	New York City suburbs		
3	Los Angeles City	11	Non-self-representing PSUs, Census Region 2
4	Los Angeles suburbs		
5	Chicago	12	Non-self-representing PSUs, Census Region 3
6	Philadelphia and San Francisco	13	Non-self-representing PSUs, Census Region 4
7	Detroit and Boston		
8	Other large self-representing PSUs	14	Smaller non-self-representing PSUs, Census Regions 1-4
9	Smaller self-representing PSUs	15	Anchorage, AK, and Honolulu, HI

$$C_{Total} \leq \text{Total data collection budget for C\&S}$$

$$M_{ij} \geq 2, i = 1, \dots, 15, j = 1, \dots, 13$$

$$K_{ij} \geq \text{Number of item strata in PSU group } i, \text{ item group } j, i = 1, \dots, 15, j = 1, \dots, 13$$

$$K_{ij} \leq \text{Maximum number of item hits in PSU group } i, \text{ item group } j, i = 1, \dots, 15, j = 1, \dots, 13$$

$$\text{Average number of item hits per stratum-index area in PSU group } i, \text{ item group } j \geq 9, i = 1, \dots, 15, j = 1, \dots, 13$$

A detailed description of these methods follows.

The Sampling Variance Function

Variance components models attempt to allocate parts of the total sampling variance to different sources of variation. For the C&S item-outlet sample, the following four sources of variation are modeled: PSU selection, item selection, outlet selection, and a residual component that includes other sources, such as sampling within the outlet.

The variance function for the C&S sample design is modeled for index areas. Each self-representing PSU is a single index area. Non-self-representing PSUs represent 7 index areas, with the sample for each area represented by 2 to 22 PSUs. As mentioned above, the variance model assumes that the total variance of price change for item group j within index area k can be expressed as a sum of four components:

$$\sigma_{j,k}^2 = \sigma_{psu,j,k}^2 + \sigma_{item,j,k}^2 + \sigma_{outlet,j,k}^2 + \sigma_{error,j,k}^2, \text{ where}$$

$\sigma_{j,k}^2$ is the total variance of price change for item group j in index area k ,

$\sigma_{psu,j,k}^2$ is the component of variance due to sampling PSU's in non-self-representing areas,

$\sigma_{item,j,k}^2$ is the component of variance due to sampling of ELIs within item strata,

$\sigma_{outlet,j,k}^2$ is the component of variance due to sampling of outlets,

$\sigma_{error,j,k}^2$ is a residual component of variance which includes the final stage of within-outlet item selection, called disaggregation

Similarly, it is assumed that the variance of price change of an individual sampled unit or quote has the same structure:

$$\sigma^2_{unit,j,k} = \sigma^2_{unit,psu,j,k} + \sigma^2_{unit,item,j,k} + \sigma^2_{unit,outlet,j,k} + \sigma^2_{unit,error,j,k}$$

where

$\sigma_{unit,j,k}^2$ is the total variance of price change of an individual sampled unit or quote for item j in index area k ,

$\sigma_{unit,psu,j,k}^2$ is the component of unit variance due to sampling PSU's in non-self-representing areas,

$\sigma_{unit,item,j,k}^2$ is the component of unit variance due to sampling of ELIs within item strata,

$\sigma_{unit,outlet,j,k}^2$ is the component of unit variance due to sampling of outlets, and

$\sigma_{unit,error,j,k}^2$ is the corresponding residual component of unit variance

Thus the projected sampling variance for a given index area k in PSU group i is:

$$\sigma^2(PC_k) = \sum_{j=1}^{13} RI_{j,k}^2 \left(\frac{\sigma_{unit,item,j,k}^2}{f_1(M_{ij}, K_j, N_k)} + \frac{\sigma_{unit,outlet,j,k}^2}{f_2(M_{ij}, K_j, N_k)} + \frac{\sigma_{unit,error,j,k}^2}{f_3(M_{ij}, K_j, N_k)} + \frac{\sigma_{unit,psu,j,k}^2}{f_4(N_k)} \right)$$

where

$$f_1(M_{ij}, K_{ij}, N_k) = (N_k H_k K_{ij})$$

$$f_2(M_{ij}, K_{ij}, N_k) = [(N_k H_k M'_{i,j} + N_k H_k M_{i,j} NPV_j) NRO_j]$$

$$f_3(M_{ij}, K_{ij}, N_k) = [(N_k H_k M_{ij} K_{ij}) (NRQV_j)]$$

$$f_4(N_k) = N'_k = \text{the number of non self-representing PSU's in index area } k$$

and

N_k is the number of PSU's in index area k ,

N'_k is the number of non-self-representing PSU's in the index area,

H_k is the number of replicate panels per PSU in the index area

NRO_j is the outlet initiation response rate for major group j .

$NRQV_j$ is the quote level response rate for major group j for variance projection.

NPV_j is the weighted sum of nonPOPS categories in major group j , each category weighted by its probability of selection, for variance projection

M'_{ij} is the number of unique in-scope outlets selected per PSU-replicate, modeled as a quadratic function of the outlet sample size:
 $M'_{ij} = (AV_{ij} M_{ij} + BV_{ij} M_{ij}^2)$

And the sampling variance of price change for the U.S. City Average C&S index is

$$\sigma_{TOTAL}^2 = \sum_j \sum_k RI_{j,k}^2 w_k^2 \sigma_{j,k}^2, \text{ where}$$

$RI_{j,k}$ is the relative importance of item group j , in index area k , scaled to sum to 1.0 over all C&S item groups, and

w_k is the 1990 Census population weight of index area k

Relative importances of item groups are obtained from the most recent two years of the Consumer Expenditure Survey. They are the proportion of total expenditures in index area k that come from item group j .

The Cost Function

The costs of the C&S portion of the CPI which are modeled are the costs of initiation data collection and travel, and pricing data collection (personal visit and telephone) and travel. Each of these models are developed in terms of outlet- and quote-related costs and as functions of the design decision variables.

Initiation Costs

Outlet Related Initiation Costs

For PSU group i and major group j , outlet related costs for initiation are:

$$CI_O(M_{ij}, K_{ij}) = 0.25 N_i \cdot H_i \cdot (CO_j + COT_j) \cdot (AC_{ij} M_{ij} + BC_{ij} M_{ij}^2 + NPC_j M_{ij})$$

$CI_O(M_{ij}, K_{ij})$ is the outlet-related initiation cost for major group j in PSU group i

N_i is the number of PSU's in group i ,

H_i is the number of replicates per PSU in PSU group i ,

CO_j is the compensation initiation cost per outlet for major group j ,

NPC_j is the weighted sum of nonPOPS categories in major group j , each category weighted by its probability of selection

COT_j is the per diem and mileage cost per outlet for major group j

and $(AC_{ij}M_{ij} + BC_{ij}M_{ij}^2)$ is an overlap function used to predict the number of unique sample outlets, accounting for the overlap of elements in the outlet sample within and between major groups for a replicate panel. The number 0.25 accounts for the rotation or reinitiation of the outlet sample in one fourth of the sample TPOPS categories-PSU's each year.

Quote Related Initiation Costs

Quote related initiation costs are

$$CI_Q(M_{ij}, K_{ij}) = 0.25N_i H_i \cdot WOD_j \cdot CQ_j \cdot M_{ij} \cdot K_{ij} \cdot NRO_j,$$

where

$CI_Q(M_{ij}, K_{ij})$ is the quote-related cost of initiation for major group j in PSU group i ,

WOD_j is a seasonal items initiation factor for major group j ,

CQ_j is the initiation cost per quote for major group j

Repricing Costs

The costs of ongoing price data collection and processing are also developed as both outlet and quote related costs.

Outlet Related Repricing Costs

For PSU group i and major group j , outlet related costs for ongoing pricing are:

$$CP_O(M_{ij}, K_{ij}) = MBO_{ij} \cdot N_i \cdot H_i \cdot NRO_j \cdot (AC_{ij}M_{ij} + BC_{ij}M_{ij}^2 + NPC_j M_{ij}) \cdot [(CPVO_j + CPO_j) \cdot (1 - RTO_j) + CTO_j \cdot RTO_j], \text{ where}$$

$CP_O(M_{ij}, K_{ij})$ is the total outlet-related cost for ongoing pricing for major group j in PSU group i

$CPVO_j$ is the compensation cost (time spent in travel) for a personal visit for pricing per outlet for major group j ,

CPO_j is the travel cost (per diem and mileage) for a personal visit for pricing per outlet for major group j , = 3.33 for every j

RTO_j is the proportion of outlets priced by telephone for major group j ,

CTO_j is the per outlet cost for telephone collection, = 3.43 for every j initially,

NPC_j is the weighted sum of NONPOPS categories in major group j , each category weighted by its probability of selection for cost projections.

MBO_{ij} is a factor to adjust for the monthly/ bimonthly mix of outlets by PSU and major group.

Quote Related Repricing Costs

Quote related costs for ongoing pricing are:

$$CP_Q(M_{ij}, K_{ij}) = MBQ_{ij} \cdot N_i \cdot H_i \cdot M_{ij} \cdot K_{ij} \cdot NRQC_j \cdot [CPVQ_j \cdot (1 - RTQ_j) + CTQ_j \cdot RTQ_j], \text{ where}$$

$CP_Q(M_{ij}, K_{ij})$ is the total quote-related cost for ongoing pricing,

MBQ_{ij} is a factor to adjust for the monthly/ bimonthly mix of quotes by PSU and major product group.

$CPVQ_j$ is the per quote cost (compensation not spent in travel) for a personal visit for pricing,

RTQ_j is the proportion of telephone collected quotes for major group j ,

CTQ_j is the per quote cost for telephone collection for major group j , and

$NRQC_j$ is the quote level response rate for projecting costs for major group j .

Total Cost Function

The total cost function associated with data collection for C&S, summed over all item groups and PSU groups, is then given by

$$C_{Total} = \sum_{i,j} [CI_O(M_{ij}, K_{ij}) + CI_Q(M_{ij}, K_{ij}) + CP_O(M_{ij}, K_{ij}) + CP_Q(M_{ij}, K_{ij})]$$

And the sample design problem can be expressed as that of minimizing the total variance, σ_{Total}^2 , subject to the constraints

$$C_{Total} \leq \text{Total expenditure limit}$$

$$M_{ij} \geq 2 \quad i=1, \dots, 15, j=1, \dots, 13$$

$$K_{ij} \geq \text{Number of item strata in PSU group } i, \text{ item group } j, i=1, \dots, 15, j=1, \dots, 13$$

$$K_{ij} \leq \text{Maximum number of item hits in PSU group } i, \text{ item group } j, i=1, \dots, 15, j=1, \dots, 13$$

Average number of item hits per stratum-index area in PSU group i , item group j , $i \geq 9$, $i=1, \dots, 15$, $j=1, \dots, 13$

We note here that the last set of constraints are added to address concerns regarding small sample bias at the elementary index level by assuring a minimum average sample allocation of nine expected quotes total per index area – item stratum combination.

Model Coefficients

The parameters of the cost function are estimated using agency administrative records, dating from fiscal year 1996 forward, and a Time and Travel Study conducted by the Office of Field Operations (OFO). Distinctions between personal visit and telephone collection of data are made based upon information from OFO and from an analysis of C&S microdata conducted within the Prices Statistical Methods Division. Response rates for each item group derive from field initiation records and ongoing pricing experience.

Since outlet samples are selected independently for each TPOPS category, and outlets may be listed in the sample frames for more than one TPOPS category, an individual outlet may be selected more than once. For example, a grocery store could be selected for both bakery products and dairy products. Thus, the number of unique outlets realized by the sampling process is needed to project outlet-related costs. Quadratic regressions are used to predict the number of unique outlets realized in sample selection as a function of designated sample size. These are developed and reevaluated with each rotation by modeling the number of unique outlets obtained in simulations of sampling procedures for each PSU and item group as a function of designated sample sizes, using the most current sampling frames available for each item .

Components of price change variance are computed using restricted maximum likelihood estimation methods with C&S price microdata, the most recent estimates being based on price data collected in 1998-2000. Component estimates are developed for 6-month price change for the 13 item groups for each index area and month. Mean unit components of variance estimates are then computed by averaging the unit components of variance across months.

Problem Solution

Solutions are found using three methods: the SPLUS NUOPT code, which utilizes a trust region method, SAS PROC NLP, which uses a quasi-Newton algorithm, and a SAS PROC IML procedure which also employs a quasi-Newton algorithm. In practice, each method has yielded identical solution sets. For each item group, the number of item selections is bounded below by the number of strata in the item group and above by a ceiling of 140% of the item group's previous item sample allocation.

ELI selections are then distributed among item strata within each item group, with consideration given to differences in relative importance, production stratum-level price change variance estimates, and response rates among the item strata within each item group, as well as special problems identified by commodity analysts and field staff. Similarly, designated outlet sample sizes are distributed among the various TPOPS categories in item groups to manage variation in expected response rates and respondent burden.

In general, recent sample designs have shifted resources in many item groups from sampling many outlets to fewer outlets, with more item selections per outlet. This is due primarily to the large residual component of price change sampling variance estimated for most item groups, coupled with an increasing trend in the number of unique outlets realized in TPOPS sampling.

Appendix 8. POPS categories

POPS category	Title and entry-level item number and title
F01	Flour or Prepared Flour Mixes FA011—Flour and Prepared Flour Mixes
F02	Breakfast Cereal FA021—Breakfast Cereal
F03	Rice, Pasta, or Cornmeal FA031—Rice, Pasta, and Cornmeal
F04	Bread FB011—Bread
F05	Fresh Biscuits, Rolls, Bagels, or Muffins FB021—Fresh Biscuits, Rolls, and Muffins
F06	Cakes or Cupcakes (Excluding Frozen) FB031—Cakes and Cupcakes (Excluding Frozen)
F07	Cookies FB032—Cookies
F08	Crackers or Other Bread Products FB041—Crackers and Bread and Cracker Products
F09	Other Bakery Products Including Frozen FB042—Sweetrolls, Coffee Cakes, and Doughnuts, (Excluding Frozen) FB043—Frozen Bakery Products and Frozen/Refrigerated Doughs and Batters FB044—Pies, Tarts, and Turnovers (Excluding Frozen)
F10	Uncooked Beef or Veal Including Frozen FC011—Uncooked Ground Beef FC021—Uncooked Beef Roasts FC031—Uncooked Beef Steaks FC041—Other Uncooked Beef and Veal
F11	Pork, Ham, or Breakfast Meats FD011—Bacon, Breakfast Sausage, and Related Products FD021—Ham FD031—Pork Chops FD041—Other Pork Including Roasts and Picnics
F12	Lunchmeats, Hot Dogs, or Other Meats FE011—Frankfurters FE012—Lunchmeats FE013—Lamb, Organ Meats, and Game
F13	Chicken or Other Poultry Including Turkey FF011—Chicken FF021—Other Poultry Including Turkey

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
F14	Fresh Fish or Fresh Seafood FG011—Fresh Fish and Seafood
F15	Processed Fish or Processed Seafood, Including Frozen, Canned, or Cooked FG021—Processed Fish and Seafood
F16	Eggs or Egg Substitutes FH011—Eggs
F17	Milk FJ011—Milk
F18	Cheese or Cheese Products FJ021—Cheese and Cheese Products
F19	Ice Cream, Frozen Yogurt, or Flavored Ices FJ031—Ice Cream and Related Products
F20	Miscellaneous Dairy Products, Including Yogurt, Powdered Milk, or Coffee Creamers FJ041—Other Dairy and Related Products
F21	Apples FK011—Apples
F22	Bananas FK021—Bananas
F23	Fresh Citrus Fruits FK031—Citrus Fruits
F24	Other Fresh Fruits FK041—Other Fresh Fruits
F25	Potatoes FL011—Potatoes
F26	Lettuce FL021—Lettuce
F27	Tomatoes FL031—Tomatoes
F28	Other Fresh Vegetables, Including Fresh Herbs FL041—Other Fresh Vegetables, Including Fresh Herbs
F29	Canned Fruits or Vegetables FM011—Canned Fruits and Vegetables

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
F30	Frozen Fruits or Vegetables FM021—Frozen Fruits and Vegetables
F31	Dried or Other Processed Fruits and Vegetables FM031—Dried and Other Processed Fruits and Vegetables
F32	Carbonated Drinks FN011—Carbonated Drinks
F33	Noncarbonated Juices or Drinks, Frozen and Nonfrozen FN021—Frozen Noncarbonated Juices and Drinks FN031—Nonfrozen Noncarbonated Juices and Drinks
F34	Roasted, Instant, or Freeze-dried Coffee FP011—Coffee
F35	Powdered Drinks, Tea, Cocktail Mixes, or Ice FP021—Tea FP022—Other Beverage Materials
F36	Sugar or Artificial Sweeteners FR011—Sugar and Artificial Sweeteners
F37	Candy or Chewing Gum FR021—Candy and Chewing Gum
F38	Jellies, Syrups, Honey, Molasses, Marshmallows, Icings, or Fudge Mixes FR031—Other Sweets
F39	Butter or Margarine FS011—Butter and Margarine
F40	Salad Dressing FS021—Salad Dressing
F41	Peanut Butter, Mayonnaise, Cooking Fats, or Oils FS031—Peanut Butter FS032—Other Fats and Oils
F42	Soups FT011—Soups
F43	Frozen Prepared Foods FT021—Frozen and Freeze-dried Prepared Foods
F44	Chips, Nuts, or Other Snacks, Excluding Candy FT031—Snacks

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
F45	<p>Seasonings, Spices, or Miscellaneous Baking Products such as Salt, Coat ‘n Bake Products, Yeast, and Baking Chocolate FT041—Salt and Other Seasonings and Spices FT044—Other Condiments (Excluding Olives, Pickles, and Relishes)</p>
F46	<p>Condiments, Sauces, or Gravies, such as Catsup, Mustard, Relishes, Tomato Sauces, or Gravy Mixes FT042—Olives, Pickles, and Relishes FT043—Sauces and Gravies</p>
F47	<p>Baby Food FT051—Baby Food</p>
F48	<p>Prepared Salads or Salad Bars, Excluding Restaurants FT061—Prepared Salads</p>
F49	<p>Easy-To-Prepare Canned or Packaged Foods, Excluding Fruits, Vegetables, and Soups FT062—Other Miscellaneous Foods</p>
F50	<p>Full-service Meals or Snacks FV011—Full-service Meals and Snacks</p>
F51	<p>Limited-service Meals or Snacks FV021—Limited-service Meals and Snacks</p>
F52	<p>Meals or Snacks at Schools or Employer-provided Cafeterias, Dining Rooms, or Snack Bars FV031—Food at Employer Sites and Schools</p>
F53	<p>Food or Beverages from Vending Machines or Mobile Vendors FV041—Food from Vending Machines and Mobile Vendors</p>
F54	<p>Catered Events or Board FV051—Board, Catered Events, and Other Food Away From Home</p>
F55	<p>Beer, Ale, or Other Malt Beverages for Home Use FW011—Beer, Ale, and Other Malt Beverages at Home</p>
F56	<p>Distilled Spirits for Home Use FW021—Distilled Spirits at Home</p>
F57	<p>Wine for Home Use FW031—Wine at Home</p>
F58	<p>Alcoholic Beverages Away From Home FX011—Alcoholic Beverages Away From Home</p>
H02	<p>Lodging Away From Home, such as Hotels, Motels, or Vacation Rentals HB021—Rental of Lodging Away From Home</p>
H03	<p>Fuel Oil for Household Heating HE011—Fuel Oil</p>

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
H04	Propane, Firewood, or Coal Used for Household Heating or Cooking HE021—Propane, kerosene, or firewood
H05	Residential Water or Sewer Service HG011—Residential Water and Sewer Service
H06	Garbage or Trash Collection Service HG021—Garbage and Trash Collection
H07	Floor Coverings, such as Hard Surface Tiling, Carpets, or Scatter Rugs HH011—Floor Coverings
H08	Window Coverings, such as Curtains, Drapes, or Blinds HH021—Curtains and Drapes HH022—Window Coverings
H09	Household Linens, such as Kitchen or Bathroom Towels, Bedding, or Tablecloths HH031—Bathroom Linens HH032—Bedroom Linens HH033—Kitchen and Dining Room Linens
H10	Bedroom Furniture, Including Mattresses and Springs HJ011—Mattresses and Springs HJ012—Bedroom Furniture Other Than Mattresses and Springs
H11	Sofas, Slipcovers, or Decorative Pillows HJ021—Sofas, Slipcovers, and Decorative Pillows
H12	Living Room Chairs or Living Room Tables HJ022—Living Room Chairs HJ023—Living Room Tables
H13	Kitchen or Dining Room Furniture HJ024—Kitchen and Dining Room Furniture
H14	Infants' Furniture HJ031—Infants' Furniture
H15	Outdoor Furniture HJ032—Outdoor Furniture
H16	Occasional Furniture, Such as Bookcases, Desks, or Ottomans HJ033—Occasional Furniture
H17	Refrigerators or Home Freezers HK011—Refrigerators and Home Freezers
H18	Washers or Dryers HK012—Washers and Dryers

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
H19	Stoves, Ovens, or Microwave Ovens HK013—Stoves and Ovens, Excluding Microwave Ovens HK014—Microwave Ovens
H20	Vacuums or Other Electric Floor Cleaning Equipment HK021—Floor Cleaning Equipment
H21	Small Electric Kitchen Appliances HK022—Small Electric Kitchen Appliances
H22	Heating or Cooling Equipment or Home Safety Devices HK023—Other Electric Appliances
H23	Household Decorative Items, Including Clocks or Lamps HL011—Lamps and Lighting Fixtures HL012—Household Decorative Items and Clocks
H24	Dishes, Glassware, or Flatware HL031—Dishes HL032—Flatware
H25	Nonelectric Kitchen Utensils, Cookware, or Bakeware HL041—Nonelectric Cookware HL042—Tableware and Nonelectric Kitchenware
H26	Indoor Plants or Fresh Cut Flowers HL021—Indoor Plants and Fresh Cut Flowers
H27	Paint, Wallpaper Tools, or Related Supplies HM011—Paint, Wallpaper, Tools, and Supplies
H28	Power Tools HM012—Power Tools
H29	Nonpowered Tools or Miscellaneous Hardware HM013—Miscellaneous Hardware, Supplies, and Equipment HM014—Nonpowered Tools
H30	Powered Lawn and Garden Equipment or Other Outdoor Items HM021—Powered Lawn and Garden Equipment and Other Outdoor Items
H31	Lawn and Garden Supplies or Insecticides HM022—Lawn and Garden Supplies and Insecticides
H32	Household Laundry and Cleaning Products or Supplies HN011—Laundry and Cleaning Products HN012—Laundry and Cleaning Equipment
H33	Paper Napkins, Paper Towels, Facial Tissue, or Toilet Paper HN021—Household Paper Products

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
H34	<p>Other Disposable Products, such as Plastic or Foil Wraps, Garbage Bags, Paper Plates, Batteries, or Light Bulbs HN031—Miscellaneous Household Products</p>
H35	<p>Housekeeping Services HP011—Housekeeping Services</p>
H36	<p>Gardening or Lawn Care Services HP021—Gardening and Lawn Care Services</p>
H37	<p>Moving, Storage, or Freight Services HP031—Moving, Storage, Freight Expense</p>
H38	<p>Major Appliance Repair HP041—Appliance Repair</p>
H39	<p>Reupholstery of Household Furniture HP042—Reupholstery of Furniture</p>
H40	<p>Inside Home Maintenance or Repair HP043—Inside Home Maintenance and Repair</p>
A01	<p>Men’s Suits or Blazers AA011—Men’s Suits AA012—Men’s Sportcoats and Tailored Jackets</p>
A02	<p>Men’s Coats or Jackets AA013—Men’s Outerwear</p>
A03	<p>Men’s Socks, Underwear, Sleepwear, or Bathrobes AA021—Men’s Underwear, Hosiery, and Nightwear</p>
A04	<p>Men’s Accessories, Such as Ties, Belts, or Wallets AA022—Men’s Accessories</p>
A05	<p>Men’s Active Sportswear, Such as Exercise Apparel or Bathing Suits AA023—Men’s Active Sportswear</p>
A06	<p>Men’s Shirts, Sweaters, or Vests AA031—Men’s Shirts AA032—Men’s Sweaters and Vests</p>
A07	<p>Men’s Pants, Jeans, or Shorts AA041—Men’s Pants and Shorts</p>
A08	<p>Boys’ Clothing or Accessories AB011—Boys’ Outerwear AB012—Boys’ Shirts and Sweaters AB013—Boys’ Underwear, Nightwear, Hosiery, and Accessories</p>

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
	AB014—Boys’ Suits, Sport Coats, and Pants AB015—Boys’ Active Sportswear
A09	Women’s Outerwear AC011—Women’s Outerwear
A10	Women’s Dresses AC021—Women’s Dresses
A11	Women’s Tops, Skirts, Pants, or Shorts AC031—Women’s Tops AC032—Women’s Skirts, Pants, and Shorts
A12	Women’s Suits or Suit Components AC033—Women’s Suits and Suit Separates
A13	Women’s Underwear or Nightwear AC041 Women’s Underwear and Nightwear
A14	Women’s Hosiery or Accessories AC042—Women’s Hosiery and Accessories
A15	Women’s Active Sportswear or Playwear AC043—Women’s Active Sportswear
A16	Girls’ Clothing or Accessories AD011—Girls’ Outerwear AD012—Girls’ Dresses AD013—Girls’ Tops AD014—Girls’ Skirts and Pants AD015—Girls’ Active Sportswear AD016—Girls’ Underwear, Nightwear, Hosiery, and Accessories
A17	Men’s Footwear AE011—Men’s Footwear
A18	Boys’ or Girls’ Footwear AE021—Boys’ Footwear AE022—Girls’ Footwear
A19	Women’s Footwear AE031—Women’s Footwear
A20	Infants’ and Toddlers’ Clothing or Accessories, Excluding Underwear and Diapers AF011—Infants’ and Toddlers’ Outerwear, Play and Dresswear, and Sleepwear
A21	Infants’ and Toddlers’ Underwear or Diapers AF012—Infants’ and Toddlers’ Underwear and Diapers
A22	Watches AG011—Watches

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
A23	Jewelry AG021—Jewelry
T01	New Cars, Trucks, or Vans TA011—New Cars and Trucks
T02	New Motorcycles TA012—New Motorcycles
T03	Leased Cars, Trucks, or Vans TA031—Leased Cars and Trucks
T04	Car, Truck, or Van Rental TA041—Automobile and Truck Rental
T05	Gasoline, Diesel, or Alternative Fuels TB011—Regular Unleaded Gas TB012—Mid-Grade Unleaded Gas TB013—Premium Unleaded Gas TB021—Automotive Diesel Fuel TB022—Alternative Motor Fuels
T07	Tires TC011—Tires
T08	Vehicle Parts or Accessories TC021—Vehicle Parts and Equipment, Other Than Tires
T09	Motor Oil, Coolants, or Fluids TC022—Motor Oil, Coolants, and Fluids
T10	Motor Vehicle Body Work TD011—Motor Vehicle Body Work
T11	Motor Vehicle Maintenance, Inspections, or Towing TD021—Motor Vehicle Maintenance and Servicing
T12	Motor Vehicle Repair TD031—Motor Vehicle Repair
T13	Motor Vehicle Insurance TE011—Motor Vehicle Insurance
T14	Local Vehicle Registration TF012—Local Vehicle Registration
T15	Parking Fees or Tolls TF031—Parking Fees and Tolls
T16	Automobile Service Clubs TF032—Automobile Service Clubs

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
T17	Ship Travel or Passenger Cruises TG023—Ship Fares
T18	Intracity Mass Transit TG031—Intracity Mass Transit
T19	Taxi Fare TG032—Taxi Fare
T20	Car or Van Pools TG033—Car and Van Pools
M01	Prescription Drugs MA011—Prescription Drugs
M02	Internal or Respiratory Over-the-counter Drugs MB011—Internal or Respiratory Over-the-counter Drugs
M03	Nonprescription Medical Equipment, Supplies, Topicals, or Dressings MB021—Topicals and Dressings MB022—Medical Equipment for General Use MB023—Supportive and Convalescent Medical Equipment
M04	Physician’s Services MC011—Physician’s Services
M05	Dental Services MC021—Dental Services
M06	Eyeglasses or Eye Care MC031—Eyeglasses and Eye Care
M07	Services by Other Medical Professionals MC041—Services by Other Medical Professionals
M08	Hospital Services MD011—Hospital Services
M09	Adult Daycare MD022—Adult Daycare
R01	Televisions RA011—Televisions
R02	Cable or Satellite Television or Radio Service RA021—Cable Television
R03	VCRs, Camcorders, or Other Video Equipment RA031—Other Video Equipment

Appendix 8. POPS Categories—Continued

POPS category	Title and entry-level item number and title
R04	Blank or Prerecorded Video Cassettes and Video Discs RA041—Video Cassettes and Discs, Blank and Prerecorded
R05	Rental of Video Tapes or Video Discs RA042—Rental of Video Tapes and Discs
R06	Audio Equipment for Automobiles or Home RA051—Audio Components, Radios, Tape Recorders/Players, and other Audio Equipment
R07	Prerecorded or Blank Audio Tapes, CDs, or Records RA061—Audio Discs and Tapes, Prerecorded and Blank
R08	Pet Food RB011—Pet Food
R09	Pets, Pet Supplies, or Accessories RB012—Purchase of Pets, Pet Supplies, Accessories
R10	Pet Services, such as Grooming, Boarding, or Training RB021—Pet Services
R11	Veterinarian Services RB022—Veterinarian Services
R12	Outboard Motors or Powered Sports Vehicles RC011—Outboard Motors and Powered Sports Vehicles
R13	Unpowered Boats or Trailers RC012—Unpowered Boats and Trailers
R14	Bicycles or Bicycling Accessories RC013—Bicycles and Accessories
R15	General Sports Equipment RC021—General Sports Equipment, Excluding Water RC022—Water Sports Equipment
R16	Hunting, Fishing, or Camping Equipment RC023—Hunting, Fishing, and Camping Equipment
R17	Film or Film Development Supplies RD011—Film and Photographic Supplies
R18	Cameras or Other Photographic Equipment, Excluding Film RD012—Photographic Equipment
R19	Photographer’s Fees RD021—Photographer’s Fees

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
R20	Film Development RD022—Film Processing
R21	Toys, Games, Hobbies, or Playground Equipment RE011—Toys, Games, Hobbies, and Playground Equipment
R22	Video Game Hardware, Cartridges, Disks, or Accessories RE012—Video Game Hardware, Software, and Accessories
R23	Sewing Machines, Fabric, or Sewing Supplies RE021—Sewing Items
R24	Musical Instruments or Musical Accessories RE031—Musical Instruments and Accessories
R25	Club Membership Dues for Fraternal or Civic Organizations or Fees for Participant Sports RF011—Club Membership Dues and Fees for Participant Sports
R26	Admissions, Such as to Movies, Concerts, or Theme Parks RF021—Admission to Movies, Theaters, Concerts, and Other Recurring Events
R27	Admissions to Sporting Events RF022—Admissions to Sporting Events
R28	Recreational Lessons or Instruction RF031—Fees for Lessons or Instruction
R29	Single-copy Newspapers or Magazines RG011—Single-copy Newspapers and Magazines
R30	Newspaper or Magazine Subscriptions RG012—Newspaper and Magazine Subscriptions
R31	Books Purchased Through Book Clubs RG021—Books Purchased Through Book Clubs
R32	Books Not Purchased Through Book Clubs RG022—Books Not Purchased Through Book Clubs
E01	College or University Level Textbooks EA011—College Textbooks
E02	Elementary or High School Textbooks EA012—Elementary and High School Textbooks
E03	Encyclopedias or Other Sets of Reference Books EA013—Encyclopedias and Other Sets of Reference Books
E04	Tuition or Fixed Fees for a College or University EB011—College Tuition and Fixed Fees

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
E05	Tuition or Fixed Fees for Private Elementary or High Schools EB021—Elementary and High School Tuition and Fixed Fees
E06	Daycare Providers, Including Nursery Schools EB031—Daycare and Nursery School
E07	Tuition or Fixed Fees for Technical or Vocational Schools EB041—Technical and Business School Tuition and Fixed Fees
E08	Delivery Services EC021—Delivery Services
E09	Local Telephone Service ED011—Land-line Telephone Service, Local Charges
E10	Long-Distance Telephone Services ED021—Land-line Telephone Service, Long-Distance Charges
E11	Personal Computers or Peripheral Equipment EE011—Personal Computers and Peripheral Equipment
E12	Computer Software or Accessories EE021—Computer Software and Accessories
E13	Online or Other Information Services EE031—Online and Other Information Services
E14	Home or Wireless Telephones, Answering Machines, or Other Phone Accessories EE041—Telephones, Peripheral Equipment, and Accessories
E15	Calculators, Typewriters, or Other Information Processing Equipment EE042—Calculators, Typewriters, and Other Information Processing Equipment
G01	Cigarettes GA011—Cigarettes
G02	Tobacco Products Other Than Cigarettes GA021—Tobacco Products Other Than Cigarettes
G03	Hair Products, such as Shampoo, Sprays, Pins, or Combs GB011—Products and Nonelectric Articles for the Hair
G04	Dental or Shaving Products, Including Nonelectric Articles GB012—Dental and Shaving Products, Including Nonelectric Articles
G05	Deodorant, Feminine Hygiene Products, Suntan Lotions, or Footcare Products GB013—Deodorant/Suntan Preparations, Sanitary/Footcare Products
G06	Electric Personal Care Appliances, such as Shavers or Hair Dryers GB014—Electric Personal Care Appliances

Appendix 8. POPS categories—Continued

POPS category	Title and entry-level item number and title
G07	Cosmetics, Perfumes, or Bath and Nail Preparations GB021—Cosmetics/Perfume/Bath/Nail Preparations and Implements
G08	Haircuts or Other Personal Care Services GC011—Haircuts and Other Personal Care Services
G09	Legal Services GD011—Legal Fees
G10	Funeral Services GD021—Funeral Expenses
G11	Laundry or Drycleaning Services GD031—Laundry and Drycleaning Services
G12	Shoe Repair or Other Shoe Services GD041—Shoe Repair and Other Shoe Services
G13	Clothing Rental, Alterations, or Repairs GD042—Alterations and Clothing Rental
G14	Watch or Jewelry Repair GD043—Watch and Jewelry Repair
G15	Checking Accounts, Credit Card Fees, or Other Bank Services GD051—Checking Accounts and Other Bank Services
G16	Tax Return Preparation or Other Accounting Services GD052—Tax Return Preparation and Other Accounting Services
G18	Stationery, School Supplies, or Gift Wrap GE011—Stationery, Stationery Supplies, and Gift Wrap
G19	Luggage, Briefcases, or Other Carrying Cases GE012—Luggage
G20	Infants' Equipment, such as Strollers, Car Seats, Bottles, or Dishes GE013—Infants' Equipment

Appendix 9. Non-POPS sample designs

For each non-POPS entry-level item (electricity, for example), the following information is given below:

1. Source of the universe data
2. Sampling unit for outlets
3. Measure of size
4. Desired final pricing unit
5. Number of designated outlets and designated quotes.

EC011 Postage

1. The distribution of household mail by type of postal service and postal zone as determined by the Postal Service in the *Household Mailstream Study, Final Report*, prepared for the U.S. Postal Service.
2. U.S. Postal Service.
3. Postal revenue for each type of postal service and postal zone.
4. Specific postal service and zones traveled.
5. Outlets 130; quotes 348.

ED031 Wireless telephone services

1. Federal Communications Commission inventory of wireless telephone companies.
2. Companies within A and B cellular blocks that serve each CPI sample area.
3. Number of subscribers.
4. Specific calling plan.
5. Outlets 124; quotes 124.

GD061 Care of invalids, elderly, and convalescents in the home

1. National Association of Home Care facilities in the United States

2. Facilities providing adult home care in each CPI sample area.
3. Each facility within a given CPI sample area receives an equal measure of size; that is, none available.
4. Specific services provided.
5. Outlets 343; quotes 597.

HB011 Housing while at school

1. Schools reported for college tuition in the TPOPS survey.
2. Schools reported for college tuition by consumers in each CPI sample area.
3. Expenditures reported for college tuition.
4. Specific housing fee for the college.
5. Outlets 322; quotes 723.

HD011/TE011 Insurance—tenants/motor vehicle

1. Data file of insurance companies obtained from A.M. Best Data Center.
2. Insurance companies serving the States in which the CPI sample areas are located.
3. Total revenue for noncommercial policies by type of insurance.
4. Specific policy serving within each CPI sample area.
5. Motor Vehicle: Outlets 438; quotes 952.
Tenants: Outlets 208; quotes 213.

HF011 Electricity

1. a. Consumer Expenditure (CE) survey.
b. Direct Information from the Bureau of Labor Statistics Regional Field Offices.
2. Electric utility companies reported in the CE survey or electric utility companies serving each of the CPI sample areas.

Appendix 9. Non-POPS sample designs—Continued

3. Expenditures reported for electricity in the CE survey or an estimate of the number of residential customers provided by the Field Offices.
4. Specific type of service for a specific number of kilowatt hours.
5. CPI: Outlets 1,520; quotes 1,520.
Average prices: 548 additional quotes.

HF021 Utility (piped) gas service

1. a. Consumer Expenditure (CE) survey.
b. Direct information supplied by the Regional Field Offices.
2. Gas utility companies reported in the CE survey or gas companies serving each of the CPI sample areas.
3. Expenditures reported for piped gas in the CE survey or an estimate of the number of residential customers provided by the Field Offices.
4. Specific type of service and specific number of cubic feet or therms of gas.
5. CPI: Outlets 1,520; quotes 1,520.
Average Prices: 1096 additional quotes.

MD021 Nursing and convalescent home care

1. National Center for Health Statistics data file consisting of an inventory of long-term care facilities in the United States.
2. Facilities providing nursing home care in each CPI sample area.
3. Number of beds.
4. Specific accommodations and services provided.
5. Outlets 552; quotes 1,314.

TA021 Used vehicles

1. J.D. Power and Associates, Power Information Network.
2. NADA, E-Valuator.

3. Expenditures reported for used vehicles in the CE survey.
4. Specific used vehicles with specific options.
5. Outlets 480; quotes 480.

TF011 State vehicle registration, license, and vehicle property taxes

1. *Digest of Motor Laws*.
2. State motor vehicle departments in each CPI sample area
3. Revenue generated by each type of fee.
4. Specific class/vehicle registration, type of license, or vehicle property tax.
5. Outlets 113; quotes 340.

TG011 Airline fares

1. U.S. Department of Transportation data file consisting of a 10-percent sample of all passenger itineraries originating in the United States.
2. All airlines providing service from any CPI sample area.
3. Total nonbusiness passenger ticket revenue per airline, per trip itinerary, per fare class.
4. Specific trip itinerary and fare class for the selected airline.
5. Outlets 1,948; quotes 1,948.

TG022 Intercity train service

1. Data file of intercity train trips provided by Amtrak and the Alaskan Railroad.
2. Amtrak and the Alaskan Railroad.
3. Number of tickets sold.
4. Specific trip and class.
5. Outlets 372; quotes 407.