

# Revision of Consumer Price Index is now under way

*Upon completion in 1987, the revised CPI will reflect current population and spending patterns, as well as an improved housing survey and other technical enhancements*

JOHN L. MARCOOT

The Bureau of Labor Statistics is in the midst of a 5-year program to update and improve the Consumer Price Index (CPI). The resulting changes will be introduced in the January 1987 indexes. The 1987 revision will use the Consumer Expenditure Survey data from 1982–84 and population distributions from the 1980 census to update the CPI market basket. A greatly enhanced housing survey is being developed that will improve the rental equivalence measure of homeowner costs recently introduced in the CPI. Many of the sampling advances introduced in the 1978 revision will be refined for 1987 and other methodological enhancements will be made.

This article explains why periodic CPI revisions are needed, briefly reviews previous revisions, and describes the current revision plans.

## **Why periodic revisions are needed**

The CPI is a measure of price change for a fixed market basket of goods and services of constant quantity and quality purchased for consumption. It is essential to update that market basket periodically so that the CPI reflects price changes of items currently purchased by consumers. Consumers change their purchasing patterns as a result of changes in a number of factors, including relative prices, real income, demographic characteristics, and tastes.

---

John L. Marcoot is the manager of the CPI Revision Program in the Office of Prices and Living Conditions, Bureau of Labor Statistics. Anna Hill of the *Review* staff provided special editorial assistance.

Price changes over time may differ among items and these differences can affect consumer demand. This is illustrated by rapidly rising prices for energy items over the last decade. In the Consumer Price Index for All Urban Consumers (CPI-U), energy products (gasoline, motor oil, electricity, natural gas, fuel oil, bottled gas, and coal) rose 218 percent from December 1972 to December 1980, more than twice as fast as the average increase for all items. According to data from the Consumer Expenditure Surveys, urban consumer units<sup>1</sup> reported an average annual expense for energy items of \$743 for the 1972–73 period and an annual average of \$1,783 for the 1980–81 period. This 140-percent increase is substantially smaller than the change that occurred for prices and implies a reduction in consumption of energy items as a result of higher relative prices. This adjustment was also seen in related consumption such as the increased demand for smaller and more fuel-efficient automobiles.

Another factor which can influence consumers' consumption patterns is changing real income. If prices paid by consumers and their money income were to increase at the same rate, consumers' real income would remain unchanged. Average money income in constant dollars declined about 7 percent between 1972 and 1981, both for households and for families. However, per capita average real money income increased by more than 3 percent during the same period.<sup>2</sup> The rise in per capita income, in contrast to the decline experienced by families and households, is a direct result of the average size of families and households becoming smaller.

The impact of rising prices on some families can be offset by having additional income from another member joining the labor force. For example, in 1972, 41.5 percent of married women with a husband present were in the labor force. By 1981, the percentage increased to 51. The labor force participation rate for married women, husband present, and with children under 6 years of age increased from 30.1 percent in 1972 to a rate of 47.8 in 1981.<sup>3</sup> Demographic-related changes of this kind affect expenditure patterns. For example, expenses for such items as day care/nursery school and babysitting might increase and there could be additional expenses for eating meals out and transportation.

Still other factors which affect the pattern of consumption over time are product changes and technological changes which can affect consumers' demand for various goods and services. The electronics industry in particular has influenced consumer preferences by its introduction of such items as the personal computer, video games, and video recorders. Over time, a number of products are modified, expanded, or improved, depending on the demand of consumers, and these changes influence subsequent purchasing decisions of consumers.

Finally, a more subtle phenomenon which contributes to changes in the relative importance of items in the market basket is that tastes of consumers change. There are a variety of ways in which lifestyles and tastes change, such as the increasing number of persons who are active in some form of physical exercise such as jogging, cycling, or using the facilities of a physical fitness organization. These preference shifts also change expenditure patterns for items such as sports clothing and equipment, and fees paid for recreational facilities.

*Population changes.* Not only do the consumption patterns of individual consumer units change over time, but also the geographic distribution of the population may change. Between 1970 and 1980, the total population of the United States grew 11.5 percent. The population of the South grew 20 percent and the population of the West increased 25 percent.<sup>4</sup> This means that consumer units in the South and West represent approximately 52 percent of the population for which the revised CPI market basket will be based, compared with 48 percent in the 1972-73 market basket currently being used. Thus, consumption patterns of consumers in the warmer climates of the South and West will have a greater influence on the CPI than before.

### **Prior revisions**

The first major activity in prior revisions of the CPI has been the implementation of a Consumer Expenditure Survey as the basis for selecting and weighting a new market basket of goods and services to be priced. Until these data are in hand, it is impossible to complete a revision of the CPI. The

periods when expenditures were collected that were the basis for the last four revisions are as follows:

<i>Reference year(s)</i>	<i>Release of revised CPI</i>
1934-36 .....	1940
1950 .....	1953
1960-61 .....	1964
1972-73 .....	1978

The time between the reference years of the Consumer Expenditure Survey and the introduction of the CPI with revised expenditure weights was typically 3 years, except for the 1978 revision.

The 1940 revision introduced the concept of a sample of cities and items and the principal of imputation, permitting the CPI to represent price change in all cities and all items purchased for consumption. Prior to 1940, the CPI measured the price change in only the 33 cities being surveyed and for only the items actually priced.

Prior to the 1950 Consumer Expenditure Survey (on which the 1953 revision was based), BLS conducted experimental surveys and test pricings to improve data collection methods and to establish the basic procedures for processing these data. The 1953 revision took 3 years to implement surveys which revised the areas and weights, and updated the item samples priced. This effort was primarily a clerical operation.

After the 1953 revision, it became apparent that the CPI should be revised every decade. By the late 1950's, dramatic changes had occurred: The composition of the urban population changed, with rapid growth of suburban areas, increased use of the automobile affected lifestyles, and new shopping centers catered to the American consumer. A contributing factor to this growth was the 37-percent increase in personal disposable income between 1950 and 1956, with more than two-thirds of the rise being reflected in real income. The BLS received, in mid-1959, authorization for a revision program, which was completed in 1964 with the release of an index with revised weights and outlet samples which included, for the first time, areas outside the central city of metropolitan areas.<sup>5</sup>

The first year of the 1964 revision was dedicated to pilot surveys for testing and debugging procedures to be used nationwide. After clerical edits and professional reviews of the data, the computer was used to process estimates of expenditures and indexes.

The 1978 CPI revision took longer than the previous revisions because it included the introduction of new approaches to the collection of consumer expenditures and a number of complex improvements and innovations in pricing for the CPI. A thorough examination of the CPI, its concepts and operational processes, was made during the revision. The growth of computer applications during the decade of the 1960's made it possible to introduce statistical techniques and monthly operational processes which were not feasible in earlier efforts of producing estimates of monthly price change.

## Innovations of the 1978 revision

Innovations in collecting expenditure data for the 1978 revision contributed to a longer time between the Consumer Expenditure Survey reference data and the introduction of the revised CPI. Prior to the 1972–73 Consumer Expenditure Survey, interviewers visited all sample households during February through June and asked the respondents questions needed to reconstruct their living expenses for the previous calendar year. These global estimates of expenditures were used to obtain annual expenditures for most items. Respondents were asked to recall weekly expenditures for food store items and small frequently purchased items.<sup>6</sup>

Several changes in these procedures were made early in 1972. A quarterly interview survey for a sample of consumer units was introduced. Expenditures for a number of items were collected for purchases made throughout the preceding 3 months, while other items were surveyed for varying reference and recall periods. Another separate sample of consumer units was asked to keep two 1-week diaries in which each purchase was recorded on the day it was made. Although this change in methodology was more expensive and took somewhat longer to process, it resulted in a marked improvement in the data used in the estimation of expenditure weights. It reduced the length of recall in the collection of data, and, therefore, reduced response errors associated with either telescoping purchases from an earlier period or forgetting certain purchases. (Telescoping occurs when the respondent inadvertently recalls and reports a purchase made prior to the survey period.)

Another significant innovation in the 1978 revision was the introduction of the Point-of-Purchase Survey.<sup>7</sup> In earlier revisions, the BLS had to rely on secondary data to establish sampling frames used in selecting outlets in which to price items comprising the market basket. These secondary data provided only the broadest classification of the outlet and provided no detail on the merchandise lines actually purchased. For example, it was not possible to identify all the types of outlets where motor oil was sold, and it was impossible to tell whether a particular grocery store sold fresh fish. As a result, despite substantial efforts, it was impossible to obtain a statistical sample of outlets for the CPI that represented where people shopped. The growth of metropolitan areas and the spread of shopping centers added to the concern about the quality of outlet samples.

In the Point-of-Purchase Survey, consumer units were interviewed in each local area where prices were to be collected for the CPI. Respondents specified the amount they actually spent in each outlet in which they shopped for a category of items. Each category was structured to be compatible with a major line of goods or services sold, and so that the category would contain one or more “entry level items”<sup>8</sup> for which a relatively broad class of products or services could be priced to represent that entry level item. (The current CPI market basket contains 382 such items.) The Point-of-Purchase Survey respondents were asked if

they purchased an item within a specific category during a prescribed reference period. If a purchase was made, the name and address of the outlet was recorded along with the cost of each transaction.

Prior to the introduction of the Point-of-Purchase Survey, each outlet was selected and weighted without specific regard for the relative sales that the outlet had for the priced item. The only exception to this procedure was in the grocery store food index where sales data were obtained from food chain organizations so that differential weights could be used to weight prices in the food index for large food chains. Since 1978, the BLS has used a probability procedure with the value of purchases of each outlet as a measure of size to select outlets for each Point-of-Purchase Survey category. This ensures that the outlet sample has an unbiased representation of large and small establishments and also allows for the estimation of variances and sampling error.

In addition, prior to 1978, there was no systematic statistical process for replacement of outlets which closed, moved, or changed merchandise lines. BLS had to rely primarily on its CPI field representatives to locate a comparable establishment to obtain price quotes for the specific items to be priced. With the composition of outlets gradually changing due to the entry of new establishments, it was difficult to ensure the representativeness of the sample of outlets. In 1978, BLS introduced a new system, based on data from the continuing Point-of-Purchase Survey, to update CPI outlet samples in each urban area on a 5-year cycle. Outlet samples in about 20 percent of the urban areas priced for the index are updated each year so that the entire outlet sample is completely updated over a period of 5 years.

When substituting a price quote for an outlet item selected from the updated sample for a corresponding outlet item quote previously priced, it is necessary to factor out of the index measure any difference between the two prices which results from this substitution. For example, if a man’s 100-percent cotton dress shirt is selected in the newly selected outlet to replace a cotton blend shirt which was priced in the outlet to be replaced, the prices of these two items would not be viewed as comparable for an index measuring price change. Differences that may exist between the new outlet item quote and the old one are factored out of the measurement of price change by a method described as linking with an overlap price. This linking method used in outlet sample updating requires that both the new and old outlet item quotes be priced in the same month. The price for the item quote or the outlet being replaced measures any price change from the previous index month up to the link month when both outlets were priced. The price of the item quote from the newly selected outlet is used to measure price change from the link month forward. This linking method assures that the process of introducing the new item has no effect on the index.

Prior to 1978, an item designated for pricing in an outlet would have characteristics specified by commodity analysts

in the national office. The detailed specification was usually the same for all outlets in the country and would generally limit the number of products that could be priced to represent the expenditures within the item class. In the 1978 revision, the BLS introduced new sampling procedures to permit all products or services within a respective item classification to be eligible for pricing, thereby increasing the efficiency and representativeness of the index. However, once an outlet item is selected, the field representative records the specific narrow characteristics of the item to identify it for continuous pricing as long as the item is available in the store.

The process used in the selection of an item within an outlet is called disaggregation. This process gives an opportunity for every variety of an item within a store to be selected to represent purchases for the whole item class. This disaggregation is an objective and efficient process which results in the selection of a sample of varieties that covers the full spectrum of purchased items.<sup>9</sup>

During the 1978 revision, a great amount of time was spent examining alternative methods of measuring price change in homeownership. This effort resulted in the definition of a flow-of-services approach<sup>10</sup> which is consistent with the economic concepts on which the CPI is based. This approach was not introduced during the 1978 revision because of difficulties in developing a workable flow-of-services measure and because of the diversity of views held by various advisory groups.<sup>11</sup>

Shortly after the revision, concern over the measurement of homeownership costs increased because of the major changes that were occurring in the financing of homes and the increasing difficulties of obtaining adequate house price data. Because of these changes and the increasing impact and importance of the CPI, BLS changed the homeownership component of the index between revisions.<sup>12</sup> A rental equivalence measure<sup>13</sup> was introduced as the measure of homeowner cost in the January 1983 CPI-U index and in the CPI-W with the January 1985 index. The rental equivalence measure estimates the change in shelter costs as the change in rents which would have to be paid for occupancy of housing units occupied by owners. This new measure replaced the previous treatment in which homeownership costs were measured by current house prices, mortgage interest, costs of new mortgages, property taxes, property insurance, and maintenance and repair costs. Because it measures the cost of consuming shelter services provided by a house (that is, the rent that would be paid), rental equivalence is consistent with the underlying concept of the CPI as a measure of price change for consumption. The old homeownership measure included investment aspects of homeownership associated with obtaining and maintaining the house as an asset.

### The 1987 revision

The CPI relates to expenditures of the civilian noninstitutional urban population of the United States. The urban

population is defined as persons who live in Metropolitan Statistical Areas as defined by the Office of Management and Budget (including the rural nonfarm within these areas) and urban areas, including places with 2,500 or more persons outside of the Metropolitan Statistical Areas.

Since the 1978 revision, the CPI has been calculated for two populations. The All Urban (CPI-U) index is based on expenditures reported by all consumer units in urban areas of the United States with two exceptions: consumer units on farms within urban areas and consumer units receiving a majority of their income from a member who is in the military and lives off base with the unit. The CPI-U population represented 81 percent of the total U.S. civilian noninstitutional population in 1981. Because a large proportion of the population is covered, this index is extremely useful in discerning the effect of changing prices on consumers.

The CPI for Urban Wage Earners and Clerical Workers (CPI-W) is based on urban consumer units who meet additional requirements related to their employment: more than one-half of the consumer unit's income has to be earned from clerical or wage occupations, and at least one of the members had to be employed for 37 weeks or more in an eligible occupation. The CPI-W population was 30 percent of the total U.S. population in 1981.

*Geographic coverage.* The first phase of a revision is to make a new selection of the geographic areas, or primary sampling units, in which price data collection will be done. The new area sample for the 1987 revision is based on the 1980 Census of Population and uses the new Consolidated Metropolitan Statistical Area definitions.<sup>14</sup> The use of these definitions resulted in some changes. For instance, the definition for the New York area now includes Danbury and other parts of Connecticut; Philadelphia includes Wilmington and Trenton; Los Angeles includes Riverside-San Bernardino; and San Francisco includes San Jose. The Metropolitan Statistical Areas which are not a part of a Consolidated Metropolitan Statistical Area were defined as individual primary sampling units. All nonmetropolitan counties were grouped into primary sampling units to allow urban places with a population greater than 2,500 outside metropolitan areas an opportunity to be selected. The overall primary sampling units design consisted of 278 metropolitan areas and 810 nonmetropolitan urban areas, which cover all urban population. Primary sampling units with at least 1.2 million persons were designated "certainty areas." This means that each of these areas represents itself in the weighting of the estimates to the total CPI population. The noncertainty selections have a population weight that represents the population of all cities including their own population in their stratum—a collection of similarly sized areas in the same general geographic region. Twenty-nine largest primary sampling units and two unique areas—Anchorage and Honolulu—were designated certainty areas.<sup>15</sup>

The remaining primary sampling units were assigned to three city-size classes—medium-sized cities, small-sized

cities, and nonmetropolitan areas—within the Northeast, North Central, South, and West regions.<sup>16</sup> The result of the sampling process was the selection of 39 new areas with the retention of 52 primary sampling units from the old sample, of which 30 were certainty selections in the new sample. Overall, the number of primary sampling units to be surveyed for the CPI has increased by six. A comparison of primary sampling units in the old and new samples by population size and region is shown in table 1.

The South will have eight more primary sampling units than it had previously. Despite the West's large population growth between the 1970 and 1980 censuses, it will still have the same number of primary sampling units; however, it will have two more certainty selections. Two reasons account for the unchanged overall number of primary sampling units in the West. First, additional primary sampling units were allocated disproportionately to the West in previous allocations to permit publication of a separate nonmetropolitan urban index for the region. Second, use of Consolidated Metropolitan Statistical Areas resulted in two certainty selections, Los Angeles and San Francisco, becoming substantially greater in population. Because of their larger populations in the new CPI design, the number of items and outlets priced in each of these two areas will be expanded.<sup>17</sup>

Allocating samples to produce the most accurate national CPI possible with the funds available will affect the frequency of publishing CPI's for 13 local areas. Beginning with the January 1987 CPI, a monthly index will continue to be published for only the four largest local areas—New York, Los Angeles, Chicago, and Philadelphia. The index for Detroit, the smallest of the areas now published monthly, will be compiled on a bimonthly basis only for even numbered months. Bimonthly indexes will be published for each of the next 10 largest areas. Bimonthly indexes which are now published for the 12 smaller local areas will be replaced by semiannual average indexes, and the index for Northeast Pennsylvania (Scranton) will be discontinued.<sup>18</sup>

*Expenditure weights.* The relative weight of each entry level item in the CPI is tabulated from data obtained by the Consumer Expenditure Survey. This survey is actually composed of two separate surveys—an interview survey and a

diary survey—both conducted by the Bureau of the Census for the BLS.

As in the 1972–73 interview survey, Bureau representatives collect data for expenditures which respondents can remember fairly accurately for periods of approximately 3 months. Each consumer unit designated for sampling is contacted each quarter for five consecutive quarters. The initial contact is used to collect socioeconomic characteristics of the unit—an inventory of properties, vehicles, major durable goods, and insurance policies. In addition, purchases of goods and services made in the past month are recorded together with a date of purchase and a description of each item.<sup>19</sup>

BLS uses only the second, third, fourth, and fifth interviews in estimating a 12-month consumption pattern for the consumer units surveyed. The current interview questionnaire differs from that used in the 1972–73 survey in that it has a uniform reference period of 3 months for each expenditure item, whereas the 1972–73 questionnaire allowed for variable lengths of the period of recall. The major advantage of a uniform reference period is that it permits each interview to be used in a quarterly estimate, even when a consumer unit was not interviewed for the full 12 months of consumption. All data collected from consumer units are used, in contrast to 1972–73 when data from consumer units who later moved were not used.

The uniform reference period facilitates rotating the sample. Each quarter, one-fifth of the consumer units are interviewed for the first time, an additional one-fifth for the second time, and so on. The rotation spreads over the calendar year any bias which may result from either conditioning or fatigue on the part of respondents as they progress from the first to the fifth interview. Because many expenditure items are seasonal, it is advantageous to have a mixture of interviews in each quarterly estimate of consumption patterns.

The purpose of the diary survey is to obtain expenditure information for small frequently purchased items which consumers tend to forget. Each selected sample unit is asked to keep 1-week diaries of expenditures for 2 consecutive weeks. The diary sample is spread among the 52 weeks of the year. However, the sample size is doubled in the last 6 weeks of the year to obtain better estimates of items pur-

**Table 1. Current and new primary sampling units, by city-size and region**

City-size	All areas		Northeast		North Central		South		West	
	Current	New	Current	New	Current	New	Current	New	Current	New
Total .....	85	91	18	15	22	23	26	34	19	19
Metropolitan Statistical Areas:										
Large-sized cities .....	27	31	6	5	8	9	6	8	7	9
Medium-sized cities .....	20	22	4	4	4	4	8	10	4	4
Small-sized cities .....	22	24	4	4	6	6	8	10	4	4
Nonmetropolitan Statistical Areas .....	16	14	4	2	4	4	4	6	4	2

chased seasonally. The interviewer, when placing the first-week diary, obtains the socioeconomic characteristics of the consumer unit and provides instructions to the respondent. The respondent records purchases made by any member of the unit during the week. (This eliminates any questions the respondent might have in determining if an item is within the scope of the survey.) The diary focuses on the recording of purchases made in grocery stores and of meals, snacks, and beverages purchased in restaurants or other eating places. Other purchases are also recorded; therefore, a number of items reported in the interview survey can also be recorded in the diary. A major difference in the two surveys is that the diary does not record expenses made while out of town on trips. Both surveys have a sample size of approximately 4,800 consumer units per year. However, in the interview survey, each unit can potentially provide four quarters of data, whereas in the diary only 2 weeks of data can be obtained from the same unit.

The BLS staff has to identify from which survey—interview or diary—estimates should be used in developing expenditure weights and selecting item samples. For many items, the design of each survey predetermines which data should be used. For example, the diary estimates are used for all individual food and beverage items because the interview survey only collects a total estimate of expenses for these items. The diary is also used for a number of small and frequently purchased items in the categories of personal care, household supplies, and nonprescription drugs and supplies which are not covered in the interview survey. For other expenses, the interview survey is the better source as it has an effective sample size of 4,800 units each quarter and expenses are recalled for a period of 3 months. The diary panel, in contrast, only has an effective sample of 1,200 units per quarter for a total of approximately 2,400 diary weeks. There are a few expenditures that are collected in both surveys for which an evaluation is necessary to determine which estimate is best. For example, gasoline purchases are a frequently reported entry in the diary, and the estimate obtained from the interview is based on an average monthly expense pattern. Also, small clothing items such as hosiery and accessories could be overlooked in the 3-month recall which is the heart of the interview survey, but are likely to be recorded in the diary.

Each expenditure reported in these two surveys is coded to one of the 382 entry level items which constitute the lowest level of the CPI classification structure. The highest level of the CPI structure consists of the seven major groups of expenditures: (1) food and beverages, (2) housing, (3) apparel and upkeep, (4) transportation, (5) medical care, (6) entertainment, and (7) other goods and services. Expenditures within a major group are divided into expenditure classes which have been established either by categories of commodities or services and with some regard to similarity in their characteristics. The CPI structure currently has 68 expenditure classes and a new one will be established in

this revision for electronic products covering personal computers, computer software, calculators, telephones and other information processing equipment. (See exhibit 1.)

Most of the expenditure classes are divided into two or more strata.<sup>20</sup> The stratum is the lowest level for which expenditure weights are calculated, and thus, the level at which the priced market basket is fixed between revisions. Because the allocation of the sample of quotes and outlets is also done at the item stratum level, the number of strata within an expenditure class generally has some overall relationship to the relative importances of expenditures in that class. The variances of the CPI can be greatly influenced by the way price quotations are allocated among the item strata. In this revision, a paramount consideration was to maximize the efficiencies that could be achieved through sample designs and the allocation of samples. Using data from the 1980–81 CES and preliminary data on variances, item strata were restructured so that, given the available resources for pricing, the variance of the All Items CPI would be a minimum. A very few selected strata were left unchanged because of their individual uses or interest. The number of strata for which expenditure weights are calculated will drop from 265 to 203.<sup>21</sup> (See exhibit 1.)

Each item stratum has at least one entry level item which is usually structured to facilitate the selection of a unique item to be priced. If there is much heterogeneity among the goods or services which comprise an item stratum or in the types of outlets where they are purchased, the stratum is usually subdivided into two or more entry level items. Currently, there are 382 entry level items and although the composition of several will be changed in this revision, the total number will probably not change by much.

In the past, there have been a few sample entry level items which have not been priced. Sometimes the item was difficult to price because its quality changed constantly. An example would be the pricing of books purchased through book clubs. The book offered varies substantially over time and various discounts or premiums may be earned. Also, an entry level item may not have been priced because an appropriate outlet sample could not be established. This is the case particularly for services provided by household workers and babysitters. If an entry level item or a potential one has a small relative importance, the Bureau does not go to a great disproportionate expense to price it. In the current revision, the Bureau plans to use the relative importances of entry level items reported in the interview and diary surveys to identify those that have become more significant since the last revision. As a result, unpriced strata are expected to comprise only 1.5 percent of the CPI, compared with 3.7 percent currently.

*Outlet selection.* The 1987 revision will rely primarily on the continuing Point-of-Purchase Survey for the selection of outlet samples. When this survey was initially designed in 1974, there was some concern that it would not be useful

**Exhibit 1. Strata titles for revised Consumer Price Index**

Expenditure class	Stratum number	Stratum title	Expenditure class	Stratum number	Stratum title
<b>Food and beverages (at home)</b>					
01	1	Flour, prepared flour mixes	24	1	Materials, supplies, equipment for home repairs
	2	Cereal		2	Other property maintenance/repair commodities
	3	Rice, pasta, cornmeal	25	1	Fuel oil
02	1	White bread		2	Other fuels
	2	Other breads, rolls, biscuits, muffins	26	1	Electricity
	3	Cakes, cupcakes, cookies		2	Utility (piped) gas
	4	Other bakery products	27	1	Telephone—main station service
03	1	Ground beef		2	Water/sewerage maintenance
	2	Chuck roast		3	Community antenna, cable TV
	3	Round roast		4	Garbage/trash collection
	4	Other steak, roast and other beef		5	Telephone—interstate toll calls
	5	Round steak		6	Telephone—intrastate toll calls
	6	Sirloin steak	28	1	Linens, curtains, drapes, sewing materials
04	1	Bacon	29	1	Bedroom furniture
	2	Pork chops		2	Sofas
	3	Ham		3	Living room chairs, tables
	4	Other pork, including sausage		4	Other furniture
05	1	Lunchmeat, lamb, organ meats, game, mutton, goat	30	1	Refrigerators, home freezers
06	1	Fresh whole chicken		2	Laundry equipment
	2	Fresh/frozen chicken parts		3	Stoves, ovens, portable dishwashers, window air conditioners
	3	Other poultry	31	1	Televisions
07	1	Canned fish and seafood		2	Video tape recorders, cassettes, tapes
	2	Fresh/frozen fish and seafood		3	Radios, phonographs, components, recordings
08	1	Eggs		9	Unpriced accessories for electronic equipment
09	1	Fresh whole milk	32	1	Floor/window coverings, outdoor/infant/laundry/cleaning equipment
	2	Other fresh milk and cream		2	Clocks, lamps, and decorator items
10	1	Butter and other dairy products (excluding cheese, ice cream)		3	Tablewear, serving pieces, nonelectric kitchenware
	2	Cheese		4	Lawn and garden equipment, tools, hardware
	3	Ice cream and related products		5	Small kitchen appliances, sewing machines, portable heating/cooling equipment
11	1	Apples		6	Indoor plants and fresh flowers
	2	Bananas		9	Unpriced household equipment parts, small furnishings
	3	Oranges	33	1	Laundry and cleaning products
	4	Other fresh fruits		2	Household paper products, including stationery
12	1	Potatoes		3	Other household products, lawn and garden supplies
	2	Lettuce	34	1	Postage
	3	Tomatoes		2	Babysitting
	4	Other fresh vegetables		3	Domestic service
13	1	Fruit juices and frozen fruits		4	Other household services
	2	Canned and dried fruits		5	Appliance and furniture repair
14	1	Frozen vegetables		6	Care of invalids, elderly at home
	2	Canned and other processed vegetables		9	Unpriced rental and repairs of household and audio equipment
15	1	Candy and other sweets	35	1	Tenants' insurance
	2	Sugar and artificial sweetener			
16	1	Fats and oils			
17	1	Carbonated drinks			
	2	Coffee	36	1	Men's suits, coats, sportcoats, jackets
	3	Other noncarbonated drinks		2	Men's furnishings, special clothing
18	1	Canned and packaged soup		3	Men's shirts
	2	Frozen prepared foods		4	Men's dungarees, jeans, trousers
	3	Snacks		9	Unpriced men's uniforms and other clothing
	4	Spices, seasonings, condiments, sauces	37	1	Boys' apparel
	5	Other prepared food		9	Unpriced boys' uniforms and other clothing
<b>Food (away from home) and alcoholic beverages</b>			38	1	Women's coats and jackets
19	1	Lunch		2	Women's dresses
	2	Dinner		3	Women's separates, sportwear
	3	Other meals and snacks		4	Women's underwear, nightwear, accessories
	9	Unpriced board and catered affairs		5	Women's suits
20	1	Beer and ale at home		9	Unpriced women's uniforms and other clothing
	2	Other alcoholic beverages at home	39	1	Girls' apparel
	3	Wine at home		9	Unpriced girls' uniforms and other clothing
	4	Alcoholic beverages away from home	40	1	Men's footwear
				2	Boys' and girls' footwear
				3	Women's footwear
<b>Housing</b>			41	1	Infants' and toddlers' apparel
21	1	Rent of dwelling		9	Unpriced infants' accessories and other clothing
	2	Lodging while out of town	42	1	Sewing materials, notions, luggage
	3	Lodging while at school	43	1	Watches
22	1	Homeowners' insurance		2	Jewelry
23	1	Property maintenance and repair services	44	1	Other apparel services
				2	Apparel laundry, dry cleaning, storage
<b>Apparel and upkeep</b>					

Exhibit 1. Continued—Strata titles for revised Consumer Price Index					
Expenditure class	Stratum number	Stratum title	Expenditure class	Stratum number	Stratum title
<b>Transportation</b>			<b>Entertainment</b>		
45	1	New cars	59	1	Newspapers
	2	New trucks		2	Magazines, periodicals, and books
	3	New motorcycles		9	Unpriced newsletters
46	1	Used cars	60	1	Sports vehicles, including bicycles
	9	Unpriced other used motor vehicles		2	Sports equipment
47	1	Motor fuel	61	1	Toys, hobbies, and music equipment
	2	Motor oil, coolant, and other products		2	Photo supplies, equipment
48	1	Tires		3	Pet expense
	2	Other parts and equipment		9	Unpriced souvenirs, fireworks, visual goods
49	1	Automotive body work	62	1	Club membership and fees
	2	Auto drive train, front end repair		2	Fees for participant sports
	3	Auto maintenance and servicing		3	Admissions
	4	Auto power plant repair		4	Fees for lessons and instructions
	9	Unpriced auto repair service policy		5	Photographers, film processing, pet services
50	1	Automobile insurance		9	Unpriced rental of recreational vehicles
51	1	Auto finance charges	<b>Other goods and services</b>		
	9	Unpriced other vehicle finance charges	63	1	Tobacco and smoking supplies
52	1	State and local auto registration, license, inspection	64	1	Hair, dental, shaving, miscellaneous personal care products
	2	Other automobile related fees		2	Cosmetics/bath/nail preparations and implements
	9	Unpriced docking/landing fees	65	1	Beauty parlor services—females
53	1	Airline fare		2	Haircuts and other barber services—males
	2	Intercity transportation		9	Unpriced repair of personal care appliances
	3	Intracity transportation	66	1	School books and supplies for college
	9	Unpriced school bus		2	Reference books and elementary/high school books
<b>Medical care</b>				9	Unpriced miscellaneous school purchases
54	1	Prescription drugs	67	1	College tuition
55	1	Internal and respiratory over-the-counter drugs		2	Elementary and high school tuition
	2	Nonprescription medical equipment and supplies		3	Child daycare, nursery school
56	1	Physicians' services		4	Other tuition
	2	Dental services		9	Unpriced miscellaneous school item rentals and other services
	3	Eyeglasses and eyecare	68	1	Legal fees
	4	Services by other medical professionals		2	Banking and accounting expenses
57	1	Hospital room		3	Cemetery lots and funeral expenses
	2	Other inpatient services		9	Unpriced miscellaneous personal services
	3	Lab tests, x-rays, emergency room, other outpatient service	69	1	Electronic and office equipment for nonbusiness use
	9	Unpriced rent/repair of medical equipment			
58	1	Health insurance			

in selecting outlets for entry level items which were purchased either infrequently or by a relatively small percentage of consumers. In updating outlet samples over recent years, a number of these entry level items have been added to the Point-of-Purchase Survey. By extending the reference period for such items, the continuing Point-of-Purchase Survey has proved effective in securing a sufficient outlet sample.

There are a few entry level items for which outlet samples are obtained from sources other than the Point-of-Purchase Survey. Generally, these items are found in a relatively small number of establishments, and reliable information is readily available for establishing a measure of size in the sampling frame. Examples of such entry level items are natural gas, electricity, basic telephone service, casualty insurance premiums, postage rates, and train fares. The ongoing Consumer Expenditure Survey is collecting outlet information (along with the expenditure data) for a small number of these entry level items. After these data are evaluated, we will determine if it is possible to use the Consumer Expenditure Survey for selecting outlet samples for such entry level items as electricity, natural gas, and

tuition. Data collected in the Consumer Expenditure Survey with regard to consumption quantities on utility bills will be used for selecting the consumption amounts to be priced for the CPI.

### New strategy: 'rolling-in' samples

In previous CPI revisions, a new area sample (primary sampling unit) and new item and outlet samples were introduced at the same time. The 1987 revision will use a concept of rolling-in the new area, item, and outlet samples. That is, the composition of the area and item samples will be gradually updated over a period of years, rather than substituting the full set of new area and outlet samples at a single time. Two innovations of the 1978 revision facilitate this rolling-in strategy: the use of the continuing Point-of-Purchase Survey for a systematic updating of outlet samples, and the broader definition of the characteristics of items which define strata. The first stage of rolling-in the new sample is to initiate pricing in new areas which will be needed in January 1987 for updating the U.S. CPI to reflect changes in population distributions. A number of the areas



which had been representative of a specific city-size had sufficient population growth between 1970 and 1980 so that they no longer represented that particular city-size. There are 19 new areas classified as either small- or medium-sized or nonmetropolitan, and one large-sized area which have to be surveyed prior to 1987 in order for the U.S. CPI to reflect the distribution of the U.S. population as enumerated by the 1980 census.

The second aspect of this phased update pertains to the item samples in all CPI areas retained in the new design. Any new entry level item or any entry level item that is substantially modified in definition will be initiated in all areas prior to the issuance of the revised CPI for January 1987.

The continuing Point-of-Purchase Survey for 1985 will be conducted in the 20 new areas so the item and outlet samples for these areas can be initiated and results introduced in the January 1987 CPI. (An additional 19 new areas will be initiated and introduced over the 1987–89 period.)

The new item expenditure weights tabulated from the 1982–84 Consumer Expenditure Surveys will replace those tabulated from 1972–73 survey data. To make this substitution of expenditure weights without causing a discontinuity in the CPI's measurement of price change, the index levels using the new expenditure weights will be set equal to those published for the old series in December 1986. The official CPI for January 1987, therefore, will reflect the price change between December and January based on the new expenditure weights. As in the past, the Bureau will continue to publish overlap indexes using the old expenditure weights for 6 months after the issuance of the revised CPI, for the convenience of users.

Outlet samples for entry level items retained from the old primary sampling unit design will be updated through the use of the continuing Point-of-Purchase Survey and the existing outlet updating procedures. A few of the retained areas will have their outlet samples updated in 1987 when 10 more new areas are rolled-in. The remaining areas will have item and outlet samples rolled-in over the next 3 years.

*Advantages.* By rolling-in the new areas and using the established outlet updating process for areas retained in the CPI design, it is possible to effect significant time and cost savings. One of the most costly activities of past revisions was the initiation of pricing of the item and the outlet samples in all areas selected in the primary sampling unit redesign. Prior to the introduction of the revised CPI, all of the item and outlet samples had to be initiated and priced in the same month as the existing samples. Even for the areas retained, a reselection of item and outlet samples required substantially more new pricing because the probability of reselecting the same outlet for an entry level item is very small. Additional field representatives had to be hired and trained to do this work while pricing was continued to produce the ongoing CPI.

Because the existing CPI is official until the revised index is released, the review and processing of data from the new samples must be done in a framework which does not jeopardize production schedules. Rolling-in the new areas into the CPI estimate over a 3-year period allows more time to train field representatives and lessens problems associated with a rapid expansion and subsequent reduction in staff. More importantly, using the existing updating procedures for introducing new outlet samples on a systematic basis precludes the need to maintain extended dual operations—one for the existing CPI and one for the data scheduled to supersede it. Over the past 6 years, the Bureau has used this technique for updating outlet samples. A few modifications to accommodate new areas and entry level items will increase the amount of data requiring processing, but by substantially less than the old procedure.

Expenditure weights for the 203 strata in the CPI market basket will be tabulated using 3 years of Consumer Expenditure Survey data—1982, 1983, and 1984. Because the CPI is a base-weighted index designed to reflect price change (and not changes in the quantities purchased), these expenditure weights will remain fixed until the next revision of the CPI. As in the past, of course, BLS will continue to update the outlet sample in one-fifth of the CPI areas each year.

Within the CPI fixed-weight constraint, however, BLS intends to make maximum use of data from the ongoing Consumer Expenditure Survey to keep the items priced to represent the strata up to date. A number of CPI strata, for example, are represented by 2 or more entry level items. The sample of entry level items for these multiple-entry level item strata have been selected from the Consumer Expenditure Survey.

Beginning in 1987, when the outlet samples are updated for one-fifth of the urban areas and new detailed items are selected for pricing, this sample of entry level items will also be updated based on the two most recent years of Consumer Expenditure Survey data. If relative shifts of consumption occur among items within a stratum or new products appear within the stratum, then entry level item reselection will gradually change the composition of the entry level items being priced. In other words, the entry level item sample will begin to reflect the changes consumers are making in the variety of products purchased which make up an item stratum of the index. The reselection of the item samples within each fixed-weight category for one-fifth of the area sample does not alter the fixed-weight nature of the CPI because the population-expenditure weights will remain fixed, as now, at the item strata level until the next revision. This reselection will not affect entry level items which have a very large relative importance or are the only ones in the particular strata and, therefore, are certain to be priced in all urban areas.

Although the CPI will continue to have its basic fixed-weight character, the existence of annual expenditure data will offer a number of opportunities for developing exper-

imental indexes with different characteristics. For example, while the expenditure weights for the official CPI are updated only about once every 10 years, experimental indexes could be developed with more frequent weight changes.

### Improvements of the 1987 revision

*Enhanced shelter survey.* The adoption in 1983 of rental equivalence to measure changes in the cost of the shelter component of owner-occupied homes put the housing component of the CPI on a flow-of-services conceptual footing, and isolated the consumption element of owner housing from its investment element.

In addition to updating the housing sample based on the 1980 census, the 1987 CPI revision program will enhance the rental equivalence method adopted in 1983.<sup>22</sup> The selection of a new housing sample is designed to represent optimally both owners and renters. A multi-stage sampling procedure was used that stratifies the residential areas of each primary sampling unit by tenure (percent owner-occupied) and rent level. Smaller areas are then defined and sampled within each selected area. The housing units of each selected small area are screened for tenure and sampled at differential rates according to tenure. In heavily owner-occupied areas, for example, the renters are selected more frequently than owners in order to find renters who are like owners, because it is from these rentals that the best estimates can be made in the implicit rent of owner-occupied dwellings.

*Enhancement of statistical techniques.* Because the Consumer Expenditure Survey estimates for each of the individual areas of the country are based on relatively small samples, BLS has undertaken research in statistical techniques to reduce the error on local area index weights. In the 1978 revision, a compositing technique was used in which the local area average expenditures were weighted together with the expenditure estimates for the same item class for the geographic region to which the local area belongs.

Research done at the BLS during the current revision involved use of the composite estimation of relative importances rather than of mean expenditures of the item categories. Relative importances in the CPI are the mean expenditures for each item as a percentage of all expenditures. BLS statisticians found compositing of relative importances to be more effective in reducing the average mean squared error than compositing of the expenditures themselves.<sup>23</sup>

Another refinement under consideration is to replace estimates for each of the four broad geographic regions of the country (Northeast, North Central, South, West) with two sub-area estimates—one for the certainty areas within each region and one for all other areas within each region. The relative importances of each certainty area within each region would be estimated based on composites which use relative importances of expenditure patterns from all cer-

tainty areas in the region. The division of the regional estimate between certainty areas and all other areas has also proved effective in reducing the average mean squared error.

Publication of quantitative measures of sampling error for selected indexes is planned for the 1987 revision. Initially, estimates of the index variance will be available in the All Items CPI and for some of the major group indexes. Eventually, more indexes will have an estimate of variance published.

*Enhanced quality.* During the implementation of the 1987 revision, the Bureau will add a new dimension to quality assurance and control of the CPI program. Throughout the years, the staff has devoted substantial time to the inspection of data collection and processing activities. The goal of the inspections was to identify and correct individual error. The goal of the new audit process to be instituted in this revision will be to achieve long-term quality improvement. This will be accomplished, in part, by an independent staff which will systematically evaluate survey processes empirically.

By having independent audit data for comparison purposes, error profiles can be used to identify the type of errors, diagnose their sources, and prescribe procedural changes to prevent these errors from occurring in the first place. The techniques used will include special, detailed evaluation studies of specific processes, ongoing process controls and reports, statistical quality control and measurement, and a system for information feedback and corrective action. The goal is to develop processes that will result in enhanced estimators of price change.

### Other concepts to be investigated

As part of the revision, BLS will investigate the appropriate treatment of insurance premiums in the CPI. Currently, premium costs for health insurance and casualty insurance for vehicles and household furnishings are priced for the index. The overriding issue in the pricing is the one of constant quality in the coverage. Quality changes that affect premium level should be removed before being used in the CPI. Using health insurance as an illustration, there are four factors which affect changes in premiums: (1) changes in the costs of medical procedures, (2) administrative cost and surplus requirements and the profit needs of commercial carriers, (3) policy benefit changes, and (4) utilization changes, that is, changes in the frequency of a covered event occurring. Changes in the first two factors do not affect policy quality, whereas changes in the latter two will. For the past 20 years, the Bureau has used an indirect method of pricing health insurance because it has been unable to develop an effective methodology for removing the effect of most changes in the coverage or the utilization rate.<sup>24</sup> The indirect method of pricing health insurance measures changes in medical costs (factor 1) by using the price changes which have occurred in physicians' and hospital fees in the CPI to represent the change in costs that insurance carriers

have incurred for their policy holders. Changes in costs for carriers (factor 2) are measured by the annual changes in the retained earnings (premium revenue less benefit payments) of insurance carriers. Thus, the indirect method measures changes which affect policy premiums while excluding from the measurement the two factors which affect quality.

Direct pricing of a sample of policies was tried during the 1978 revision, but was dropped due to the unresolved issue of quality adjustment. BLS was unable to measure satisfactorily the premium value for changes in the coverage of the policies and for the impact of changes in the utilization of policies. For the 1987 revision, research is continuing to determine if a procedure can be adopted that produces adequate direct adjustment for changes in coverage and utilization.

Casualty insurance on vehicles and household effects is directly priced in the CPI. Factors for removing quality changes from these kinds of policies were developed for changes in deductible provisions and for mandatory "no fault" automobile insurance. Generally, other policy coverage changes are treated by not using the policy and its premium in the index calculation for the month of the change. With casualty insurance, however, price changes which result from changes in utilization rates are usually reflected in the index. The difference in the treatment of utilization changes for health insurance and casualty insurance is being reviewed as part of the revision.

### Evaluating substitute items

One of the most difficult problems for those who compile price indexes is that of quality change. Products and services change constantly, and new items replace old ones on the market. There is a large body of literature on the effect of quality change on Consumer Price Indexes.<sup>25</sup> Most of these studies show mixed results. Although it is generally agreed that quality adjustment error exists, the extent of the error, and, indeed, even its direction, are not known.

A series of practical techniques for handling substitution and quality change issues in an operating environment has been developed. Briefly, if an item and its substitute are comparable, with no significant difference in quality, then the prices are directly compared and used in the index. If the items are judged not comparable, then the price difference must be broken down into quality change and price

change. This process results in one of three actions: (1) a quality adjustment is made by using the difference in production costs and adding a markup to retail or by some other method of valuing the difference in characteristics, (2) if both the old and new items can be priced in the current period, the difference in price in this period is considered the value of quality change (this "overlap pricing" is the technique used in outlet updating), or (3) if neither a quality adjustment nor an overlap price is possible, then the price change of the new item is not used in the current estimate, and a current price for the old item is imputed using price movements of the quotes with comparable prices in both periods in the item strata or market basket. This third action (referred to as linking) not only precludes a quality change from being reflected in the index, but can also preclude capturing the price change—either positive or negative—which may have occurred at the time of the substitution in the specific item.

Of the more than 1 million distinct price quotes obtained for items other than shelter in the index during 1983, only 3.8 percent were substitutions. But this relatively low frequency of substitution still had a major impact on the CPI. Price changes associated with the substitutions accounted for more than one-half of the total price change in the year, and quality changes equal to about one-third of the total price change were excluded from the index. More than 40 percent of these substitutions were comparable, and an additional 8 percent were adjusted explicitly for quality changes. An additional 45 percent of the substitutions were judged noncomparable and linked, while an overlap price was obtained about 6 percent of the time. The highest substitution rate (17.3 percent) was for apparel and upkeep items.<sup>26</sup>

In cases where noncomparable substitutes are "linked" out of the index, there is a danger that the CPI is missing some real price change. The converse danger of including some quality change in the index also occurs when two versions of an item are declared comparable. Because of the significant impact such substitutions have on the index, research is under way to identify methods to reduce the risks associated with missing price change by linking and with reflecting quality change as price change when declaring substitutes comparable.

As the revision progresses, detailed reports will be prepared on the results of specific investigations and research. □

### —FOOTNOTES—

<sup>1</sup>A consumer unit is comprised of either all members of a particular household who are related by blood, marriage, adoption, or other legal arrangements such as a foster child; a person living alone or sharing a household with others or living as a roomer in a private home or lodging house or in permanent living quarters in a hotel or motel, but who is financially independent; or two or more persons living together who pool their income to make joint expenditure decisions.

<sup>2</sup>See *Current Population Reports, Consumer Income*, Series P-60, No.

142 (Washington, Bureau of the Census, February 1984), tables 3, 14, and 38.

<sup>3</sup>Elizabeth Waldman, "Labor force statistics from a family perspective," *Monthly Labor Review*, December 1983, pp. 16-20.

<sup>4</sup>Derived from table 52, *Persons by Race for Regions: 1980 and 1970, United States Summary, General Population Characteristics*, PC80-1-81 (Washington, Bureau of the Census, May 1983).

<sup>5</sup>For a detailed description of the 1964 CPI revision, see *The Consumer Price Index: History and Techniques*, Bulletin 1517 (Bureau of Labor Statistics, 1966).

<sup>6</sup>For a detailed description of the 1960–61 survey, see *Consumer Expenditures and Income: Survey Guidelines*, Bulletin 1694 (Bureau of Labor Statistics, 1971).

<sup>7</sup>The Point-of-Purchase Survey is a household survey conducted by the Bureau of the Census each year in one-fifth of the areas sampled by BLS for the CPI. The survey is designed to periodically update the outlet sample used for pricing various items. Approximately 4,000 households are contacted each year and asked to provide data on names of retail, wholesale, or service establishments for purchases of 156 categories of goods and services.

<sup>8</sup>An entry level item is the ultimate sampling unit for expenditure items selected from the Consumer Expenditure Surveys by the Washington office. Each entry level item establishes the definition to be used by data collectors in the identification of unique items within an outlet that can be selected for pricing an entry level item.

<sup>9</sup>For further elaborations of the CPI methodologies, see BLS *Handbook of Methods, Volume II, The Consumer Price Index*, Bulletin 2134 (Bureau of Labor Statistics, 1984).

<sup>10</sup>The flow-of-services approach measures the cost of consuming shelter services provided by a house. The approach focuses on consumption and abstracts from the investment aspects of home purchase decisions. See the following *Monthly Labor Review* articles: Robert Gillingham, "Estimating the user cost of owner-occupied housing," February 1980, pp. 31–35; and Robert Gillingham and Walter Lane, "Changing the treatment of shelter costs for homeowners in the CPI," June 1982, pp. 9–14.

<sup>11</sup>For more information, see "Changing the Homeownership Component of the Consumer Price Index to Rental Equivalency," *CPI Detailed Report*, January 1983, pp. 7–13.

<sup>12</sup>Janet L. Norwood, "Statement Regarding Changes in the Consumer Price Index," *USDOL News Release*, 81–506, Oct. 27, 1981. This release explains reasons for introducing rental equivalence between revisions. See also "Changing the treatment of shelter costs" and "Changing the Homeownership."

<sup>13</sup>The rental equivalence approach as incorporated into the CPI attempts to answer the following question: How much rental income do the owners of housing units forego when they choose to occupy the units themselves instead of renting them out?

<sup>14</sup>Consolidated Metropolitan Statistical Area is an area which has more than 1 million population and is contiguous to one or more primary metropolitan statistical areas.

<sup>15</sup>Anchorage and Honolulu have been designated certainty areas since 1964, shortly after these territories were legislated to statehood. They are great distances from the areas comprising the West region so it is unlikely that a population market basket of other areas would provide a good representation of them.

<sup>16</sup>In order to allocate the remaining primary sampling units to each size class of the design as proportionally as possible to its share of the urban population, the population demarcation between medium-sized cities and small-sized cities varies by region—from 330,000 in the West to 500,000 in the Northeast. Further, proportional allocation will preclude the publication of nonmetropolitan urban areas in the Northeast and West as a minimum of four primary sampling units are required, and these regions received only two.

When selecting the sample of primary sampling units, major considerations are the costs of hiring and training field staff in new areas as well as the requirements related to the linking of CPI region city-size indexes. Thus, the BLS uses a statistical procedure which maximizes the probability of retaining primary sampling units from the old design.

The goal of this procedure is to increase the number of primary sampling units overlapped between the two designs, compared to an independent selection of primary sampling units, while at the same time reflecting the shifts in population of primary sampling units between the censuses. The BLS also uses a controlled selection to ensure that the representation of the

sample by State is directly proportional to the population of the State. (See Cathryn S. Dippo and Curtis A. Jacobs, "Area Sample Design for the Consumer Price Index," *1983 Proceedings*, American Statistical Association.)

<sup>17</sup>The budget of the CPI constrains the number of items and outlets which can be priced. The item sample design developed in the 1978 revision designates the number of price quotes which are required for each item stratum in the CPI market basket. Some variability in the number of quotes obtained occurs because of the greater relative importance of some items and differential allocation based on collection costs and variances of price change. The basic unit for allocating item quotes among the primary sampling units selected for pricing is called a halfsample. Each halfsample has approximately 1,100 quotes and is called a halfsample because at least two are required to calculate a price index for a specific CPI market basket area. The proposed budget for maintaining the CPI after the 1987 revision supports 127 halfsamples.

When allocating the 127 halfsamples among the primary sampling units of the new design, the primary objective was to make the sample as efficient as possible to minimize the sampling error of the national index. Each of the 91 primary sampling units was allocated one halfsample. For the optimization of the design, a primary sampling unit should only receive an additional halfsample if its population is greater than  $\frac{1}{127}$  of the total population. The remaining halfsamples were allocated among the 15 largest primary sampling units. By doing this, the efficiency of the national CPI estimate was improved. With other changes made by establishing population proportionality among the region according to size of cities, and optimizing the sample allocation between major groups, the overall efficiency of the national index will be improved by approximately 35 percent. However, the policy of optimization of the area design did have an impact on the publication policy.

<sup>18</sup>Bimonthly indexes will continue to be published for the local areas of Boston, Pittsburgh, Cleveland, St. Louis, Baltimore, Dallas, Houston, Miami, Washington, D.C., and San Francisco. Semiannual averages will be published for Buffalo, Cincinnati, Kansas City, Milwaukee, Minneapolis-St. Paul, Atlanta, Anchorage, Denver, Honolulu, Portland, San Diego, and Seattle.

<sup>19</sup>These data are used in a technique described as "bounding" the reference period of the subsequent interview. Bounding minimizes response errors which may result from the respondent inadvertently duplicating purchases from an earlier period. By recording dates and descriptions of purchases for the preceding month of each visit, the technique can be repeated in each subsequent interview.

<sup>20</sup>Item strata constitute the level of detail for calculating the expenditure weights of the CPI market basket, and the qualities and implicit quantities of this market basket are kept fixed between revisions. That is, any change in the CPI from one month to another is the effect of price changes of the item strata comprising the market basket.

<sup>21</sup>The reduction in the number of strata will affect the number of indexes that are currently published. The BLS will, however, produce a number of substratum (entry level items) indexes for old item strata that are now published and that have a significant number of price quotations collected.

<sup>22</sup>See Walter F. Lane and John P. Sommers, "Improved Measures of Shelter Costs," *1984 Proceedings*, American Statistical Association.

<sup>23</sup>Michael P. Cohen and John P. Sommers, "Evaluation of Methods of Composite Estimation of Cost Weights for the CPI," *1984 Proceedings*, American Statistical Association.

<sup>24</sup>See Daniel H. Ginsburg, "Medical care services in the Consumer Price Index," *Monthly Labor Review*, August 1978, pp. 35–39.

<sup>25</sup>For a detailed discussion of this and other problems, see Janet L. Norwood, *Problems in Measuring Consumer Prices*, Report 697 (Bureau of Labor Statistics, 1983) and Jack E. Triplett, "Quality Bias in Price Indexes and New Methods of Quality Measurement," in Zvi Griliches, ed., *Price Indexes and Quality Change* (Cambridge, MA, Harvard University Press, 1971).

<sup>26</sup>Paul A. Armknecht, "Quality Adjustments in the CPI and Methods to Improve It," *1984 Proceedings*, American Statistical Association.