

An experimental Consumer Price Index for the poor

Experimental Laspeyres, Paasche, and Fisher price indexes are derived for poor consumers; the minimal differences between these indexes and the Consumer Price Index for All Urban Consumers (CPI-U) in the calculation of poverty rates indicate that the poor and the general population face similar price trends

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Each year, price inflation adjustments are made for various Federal, State, and local programs in the United States. According to the Congressional Research Service,¹ approximately 80 benefit programs provide cash and noncash aid, primarily to persons with limited incomes. The combined cost of these programs in fiscal year 1994 was almost \$345 billion, up 11 percent from the previous fiscal year. Federal funds accounted for nearly 72 percent of total spending.

The benefit levels and eligibility guidelines for a substantial number of these programs are adjusted annually for inflation.² For example, food stamp levels are adjusted each October for changes in the Consumer Price Index for All Urban Consumers (CPI-U) for food. Similarly, the U.S. Department of Health and Human Services poverty guidelines (or some adaptation of them)³ are adjusted each year using the CPI-U for all items.⁴ All of these adjustments can lead to significant changes in eligibility requirements for the receipt of government benefits and in increases or decreases in benefit levels, thereby directly influencing government budgets.

Perhaps one of the most visible results of adjusting for price inflation with respect to a specific group in the population is in the use of the CPI-U to update the official poverty thresholds published by the Bureau of the Census. Since 1969, the CPI-U has been used for this purpose; prior to that date, the U.S. Department of

Agriculture's Economy Food Plan cost index was used.⁵ These thresholds are generally used for statistical purposes—for example, to determine the number of persons or families that are poor. Poverty rates, based on the use of the official poverty thresholds, are sometimes used to target government funds to poor areas.

In this article, we produce an experimental price index for poor consumers in order to determine whether such an index would be lower than, higher than, or equal to the current CPI-U. If a significant difference results, this could have major implications for funding and eligibility requirements for poverty programs, as well as for government budgeting and decisionmaking in general. Requests for price indexes for specific subpopulations were made as early as 1958, when Kenneth Arrow noted that lower income people are likely to have consumption patterns that differ from those of higher income people; for example, lower income people spend more of their budget, on average, on necessities than they spend on luxuries. In fact, Arrow states that "there should be a separate cost-of-living index number for each income level."⁶ Whether such price indexes *should* really be used to adjust poverty thresholds or eligibility requirements is not addressed in our study, although adjustments using them are made for expository purposes.

In this article, we use internal BLS Consumer Expenditure (CE) Survey data from 1982–84 and 1992–94 to obtain expenditure weights for the

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poor. Relative price data are from the BLS Consumer Price Index program for 1984 through 1994. Because price data are collected just in urban areas,⁷ the sample is composed of urban consumers only (although the CE Survey is used to collect data from consumers in urban *and* rural areas).

Three concepts of the poor are used to define the sample from which the expenditure weights are derived: income poor, expenditure poor, and program participant poor.⁸ A consumer unit⁹ is identified as *income poor* or *expenditure poor* if its income or expenditures, respectively, are below the official Bureau of the Census poverty threshold.¹⁰ A consumer unit is *program participant poor* if someone in the consumer unit or the consumer unit itself participates in selected welfare programs.¹¹ (See the section titled "Identifying the poor" for more information.)

Based on our study, we find there to be very little difference between the experimental consumer price indexes produced for the poor and the corresponding CPI for the whole sample. Using these experimental indexes, we derive poverty rates that are only marginally different from rates based on an index using expenditure weights for the total urban population. We also calculate Fisher indexes, which are theoretically closer to a true cost-of-living index and which employ more recent information on expenditures. The results reveal that the Fisher indexes for the poor are much the same as those for the whole urban CPI sample.

We precede our actual analysis with a review of some related research in the next section. Following that, we define and give descriptive statistics of the three populations of poor consumer units. The third section presents the methodology used in calculating the price indexes. The final section sets out the results of our analysis and offers concluding remarks.

Related research

Several studies have focused on price indexes for specific demographic groups within the U.S. population, including the poor. Related studies have examined the impact of inflation on low-income consumers, and a few have applied different price indexes to adjust poverty thresholds and analyzed the impact of those adjustments on poverty rates. In this section, we briefly review selected studies covering each of these topics.

Price indexes for subpopulations. Using data on expenditures, income, and prices for selected years from 1936 to 1955, Eleanor M. Snyder produced experimental indexes for low- and high-income groups.¹² She defined the groups in terms of their incomes and the income elasticity of food commodities. Low-income items had a negative or zero elasticity, middle-income items a moderate income elasticity, and high-income items the highest income elasticity. Snyder's

Laspeyres indexes for items with a negative or zero income elasticity were noticeably larger than for items with a positive income elasticity, for the period 1936–55. She reported that during recessions, the prices of inferior commodities and other commodities considered to be of greater importance to low-income groups (based on income shares) declined more slowly, relative to the prices of commodities most important to middle-income households. During periods of full employment and rising prices, the prices of "low-income" items rose, but at a more rapid rate than did the prices of commodities most likely purchased by higher income households. By contrast, Snyder's Paasche indexes, based on data collected in the 1955 survey of food expenditures conducted by the Department of Agriculture, revealed no significant variation over the income distribution.

More recent research has focused more broadly on subpopulation-based indexes. Robert Michael and Robert Hagemann examined not only empirical differences in the price indexes, for different groups, but also the statistical significance of these differences.¹³ Both researchers constructed Laspeyres indexes for each household in the CE Survey and then regressed the index values on a set of variables for household demographic characteristics. Using the 1960–61 CE Survey, Michael found some significant differences, but no group in his study had consistently higher or lower price changes than the sample as a whole. He discovered little correlation over time in any household's relative position in the distribution of price index values. Both studies found that the price index dispersion within each demographic group was too great to make the between-group differences statistically significant. While both found some evidence that poorer households experienced higher inflation than higher income households did, the results were not generally statistically significant.

Mary Kokoski, who also investigated differences in true cost-of-living indexes, as calculated by the superlative Törnqvist formula, found few statistically significant results as well.¹⁴ While the magnitudes of the differences were small and insignificant, her study also showed a pattern of lower than average inflation rates for households in either the uppermost or the lowest quartile in 1980, with a base period of 1972.

Nathan Amble and Ken Stewart directed a research effort at another important demographic group: the elderly.¹⁵ They calculated an experimental price index based on the expenditure patterns of elderly households in the CE Survey. Their index rose somewhat more rapidly than did their reference CPI, but the statistical significance of this result is unknown. Like the subset of households that qualify as poor, the elderly subset of the CE Survey is a small sample, so there is reason to suspect substantial sampling error. Amble and Stewart show that the relatively higher inflation rate in their

experimental index for the elderly is due in large part to relatively higher price increases over their research period for specific categories, such as medical care, that represent a larger relative proportion of the average older household's budget. However, as other researchers have found, the experience that this subgroup has had with inflation does not differ substantially from that of the general population.¹⁶

Impact of inflation on selected subpopulations. The impact of inflation on the size distribution of income was simulated by Joseph Minarik using the Brookings 1970 MERGE file.¹⁷ Minarik found that, because "low income households are intensive food and fuel consumers,"¹⁸ individuals living in these households are more likely to be worse off than individuals living in other households if overall inflation is concentrated in food and fuel commodities. (Such a situation existed in the 1970s.) In another study, Minarik reported that the prices of necessities over the 1970-79 period rose slightly less than did the overall CPI.¹⁹ Thus, if necessities compose a larger share of the poor's budget, then they would experience a lower inflation rate relative to that of the general population.

Other researchers also have examined the price inflation experienced by those with lower incomes. Rebecca M. Blank and Alan S. Blinder conclude, from their review of the literature and their own research, that inflation rates for the poor are similar to inflation rates for the whole population. They report that the prices of commodities the poor buy did not systematically rise faster than did prices in general during the period from 1947 to 1982.²⁰

Updating the poverty thresholds. The impact of using different indexes to update the official U.S. poverty line was discussed recently by Daniel H. Weinberg and John C. Weicher.²¹ The National Research Council also has examined this issue.²² Weinberg and Weicher chose two different BLS price indexes and used them to adjust the official poverty thresholds; one was the official CPI-U produced by the Bureau prior to 1983, and the other was an experimental index known as the CPI-U-X1. Before 1983, the official CPI-U had weights for the purchase prices of houses, mortgage interest (the total interest expected to be paid over half the mortgage term) for newly purchased homes, and various other components (for example, property taxes) that are currently not included in the CPI market basket. The earlier measure overstated the cost of homeownership. To correct this problem, the housing component of the official CPI-U has been based on a rental equivalence concept since 1983. In order for researchers to compare earlier prices with those being produced on the basis of the rental equivalence adjustment, the Bureau developed the experimental CPI-U-X1 back to 1967. This index was based on the rental equivalence concept, although it

was never as rigorously computed as was the official CPI-U.²³

Weicher and Weinberg found that by 1981 the CPI-U-X1 was 91 percent of the official CPI-U (before the rental equivalence methodology was introduced). Weicher (as noted by Weinberg) reported that "As the official CPI overstated the increases in prices for all consumers between 1967 and 1982, so the official poverty thresholds, adjusted by the CPI, overstated the increase in prices for the poor."²⁴ Weinberg maintains that if the poverty thresholds had been adjusted with the CPI-U-X1, poverty rates would have been substantially lower than they officially were reported to be. He states that the recessions during the 1967-85 period had a smaller effect on poverty rates when the thresholds were updated using the CPI-U-X1.

In addition, Weinberg reports that population groups would have been affected differently according to the two indexes. Using the CPI-U-X1 did not significantly affect the trend in elderly or nonelderly poverty compared to using the official CPI of the period, although the poverty rates for both groups were smaller when the CPI-U-X1 was applied. In contrast, the poverty rates for families headed by women increased over the period when the thresholds were updated using the CPI-U-X1.

For purposes of illustration, the National Research Council produced poverty thresholds updated using different methods. The Council reports that if the poverty thresholds had been updated by changes in the cost of the Department of Agriculture's Economy Food Plan, rather than the CPI-U, from 1963 to 1992, the resulting threshold for a two-adult, two-child household would have been 92 percent of the official poverty threshold. This relationship is quite similar to that found by Weicher and Weinberg in their comparisons of the thresholds updated using the CPI-U, as against the CPI-U-X1.

Identifying the poor

To identify the poor population, information on income and expenditures, as well as demographic information, was used from the Interview portion of the CE Survey.²⁵ The data are collected for the Bureau of Labor Statistics by the Bureau of the Census and have been collected on a continuous basis since 1980. Consumer units are interviewed once each quarter for five consecutive quarters. Twenty percent of the sample is replaced each quarter as consumer units that have completed their fifth interviews are succeeded by new consumer units beginning their participation in the survey. The first interview is a boundary-fixing interview to reduce telescoping; thus, these data are not used for purposes of estimation. Because of the rotating panel design of the continuing survey, a consumer unit may be in the sample from 1 to 5 times over a five-quarter period. If a consumer unit misses an interview, no attempt is made to reconstruct the expenditure data for

that quarter. Detailed expenditure data are collected at each interview, while detailed income data are collected only in the second and fifth interviews.

To obtain estimates of the poor population, the data from consumer units interviewed between January 1982 and December 1984 were used. Only consumer units living in urban areas were included in the sample. This approach is similar to the official CPI procedure of collecting prices only in urban areas and using the base period of 1982–84. Consumer units were selected for inclusion in the study sample if they participated in the survey for at least two of the last four interviews and if they had a fifth interview. Using only those consumer units with data for at least two quarters of expenditures yields better estimates of annual expenditures than does using data from all consumer units, while keeping the sample fairly representative.

To obtain annual expenditures, the quarterly expenditures were aggregated over the quarters in which the consumer unit participated in the survey and then were adjusted to annual figures using the number of interviews that took place. For example, the annual expenditures for a consumer unit with two quarters of expenditures are twice the sum of the expenditures for those two quarters. To get income and expenditure data to represent the same annual period, we used income data from the fifth interview.²⁶ Note that income is total cash income before taxes and does not include the cash value of food stamps; this definition is used by the Bureau of the Census in producing the official poverty statistics.

The poor population is defined in three alternative ways:

1. *Income poor:* Those consumer units identified by the Bureau of Labor Statistics as complete income reporters²⁷ and whose income is below the Census Bureau's poverty threshold (using the annual poverty thresholds for 1982, 1983, and 1984 by age and family composition).²⁸
2. *Expenditure poor:* Those consumer units whose annualized expenditures are below the annual poverty thresholds.²⁹
3. *Program participants:* Those consumer units which received supplemental security income (SSI) or general welfare (which encompasses other public assistance and job-training grants, such as that for the Job Corps) in the fifth interview, or which received food stamps, Medicaid, or housing assistance in at least half of the quarters covered by the interviews.³⁰

Table 1 shows the demographic composition of the weighted urban sample and each of the poor populations of consumer units. The latter contain a much larger percentage of single persons and single parents, and a much smaller percentage of married couples, than the overall population does.

These characteristics are similar to those of the poor population of households examined by the Bureau of the Census.³¹ The poor populations defined in table 1 also contain a larger percentage of black households and older and younger households and a smaller percentage of homeowners. The majority of the reference persons in poor consumer units do not have a high school education. As expected, the program participation rate of poor households is higher for all programs.³²

The poverty rates for consumer units are 14.1 percent for the income poor, 11.9 percent for the expenditure poor, and 11.6 percent for program participants. For persons, the rates are 15.1 percent, 12.6 percent, and 13.6 percent. The average poverty rate for persons in metropolitan areas for the 1982–83 period, using Census Bureau figures, is 13.7 percent.³³

Table 2 presents the distribution of our weighted, annualized, urban sample by the ratios of expenditures and income to the poverty thresholds. While the majority of income poor are also expenditure poor (and vice versa), many consumer units are classified as poor under one of the two definitions, but not the other. More than 75 percent $((7.3 + 3.4)/14.1)$ of the income poor have expenditures that are less than 150 percent of the poverty threshold, while more than 80 percent $((7.3 + 2.5)/11.9)$ of the expenditure poor have income that is less than 150 percent of the poverty threshold. John M. Rogers and Maureen B. Gray find similar results by examining the quintiles defined by income and expenditure outlays:³⁴ sixty percent of the first quintile of either income or outlays are also in the first quintile using the other measure. They report, in addition, that 14 percent of the consumer units ranked in the first income quintile are in the top three outlay quintiles (with 2.5 percent in the top outlay quintile), while only 0.1 percent of those in the first outlay quintile are in the top income quintile. In a similar manner, table 2 also shows that there are more income poor who have expenditures greater than 200 percent of the poverty threshold (2.3 percent) than there are expenditure poor who have high income (0.3 percent). This suggests that, in the use of CE Survey data, low expenditures may be a better proxy of resources to identify the poor population than low income is.³⁵

Table 3 presents a similar comparison for consumer units that are program participants. Almost 70 percent of program participants have income and expenditures less than 150 percent of the poverty thresholds, and about 11 percent have income and expenditures greater than twice the poverty thresholds. Because many of the program eligibility requirements for income are higher than the poverty thresholds, the latter finding is not surprising.

Calculating a price index

The official U.S. CPI is a measure of the average change in prices paid by urban consumers for a fixed market basket

Table 1. Percent distribution of the weighted Consumer Expenditure Survey sample by characteristics, 1982-84

Characteristic	All consumer units (n = 11,236)	Income poor (n = 1,542)	Expenditure poor (n = 1,267)	Program participants (n = 1,313)
Type of family				
Married couple, no children	22.1	6.5	5.3	4.7
Married with children	31.2	19.4	13.6	18.5
Other married couples ¹	4.8	6.6	6.2	9.6
Single parent	5.6	15.6	15.7	19.6
Single person	25.6	33.3	41.5	26.1
Other families ²	10.6	18.6	17.6	21.6
Region				
Northeast	23.4	21.6	21.8	25.5
Midwest	26.1	25.4	25.0	24.9
South	31.9	37.9	39.3	30.2
West	18.6	15.1	13.9	19.4
Homeowner	64.2	44.9	34.8	29.6
Program participation³				
Food stamps	6.1	39.4	36.7	50.8
Medicaid	5.6	34.5	29.1	45.7
General welfare	3.7	19.8	21.6	32.2
Housing assistance	3.4	20.4	17.3	25.4
Supplemental Security Income	2.9	12.7	14.2	25.4
Characteristics of reference person				
Male	67.5	43.3	37.6	38.7
Black	11.1	25.2	29.4	30.3
Education:				
Less than high school	26.1	51.9	63.7	54.9
High school graduate	30.2	23.9	22.4	26.7
Some college	21.3	15.3	10.3	13.2
College graduate	22.4	8.8	3.6	5.2
Age, years:				
Less than 25	7.0	9.5	12.6	7.8
25-44	41.4	35.9	29.7	38.3
45-64	30.5	28.1	24.1	27.2
65 or older	21.1	26.5	33.6	26.8

¹ Other married couples are married-couple families that include persons other than the couples' own children.

² Other families include those that do not exactly meet any of the preceding definitions—for example, single-parent families that include persons, other than children, related to the single parent.

³ Consumer units may receive multiple forms of assistance and therefore can fall into more than one category.

of goods and services.³⁶ It is based on the average expenditure pattern of a representative sample of U.S. urban households, as taken from the CE Survey. A separate Point of Purchase Survey is used to determine from which specific outlets goods and services will be priced for the index and to assess the types of establishments at which its representative sample purchases goods and services. The CPI aims at pricing the same fixed market basket of goods and services each month, using that market basket as the reference "standard of living."

The CPI is a fixed-quantity price index, described by the equation

$$(1) \quad I_{t,0} = \frac{\sum_{i=1}^n p_{it} q_{ib}}{\sum_{i=1}^n p_{i0} q_{ib}} * 100.0,$$

where p_{it} is the price of item i in period t , q_{ib} is the quantity of item i in the expenditure base period b , and p_{i0} is the price of item i in base period 0. When the base and expenditure reference periods coincide (that is, when $b = 0$), this formula is the Laspeyres index and can be expressed in terms of expenditure shares and price ratios as

$$(2) \quad L_{t,0} = \sum_{i=1}^n w_{i0}^H \left(\frac{p_{it}}{p_{i0}} \right) * 100.0,$$

where w_{i0}^H is the average expenditure share for item i for the sample of households, H . While, for the CPI, the sample H represents all urban households, the formula may be used to calculate a price index for subgroups of that sample, based on any chosen demographic characteristics.

Because it is a fixed-weight index, the Laspeyres index does not allow for substitution by consumers across goods and services when the relative prices of those goods and services change. Such substitution permits consumers to adjust their market basket and achieve the same level of satisfaction in response to certain relative price changes that they enjoyed with the previous basket. By ignoring this flexibility in consumer behavior, the Laspeyres formula becomes, in terms of economic theory, an upper bound to the true cost-of-living index measure.³⁷

Other indexes also may be used as measures of changes in prices or the "cost of living." If current-period expenditure shares are used as weights, one can calculate the Paasche index,

$$(3) \quad P_{t,0} = \frac{1}{\sum_{i=1}^n w_{it}^H \left(\frac{p_{i0}}{p_{it}} \right)} * 100.0,$$

where w_{it}^H is the average expenditure share for group H in period t . Although the expenditure weights are from the period t , whereas the Laspeyres index uses period 0, the Paasche index is less useful for official measures because the time needed to estimate these shares from survey data creates a lag in publishing the current value of the index. It also requires more resource costs, because one must estimate a new

set of expenditure shares for each successive period in the index series. If both Paasche and Laspeyres indexes are calculated, however, it is possible to produce an index that is, in theory, a very close approximation to a true cost-of-living index. This is Fisher's ideal index, written

$$(4) \quad F_{i,t} = (L_{i,t})^{1/2} * (P_{i,t})^{1/2}$$

This formula, which is of the class of "superlative indexes,"³⁸ is the geometric mean of the Laspeyres and Paasche indexes. Used as the true, benchmark cost-of-living index, Fisher's ideal index can assess the degree of substitution bias inherent in the fixed-weight Laspeyres calculation.³⁹

Within the framework of the CPI program, the only way to construct price indexes for demographic subgroups of the population is to adjust the expenditure weights to represent those groups. There are no data on prices paid for items by specific types of consumers, the outlets in which different groups are most likely to shop, differences in the quality of items across demographic groups, or differences in households' costs of time or use of technology in shopping for goods and services. Thus, to empirically compare the effects of price changes on different subgroups within the U.S. urban sample, one must assume that the distribution of prices paid for the same items, as well as differences in the quality of items purchased, is the same across population subgroups. Consumption costs beyond the purchase price of each item (for example, the cost in time of public transportation to suburban outlets for inner-city residents) are beyond the scope of the CPI framework.

The expenditure weights are calculated for the 136 categories of goods and services defined by the CPI that are consistent with the data collected in the Interview portion of the CE Survey.⁴⁰ The price indexes for these categories are published by the Bureau of Labor Statistics at the national average level and are subindexes of the CPI-U. This level was therefore the most disaggregated one at which we could define goods and services in the construction of our indexes.

Table 4 presents the aggregate shares for seven commodity groups: food and beverages, housing, apparel and upkeep, transportation, medical

care, entertainment, and other items. These represent the average expenditure shares for the 1982-84 period. The shares for our annualized urban sample are similar to the relative importance weights used for the CPI-U during the same period.⁴¹ As expected, the poor populations have larger shares than the entire sample for items generally considered necessities, such as food and housing, and smaller shares for entertainment and transportation. The table also shows that the expenditure poor have spending patterns that are most dissimilar to that of the entire sample. Chart 1 plots the Consumer Price Indexes for the seven commodity groups listed in the table and for all items. Plainly, relative prices of most commodities exhibit the same increasing trend. The two exceptions are medical care and other commodities; however, because these account for small expenditure shares, we did not expect their price changes to affect our experimental indexes substantially.

From 1985 to 1986, the transportation index decreased slightly and then continued to follow a path similar to that of the other major groups. Also, between 1991 and 1992, relative food and beverage prices increased, but at a lower rate

Table 2. Percent distribution of 1982-84 sample, by ratios of expenditures and income to poverty thresholds

Income as a percent of poverty threshold	Expenditures as a percent of poverty threshold				Percent of all consumer units with respective income
	Less than 100 percent	100 percent to 150 percent	150 percent to 200 percent	Greater than 200 percent	
Complete income reporters:					
Less than 100 percent	7.3	3.4	1.1	2.3	14.1
100 percent to 150 percent	2.5	3.7	2.3	1.7	10.2
150 percent to 200 percent .....	.5	3.4	3.0	2.6	9.5
Greater than 200 percent .....	.3	3.7	9.0	41.7	54.7
Incomplete income reporters	1.3	2.1	2.2	5.9	11.5
Percent of all consumer units with respective expenditures	11.9	16.3	17.6	54.2	100.0

Table 3. Percent distribution of 1982-84 program participants, by ratios of expenditures and income to poverty thresholds

Income as a percent of poverty threshold	Expenditures as a percent of poverty threshold				Percent of all consumer units with respective income
	Less than 100 percent	100 percent to 150 percent	150 percent to 200 percent	Greater than 200 percent	
Complete income reporters:					
Less than 100 percent	41.0	10.5	1.8	1.6	54.9
100 percent to 150 percent	8.6	6.7	2.0	1.3	18.6
150 percent to 200 percent .....	.5	3.9	2.6	.8	7.9
Greater than 200 percent .....	.1	2.8	2.0	7.2	12.0
Incomplete income reporters	4.1	1.6	.4	.4	6.6
Percent of all participant poor with respective expenditures	54.3	25.6	8.9	11.2	100.0

than those for other commodities. A similar pattern emerges for relative prices of apparel and upkeep between 1993 and 1994. For purposes of exposition, we also computed Laspeyres indexes using these seven more aggregated categories of goods and services as the basic components.

Results

The Laspeyres indexes using the 136 components are presented in table 5. By means of formula (3), we also calculate Paasche indexes, using 1994 expenditure weights for the same 136 goods and services categories, rebased to 1984 = 100 for comparison with the Laspeyres index values. The results are presented in the first row of Table 6. Consistent with theoretical expectations, the values of this index are lower than the corresponding values of the Laspeyres index.⁴² Chart 2 shows the percent differences between each of the inflation rates for the poor and the overall inflation rate. The 1982–84 Laspeyres indexes for the income poor and the expenditure poor lie above the overall index in all but the last 2 years. Alternatively, the index for the program poor lies below the overall index in all of the years. The differences among all these indexes are small, and the results of other research suggest that the differences would likely not be statistically significant, given the small sample sizes of the poor household groups.

Robert G. Michael has suggested that comparing Laspeyres price indexes across groups may not be an accurate indication of real differences in the effects of inflation. According to Michael, Laspeyres price indexes may not capture significant consumption responses to price changes.⁴³ Substitution opportunities, he maintains, may be different for households with different levels of income, and perhaps the degree of substitution bias may differ across income groups. To examine this issue, we have used 1992–94 CE Survey shares for each population group in our study to construct the Paasche and Fisher's ideal indexes shown in table 6. The percent difference between the 1994 Fisher's ideal index and the corresponding 1994 Laspeyres index represents the degree of substitution bias.⁴⁴

$$(5) \quad \left[\frac{L_{1994,1984} - F_{1994,1984}}{F_{1994,1984} - 100} \right] * 100.0.$$

Using the results for the Laspeyres and Fisher ideal indexes, for each population group, we estimated the degree of bias. The results are presented in table 6. The magnitudes of the estimates are similar to those obtained by Kokoski in a comparison of 1972–73 demographic groups with their 1980–81 counterparts.⁴⁵ Although these results may not be statistically significant, it is interesting that the bias appears to be lower for the income poor and program participant poor groups. Because the statistical significance of the index numbers, and thus the substitution bias results, are unknown, this

observation only suggests further research.

The difficulty in making comparisons of index values using the Laspeyres formula is also illustrated by comparing the figures listed in table 5 with those shown in table 7, which are based on the more aggregate components presented in table 4 and illustrated in chart 1. It is well known, as Bert M. Balk points out, that higher levels of aggregation of commodities tend to reduce the magnitude of the differences in index values between groups.⁴⁶ The more aggregated index values in table 7 are closer to the official CPI for the years shown, as well as closer to each other when compared across groups in any given year. Interestingly, if one starts with a higher level of aggregation to construct the indexes, the pattern of differences appears to change. Taken at face value, the

Table 4. Average expenditure shares over the 1982–84 period, for all consumer units and for poor consumer units, for each definition of poverty

Expenditure category	All consumer units ¹	Income poor	Expenditure poor	Program participants
Food and beverages ²	18.3	21.1	26.1	24.4
Housing ³	41.7	44.5	50.9	42.9
Apparel and upkeep ⁴	5.7	5.3	4.5	5.5
Transportation ⁵	20.6	15.7	8.8	15.2
Medical care ⁶	4.7	4.7	4.0	4.7
Entertainment ⁷	4.1	3.3	1.6	2.6
Other commodities ⁸	4.8	5.6	4.0	4.7

¹ The relative importance figures for the seven categories, according to J. L. Marcot and R. C. Bahr, are 18.0, 42.4, 6.6, 18.9, 4.7, 4.5, and 5.1, respectively. (See J. L. Marcot and R. C. Bahr, "The revised Consumer Price Index: changes in definitions and availability," *Monthly Labor Review*, July 1986, pp. 15–23.)

² Food and beverages consist of food at home, food away from home, and alcoholic beverages.

³ Housing consists of residential rent; lodging out of town; other lodging; tenants' insurance; rental equivalence for homeowners; fuel oil; other fuel commodities; electricity; utility gas; telephone services; water and sewer services; textile house furnishings; bedroom furniture; sofas; living room furniture; other furniture; televisions; audio equipment; video equipment; refrigerators and freezers; laundry equipment; stoves, ovens, and dishwashers; floor and window coverings; clocks, lamps, and related articles; tableware; lawn equipment and related items; housekeeping supplies; and appliance repair.

⁴ Apparel and upkeep consists of men's apparel, women's apparel, boys' apparel, girls' apparel, infants' apparel, sewing materials, watches and jewelry, footwear, other apparel services, and laundry services.

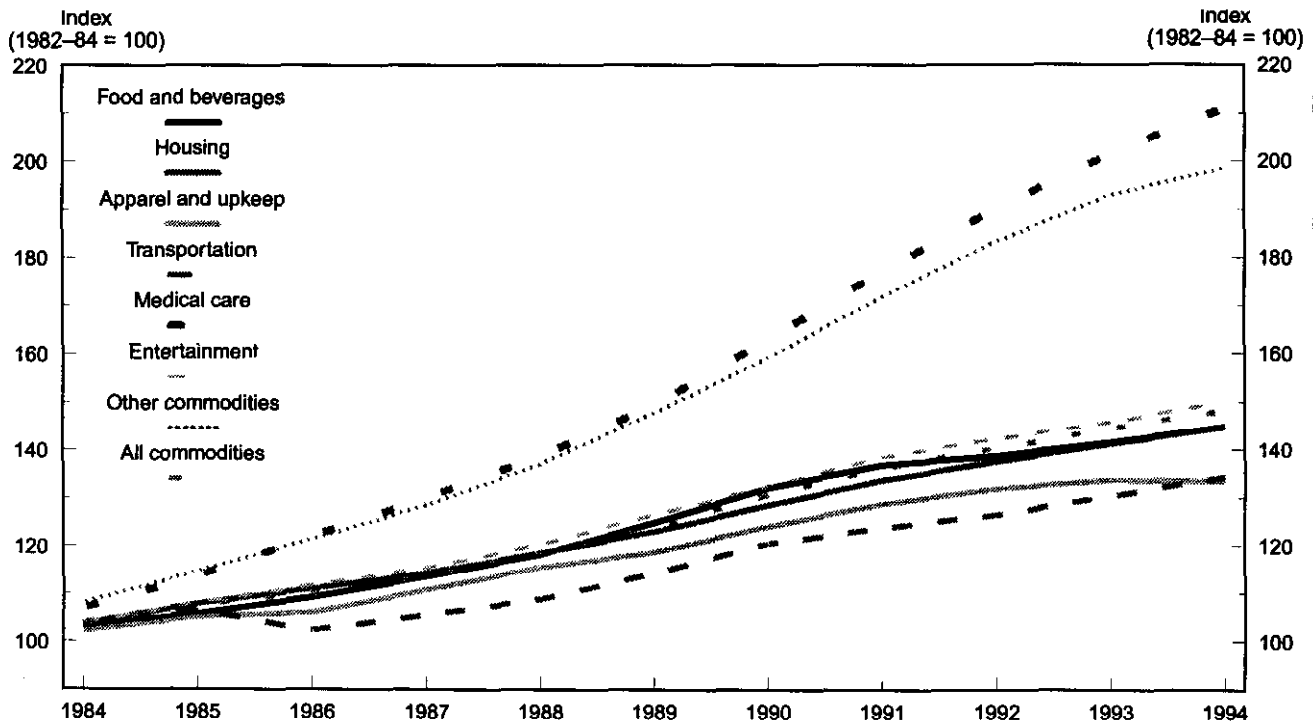
⁵ Transportation consists of new cars; used cars; motor fuel; auto body repair; auto drive train repair; auto maintenance; auto power plant repair; motor oil, coolant, and other fluids; tires; other auto parts; auto insurance; auto finance charges; auto registration; other auto fees; airline fares; other intercity transportation; and intracity transportation.

⁶ Medical care consists of prescription drugs; nonprescription medical commodities; physician services; dental services; and eye care, hospital room, and other inpatient services.

⁷ Entertainment consists of newspapers, magazines, sport vehicles, other sporting goods, toys, photo supplies, pet supplies, club memberships, fees for participation sports, and admissions.

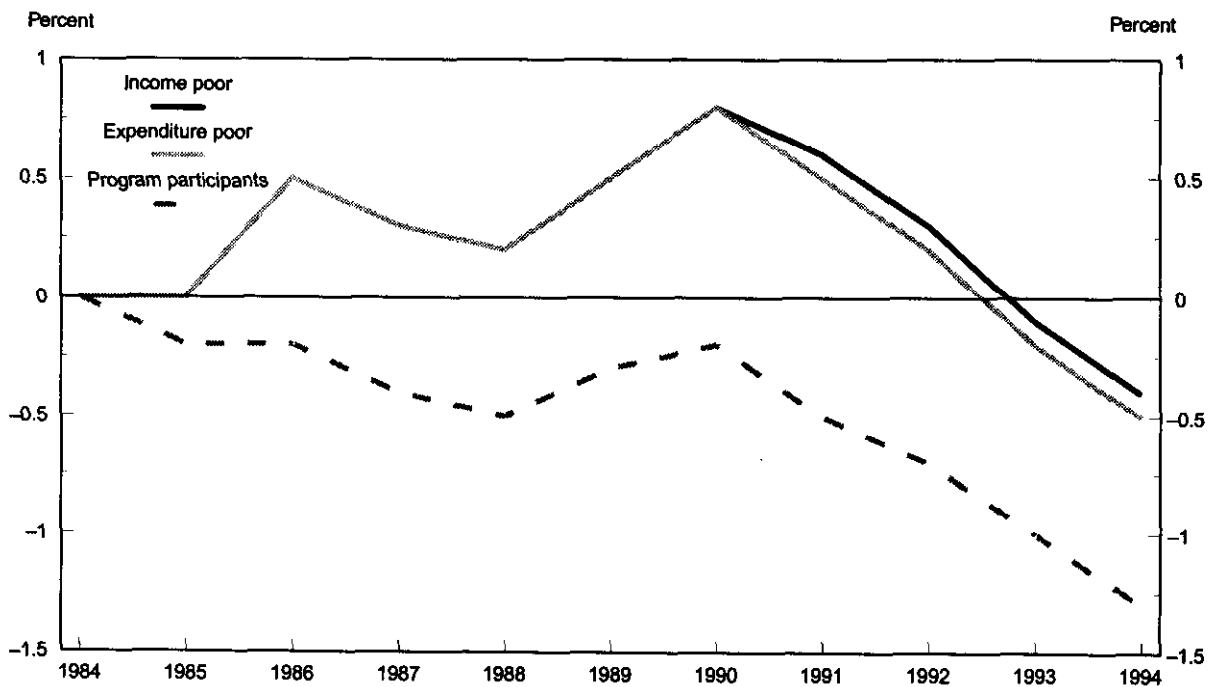
⁸ Other commodities consist of tobacco and smoking commodities, toilet goods, beauty parlor services, haircuts for males, schoolbooks, college tuition, elementary and high school tuition, personal expenses, and information-processing equipment.

Chart 1. Consumer Prices Indexes for selected commodity groups, 1984-94



SOURCE: *Monthly Labor Review*, May 1995, table 33, p. 110; September 1995, table 33, p. 94.

Chart 2. Percent differences between inflation rates for the poor and the overall inflation rate, using Laspeyres indexes



NOTE: Zero line represents Laspeyres index for all consumer units.

results would indicate that the poor subgroups have generally experienced higher levels of inflation than the overall population. However, because we are comparing Laspeyres indexes, which are *upper bounds* on the true cost-of-living indexes and not, in general, true cost-of-living indexes themselves, these results are difficult to interpret. It appears that the expenditure patterns within each of the seven aggregate categories are different for the poor households in our sample, with higher relative shares for those goods and services in each aggregate category with more rapidly increasing prices. Within transportation, for example, the share spent on new cars was lower for all three of the poor household groups (indeed, it was zero for the expenditure poor) than for all consumer units in the sample, and new-car prices rose relatively more slowly than the other components of transportation.

Finally, we can use our experimental price indexes to inflate the 1984 poverty thresholds and examine how sensitive the poverty rates for individuals are to different adjustments for inflation. The following shows 1992–94 poverty rates for the income poor and the expenditure poor, calculated in four different ways—three using the experimental Laspeyres indexes (to adjust the 1984 official poverty thresholds, first for the entire sample, then for the income poor, and then for the expenditure poor) and the fourth using the thresholds published by the Census Bureau for the 1992–94 period:

	<i>Income poor</i>	<i>Expenditure poor</i>
Updated 1984 thresholds using index—		
For all consumer units	13.9	11.7
For income poor	13.9	...
For expenditure poor .....	...	11.6
Published Census Bureau thresholds	14.1	12.1

Because our experimental indexes are similar to the overall index, the poverty rates are minimally affected. For example, using the experimental index for the expenditure poor to inflate the 1984 poverty thresholds yields a poverty rate for the expenditure poor of 11.6 percent, which is only 0.1 percent lower than that obtained using the overall index to inflate the thresholds (11.7 percent). Alternatively, using the indexes calculated with the more aggregate components yields a poverty rate for the expenditure poor that is 0.1 percent higher than that obtained using the overall index (based on the aggregate components). For comparison, the average poverty rates for persons, using the official Census Bureau poverty thresholds for 1992–94, are 14.1 percent for the income poor and 12.1 percent for the expenditure poor.⁴⁷

THIS ARTICLE HAS PRESENTED experimental Laspeyres, Paasche, and Fisher price indexes for poor consumers. Data on rela-

Table 5 Laspeyres indexes for 1984 to 1994, based on 136-commodity aggregation

Year	All consumer units	Income poor	Expenditure poor	Program participants
1984	100.0	100.0	100.0	100.0
1985	103.6	103.6	103.6	103.4
1986	105.6	106.1	106.1	105.4
1987	109.6	109.9	109.9	109.2
1988	113.9	114.1	114.1	113.4
1989	119.3	119.8	119.8	119.0
1990	125.4	126.2	126.2	125.2
1991	130.1	130.7	130.6	129.6
1992	133.7	134.0	133.9	133.0
1993	137.6	137.5	137.4	136.6
1994	141.1	140.7	140.6	139.8

Table 6 Price indexes and substitution bias in Laspeyres index, 1984 and 1994

[1984 = 100]				
Index and bias	All consumer units	Income poor	Expenditure poor	Program participants
Paasche Index	139.5	139.6	139.1	139.6
Fisher ideal index	140.3	140.0	139.8	139.7
Laspeyres index	141.1	140.7	140.6	139.8
Substitution bias (percent)	1.99	1.75	2.01	.25

Table 7 Laspeyres indexes for 1984 to 1994, using aggregation of seven commodity groups

[1984 = 100]				
Year	All consumer units	Income poor	Expenditure poor	Program participants
1984	100.0	100.0	100.0	100.0
1985	103.5	103.6	103.5	103.5
1986	105.5	105.9	106.3	105.9
1987	109.3	109.8	110.2	109.7
1988	113.7	114.3	114.7	114.2
1989	119.2	119.8	120.0	119.8
1990	125.6	126.2	126.4	126.2
1991	130.8	131.6	131.7	131.5
1992	134.7	135.5	135.5	135.3
1993	138.6	139.5	139.3	139.2
1994	142.3	143.1	142.8	142.8

tive prices from 1982 through 1994 for urban areas were used, in conjunction with data on expenditure shares from the 1982–84 and 1992–94 Interview portion of the CE Survey. Based on the analysis set forth in the article, we find that there is little difference between our indexes for the poor and the indexes for the entire urban population. Given the small differences, it should come as no surprise that poverty rates based on thresholds adjusted using the Laspeyres index for the poor are only marginally different from the rates based on an index for the total urban population.

Requests for indexes for the poor originate from a belief that the movement of relative prices for this group may differ from that of the general population. If poor consumers do face differential price inflation, it could have major implications for governments providing benefits to these consumers and for the measurement of poverty in general. Based on our research, however, we conclude that the poor and the general population have faced similar trends in relative prices over the last several years; thus, the level of assistance rendered the poor, as well as poverty rates, would not be expected to have been different with a price index specifically designed to reflect the spending patterns of the poor. This conclusion, of course, is limited in that it is based on data available at the current time; also, methodological problems in measuring differences in price indexes between the poor and the general population were identified.

The differences between our experimental indexes and the indexes calculated using the aggregate components suggest some interesting issues for research. For example, it is possible that small price increases in a given category of goods or services (such as entertainment or automobile expenses)

may induce large shifts away from expenditures on these categories, especially for households on the economic margin. This hypothesis could be tested using a discrete-choice demand model if sufficient data were available. The importance of how component categories of goods and services are defined in the context of computing indexes also appears to be an interesting question when comparing index values across households or household groups.

Finally, if prices from rural areas were available, we might report a higher or lower CPI for the poor if relative prices faced by consumers living and shopping in rural areas are different from relative prices faced by urban consumers.⁴⁸ At the present time, we cannot test the robustness of our indexes relative to this geographic variable. Also not addressed in this study are the interarea differences, both across and within urban areas, in prices faced by U.S. consumers;⁴⁹ this could be tested in future research. Whether the poor shop in different types of outlets or whether they purchase commodities of different quality than the nonpoor do cannot easily be tested without conducting a Point of Purchase Survey specifically addressing the poor population. □

Footnotes

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¹ Vee Burke, *Cash and Noncash Benefits for Persons with Limited Income: Eligibility Rules, Recipient and Expenditure Data, FY 1992-1994*, Congressional Research Service Report 96-159 EPW (Library of Congress, 1996).

² See Burke, *Cash and Noncash Benefits*; and Gordon M. Fisher, "Poverty Guidelines for 1992," *Social Security Bulletin*, vol. 55, no. 1, Spring 1992.

³ The Health and Human Services poverty guidelines are a simplified version of the Federal Government's official statistical poverty thresholds and are updated at different times. (See Fisher, "Poverty Guidelines for 1992.")

⁴ Unless otherwise noted, the term *CPI-U* refers to the index for all items.

⁵ Constance F. Citro and Robert T. Michael (eds.), *Measuring Poverty: A New Approach* (Washington, DC, National Academy Press, 1995).

⁶ Kenneth J. Arrow, "The Measurement of Price Changes," in *The Relationship of Prices to Economic Stability and Growth* (Joint Economic Committee, U. S. Congress, Mar. 31, 1958).

⁷ Urban areas are defined by the Consumer Price Index program either to be within metropolitan statistical areas (MSA's), including areas identified as rural nonfarm (*but not* rural farm), or to be urbanized areas outside MSA's. An MSA is a geographic area consisting of a large population nucleus, together with adjacent communities which have a high degree of economic and social integration with that nucleus. (See *Consumer Expenditure Survey, 1992-93*, Bulletin 2462, Bureau of Labor Statistics, September 1995.)

⁸ Other definitions to identify the poor could have been chosen. See, for example, Citro and Michael, *Measuring Poverty*; Maya Federman, Thesia I. Garner, Kathleen Short, W Boman Cutter IV, John Kiely, David Levine, Duane

McGough, and Marilyn McMillen, "What does it mean to be poor in America?" *Monthly Labor Review*, May 1996, pp. 3-17; Mark Lino, "Income and Spending of Poor Households with Children," *Family Economics and Nutrition Review*, vol. 9, no. 1, 1996; Susan Mayer and Christopher Jencks, "Has Poverty Really Increased among Children since 1970?" Working Paper 94-14, Center for Urban Affairs and Policy Research, Northwestern University, 1995; William D. Passero, "Spending Patterns of Families Receiving Welfare or Public Assistance, 1992-94," paper prepared for the 42nd Annual Conference of the American Council on Consumer Interests, Nashville, TN, March 27-30, 1996; and Patricia Ruggles, *Drawing the Line: Alternative Poverty Measures and Their Implications for Public Policy* (Washington, DC, The Urban Institute Press, 1990).

⁹ A consumer unit comprises members of a household who are related or who share at least two out of three major expenditures—housing, food, and other living expenses.

¹⁰ See Current Population Reports, Series P60-185, *Poverty in the United States: 1992* (Bureau of the Census, 1993).

¹¹ Passero employs this definition to identify the poor, using CE Survey data; see William D. Passero, "Spending patterns of families receiving public assistance," *Monthly Labor Review*, April 1996, pp. 21-28.

¹² Eleanor M. Snyder, "Staff Paper 7: Cost of Living Indexes for Special Classes of Consumers," in *The Price Statistics of the Federal Government: Review, Appraisal, and Recommendations, a Report to the Office of Statistical Standards, Bureau of the Budget* (National Bureau of Economic Research, 1961). This report is also known as the 1961 Stigler report.

¹³ Robert Michael, "Variation across Households in the Rate of Inflation," *Journal of Money, Credit, and Banking*, February 1979, pp. 32-46; and Robert Hagemann, "The Variability of Inflation Rates across Household Types," *Journal of Money, Credit, and Banking*, November 1982, pp. 494-510.

¹⁴ Mary Kokoski, *Consumer Price Indices by Demographic Group*, Working Paper No. 167 (Bureau of Labor Statistics, April 1987).

¹⁵ Nathan Amble and Ken Stewart, "Experimental price index for elderly consumers," *Monthly Labor Review*, May 1994, pp. 11-16.

¹⁶ See also Michael Boskin and Michael Hurd, "Indexing Social Security

Benefits: A Separate Price Index for the Elderly," *Public Finance Quarterly*, October 1985, pp. 436-49; and Dale Jorgenson and Dan Slesnick, "Individual and Social Cost-of-Living Indexes," in W. Erwin Diewert and Claude Montmarquette, eds., *Price Level Measurement* (Ottawa, Ont., Canada, Statistics Canada, 1983), pp. 241-323.

¹⁷ The MERGE file is a statistical match of responses from the Census Bureau's March 1971 Current Population Survey, a uniform sample of about 50,000 households, and the Internal Revenue Service's 1970 Individual Income Tax Model File, a stratified sample of 100,000 personal income tax returns, including a 100-percent sample of returns with adjusted gross income greater than \$200,000. (Both samples are without individual identifying information.) The MERGE file has detailed demographic information, together with complete data on income and income taxes, permitting precise computation of the latter and accurate estimation of all other taxes. (See Joseph Minarik, "The Size Distribution of Income During Inflation," *Review of Income and Wealth*, vol. 25, 1979, pp. 377-392, for more details.

¹⁸ Minarik, "Size Distribution of Income," p. 389.

¹⁹ Joseph Minarik, "Inflation in the Necessities?" *Brookings Bulletin*, Spring 1980, pp. 8-10.

²⁰ See Rebecca M. Blank and Alan S. Blinder, "Macroeconomics, Income Distribution, and Poverty," in Shelton Danziger and Daniel Weinberg, eds., *Fighting Poverty* (Cambridge, MA, Harvard University Press, 1986); Robinson G. Hollister, Jr., and John L. Palmer, "The Impact of Inflation on the Poor," in K. E. Boulding and M. Pfaff, eds., *Redistribution to the Rich and the Poor* (Belmont, CA, Wadsworth, 1972); and Thad W. Mirer, "The Distributive Impact on Purchasing Power of Inflation during Price Controls," *Quarterly Review of Economics and Business*, vol. 15, 1975, pp. 93-96.

²¹ Daniel H. Weinberg, *Implications of Mismeasuring the Consumer Price Index for Poverty Statistics*, Technical Analysis Paper No. 34 (Department of Health and Human Services, 1987); and John C. Weicher, "Mismeasuring Poverty and Progress," American Enterprise Institute, mimeo., 1986.

²² See Citro and Michael, *Measuring Poverty*.

²³ The authors thank John Greenlees for pointing out the distinction between the CPI-U prior to 1983 and the CPI-U-X1.

²⁴ Weinberg, *Implications of Mismeasuring*, p. 4.

²⁵ We used relative prices for total food for our analysis; the official CPI-U is based on detailed information about food from the Diary portion of the CE Survey. This difference in methodology seems to make very little difference in the expenditure share used for this study compared with the official index.

²⁶ The sociodemographic characteristics and population weights of consumer units are also from the fifth interview.

²⁷ For a definition of "complete income reporter," see *Consumer Expenditure Survey, 1992-93*.

²⁸ For the actual poverty thresholds in those years, see *Poverty in the United States: 1984*, Series P-60 (Bureau of the Census, 1985), table A-2.

²⁹ The CE Survey publication definition of total expenditures is used in this article. According to the definition, these expenditures consist of the transaction costs, including excise and sales taxes, of goods and services acquired during the period covered by the interview. They include expenditures for gifts, but exclude purchases or portions of purchases directly assignable to business purposes. Also excluded are periodic credit or installment payments on goods or services already acquired, with the exception of payments for housing that has been purchased. For such housing, all expenses, including mortgage interest repayments, but not mortgage principal repayments, are included in the total. (See *Consumer Expenditure Survey, 1992-93*.)

³⁰ See Passero, "Families receiving public assistance," for a more complete definition of "program participants."

³¹ See the three Census Bureau publications titled "Characteristics of the Population Below the Poverty Level," for the years 1982, 1983, and 1984. The publications are from series P-60 and are numbered 144, 147, and 152.

³² The figures in table 1 are similar to those in Passero, "Families receiving public assistance."

³³ This rate is calculated from tables published in the Census Bureau's

Poverty in the United States: 1984; data for 1984 are not comparable.

³⁴ John M. Rogers and Maureen B. Gray, "ce data: quintiles of income versus quintiles of outlays," *Monthly Labor Review*, December 1994, pp. 32-37; outlays are simply total expenditures plus principal payments on home mortgages and financed vehicles, minus the purchase price of financed vehicles.

³⁵ See also Patrick McGregor and Vani K. Borooah, "Is Low Spending or Low Income a Better Indicator of Whether or Not a Household is Poor: Some Results From the 1985 Family Expenditure Survey," *Journal of Social Policy*, vol. 21, no. 1, 1992, pp. 53-69. Using data from the United Kingdom, these authors, too, suggest that low spending is a better indicator of poverty than low income is.

³⁶ *BLS Handbook of Methods*, Bulletin 2414 (Bureau of Labor Statistics, September 1992), p. 176.

³⁷ See Bert M. Balk, "On Calculating Cost-of-Living Index Numbers for Arbitrary Income Levels," *Econometrica*, vol. 58, January 1990, pp. 75-92.

³⁸ See W. Erwin Diewert, "The Theory of the Cost-of-Living Index and the Measurement of Welfare Change," in W. Erwin Diewert and Claude Montmarquette, eds., *Price Level Measurement* (Ottawa, Ont., Statistics Canada, 1983), pp. 163-233.

³⁹ Substitution bias is inherent in fixed-weight index number formulas when elasticities of substitution between goods are not zero. As relative prices change, consumers will substitute relatively cheaper goods for those which become more expensive. Because the Laspeyres index continues to evaluate price changes with respect to a fixed market basket, ignoring this substitution behavior, it overstates the true changes in the cost of living experienced by households. Index formulas, such as Fisher's, are closer to the true cost-of-living measure because they weight each good's price change in terms of both the reference- and comparison-period market basket.

⁴⁰ Categories were aggregated because only the Interview portion of the survey was used for this study, whereas the official CPI uses the detailed information on expenditures from the Diary portion of the survey as well. For a detailed list of the categories used in our study, see footnotes 2-8 of table 4. Note that, in contrast to the measure of expenditures for shelter used in the CE Survey publication definition, rental equivalence is used for the CPI-U.

⁴¹ For a derivation of these weights, see J. L. Marcoot and R. C. Bahr, "The revised Consumer Price Index: changes in definitions and availability," *Monthly Labor Review*, July 1986, pp. 15-23.

⁴² Although the Laspeyres and Paasche indexes are not, strictly speaking, upper and lower bounds, respectively, on the same true cost-of-living index, it is usually expected that the Laspeyres index will overstate, and the Paasche index will understate, the true change in the cost of living. For a detailed discussion of the properties of the Laspeyres and Paasche indexes, see Diewert, "Cost-of-Living Index and Welfare Change."

⁴³ Michael, "Variation in the Rate of Inflation."

⁴⁴ See P. J. Lloyd, "Substitution Effects and Biases in Nontrue Price Indices," *American Economic Review*, June 1975, pp. 301-13.

⁴⁵ See Kokoski, *Consumer Price Indices*.

⁴⁶ Balk, "Cost-of-Living Index Numbers," p. 76.

⁴⁷ With income as the measure of resources, the poverty rate for the metropolitan population over the 1992-94 period, using the Census Bureau figures, is 14.3 percent.

⁴⁸ According to the Bureau of the Census, approximately 20 percent of the total U.S. population lived in nonmetropolitan areas in 1994 (see www.census.gov, PPL-27, table 2: "Resident Population and Change for Metropolitan Areas in the United States, April 1, 1990 to July 1, 1994"), and 16 percent of the poor lived in nonmetropolitan areas that year (see table 8, "Poverty of Persons, by Residence," from www.census.gov). "Metropolitan" and "urban" are defined slightly differently by the Bureau of Labor Statistics and the Census Bureau.

⁴⁹ See Citro and Michael, *Measuring Poverty*; Ruggles, *Drawing the Line*; and Mary Kokoski, Patrick Cardiff, and Brent Moulton, "Interarea Price Indices for Consumer Goods and Services: An Hedonic Approach Using CPI Data," BLS Working Paper 256 (Bureau of Labor Statistics, July 1994).