Consumer Price Index Overstates Food-Price Inflation

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The Consumer Price Index (CPI) is the most widely used and most well-known measure of inflation, or general price changes, in the United States. The CPI is a measure of the average change in prices paid by urban consumers for a fixed market basket of goods and services, including food. Annual cost of living adjustments to Social Security benefits, as well as wage changes in many union contracts, are explicitly based on formulas that include changes in the CPI. Annual changes in the CPI are also used informally to adjust salaries for many nonunion jobs and to adjust prices in many sales contracts between firms.

The CPI has been recently criticized by economists, general interest business magazines, and others on the grounds that it overstates changes in general living costs. Articles examining the issue appeared in *Fortune*, *Business Week*, and *The Economist*. The issue gained even greater saliency during the winter of 1995, when the Federal Reserve Board Chairman asserted to a joint meeting of the Senate and House Budget Committees that the CPI overstated inflation. His testimony indicated that Congress could reduce Federal expenditures substantially by adjusting the CPI-based formula used to calculate increases in Social Security benefits. In September 1995, a panel of five distinguished economists with extensive experience in the analysis of prices and price indices examined the issue and reported to Congress that their "best estimate" of the overstatement was 1 percentage point a year.

The CPI for Food at Home is a major component of the CPI, and is the Nation's principal indicator of changes in retail food prices. As such, the Food at Home CPI is watched closely by policymakers, investors, and corporate leaders. The U.S. Labor Department's Bureau of Labor Statistics (BLS) collects food prices and each month calculates the CPI for Food at Home. BLS has identified some sources of overstatement in the Food at Home CPI and has made changes to improve accuracy. These improvements will change how the CPI for Food at Home is calculated.

The Food at Home CPI also indirectly affects policy decisions, when it is used to provide base estimates for reporting the present situation and for various policy outcomes. Take the case of expenditure surveys used to measure trends in food consumption. When spending changes are converted to changes in physical quantities of foods using price changes between surveys, an adjustment based on an inaccurate CPI will lead to inaccurate measures of consumption changes. Between 1978 and 1988, for example, CPI-adjusted expenditure data show per capita consumption of fresh vegetables falling by 15.2 percent and by 2.4 percent for fresh fruits. Those indicators conflict sharply with retailer perceptions as well as with USDA disappearance data, which show a 25-percent increase in that period. (Disappearance data estimate food consumption by subtracting exports, yearend inventories, processing, and nonfood uses from production, imports, and beginning of year inventories.) Clearly, something is wrong if the alternative methods give such sharply different conclusions.

Prices Overstated for Food at Home

Analyses by BLS and USDA's Economic Research Service (ERS) suggest that the CPI for Food at Home overstates inflation of food prices, and that the gap could be as high as 1 to 1.9 percentage points per year beginning around 1978.

The ERS findings are based on two analyses of price data for food items in dry grocery product classes, using supermarket scanner data ob-

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tained from the A.C. Nielsen Company. The Nielsen data report the quantity sold nationwide in a given month for a particular item, as well as total dollar sales of the item. An item's average monthly price is calculated by dividing sales by quantity.

In the first analysis, inflation rates for 14 product categories in the Food at Home CPI were compared with average annual price changes for precisely defined Nielsen product classes or groups of classes (based on all items in the group) that correspond closely to the CPI product categories (examples of CPI categories include bacon, butter, and canned and packaged soup) over 1988-91. For each of those 14 groups, the CPI measures were consistently higher, averaging 1.5 percent per year higher (table 1).

The second comparison represented a wider array of product classes (323 nonperishable grocery product classes), but compared average annual price changes for only the leading item of the leading brand in each product class between April 1988 and April 1993. For example, in the category of "canned soup," Campbell's is the leading brand, and its largest selling item is the 10.75-ounce can of mushroom soup.

A weighted average of the individual price changes provided overall food price inflation for this group of 323 items, giving more weight in the average to product classes with greater consumer expenditures (because, for example, consumers typically spend far more on breakfast cereals than on pimientos, price changes in breakfast cereals should be accorded more importance in a price index).

Nielsen-based food prices grew much slower than the corresponding CPI measure in the second comparison, too. When calculated for nonperishable grocery products, the CPI grew at an average annual rate of 3.7 percent per year over the 5-year period, compared with 1.88 percent per year for the Nielson items (table 2).

These findings are consistent with two related analyses: one compares the CPI with "average prices" and one with the Producer Price Index (table 2). Similar to the calculation with Nielsen data, the BLS calculates average prices across the country for precisely defined products, such as Red Delicious apples (fresh meats and produce, which are not recorded in the Nielsen data, account for about half of the products in the average-price series) when it collects prices for the CPI.

A corresponding CPI category generally will be broader than an average-price category. For example, pears are reported separately in the average-price series, but are included in the CPI as part of a category called "other fresh fruits." Likewise, the CPI for apples includes several varieties of apples, but the average-price series measures only the prices of Red Delicious apples. Since average-price categories do not precisely match CPI categories, we should not expect the two series to show identical rates of price change. Nonetheless, the two should not show large and systematic differences.

Between 1980 and 1992, BLS research shows that prices for the usually broader CPI categories grew faster than average prices for 64 of the 68 products analyzed. The average annual difference was 1.66 percent per year, quite close to the earlier ERS findings based on Nielsen data. The difference was especially pronounced for fresh fruits and vegetables, where CPI indices grew 2.93 percent per year faster than the average-price indices.

Now consider a fourth comparison between the CPI for Food at Home, based on prices observed at retail stores for items sold to consumers, and the BLS Producer Price

Table 1
The CPI Increases More Than Nielsen Average Prices

CPI product category	Annual rates of price change, 1988-94		Difference
	CPI	Nielsen	
	Percent		*Percent*
Bacon	2.18	0.51	1.67
Butter	-4.09	-6.23	2.14
Canned and packaged soup	5.60	4.59	1.01
Canned fish & seafood	-.04	-.54	.50
Carbonated drinks	1.60	-.53	2.13
Cut corn & canned beans	1.22	-1.64	2.86
Frankfurters	2.90	1.30	1.60
Frozen fruit & fruit juices	-.52	-1.59	1.07
Frozen vegetables	2.71	1.12	1.59
Ice cream & related products	2.88	.49	2.39
Instant & freeze-dried coffee	5.15	4.66	.49
Margarine	1.96	.57	1.39
Rice, pasta, & cornmeal	2.31	1.31	1.00
Roasted coffee	7.49	6.39	1.10

Table 2
Three Comparisons Highlight Exaggerated Food-Price Inflation in the CPI

1. **Average annual growth in aggregate nonperishable grocery categories, 1988-93**
   CPI: 3.70%
   323 Nielsen classes: 1.88%

2. **CPI minus growth in related BLS average-price series, 1980-92**
   All food products: 1.66% per year difference
   Fresh fruits & vegetables: 2.93% per year difference

3. **CPI minus growth in Producer Price Index (PPI) for consumer foods, 1971-93**
   1971-78: PPI grows 0.2% per year faster (7.80% annually versus 7.60%).
   1978-93: CPI grows 1.31% per year faster (4.37% annually versus 3.06% annually)

Index (PPI) for consumer foods, based on prices observed at processing plants for items sold to wholesalers and retailers.

For most of the 1970's, the two indexes grew at about the same rate (table 2). But the two diverged after 1978: the PPI grew 3.1 percent per year in 1978-93, while the CPI grew at an average rate of 4.3 percent per year. Taken alone, this divergence does not prove that the CPI grows too fast, because retail costs could have been growing faster than processing costs. However, the divergence does become significant when combined with other patterns, as seen in the previous three analyses.

Although each of these four comparisons has weaknesses, they all suggest that the Food at Home CPI may overstate rates of retail food price increases. Taken together, the evidence suggests that there may be something systematically incorrect with the CPI for Food at Home, and that the measure could have been off by 1 to 1.9 percentage points per year for more than a decade. Small annual differences accumulate into large ones over time. For example, over the full 1988-94 period in table 1, the CPI for Food at Home increased 9.3 percent faster than the corresponding Nielsen prices.

Higher Rates of Inflation Due to Construction of the CPI

To see how the CPI could go wrong, we first need to appreciate the enormity of the task involved in constructing a CPI in a dynamic modern economy. First, consumers' broad expenditure patterns change dramatically over time. People spend much smaller proportions of their income on food today than three or four decades ago, and a smaller proportion of food expenditures goes for food at home. Consumers eat less red meat and more poultry, and more fresh fruits and vegetables and less canned produce. Indexes must be adjusted periodically to reflect changing consumption patterns.

Second, there is a growing influx of new items within product categories, including new products (rice cakes or bottled iced tea), as well as new flavors, container sizes, and container materials (plastic ketchup bottles now outsell glass). The number of new items introduced in supermarkets increased from 5,400 in 1984 to 12,300 in 1992. Price analysts have to find ways to smoothly introduce new items into samples, so that price indices accurately reflect the mix of items actually bought by consumers.

Finally, price indices must account for another type of important change in consumer buying patterns—shifts in the types of stores where people shop. Conventional supermarkets (typically around 25,000 square feet of selling space) accounted for 73 percent of all supermarket sales in 1980, but only 28 percent in 1994. Large superstores (typically more than 50,000 square feet of selling space) took in 18 percent of supermarket sales in 1980 but 36 percent in 1994, while sales by warehouse-type supermarkets grew from 4 to 11 percent of total supermarket sales. Further, a growing share of food sales occurs outside of supermarkets, in convenience stores, club stores, and other retailers (like Wal-Mart).

Changing Shopping Patterns Partially Account for Overstatement...

To keep up with changing retail purchasing patterns, the BLS has relied on a sophisticated system of household and store sampling since 1978. Each year, the agency uses the system to introduce new samples of stores and items in about one-fifth of the 95 metropolitan areas where prices are gathered. Thus, a given area's sample of stores stays in the index for about 5 years, and the na-

tional sample is completely revised over a 5-year period.

The approach represents a major advance in incorporating changes in consumer behavior into price indexes, because frequent sampling can capture changes in consumption patterns, item characteristics, and stores. But two problems seem to lie at the heart of discrepancies with price indices other than the CPI. One problem is well understood but extremely difficult to fix, while the other is more subtle but easier to fix. Let's take the well-understood problem first.

Consider what happens when a new supermarket opens. Today's new supermarkets are likely to be much larger than older stores and offer a wider variety of food and nonfood products and services. New supermarkets usually also offer lower prices: BLS research found that during a 2-year period, stores in newly selected samples offered prices averaging about 1.2 percent lower than the stores that they replaced in the sample.

Average price indices, such as the ERS measures based on Nielsen price data, are sensitive to price differences between stores. If a store with lower prices for a particular product, such as Oscar Mayer bacon, enters the Nielsen sample, the effect will be to lower the U.S. average price of bacon. Average price indices will increase less over time if a lot of this "store substitution" goes on.

By contrast, the CPI is explicitly designed to omit the effects of average price differences between new and old sample stores, by measuring price changes in stores. A CPI for bacon will fall only if bacon prices fall in stores already in the sample. An average-price measure (such as the ERS Nielsen-based index or the BLS average-price series) will fall for that reason, too, but it will also fall if new stores have lower prices than the stores that they replaced in the sample.

The CPI design follows from an assumption that price differences between stores must reflect differences in service quality. In other words, bacon is lower priced in one store because that store offers less service, and customers in the higher priced store are merely paying for more service. Recent ERS evidence suggests that may not be an accurate assumption: new stores appear to offer more services, on average, as well as lower prices, and consumers are shifting to those stores in large numbers.

The assumption behind the CPI design is not made out of sloth or stupidity. An attempt to measure quality-adjusted differences in store prices for the CPI would require more resources than BLS now spends, as well as some intellectual breakthroughs in measuring the value of quality. As a result, while BLS understands this discrepancy, it is hard to fix. It also appears to be a relatively minor source of the total discrepancy—less than one-third of the problem—because store price differences are not nearly large enough to account for the price gaps between the CPI and other price series.

... But Weighting Procedures the Biggest Culprit

The larger overstatement of food price increases seems to arise from a subtle bias attached to the weights (that is, the relative importance) given to prices of a particular item collected from different stores. BLS procedures appear to give too much weight to stores where the item's price is going to rise and too little to stores where the price is about to fall.

When the BLS constructs a price index for a particular product, it collects prices each month from a sample of stores. But the agency correctly does not take the simple average of price changes across stores, because some stores sell a lot more of a product than do others. Therefore, it constructs a weighted average. Continuing with the bacon example, each store receives a weight corresponding to the quantity of bacon it sells. A store that sells 500 packages of bacon per week should receive 5 times the weight of a store selling 100 packages.

However, BLS does not know precisely how much bacon a store sells. Instead, the agency estimates the quantity of bacon by dividing sales (obtained in a separate survey performed several months before a store enters the sample for the first time) by the price that the store is charging for bacon at the time it enters the survey (with an additional adjustment that need not concern us here).

To understand the bias that this can cause, think about how this procedure would work for a single store (simplifying the actual procedure considerably to focus on the key problem). Suppose that this store sold $3,000 worth of bacon in the survey period and that it generally charged a price of $2.25 per pound for the product. But bacon prices fluctuate; suppose that the store ran a sale on bacon at the time of entry into the CPI sample, when its prices were first observed and its weight was calculated. If the price at that time was $2.00, then the store would receive an estimated weight of 1,500 pounds.

But the store could just as easily have been off sale, and charging unusually high prices at the time of sample entry. If the price had been $2.50, the store would have a lower estimated weight—1,200 pounds. Note that the weight given to the store will be higher if its price is unusually low this period, and lower if the price is unusually high.

Now what should happen to unusual prices in the future? In many stores, a food item's price may fluctuate sharply from week to week because of store sales, changing manu-

facturer strategies, seasonal changes, and competition. Prices that are unusually low this week, perhaps because of a sale, will probably rise. Prices that are unusually high this week are likely to fall. But BLS' weighting procedure gives more importance to those stores with sharply rising prices, leading to an upward bias in the estimates of the average-price increase.

The method of estimating weights can cause problems for products whose prices fluctuate over time and whose price changes vary across stores. That price behavior makes it more likely that the weighting estimation will introduce a bias by giving inaccurately high weights to stores whose prices are likely to rise. Products with the greatest price fluctuations should see the most severe overstatements. Fresh fruits and vegetables show very sharp monthly price fluctuations, and the CPI overstatement is most severe for those products.

Most Problems To Be Corrected

BLS researchers first identified the weighting bias. In January 1995, the agency changed its procedures for estimating the weights to be assigned to specific price observations at particular stores. Rather than divide sales by prices in the month of entry to the sample, the new procedure will observe prices for 3 months before the store enters the sample, and will estimate the store's base period quantities (hence its weighting factor) based on the earlier price. This adjustment should limit the influence of sharp and temporary price fluctuations. BLS estimates that the change will reduce the growth in the CPI for Food at Home by about 0.3 to 0.4 percent per year.

Over the longer term, the BLS will need to look closely at its procedures for collecting prices and for forming price indices at the most basic level of the CPI. The agency is looking at alternative formulas for averaging prices, which might by themselves remove much of the bias described above. The BLS may also move to greater reliance on electronic collection of prices, through retention of scanner data at stores. The advantage of such data is that they record price and quantity sold for highly specific food items (recall that the weighting bias occurs through efforts to estimate quantity). Scanner data, therefore, hold the promise of providing far more accurate, timely, and precise information for price indices. The weakness is that at present, electronic scanners do not record information on all items (most important, they miss fresh meats and fresh fruits and vegetables) and they do not cover all types of stores.

What about the effects of store substitution, as consumers shift to lower priced stores? As noted earlier, the problem raises difficult conceptual issues. Even if the problem was solved, BLS likely would need a major commitment of new resources to implement index adjustments, resources that might be better spent on other index problems. In short, the CPI is not likely to be adjusted to account for store substitution, but store substitution does not appear to be a major problem for the index.

How should users react to CPI problems? First, use caution. The index probably did overstate food-price inflation over the last decade and a half and, as a result, the price series are overstated while a variety of data series on real sales, retail productivity growth, and consumption trends should and do look understated. The problem becomes larger as the time span covered becomes larger, and it is most serious for products that show the sharpest price fluctuations (like fresh fruits and vegetables). Second, the problem is not permanent. The weighting bias can be fixed, and the recent BLS adjustments to the index should help to do that. Third, price indices are not perfect measures of changes in the costs of living. They do not capture all the important changes in consumer behavior. Any user who bases major financial decisions on any price index should invest the time and money to understand the attributes of that index and its suitability for that decision.

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