Focus on Prices and Spending

Current Price Topics

A Comparison of the CPI-U and the C-CPI-U

Background

Before 1999, the U.S. Consumer Price Index (CPI) was viewed by many as overstating a cost-of-living index.[1] To understand why this was the case, it helps to first understand that the CPI is calculated in two stages. At the first stage, consumer goods and services are partitioned into 211 item categories and 38 geographic index areas, or 8,018 item-area combinations. The sampled prices within each of those 8,018 cells are first averaged together to form 8,108 basic indexes. Then, at the second stage of aggregation, these basic indexes are averaged together to form aggregate indexes, such as the All items index.

Before 1999, both the prices and the basic indexes were averaged together using a Laspeyres or arithmetic mean formula. The Laspeyres formula can overstate a cost-of-living index by, in effect, assuming that consumers purchase the same quantity of goods and services when relative prices change over time. Under a cost-of-living framework, changes in relative prices can result in consumers changing their spending patterns. The difference between an estimate of price change using the Laspeyres formula and a cost-of-living index could thus be

viewed as a bias, in particular, a "consumer substitution bias." When a Laspeyres formula is used at the first or lower level of aggregation to average the individual prices together, lower-level consumer substitution bias results to the degree consumers substitute *within* those CPI item categories. When a Laspeyres formula is used at the second or upper-level of aggregation to average the basic indexes together, upper-level consumer substitution bias results to the degree consumers substitute *across* CPI item categories.

In 1999, to address the issue of lower-level consumer substitution bias, the Bureau of Labor Statistics (BLS) adopted a geometric mean formula to average the prices together within most of the 8,018 item-area cells for both the Consumer Price Index for All Urban Consumers (CPI-U) and the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). While the adoption of the geometric mean formula essentially addressed lower-level substitution bias, the CPI-U and CPI-W still suffer from upper-level substitution bias in that the basic indexes are averaged together using a Laspeyres formula.

To address upper-level substitution bias, BLS began publication of a new Chained CPI for All Urban Consumers (C-CPI-U) in 2002, with indexes calculated back to December 1999. The C-CPI-U employs a "superlative" formula to combine the basic indexes together, to reflect the effect of substitution that consum-

ers make across CPI item categories in response to changes in relative prices. The C-CPI-U does not replace the CPI-U or CPI-W; it is, instead, a new, supplemental measure of inflation.

## Comparing and Contrasting the CPI-U and the C-CPI-U

In both the CPI-U and the C-CPI-U, the prices and the formulas used to average those prices together within each CPI item-area at the first stage of aggregation are the same. It is at the second stage of aggregation—the averaging of the basic indexes across CPI item categories and geographic areas—where the formulas used in the CPI-U and C-CPI-U differ. The CPI-U continues to use a Laspeyres formula to average these basic indexes together. In addition, expenditure weights from a previous 2-year period are used to calculate aggregate indexes. For example, the CPI-U for 2010–2011 uses consumer expenditure estimates from the 2007–2008 period. Similarly, weights pertaining to 2009–2010 will be used in the CPI-U beginning in January 2012.

The final C-CPI-U[2], on the other hand, uses expenditures from both the current and previous month to combine the basic indexes together. Since the final C-CPI-U uses both current and base expenditure weights in its final form, the formula effectively incorporates the impact of changes in consumer spending patterns, and thus does not suffer from upper-level substitution bias.

Chart 1 shows the behavior of the All items CPI-U and the final C-CPI-U from December

Chart 1. **CPI-U and final C-CPI-U indexes, December 1999–December 2009**
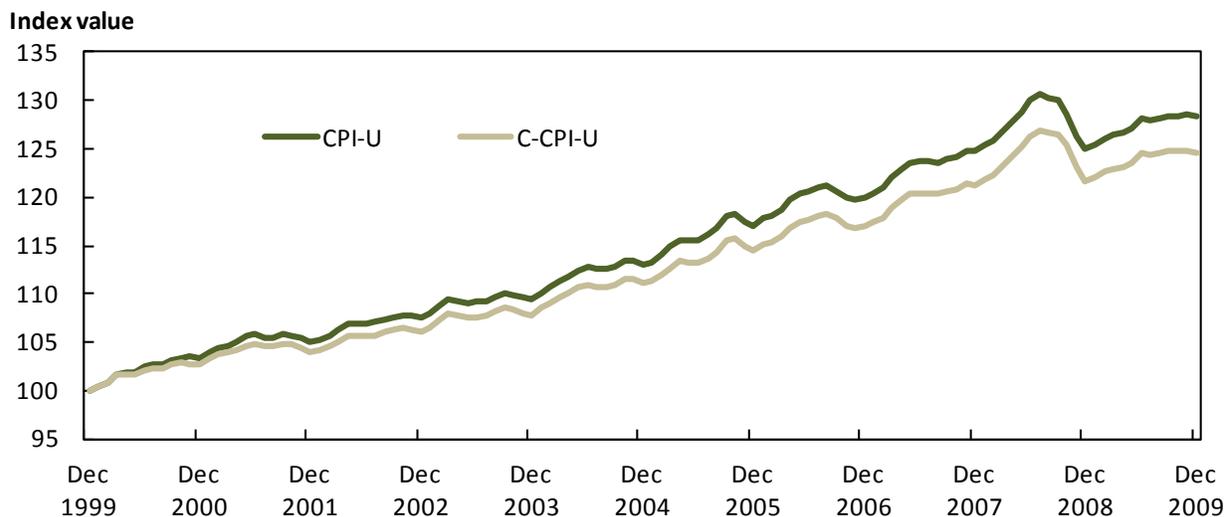
NOTE: CPI-U, U.S. city Average, All Items index values are converted to reflect a base period of December 1999=100.
SOURCE: U.S. Bureau of Labor Statistics

Year	CPI-U	C-CPI-U	Difference
2000	3.4	2.6	0.8
2001	1.6	1.3	0.3
2002	2.4	2	0.4
2003	1.9	1.7	0.2
2004	3.3	3.2	0.1
2005	3.4	2.9	0.5
2006	2.5	2.3	0.2
2007	4.1	3.7	0.4
2008	0.1	0.2	-0.1
2009	2.7	2.5	0.2

Table 1. **December-December percent changes, CPI-U and C-CPI-U, 2000–2009**

SOURCE: U.S. Bureau of Labor Statistics

1999 through December 2009. (C-CPI-U data for 2010–2011 are not shown in chart 1 as these data are preliminary.) Over this 10-year period, the All items CPI-U rose at an annual average rate of 2.5 percent, compared with an average increase of 2.2 percent for the C-CPI-U—an annual difference of 0.3 percent a year.

Although the differences between the CPI-U and C-CPI-U average about 0.3 percent a year, those differences vary somewhat by year (See table 1). Excluding the relatively large difference in 2000, the difference between the CPI-U and C-CPI-U average about 0.25 percent a year.

Summary

In both the CPI-U and the C-CPI-U, the prices used—and the formulas used to average those prices together within each CPI item-area—are the same. At the second stage of aggregation—the averaging of the basic indexes across CPI item categories and geographic areas—the CPI-U continues to use a Laspeyres formula to average

these basic indexes together, using expenditure weights from a previous 2-year period. In contrast, the final C-CPI-U uses a superlative formula to combine the basic indexes together using both current and previous monthly expenditure data.

In short, the C-CPI-U is designed to be a closer approximation to a cost-of-living index than the CPI-U. That said, the C-CPI-U is subject to two annual revisions, while the CPI-U is deemed final when issued.

Current Price Trends
Energy Prices Jump while Food Prices Continue to Rise

All Items

The all items Consumer Price Index for All Urban Consumers (CPI-U) increased at a 4.8-percent seasonally adjusted annual rate during the third quarter of 2011. This rise

follows increases of 6.1 percent and 1.5 percent in the first and second quarters of 2011, respectively. For the first 9 months of 2011, the index has increased at a 4.1-percent annual rate. This compares with a rise of 1.5 percent in 2010

The food index continued its rise in 2011 after more modest increases in 2010, increasing 5.7 percent in the third quarter. The energy index increased 26.6 percent in the third quarter, after falling 12.5 percent in the second quarter. The index for all items less food and energy rose 2.1 percent in the third quarter, after increasing 2.9 percent in the second quarter. The index for all items less food and energy is up 2.0 percent over the past year.

Energy

Energy prices continued to be volatile. After climbing 42.4 percent in the first quarter and falling 12.5 percent in the second quarter, the energy index jumped 26.6 percent in the third quarter. The previous 6 months overall have seen a slowdown in energy prices, rising 5.3 percent at a seasonally adjusted annual rate, after rising 36.0 percent in the 6 months ending in March 2011. The energy index rose 7.7 percent in 2010.

The rise in the energy index in the third quarter of 2011 was driven by an increase in the gasoline index, which rose 45.4 percent in the third quarter, after falling 20.5 percent in the second quarter of 2011. Fuel oil was down 11.0 percent, while electricity and natural gas

prices increased 6.0 and 7.4 percent, respectively. Overall, the household energy index rose 5.2 percent in the third quarter, after falling 0.1 percent in the second quarter.

Crude oil prices—and, subsequently, retail gasoline and fuel oil prices—have been quite volatile over the past few years. From July 2007 to July 2008, gasoline prices rose sharply, increasing 37.9 percent. After crude oil prices peaked in July 2008 at over $134 a barrel, prices plummeted during the last 5 months of 2008, with crude oil prices falling to under $32 a barrel. At the retail level, gasoline prices fell by more than 50 percent. In 2009, pump prices turned sharply higher again, increasing more than 50 percent, with crude oil prices increasing to around $70 by the end of 2009.[3] In 2010, gas prices saw a more moderate increase of 13.8 percent and are up 25.6 percent through the first 9 months of 2011.

Food

Food prices rose at a seasonally-adjusted annual rate of 5.7 percent in the third quarter of 2011, after rising 4.1 percent in the second quarter and 7.5 percent in the first quarter. The food index increased 1.5 percent in 2010.

Grocery store food prices were up at a 7.4 percent annual rate in the third quarter, after increasing 4.7 percent in the second quarter and 11.2 percent in the first quarter. All six major grocery store food groups increased, with the dairy and related products group leading the way with a 14.1-percent jump.

Fruits and vegetables were the only other grocery store item to see a double-digit increase, rising 11.0 percent over the quarter. Cereals and bakery products were up 7.8 percent, meats, poultry, fish and eggs rose 5.0 percent, nonalcoholic beverages and beverage materials increased 2.7 percent, and other food at home increased 7.0 percent.

Double-digit increases in price were seen almost across the board for major dairy items, led by a 22.2-percent jump in the price of cheese. Only fresh whole milk prices saw a single-digit increase of 6.5 percent. The fresh fruits index increased 22.5 percent, while the index for processed fruits and vegetables increased 7.7 percent. Within fresh fruits, the prices of apples and oranges increased 47.6 percent and 25.5 percent, respectively. The prices of processed fruits and vegetables was driven partly by an increase of 11.2 percent in canned vegetables, which contrasts with a relatively small 2.8-percent increase in fresh vegetables prices. The prices of fresh vegetables were held down by lettuce and tomatoes, which bucked the trend with decreases of 4.0 and 15.6 percent, respectively, over the quarter.

The food away from home index rose at a 3.4-percent rate in the third quarter, after rising at a 3.2-percent rate in the second quarter. The food at employee sites and schools index jumped 15.5 percent in the third quarter, after more modest increases earlier in the year, while the prices of food from vending machines and mobile vendors were up 9.5 percent.

All Items Less Food and Energy

The index for all items less food and energy rose 2.1 percent in the third quarter of 2011, slowing down from its 2.9-percent increase recorded in the second quarter, but almost equal to the 2.0 percent rate in the first quarter.

The shelter index continued its upward trend with an increase of 2.3 percent in the third quarter after a 1.9-percent increase in the second quarter and 1.3-percent increase in the first quarter. Within shelter, owners' equivalent rent and rent of primary residence both accelerated in the third quarter, rising 2.4 percent and 3.5 percent, respectively. Lodging away from home, on the other hand, declined 6.1 percent in the third quarter, after a 25.8-percent second quarter spike.

The acceleration in shelter prices stands in contrast to decreases observed in recent years. The 12-month percent changes in shelter ending September 2006, 2007, 2008, 2009, and 2010 were 4.2, 3.5, 2.4, 0.7, and minus 0.4 percent, respectively.

After nearly across-the-board decreases in the first quarter, apparel prices were up 5.0 percent in the third quarter, after an 11.5-percent increase in the second quarter. Men's and boys' apparel prices were up 5.4 percent, women's and girl's apparel prices were up 5.2

Chart 2. **Twelve-month percent change, all items and all items less food and energy, January 2008–September 2011**

Percent change
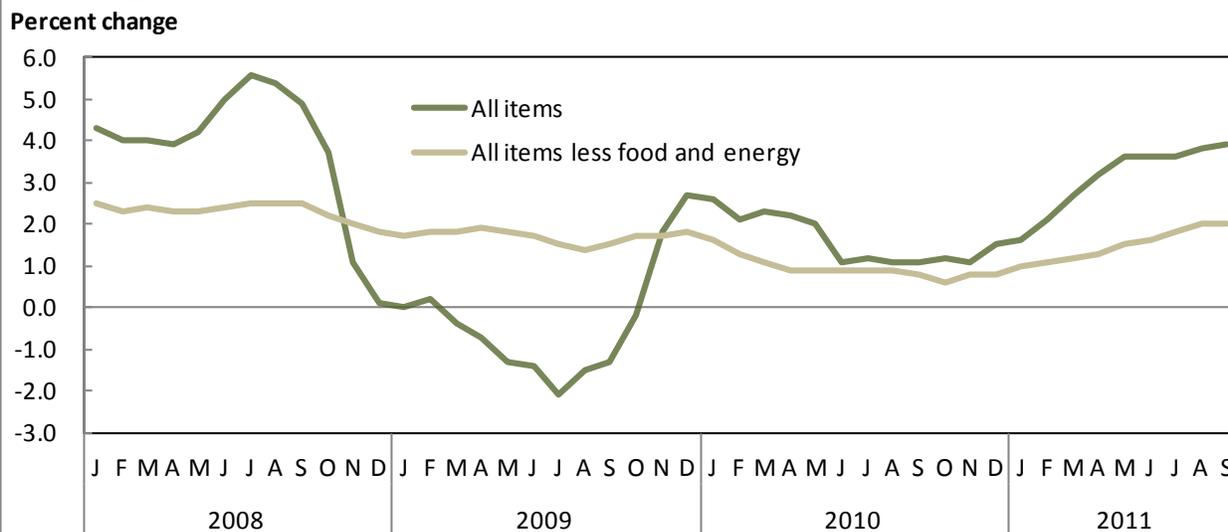
SOURCE: U.S. Bureau of Labor Statistics

percent, and infants' and toddlers' apparel prices were up 17.9 percent. Jewelry prices were up 1.1 percent—a sharp slowdown from previous quarters.

Household furnishings and operations increased 1.4 percent in the third quarter of 2011, the same rate observed in the second quarter. The transportation index was up 13.9 percent over the quarter, driven mostly by soaring gas prices but also by higher airline fares, which increased 9.1 percent after a 14.9-percent drop in the second quarter. The index for used cars and trucks rose 4.4 percent.

Other significant components with increases included the index for other goods and services, which rose 2.9 percent, and the medical care index, which grew 2.8 percent. The index for education and communica-

tion rose 1.4 percent in the quarter, though communication prices decreased 1.6 percent.

The recreation index fell 0.2 percent. The price of televisions continued to decline, falling 21.7 percent in the quarter, after decreases of 21.1 percent, 12.4 percent, and 15 percent in the previous three quarters. The index for rental of video or audio discs and other media increased 29.5 percent.

The index for all items less food and energy rose 2.0 percent for the 12 months ending September 2011. For the 5-year period from September 2005 to September 2010, this index also increased at a 2.0-percent annual rate.

Price movements described in this text reflect data as released on October 19,

2011. All 12-month and longer percent changes reflect not seasonally adjusted data except as noted. Percent changes covering less than a year are based on seasonally adjusted annual rates, unless otherwise noted. CPI seasonally adjusted indexes and percent changes are subject to annual revision.

For more information, contact Jonathan Church at (202) 691-5379 or email church.jonathan@bls.gov.

Notes

[1] A cost-of-living index (COLI) attempts to measure the change in the cost over time of maintaining a fixed standard of living. While a true cost-of-living index can only be approximated, it is the measurement objective of the U.S. CPI. As noted in Chapter 17 of the *BLS Handbook of Methods*, at **http://www.bls.gov/opub/hom/pdf/homch17.pdf**, it is sometimes said that the Laspeyres formula provides an "upper bound" on the COLI.

[2] This description applies only to the "final" C-CPI-U. Unlike the CPI-U, the C-CPI-U is subject to two annual revisions before being issued in final form. This is because expenditure data for the current period are not available until 13-24 months after the current month. Since the two preliminary (initial and interim) estimates of the C-CPI-U include only base-period expenditure weights, they are not true "superlative" indexes. A complete description of how the C-CPI-U is calculated can be found at **http://www.bls.gov/cpi/super_paris.pdf**.

[3] Energy Information Administration; see **http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=WTOTUSA&f=W**.