BEYOND THE NUMBERS

BLS

September 2014 | Vol. 3 / No. 21

PRICES AND SPENDING

Two measures of consumer price change: How are they different?

By Steve Reed and Malik Crawford

The primary product of the Consumer Price Index (CPI) is price indexes. However, the program also produces average price data for selected goods, primarily food commodities and gasoline.[1] These average price series allow users to see the actual average price of the items in question, which the index series do not. For many goods, one can look at price change in terms of the movement of the index series or the movement of average prices. For example, the Bureau of Labor Statistics (BLS) provides an apple index, and an average price series for apples. This article compares price change as measured by the CPI for all urban consumers (the broadest and most commonly used CPI measure) and the average price series for selected goods.

One might intuitively expect the index and average price measures to show nearly identical change over time, but that is not always the case. For instance, for the 12 months ending June 2014, CPI average price data show a 0.8-percent increase in the price for apples. (See table 1.) The change in the index for apples in the CPI for all urban consumers is significantly larger, at 3.1 percent. In contrast, while average price data show banana prices rising 0.7 percent, about the same amount as apples, the CPI for bananas actually shows a decline of 0.9 percent.

Even over long periods of time, there are notable differences between the index and the average price measures, in some cases. Although the two series show price movements for bananas that are nearly identical over the past 10 years, the price movements for apples and milk show a significantly larger increase in the index series compared with the average price series. The gasoline price index also shows a somewhat larger increase than average prices of gasoline, and the bread average price series has increased slightly faster than the index series over the past 10 years.

Why, then, might an average price series and an index series move so differently? This **Beyond the Numbers** article looks at several possible explanations for such differences.

Scope: variety and size

A meaningful average price series can only be calculated for narrowly defined types of goods. There are no average price series for most nonfood items because there is too much differentiation for such a series to be meaningful. However, even for items such as apples, milk, and bread, the average price data often include a specific variety and size of that good. For example, the average price series for apples is based only on red delicious apples. In contrast, a CPI index series likely includes many different sizes, and varieties of the item. The CPI index series for apples would include many different apple varieties.

Similarly, the average price series for particular food categories may be based on one exact size. The average price series for milk, for instance, is based on whole milk per gallon. Thus, the prices used in computing the average price of milk are a subset of the entire milk sample of the CPI, which contains many different sizes (as well as other types of milk such as skim and low fat.) It is plausible that price might change differently for different sizes of a good, so this could cause index and average price series to move differently. For instance, one might hypothesize that consumers who buy smaller sizes of milk, such as a pint or a quart, are less price-sensitive than those purchasing a gallon. This might lead to different sizes of milk having different patterns of price change. If we use the average price data for milk, which only measures sizes near a gallon, the annualized increase is only 0.14 percent over the past 10 years. If we use the index series, which includes all sizes and types, the annual increase is 1.3 percent over the same period. So, it does appear that smaller sizes of milk have increased in price more rapidly than the gallon size.

Table 1. CPI-U percent changes: all items, food, energy, and all items less food and energy, for 2013 and second quarter, 2014

Category	2013 change, not seasonally adjusted	2014 second-quarter change, seasonally adjusted annual rate
All items	1.5	3.5
Food	1.1	3.6
Energy	0.5	11.9

Table 1. CPI-U percent changes: all items, food, energy, and all items less food and energy, for 2013 and second quarter, 2014

Category	2013 change, not seasonally adjusted	2014 second-quarter change, seasonally adjusted annual rate
All items less food and energy	1.7	2.5

Formula

The index and average price series are calculated using different formulas. The average price in any given month is a weighted arithmetic average of the eligible quotes for that item. Indexes are calculated using a geometric means formula. This formula assumes a modest degree of substitution towards items whose relative price falls. (Remember, this is within an item category, so the substitution would be between varieties of apples or cuts of steaks.) In general, a geometric means formula yields a slightly smaller price increase than the formula used to calculate average prices.

Quality change

The CPI and its component indexes are designed to be constant quality measures, so changes in quality (increases or decreases) are factored out of the computation of indexes. Because most of the food series for which BLS publishes average price data have little or no quality change, this is not a major factor in explaining the difference between average price and index series movements. However, it is a major explanation why indexes might move differently than the prices that consumers observe in items that do change over time. For example, the CPI new vehicles index has clearly increased less over the past several decades than the price typically paid for cars; quality improvement in cars is part of the explanation for this.

Sample rotation and substitution

The CPI sample of goods and services that are included in the CPI survey is constantly changing through a process called sample rotation, in which approximately one eighth of the sample is rotated every 6 months. In addition, items may have to be replaced in the sample when they are no longer available. (For instance, if the particular brand of cheese being priced was no longer sold at the store in the sample.) For average prices, all quotes are used to calculate the average price, including brand new ones. For indexes, many new price quotes will not be used to calculate price change in the index in the month they are introduced. If a banana quote that had previously been from a convenience store was replaced by a lower one from a large grocery store, this would cause the average price to fall for the month the quote was introduced, but not the index. Price change in the new quote would affect the index moving forward, but any price difference between the new quote and the one it replaced would not be factored into the index. One unpublished BLS study suggested that at least for some food items, this difference might be important in explaining the difference between the measures.

Therefore, there are several possible reasons why an average price series and an index series published by the Consumer Price Index program might diverge. The series may have different scope, with index series often being based on a wider variety or size range of the item in question. They are calculated using different formulas. The index series adjusts for quality change and changes in the sample, whereas the average price series does not. Users of the data should keep these differences in mind when interpreting the two measures.

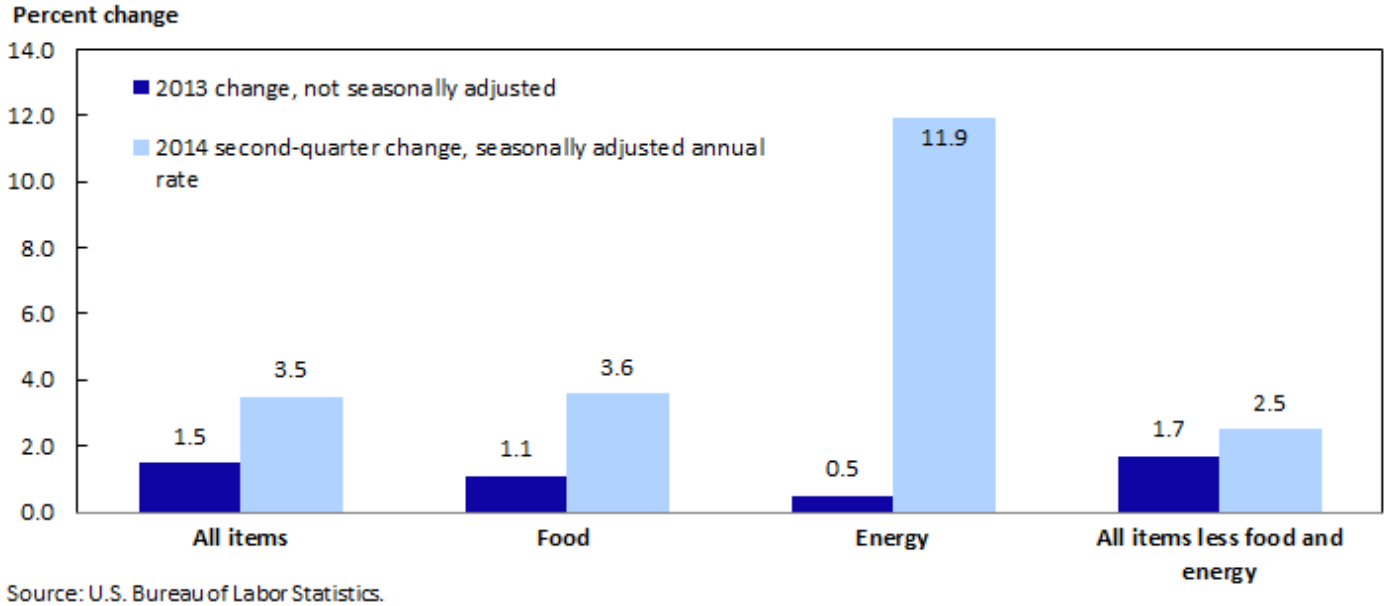
Current Price Trends

All items

The U.S. all items Consumer Price Index for All Urban Consumers (CPI-U) increased at a 3.5-percent annual rate during the second quarter of 2014.[2] This follows an increase of 1.8 percent during the first quarter of 2014. For the 12 months ended in June 2014, the all items CPI increased 2.1 percent. From June 2009 to June 2014, the 5-year annualized increase in this index was 2.0 percent.

Quarterly price movements in the U.S. energy index contributed significantly to the increase in the CPI for all items for the second quarter of 2014. From March 2014 through June 2014, the energy index increased 11.9 percent. The food index contributed too, rising 3.6 percent. Excluding food and energy, the CPI increased 2.5 percent during the second quarter of 2014. (See chart 1.)

Chart 1. CPI-U percent changes: all items, food, energy, and all items less food and energy, for 2013 and second quarter, 2014



Source: U.S. Bureau of Labor Statistics.

Energy

Energy price movements have become less volatile since 2012. The second quarter 11.9-percent increase, following a first quarter decline of 0.2 percent, was the first double-digit price change since the fourth quarter of 2012. In 2012, all of the quarterly movements were of the double-digit variety, whereas the five most recent quarters preceding this one fell inside the range of an increase of 1.3 percent and a decrease of 0.2 percent. Annually, the energy index increased 3.2 percent from June 2013 to June 2014. Energy has increased at a 4.8-percent annualized rate from June 2009 to June 2014.

As is often the case, the motor fuel index contributed significantly to changes in the energy index. Motor fuel, the only energy component that rose during the second quarter, increased 28.5 percent in the second quarter, following a 15.9-percent decline during the first quarter. The indexes for fuel oil, natural gas, and electricity fell 21.7 percent, 14.8 percent, and 0.4 percent, respectively. During the first quarter of 2014, all three of these energy

indexes increased, with fuel oil up 20.7 percent, natural gas up 76.9 percent, and electricity 11.5 percent higher. For the 12 months ending June, motor fuel increased the slowest of the energy components, up 2.1 percent since June of 2013. Over that same time period, natural gas grew 5.1 percent, while electricity and fuel oil rose 4.2 percent and 4.0 percent, respectively. Motor fuel (7.3 percent) and fuel oil (9.6 percent) made significant contributions to the 5-year increase in energy of 4.8 percent annually.

Food

Retail food price inflation increased 3.6 percent from March 2014 to June 2014. This follows a similar increase of 3.6 percent during the first quarter of 2014. From June 2013 to June 2014, the food index increased 2.3 percent. The 5-year annualized change in this index from June 2009 to June 2014 was 2.2 percent. The food at home index increased 4.4 percent in both the first and second quarters of 2014. The food away from home index rose 2.6 percent during both quarters of 2014. Food at home and food away from home increased 2.4 and 2.2 percent, respectively, over the 12 months ending June. The indexes for both food at home, and food away from home, have increased 2.2 percent since June 2009.

Five of the six subcategories of the food at home index increased during the second quarter of 2014. The cereal and bakery products index was the exception, falling 1.0 percent. Meats, poultry, fish, and eggs index (up 12.9 percent) and the fruits and vegetables index (6.2 percent) contributed significantly to the increase in food at home. Notable contributors to the increases were pork (up 29.6 percent) and lettuce (up 78.8 percent). The remaining components grew modestly, with dairy and related products up 2.6 percent, nonalcoholic beverages and beverage materials increasing 1.1 percent, and the other food at home index (comprised largely of sugars and fats) up 0.9 percent. Meats, poultry, fish, and eggs increased 7.5 percent in the last year and 4.4 percent annualized over the last 5 years. The other five components grew less than four percent annualized over both the last year and last 5 years.

All items less food and energy

Excluding food and energy, the CPI accelerated during the second quarter of 2014, rising 2.5 percent, following the 1.8-percent increase in the first quarter. For the 12 months ended in June 2014, this index increased 1.9 percent. From June 2009 to June 2014, the all items less food and energy index increased at an annualized rate of 1.7 percent.

The shelter index increased 2.8 percent during the second quarter of 2014, following an increase of 3.1 percent during the first quarter. The rent of primary residence index increased 3.9 percent this quarter, after a 2.9-percent increase in the first 3 months of 2014. The owners' equivalent rent of primary residence increased 2.5 percent after a 2.6-percent first-quarter increase. The household furnishings and operations index was flat in the second quarter, after a decline of 1.8 percent over the first quarter of 2014.

The medical care index increased 3.1 percent during the first and second quarters of 2014. The second quarter increase was due in large part to the medical care commodities component of the index, which increased 6.3 percent during the same period. Medicinal drugs and prescription drugs increased 4.5 percent and 8.3 percent, respectively. Medical care services increased 2.1 percent with the eyeglasses and eye care index logging a 3.9-percent increase in the April to June timeframe. Year-over-year, the medical care index increased 2.6 percent since June 2013.

After declines of 1.1 and 0.3 percent in the two previous quarters, the rate of inflation for apparel grew 3.3 percent during the second quarter of 2014 on the strength of a 15.1-percent increase in boys' apparel, a 17.7-increase in girls' apparel, and a 4.8-percent increase in women's apparel. The footwear index increased 1.0 percent, with men's footwear increasing 11.1 percent and boys' and girls' footwear increasing 28.3 percent. In contrast, women's footwear fell 12.7 percent over the period.

The recreation index increased 1.1 percent during the second quarter of 2014 after an increase of 0.8 percent during the first quarter. The education and communication component increased 2.1 percent during the second quarter, following an uptick of 1.3 percent during the year's first quarter. Education led the move higher, increasing 4.7 percent during the second quarter. Communication placed downward price pressure on the broader category by falling 0.2 percent.

The other goods and services index increased 1.6 percent during the 3 months ended June 2014.

The tobacco and smoking products index rose 5.2 percent for the 3-month stretch between March and July of 2014, while personal care rose 0.7 percent.

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NOTES

[1] BLS publishes monthly average price data for gasoline, electricity, and natural gas, and about 60 specific food and beverage items. To access these data online, go to https://www.bls.gov/cpi/data.htm.

[2] All quarterly rates of change are annualized unless otherwise noted.

SUGGESTED CITATION

Steve Reed and Malik Crawford, "Two measures of consumer price change: How are they different? ," *Beyond the Numbers: Prices and Spending*, vol. 3, no. 21 (U.S. Bureau of Labor Statistics, September 2014), https://www.bls.gov/opub/btn/volume-3/two-measures-of-consumer-price-change-how-are-they-different.htm