



Owners' equivalent rent and the Consumer Price Index: 30 years and counting

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The objective of the Consumer Price Index (CPI) is to measure the change in expenditures required to maintain a given standard of living. For expenditures on houses, this leads to a measurement objective that focuses on the shelter services provided by a house over a period of time. A house is a capital asset that provides a flow of services over a substantial period of time, not a one-time consumption item.

The Bureau of Labor Statistics (BLS) explored two major approaches to determine how to estimate the cost of shelter services for owner-occupied dwellings. The first approach attempts to estimate the flow of shelter services for an owned dwelling from items related to living in it. This approach is called "user cost" and includes items such as real estate taxes, insurance, and an

Related articles

More BLS articles and information related to housing and the Consumer Price Index are available online at the following links:

- "How the CPI measures price change of Owners' equivalent rent of primary residence (OER) and Rent of primary residence (Rent)," www.bls.gov/cpi/cpifacnewrent.pdf
- *BLS Handbook of Methods* - Chapter 17. The Consumer Price Index, www.bls.gov/opub/hom/homch17.htm

interest estimate based on the market value of the house. The second approach attempts to estimate the flow of services for an owner dwelling based on market rents for rented dwellings. This research led to a method referred to as “rental equivalence.” This method measures the rate of change in the amount an owner would need to pay in order to rent on the open market. It is based on actual market rents collected from a sample of renter-occupied housing units that are identified to be representative of owner-occupied housing.

On October 27, 1981, Commissioner Janet Norwood announced that BLS would convert the CPI for All Urban Consumers (CPI-U) to a rental equivalence measure for homeowner costs, effective with data for January 1983. The CPI for Urban Wage Earners and Clerical Workers (CPI-W) would be converted to the new method, effective with the January 1985 data. This announcement was consistent with general BLS practice of giving at least 1-year’s notice before making a major methodological change. The change also meant that the CPI-U for 1983 and 1984—the first years the CPI was to be used in the escalation of personal income tax brackets and exemptions—would use the new methodology. The longer period of notice for the CPI-W was provided, because the CPI-W continued to be the primary index used in cost-of-living adjustments in collective bargaining agreements and in the escalation of government entitlement payments. It was felt that sufficient time needed to be provided for users to adapt to the change. The transition to the new method was smooth, in large part, owing to the open way it was done and the extensive public information effort.

Implementation of rental equivalence in January 1983

There were many steps required before the rent equivalence method could be implemented. The process started with the existing 1978 sample for rented housing units. This was derived using a multistage design based on 1970 Decennial Census data. A stratified sample of Census enumeration districts was selected in each CPI pricing area or primary sampling unit. The enumeration

districts were subdivided into segments (neighborhoods). Another process selected one or more segments in each enumeration district, using a “probability proportional to size” sampling technique, in which the measure of size was the number of renters in the neighborhoods. The next step was a laborious process of physically listing the addresses of all units located in sampled segments. BLS data collectors manually listed the addresses of every housing unit on listing forms. These forms were sent into the Washington office, where they were keyed into computer databases. The next step was to apply a sampling algorithm to select a sample of the listed addresses.

The addresses for the housing sample are divided into six sub-samples called panels. One-sixth of the neighborhoods in each CPI primary sampling unit was randomly assigned to panel 1, one-sixth to panel 2, etc., so each panel is a proper subset of the entire sample. Panel 1 is collected in January and July, panel 2 in February and August, and so on through panel 6 in June and December. Thereafter, these selected addresses were sent out on panel on paper screening forms, so the data collectors could determine whether the selected addresses were eligible for the housing sample (screening).

The primary determinant in selecting a housing sample was the tenure (owner or renter status) of the occupant. Renters were eligible, but there were other criteria, as well. The unit had to be located in an eligible housing structure. There is a long list of ineligible structure types, but basically the units could not be located in institutional, commercial or temporary housing structures. Units could not be public housing, a unit had to be the primary residence of an occupant, and the occupant could not be a relative of the landlord. Certain criteria (owner tenure, ineligible housing, and public housing) were considered permanent, so the units were dropped from the sample (permanently out of scope). Other criteria (primary residence and relative of the landlord) were considered temporary (temporarily out of scope), so the units were put into a wait status for some period and then forms were sent out again for another screening attempt.

If a unit passed all of the criteria, it was considered to be eligible (in scope) and the unit was then initiated. Initiation is the first collection of all of the data necessary for the unit to be used in the housing price relative computation. If all of the required data were collected, the unit was successfully initiated. If some of the required data were missing, the unit went back out on panel for another initiation attempt. In-scope, successfully initiated units were priced on-panel twice before they could be used in the housing price relative computation.

Additional adjustments in 1983

Since the rental equivalence process started with the existing 1978 sample for rented housing units, more neighborhoods were added to the rent sample in heavily owner-occupied areas of the CPI primary sampling units. This was done by selecting new neighborhoods and going through the listing, sampling, screening, initiation, and pricing processes described above. The updated housing sample was used for two purposes: 1) to produce price relatives for the Residential rent of primary residences index using the existing renter weights; and 2) to produce price relatives for the Owners' equivalent rent of primary residence index using newly derived owner-occupied housing weights, so the rent sample could be used for both estimates. The resulting sample was used from January 1983 through December 1986, so the first on-panel pricing of the new neighborhoods started with panel 1 units in July 1982.

Changes in 1987 and the CPI revision

In 1987, the method for estimating the owners' equivalent rent of primary residence index was changed to use a sample of homeowners to estimate the price movement of the shelter service of the owned homes rather than reweight the renter sample. The sample of rented units and the renter and owner weights were estimated as in 1983, using the 1980 Decennial Census data. Augmenting the renter sample to represent owners was dropped and a sample of homeowners was selected. Owners were asked for an estimate of how much their house would rent for monthly (an implicit rent). Units

from the rent survey were then matched to units from the owner survey.

At this point, the concept of economic rents and pure rents comes into play. If the landlord provides utilities, the cost of those utilities is included in the collected rents. The collected rents, adjusted for quality change, are called economic rents. Because owners pay for their own utilities, the housing system estimates the value of the landlord-provided utilities (cost of utilities). The pure rents are the collected rents, less the cost of utilities, adjusted for quality changes. The change in the pure rents from one period to the next for the matched rental units were used to estimate rent change for updating the implicit rent for owned units.

Results from 1987 revision

The changes introduced in 1987 were an attempt to develop rent payment information that was more representative of the owner-occupied housing stock. In reality, the criteria for matching renter units to owner units were found to be too strict to find enough good renter matches for each owner unit. As the criteria were relaxed to find more renter matches, the same renter units were being matched to many owner units. Performance indicated that use of an owner sample and the matching of renter units to owner units resulted in estimates inferior to those from the reweighting methodology used to represent owners introduced in 1983. A decision was made to base the 1998 revision on a design for rental equivalence that relied on reweighting the rental sample; similar to the approach utilized in 1983.

The 1998 revision and sample

A new multistage design, based on 1990 Decennial Census data, was developed to represent both renters and homeowners. A stratified sample of census blocks (rather than enumeration districts) was selected in each CPI primary sample unit. Neighborhoods were selected, using a probability proportion to size sampling technique in which the measure of size was the estimated total rent payment for renters and owners. Estimated total rent estimates also were used to derive renter and owner weights for each neighborhood. The

neighborhoods with high renter expenditures and low owner expenditures had high renter weights and low owner weights and vice versa.

One of the major innovations for the 1998 revision was the development of Computer-Assisted Data Collection (CADC). The CADC had two important instruments that automated the data collection process. The CADC listing instrument allowed the data collectors to electronically list all addresses in the selected neighborhoods. After a neighborhood was listed, the listing instrument would apply the sampling rates, automatically selecting units to be screened. The selected units then were passed to the CADC collection instrument. The collection instrument went through the screening criteria to determine the eligibility of the selected units; and, if they were in scope, the collection instrument would proceed through a structured interview to initiate them into the housing sample.

The sample design produced a sample of renters that could be used in the rent calculations, the owners' equivalent rent calculations, or both. Most rental units were used in both calculations. Another major innovation was the Housing Review and Correction Preprocessor. This system processed the collected data and derived all of the necessary unit-level data needed for the review, correction, and use of the units in the housing price relative computation. The Housing Review and Correction Preprocessor derived a set of economic rent data that are used in the rent calculations and another set of pure rent data that are used in the owners' equivalent rent calculations. The new sample was introduced in January 1999.

Improving the way we look for renters

The 1990 sample design called for initiating approximately 50,000 renters distributed equally across BLS geographic neighborhoods within primary sampling units. However, only 25,000 units were found. An augmentation effort in 1999 increased the sample by about 10,000 units.

However, the sample shortfall in 1999 caused the housing sample to be much smaller than expected. In addition, the sample constantly faces attrition as units are demolished or converted to owner occupied and as respondents refuse to participate in the survey. A lack of funding had postponed the planned rotation of the housing sample for several years. The housing sample is now being improved using a three-step approach:

1. A 2-year augmentation of the 1990 Census-based sample with neighborhoods from a new design based on the 2000 Decennial Census data. (This step is complete.)
2. A 4-year replacement of the existing 1990 sample with neighborhoods from the new 2000 design. (This step is in progress.)
3. A 6-year replacement of the 2000-based sample with a sample design based on the 2010 Decennial Census data and Census data from the American Community Survey (ACS).

For the first step, BLS created a sampling frame from the 2000 Decennial Census and selected a stratified sample of block groups (rather than blocks) in each CPI primary sampling unit. (The Decennial Census has been reducing the amount of housing data collected, causing BLS to construct sampling frames from larger geographic areas.) Neighborhoods were selected, using a probability proportional to size sampling technique, similar to the one that was used with the 1990 Census-based sample; and weights were derived in a similar manner. Because the 1990 and the 2000 sample designs are based on two different sampling frames, the 1990 segments were mapped into the 2000 sample design and reweighted, so they would be consistent with the 2000 sample design segments.

For the second step, BLS purchased commercial address lists with owner/renter codes (ranked from 0 to 9) that indicate the probability that the unit is likely owner-occupied (9) or renter-occupied (0). BLS research confirmed that units coded 9 were almost certainly owner-occupied, so they could be removed from the sample. Analysis of the address lists also allowed BLS to remove addresses with post office boxes (that cannot be priced) and the addresses that were clearly commercial.

Next, BLS applied a sampling algorithm to select a sample of the addresses. To further reduce the selected addresses, BLS contracted with a vendor to do a mail prescreening process that identified homeowners and commercial establishments. The address lists and the prescreening process reduced the number of selected units that would be sent out for screening.

Sample augmentation and replacement places a large screening and initiation burden on the data collectors, so an improvement was made to the screening and initiation processes, as well. Data collectors were given a multi-month period to screen and initiate the augmentation and replacement neighborhoods. Deadlines were set for each panel, so units could be processed and reviewed in time for their first on-panel collection. The success of the augmentation indicates that these improvements have been effective.

Units that had not yet been screened would be sent out on-panel as screening and initiation schedules, units that were in scope but were not successfully initiated would be sent out on-panel as initiation schedules, and units that were in scope and successfully initiated would be sent out as pricing schedules. The only difference between the augmentation and the replacement processes has to do with the 1990 sample neighborhoods. During augmentation, neighborhoods were added to the remapped 1990 sample neighborhoods; and during replacement, a set of 1990-based neighborhoods are dropped, as a set of new 2000-based neighborhoods are added to the housing sample.

Step 3 of the revised approach to the housing sample will begin a continuous updating, similar to replacement, where the 2000-based sample neighborhoods will be replaced by neighborhoods from a new sample design based on the 2010 Decennial Census data and census data from the American Community Survey. (The Decennial Census continues to reduce the amount of housing data collected, causing BLS to construct this sampling frame from a combination of the Decennial Census and the American Community Survey.) Since the 2000 and the 2010 (plus the American Community Survey) sample designs are based on two different sampling frames, the 2000

segments will have to be mapped into the 2010 sample design and reweighted, so that they will be consistent with the 2010 sample design segments. BLS intends to update up to one-sixth of the housing sample annually to improve estimates of the residential rent index and owners' equivalent rent index.

Current price trends: modest energy increases drive first-quarter inflation

All items

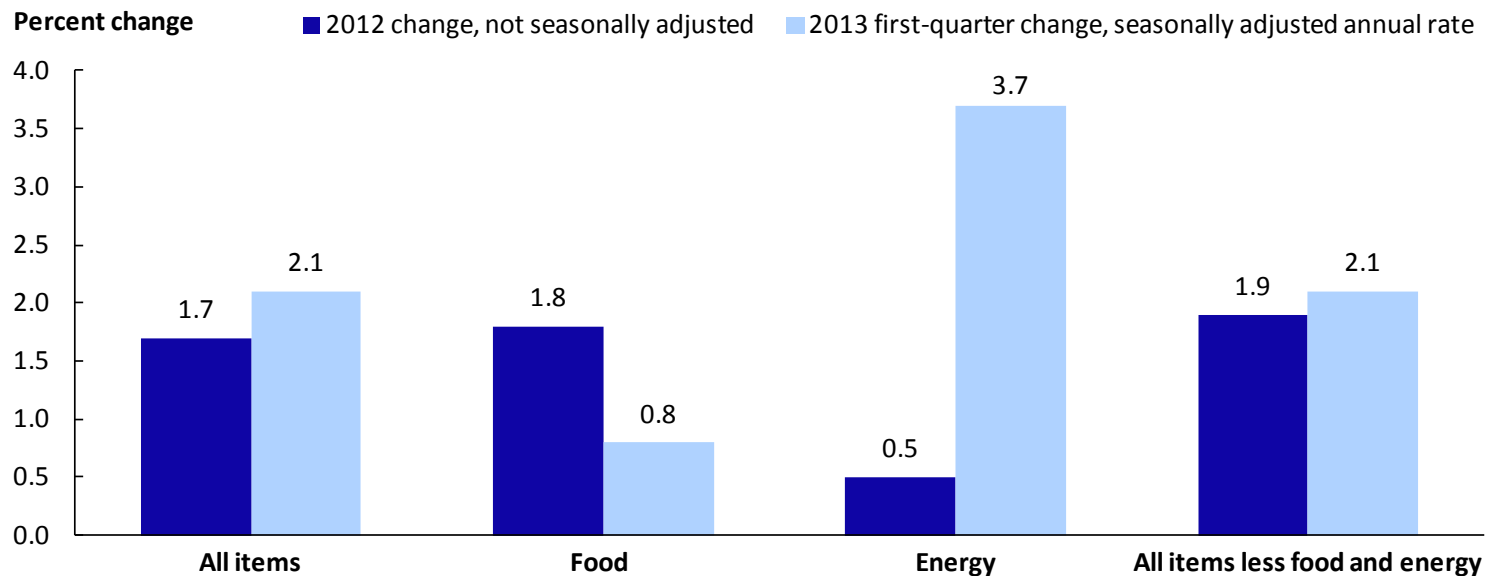
The U.S. all items¹ Consumer Price Index for all Urban Consumers (CPI-U) increased 2.1 percent during the first quarter of 2013, following a decrease of 0.2 percent in the fourth quarter of 2012. Over the previous 12 months ending March 2013, the all items CPI-U increased 1.5 percent.

The combination of a relatively moderate quarterly increase in the energy index and a restrained food index over the first quarter largely explains the modest increase in the all items index.

Although the cumulative relative weight of the energy components of the CPI is approximately 10 percent of the all items index, steep and volatile price movements in the energy index tend to account for more than 10 percent of the change in the all items index. By increasing only 3.7 percent over the first quarter, as contrasted with double-digit percentage changes each quarter since the fourth quarter of 2011, the energy index contribution to the all items quarterly increase was more commensurate with its relative weight, accounting for approximately 17 percent of the all items quarterly increase over the first quarter.

The food index increased 0.8 percent during the first quarter of 2013. This is the smallest quarterly increase in the food index since the second quarter of 2010, when the index increased 0.6 percent. Increases in the food index accounted for approximately 5 percent of the all items increase. (See chart 1.)

Excluding food and energy, the U.S. CPI-U increased 2.1 percent from December 2012 through March 2013, and 1.9 percent over the previous 12 months ending March 2013.

Chart 1**CPI-U percent changes in all items, food, energy, and all items less food and energy, for 2012 and first quarter, 2013**

Source: U.S. Bureau of Labor Statistics.

Energy

Beginning with the fourth quarter of 2011, the energy index has exhibited wild reversals in price movements from one quarter to the next. This pattern persisted through the first quarter of 2013, though the percentage point change—a 19.2-point reversal—was less acute relative to the preceding quarters of this period; the energy index recorded a 52.4-point reversal from the second quarter to the third quarter of 2012, for example. This volatility is explained by quarterly price movements in the energy commodities component, which has displayed the same trend since the fourth quarter of 2011 but with greater intensity. The energy commodities index increased 4.1 percent during the first quarter of 2013. This increase follows a 25.4-percent decrease in the previous quarter. This disparity, however, pales in comparison to the volatility exhibited during each quarter of 2012, when the smallest percentage point reversal was 56.6 points from the first to the second quarter.

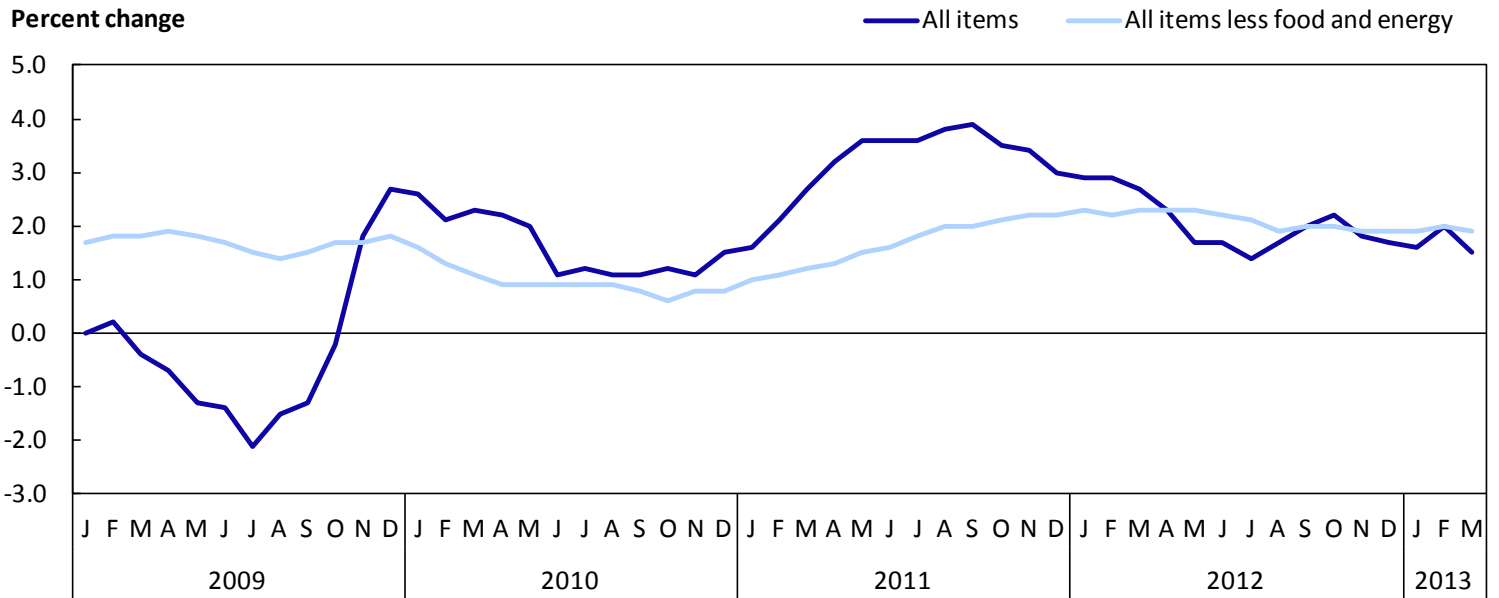
Quarterly price movements in the gasoline index also follow the price movements in energy commodities, and this is not surprising because gasoline is the most heavily weighted item in the energy commodities index.

The gasoline index increased 4.8 percent during the first quarter of 2013. This is the smallest quarterly percentage point change, in absolute terms, since the third quarter of 2008, when the index was essentially unchanged from the previous quarter by decreasing 0.2 percent.

The energy services index increased 2.9 percent during the quarter, which is the first time since the third quarter of 2011 that this category has registered two consecutive quarterly increases. Although the weight of the natural gas service index is only about a quarter of the cumulative weight of the energy service index, this index's price movements have largely driven changes in the energy services index since the fourth quarter of 2011. For example, from the fourth quarter of 2011 to the second quarter of 2012, double-digit quarterly decreases in the natural gas service were the primary cause of the quarterly decreases in the energy services index over the same period. The first quarter of 2013 is a recent exception, when the natural gas index percent contribution to the change in the energy services index—approximately 13 percent—was less than its relative weight. The natural gas index has now increased over the quarter for three consecutive quarters. This index last exhibited this behavior from the fourth quarter of 2007 to the second quarter of 2008.

Chart 2

Twelve-month percent change, indexes for all items and all items less food and energy, January 2009–March 2013



Source: U.S. Bureau of Labor Statistics.

Food

The food index has increased in each quarter since the fourth quarter of 2009. Its most recent increase of 0.8 percent in the first quarter of 2013 is almost entirely due to the quarterly increase in the food away from home index.² The food away from home index increased 1.8 percent during the period, accounting for 90 percent of the food index quarterly increase. The data series for food away from home spans back to 1953, and there has not been a quarterly decrease in this index over that entire period. The food at home index was essentially unchanged from the previous quarter, inching upward by 0.1 percent. Increases in three of the six aggregate food at home categories (cereals and bakery products; meats, poultry, fish, and eggs; and fruits and vegetables) offset the decreases in the remaining categories (dairy and related products; nonalcoholic beverages and beverage materials; and other food at home). The food at home index has remained unchanged or increased over the quarter since the fourth quarter of 2009.

The fruits and vegetables index recorded the largest quarterly increase, ending the first quarter 5.3 percent higher than the fourth quarter of 2012. The 2.8-percent

decrease in the nonalcoholic beverages and beverage materials index represented the largest quarterly decrease among the three aggregate food at home categories that decreased. With a reduction of 2.5 percent over the first quarter, the other food at home index registered its first quarterly decline since the second quarter of 2010.

All items less food and energy

Excluding food and energy, the U.S. CPI-U has increased consistently since the second quarter of 2010. Composing three quarters of the all items less food and energy index, the services less energy services index preponderantly affects movements in the all items less food and energy index. The services less energy services component too has increased every quarter since the second quarter of 2010, most recently increasing 2.8 percent over the first quarter of 2013. The 2010 first quarter decline in both indexes was the only quarterly decline recorded by either index during the 41 quarters spanning 2003 through the end of March 2013. The median quarterly change for this 41-quarter period is an increase of 2.0 and 2.6 percent, respectively, for the all items less food and energy, and the services less energy services indexes. (See chart 2.)

Each of the six aggregate indexes of the services less energy services index increased during the first quarter of 2013. Disregarding the shelter index, which composes more than half of the cumulative weight of the services less energy services index, the education and communication services index, which increased 4.3 percent, contributed the most to the overall increase in the services less energy services index, contributing about 16 percent to the 2.8 percent quarterly increase. The medical care services (3.4 percent increase) and transportation services (3.0 percent increase) each contributed approximately 11 percent to the overall rise in the services less energy services index during the first quarter of 2013. The other personal services index matched its largest quarterly increases since publication of this index began in 2010, increasing 3.5 percent.³ The shelter index increased 2.4 percent during the first quarter, which is near average relative to its median change (2.2-percent increase) over the 41-quarter period beginning 2003. The recreation services index increased at exactly its median rate of change—for the 13 quarters since publication began in 2010—with a 2.0-percent increase over the first 3 months of 2013.

Excluding food and energy commodities, the commodities component of the all items less food and energy index also increased, by 0.2 percent, during the first quarter. This index, however, has exhibited very different behavior from the services component since the first quarter of 2003. Of the 41 quarters completed since 2003, the commodities less food and energy commodities index has recorded nearly equal counts of quarterly decreases (18) as increases (21); there were two quarters, one each in 2004 and 2005, when this index was unchanged from the end of the previous quarter. The median quarterly change for the commodities less food and energy commodities is an increase of 0.2 percent for this 41-month period.

Nearly completely offsetting changes in the eight aggregate commodities indexes of the commodities less food and energy commodities index caused the index to be almost unchanged for the first quarter of 2013. Alcoholic beverages (2.3 percent), transportation commodities less motor fuel (2.5 percent), recreation commodities (1.7 percent), and other goods (1.5

percent) each increased during the quarter. The quarterly increase in the transportation commodities less motor fuel ends two consecutive quarters of decreases in this index. The increase over the first quarter marks only the third time the recreation commodities index has increased since publication of this index began in 2010. The increases in the alcoholic beverages and other goods indexes were average relative to their respective 41-quarter (alcoholic beverages) and 13-quarter (other goods) median change.

Apparel (1.3 percent), medical care commodities (0.7 percent), and education and communication commodities (1.6 percent) each decreased during the first 3 months of 2013. The medical care commodities index has recorded a quarterly decline only four times over the previous 41 quarters. Further analysis is appropriate to fully understand the quarterly decrease in the education and communication commodities index. Decomposing the index into its constituent education and communication components, it's clear that the quarterly decrease is entirely due to the first quarter decline in the information technology commodities index, which includes personal computers and peripheral equipment, computer software and accessories,⁴ and other consumer information items.⁵ The educational books and supplies index, on the other hand, increased 5.7 percent over the first quarter, and has increased in every quarter except one over the previous 41 quarters. The apparel-index quarterly decrease breaks a stretch of quarterly increases since the first quarter of 2011.

To recap, relative to each index median quarterly change since 2003, the combination of below-average quarterly increases in the energy (3.7 percent) and food (0.8 percent) indexes with relatively average increases in the commodities less food and energy commodities index (0.2 percent) and the services less energy services index (2.8 percent) resulted in a moderate quarterly increase of 2.1 percent in the all items index over the first quarter of 2013. ■

This **BEYOND THE NUMBERS** summary was prepared by Frank Ptacek and Darren A. Rippy, economists in the Office of

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Notes

1. Price movements described in this text reflect data as released on April 16, 2013. 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.
2. The food away from home index is not seasonally adjusted.
3. The other personal services index is not seasonally adjusted.
4. The computer software and accessories index is not seasonally adjusted.
5. The telephone hardware, calculators, and other consumer information items index is not seasonally adjusted.