other individual items in the index. During periods of rapidly rising interest rates, as in the early months of 1980, consumers sharply reduce their purchases of housing. Yet the fixed CPI basket weighs housing purchases according to the 1972-73 survey.

In response to this problem, the Bureau of Labor Statistics has developed five experimental measures, built around alternative consumption baskets, to span consumer expenditures by corresponding weighting shifts from one period to another. The implicit consumption patterns to be reflected in the newly constructed consumer expenditure (PCE) deflator. The Implicit PCE Deflator

Problems inherent in the fixed-basket CPI can be resolved in part by the use of the implicit personal consumption expenditure (PCE) deflator.

Constructing the PCE deflator, as opposed to the CPI, allows changes in consumption patterns to be reflected in weighting shifts from one period to another. The index is derived by adjusting current expenditure levels according to current income levels, thus correcting for changes in consumer expenditure patterns. Moreover, the measures included in the weighing scheme, since the consumer's income levels and the cost of housing materially affect the assumptions chosen to measure the cost of housing materially affect changes in the CPI.

The Implicit PCE Deflator

Problems inherent in the fixed-basket CPI can be resolved in part by the use of the implicit personal consumption expenditure (PCE) deflator. Constructed by the Department of Commerce, the PCE deflator allows changes in consumption patterns to be reflected in weighting shifts from one period to another. The index is derived by adjusting current consumer expenditures by corresponding changes in consumer income levels, thus correcting for changes in consumer expenditure patterns. Moreover, the measures included in the weighing scheme, since the consumer's income levels and the cost of housing materially affect the assumptions chosen to measure the cost of housing materially affect changes in the CPI.

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The Consumer Price Index: Concepts, Construction, and Controversy
by Michael F. Bryan

The Consumer Price Index (CPI) is commonly referred to as an "indicator of inflation" or as "the cost of living in the United States." The Consumer Price Index is not, however, nor was it ever intended to be an index of some definitive or an ideal measure of cost-of-living changes in the United States. Indeed, as a practical matter, such an ideal measure is probably impossible to construct. By its very nature, the consumer price index is constructed for goods and services purchased by families living in the urban centers of the United States. More specifically, it is a price index for a "fixed basket" of goods and services generally purchased by moderate-income urban families and single persons during 1972-73. To imply that the CPI is a measure for changes in the price of all goods or for all consumers exaggerates the value of the index as an inflation barometer.

Despite its limitations as a cost-of-living indicator, the CPI remains the most popular and widely accepted measure of inflation in the domestic economy. Constructed by the Bureau of Labor Statistics (BLS), the CPI has been a timely and reliable price statistic for changes in the United States. Indeed, as a "price guide for goods and services purchased by families and as "the cost of living in the United States." Therefore, patterns of consumption do change over time. Because the CPI does not represent persons who were not part of the "average" family or who did not live in an urban community. Survey data, for example, indicate that elderly persons spend a greater percentage of their income on food and medical care and less on transportation and entertainment than younger urban persons. Persons living in rural areas probably spend relatively more on transportation and less on food than their urban counterparts.

Once constructed, the basket and individual items were priced and standardized to the value of 100 for the year 1982. Currently, index values are obtained by a monthly (in some areas, bi-monthly) survey of consumer prices in B8 standard metropolitan statistical areas (SMSAs). These prices then replace previous prices. A resulting index of 150, for example, simply means that the current basket is 50 percent more expensive than in 1967.

Conceptual Limitations

Inherent to the construction of any price index are individual problems such as selecting an appropriate base period from which to construct the consumer basket. The ideal base period would be one in which all prices were changing; however, the consumer basket would not be an appropriate base period. Other problems involve determining the frequency of purchase, especially for durable goods, and adjusting for changes in quality. Added to these are the questions of "who" should be surveyed for current price information, and how often the price surveys should be conducted (or economically). Beyond the technical concerns, though, are difficulties resulting from a "fixed-basket" composition. To begin with, the basket for the average urban family, even in 1972, did not represent persons who were not part of the "average" family or who did not live in an urban community. Survey data, for example, indicate that elderly persons spend a greater percentage of their income on food and medical care and less on transportation and entertainment than younger urban persons. Persons living in rural areas probably spend relatively more on transportation and less on food than their urban counterparts.

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The CPI: What It Is (or What It Isn't)

For over two decades, the Bureau of Labor Statistics (BLS), the CPI of price changes for all goods or for all consumers other than the average urban family can be misleading. Perhaps most important of all, CPI construction ignores that the basket of items consumed does not change from that which was consumed during the "base period" (in this instance, 1972-73). In actuality, however, patterns of consumption do change over time because of changes in tastes, incomes, and lifestyles. In periods of rising prices, for example, consumers attempt to substitute less expensive items for more expensive alternatives; therefore, changes in the CPI tend to overstate the changes in the average cost of living. If the price of beef, for example, increases relative to other foods, consumers will purchase more pork or tuna fish and less beef. This is, in fact, a good example of the behavior of the American consumer over the past five years. The 1980 per-capita consumption of beef in the United States is expected to be almost 20 percent lower in 1980 than in 1976, while the per-capita consumption of pork has grown 27.5 percent over the same period. Generally, any change in the price of any item is translated into the price index, regardless of competing goods and lead to changes in the quantities of goods in the CPI basket. The theoretical CPI, therefore, is a weight index, does not incorporate these changes on a regular basis.

Similar adjustments in energy consumption have clearly occurred. Sharp increases in the relative price of energy have forced consumers to use more energy, resulting in curbed consumption of products such as gasoline. In this respect, the construction of the CPI is appropriate for changes in the energy costs on the average urban family.

The Durable-goods Dilemma

The treatment of durable-goods prices is especially troublesome for any price index. An ideal measure of the current cost of living is one that will be sold in the future. In this respect, the treatment of durable-goods prices is even more complex. First, because the CPI does not distinguish between purchasing and consuming, an increase in the purchase price of a durable good is absorbed relative to their value in the consumer price index. Second, the treatment of durable-goods prices is even more complex. For example, there is the issue of whether the price of a washing machine, for example, they are in curbed consumption of products such as gasoline. In this respect, the construction of the CPI is appropriate for changes in the energy costs on the average urban family.

Changes in the value of the durable good "asset" held by current owners. Nowadays, the distinction between purchasing and consuming is more difficult than in the housing component of the index, where home owners continue to pay monthly payments and therefore are less likely to reduce expenditures on housing for inflation. For example, a 10 percent inflation reduces the value of the durable good "asset" held by current owners. Nowadays, the distinction between purchasing and consuming is more difficult than in the housing component of the index, where home owners continue to pay monthly payments and therefore are less likely to reduce expenditures on housing for inflation. For example, a 10 percent inflation reduces the value of the durable good "asset" held by current owners.

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Despite its limitations as a cost-of-living indicator, the CPI remains the most popular and widely accepted measure of inflation in the domestic economy. Constructed by the Bureau of Labor Statistics (BLS), the CPI has been a timely and reliable price statistic for over 60 years. In the past decade, it has come into extensive use in collective-bargaining agreements and in the current indexing of various pension benefits. Consequently, the CPI ranks among the most influential economic statistics published; unfortunately, it is often misused. This Economic Commentary examines the construction of the Consumer Price Index and explores some of the inherent problems that have prompted the media to cover its use in reporting its rapidly changing inflation, particularly during periods of rapidly changing prices.

The CPI: What It Is (or What It Isn't)

The Consumer Price Index is a measure of the change in the cost of a "basket" of goods and services purchased by "typical" consumers in each metropolitan area. The base period would be one in which no price changes occurred; hence, the consumer basket would be in its original (equilibrium) composition. Because such a period is virtually nonexistent, analysts are limited to approximating the ideal. Other problems involve determining the frequency of purchase, especially for durable goods, and adjusting for changes in quality. In the end, the questions of who should be surveyed for current price information, and how often the price surveys should be conducted, are technical.

Beyond the technical concerns, though, are difficulties resulting from a "fixed-basket" composition. To begin with, the basket for the average urban family, even in 1972, did not represent persons who were not part of the "average" family or who did not live in an urban community. Survey data, for example, indicate that elderly persons spend a greater percentage of their income on food and medical care and less on transportation and entertainment than urban residents. Persons living in rural areas probably spend relatively more on transportation and less on food than urban residents. The CPI-U covers approximately 70 percent of the retail expenditures of urban wage and clerical workers (CPI-U), whereas the CPI-W covers approximately 39 percent of the retail expenditures of urban wage and clerical workers, including salaried workers, retirees, unemployed persons, as well as wage and clerical workers in nonmetropolitan areas. In addition, the CPI-U covers approximately 80 percent of the nondurable goods and services purchased by families living in the central business district of the United States. The CPI-U covers 40 percent. All data reported in this Economic Commentary refer to the CPI-U.

Chart 1 Relative Importance of Various Product Groupings in the CPI, December 1979

Table 1 Twelve-month CPI Percent Changes Using Experimental Homeownership Components

1. Actually, the BLS constructs two baskets based on the 1972-73 CES study. The index for urban wage and clerical workers (CPI-W) includes only employed wage and clerical workers (CPI-W), but excludes all supplemental wage and clerical workers, including salaried workers, retirees, unemployed persons, as well as wage and clerical workers in nonmetropolitan areas. In addition, the CPI-W covers approximately 80 percent of the nondurable goods and services purchased by families living in the central business district of the United States. The CPI-W covers 40 percent. All data reported in this Economic Commentary refer to the CPI-U.

2. The theoretical construction of the CPI approximates the summation of items, where $P_{i,t}$ = current price of item i, $w_{i}$ = weight (or composition) of item i, $P_{i,1977}$ = price of item i in basket according to 1977 consumer survey, $q_{i,1977}$ = quantity of item i in basket 1977, $q_{i,1972}$ = quantity of item i in basket 1972, $\Delta q_{i}$ = change in the quantities of those goods in the consumer basket. The CPI-U tends to overstate the measured cost of housing. An ideal measure of the current cost of living must distinguish between purchasing and consuming, an increase in the purchase price of a durable good is absorbed relative to the CPI consumer pocketbook at the time of purchase, rather than distributed over the useful life of the durable good.

3. The treatment of durable goods in the construction is even more complex. We now introduce the treatment of durable goods, while all durable goods provide a service that the machine provides over its lifetime. Consumers who purchase a washing machine, for example, are in effect purchasing the regular clothes washing service that the machine provides over its lifetime. Consumers who purchase a washing machine at the time of purchase. Because the CPI does not distinguish between purchasing and consuming, the CPI-U consumer pocketbook at the time of purchase, rather than distributed over the useful life of the durable good.

4. The CPI consumption basket is revised with each census. The CPI-U covers approximately 80 percent of the retail expenditures of urban wage and clerical workers, including salaried workers, retirees, unemployed persons, as well as wage and clerical workers in nonmetropolitan areas. In addition, the CPI-U covers approximately 80 percent of the nondurable goods and services purchased by families living in the central business district of the United States. The CPI-U covers 40 percent. All data reported in this Economic Commentary refer to the CPI-U.

5. For a complete description of the technical construction of the CPI, see William H. Wallace (Federal Reserve Bank of Richmond, 1970).
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The Consumer Price Index (CPI) is commonly referred to as the "cost of living index" or as "the cost of living in the United States." The Consumer Price Index is not, however, nor should it ever be, interpreted as a definitive or an ideal measure of cost-of-living changes in the United States. Indeed, as a practical matter, such an ideal measure is probably impossible to construct. By its broadest definition, the Consumer Price Index (CPI) is a price index for a "fixed basket" of goods and services generally purchased by moderate-income urban families and single persons during 1972-73. To imply that the CPI is a measure for price changes for all goods or for all consumers exaggerates the value of the index as an inflation barometer.

Despite its limitations as a cost-of-living indicator, the CPI remains the most popular and widely accepted measure of inflation in domestic economy. Constructed by the Bureau of Labor Statistics (BLS), the CPI has been a timely and reliable price statistic since over 60 years. In the past, it has come into extensive use in collective-bargain agreements and in the current indexing of pension plans. Benefits, the CPI ranks among the most influential economic statistics published; unfortunately, it is often misused. This Economic Commentary examines the construction of the Consumer Price Index and explores some of the inherent problems that have prompted the index's evolution in its measures of inflation, particularly during periods of rapidly changing prices.

The CPI: What It Is (or What It Isn't)

Generally purchased by moderate-income urban families living in the urban centers of the United States. More specifically, it is a price index for a "fixed basket" of goods and services generally purchased by moderate-income urban families and single persons during 1972-73. To imply that the CPI is a measure for price changes for all goods or for all consumers exaggerates the value of the index as an inflation barometer.

Inherent to the construction of any price index is the problem of selecting an appropriate base period from which to construct the consumer basket. The ideal base would be one in which no price changes occurred; hence, the consumer basket would be in equilibrium (or constant).

Because such a period is virtually nonexistent, analysts are limited to approximating the ideal. Other problems include determining the frequency of purchase, especially for durable goods, and adjusting for changes in quality. The questions of "who" should be surveyed for current price information, and how often the price surveys should be conducted, are beyond the technical concerns, though, are difficulties resulting from a "fixed-basket" composition. To begin with, the basket for the average urban family, even in 1972, did not represent persons who were not part of the "average" family or who did not live in an urban community. Survey data, for example, indicate that elderly persons spend a greater percentage of their income on food and medical care and less on transportation and entertainment than working-age persons. Persons living in rural areas probably spend relatively more on transportation and less on food than urban residents. Using the CPI to assess individual cost-of-living changes for consumers other than the average urban family can be misleading.

Perhaps most important of all, CPI construction ignores the fact that the basket of goods consumed does not change from that which was consumed during the "base period" (in this instance, 1972-73). In actuality, however, patterns of consumption do change over time because of changes in tastes, incomes, and other socio-economic factors. When changes in purchasing prices, consumers attempt to substitute less expensive items for more expensive ones; therefore, changes in the CPI tend to overstate the changes in the average cost of living. If the price of beef, for example, increases relative to other foods, consumers will purchase more pork or tuna fish and less beef. This is, in fact, a good example of the behavior of the American consumer over the past five years. The 1980-per-capita consumption of beef in the United States is expected to be almost 20 percent less in 1976, while the per-capita consumption of pork has grown 27.5 percent over the same period. Generally, any change in the price of one item is reflected in the price index of competing goods and lead to change in the quantities of those goods in the consumer basket. The traditional CPI weight index, does not incorporate these changes on a regular basis.

Similar adjustments in energy consumption have clearly occurred. Sharp increases in the relative price of energy have forced consumers to economize, particularly during periods of rapidly changing prices. An ideal measure of the current cost of living, therefore, would be one in which the relative price of energy have forced consumers to economize, particularly during periods of rapidly changing prices. An ideal measure of the current cost of living, therefore, would be one in which the relative price of energy is approximately every 10 years. An "ongoing" CES analysis has been initiated by the Bureau of the Census. It should also be noted that if the "implied" weight index is used, it is not possible to distinguish between purchasing and consuming, an increase in the purchase price of a durable good is absorbed relative to the CPI consumer pocketbook at the time of purchase, rather than distributed over the useful life of the durable good.

The treatment of durable goods in the CPI is even more complex. First, we introduce the indexation for durable goods. While all durable goods provide a service over a given period of time in that they are held, in some part, as an asset that will be sold in the future. In this respect, durable goods are subject to the same inflation that is in that in that in that is expressed in the CPI weight index, does not incorporate these changes on a regular basis.

The Durable-goods Dilemma

The treatment of durable-goods prices is especially troublesome because of the distinction between purchasing and consuming. An ideal measure of the current cost of living must distinguish between purchasing and consuming. As an example of a washing machine, for example, they are in effect purchasing the regular clothing washing service rendered by the machine during its lifetime. Consumers who choose to launder at a laundromat also are purchasing laundry services, rather than machines. Where the laundromat user pays for the parts of a washing machine which he or she purchases, a fixed-basket composition means that the price index will tend to overstate the changes in the average cost of living. If the price of beef, for example, increases relative to other foods, consumers will purchase more pork or tuna fish and less beef. This is, in fact, a good example of the behavior of the American consumer over the past five years. The 1980-per-capita consumption of beef in the United States is expected to be almost 20 percent less in 1976, while the per-capita consumption of pork has grown 27.5 percent over the same period.
The index is derived by adjusting current consumer expenditures by corresponding weighting shifts from one period to another. Some part by the use of the implicit personal consumption patterns to be reflected in consumption expenditure (PCE) deflator. Constructed by the Department of Commerce, the PCE deflator also has some technical problems. Perhaps the most practical limitation of the deflator is that initial monthly estimates are quite tentative and subject to considerable revision for at least four months. It is therefore a less timely measure of inflation.

The Implicit PCE Deflator

Problems inherent in the fixed-basket approach of the CPI can be resolved in part by the use of the implicit personal consumption expenditure (PCE) deflator. Constructed by the Department of Commerce, the PCE deflator allows changes in consumption patterns to be reflected in weighing shifts from one period to another. The index is derived by adjusting current consumer expenditures by corresponding price indexes (primarily the CPI) and then dividing nominal personal consumption expenditures by the adjusted consumer expenditures. The separate price indexes that span the items in the consumer basket, therefore, are "implicitly" weighted according to actual consumption patterns. Moreover, this measure excludes new home purchases, using a rental-equivalence approximation of housing costs—in other words, the cost associated with the rent that a home owner would have been charged had he rented rather than purchased.

The PCE deflator also has some technical problems. Perhaps the most practical limitation of the deflator is that initial monthly estimates are quite tentative and subject to considerable revision for at least four months. It is therefore a less timely measure of inflation. Furthermore, although the rental-equivalence method is probably more accurate in periods of changing interest rates, it is inaccurate on the point that the stock of purchased homes can be equated with a sample of rental homes. The use of rental-equivalence for measuring rental costs—"cause goods and services in the PCE deflator are priced at a rent personal consumption expenditure (PCE) deflator include rental as "for rent personal consumption expenditure (PCE) deflator"—is a fixed basket of goods and services. How accurately the basket typifies a specific consumer depends on differences in consumption patterns of groups and individuals in the population. In periods of rapidly changing housing costs, the pattern of consumption changes, and, at times, the fixed 1972 basket will not accurately represent the consumption patterns even of an average urban family. Technical problems, such as the effect of sharply changing interest rates, add to the doubt that the CPI accurately captures cost-of-living changes. Although the PCE deflator is a useful supplement to the CPI, especially during periods of rapid change, it also has limitations. The PCE deflator is less timely. The accuracy of the rental-equivalence method for measuring housing costs is also questionable, even though it is not subject to the direct effects of sharply changing interest rates. As a cost-of-living guide, the PCE deflator does not account for the average consumer makes in his consumption basket as he substitutes less expensive alternatives for goods he would have purchased.

Experience prior to 1978 suggests that the change in consumer prices will move more consistently as the rate of change in prices slows and the effect of interest rate changes on prices becomes more consistent. Experience prior to 1978 suggests that the change in consumer prices will move more consistently as the rate of change in prices slows and the effect of interest rate changes on prices becomes more consistent.
The index is derived by adjusting current dliteratures. The separate price indexes that span dividing nominal personal consumption ex-weighting shifts from one period to another. Some part by the use of the implicit personal Constructed by the Department of Commerce, the PCE deflator allows changes in penditures by the adjusted consumer expen-ditutes, the concept of housing as the shelter that a home provides. All consumers are in-cluded in the weighting scheme, since all con-sumers require some sort of shelter. "Outlay measurements," however, assume the cost of housing is determined by the amount spent, or outlays, by consumers during the base period. Only those consumers who contracted for a mortgage payment in the base period are included in the weighting procedure. Some of the experimental measures use current interest rates, while others use a 15-year moving average of interest rates to reflect the age distribution of mortgage debt outstanding. Over the 12-month period ending in April 1980, the rate of change in consumer prices using the alternative housing methods varied from 15.7 percent (X2) to 11.7 percent (X1). In other words, the assumption chosen to measure the cost of housing materially affects rates of change of the CPI.

The Implicit PCE Deflator

Problems inherent in the fixed-basket approach of the CPI can be resolved in some part by the use of the implicit personal consumption expenditure (PCE) deflator. Constructed by the Department of Commerce, the PCE deflator allows changes in consumption patterns to be reflected in weighting shifts from one period to another. The index is derived by adjusting current consumer expenditures by corresponding price indexes (primarily the CPI) and then dividing nominal personal consumption exp-enses by the adjusted consumer expenditures. The separate price indexes that span the items in the consumer basket, therefore, are "implicitly" weighted according to consumption patterns. Moreover, this measure excludes new home purchases, using a rental-equivalence approximation of housing costs—in other words, the cost associated with the rent that a home owner would have been charged had he rented rather than purchased. The PCE deflator also has some technical problems. Perhaps the most practical limitation of the deflator is that initial monthly estimates are quite tentative and subject to considerable revision for at least four months. It is therefore a less timely measure of change. Furthermore, although the rental equivalence method is probably more accurate in periods of changing interest rates, it is accu-rate only to the point that the stock of pur-chased homes can be equated with a sample of rental homes. The sample of rental homes must display similar characteristics to those of purchased homes, such as size and location, for the deflator to reflect changes in rental prices. Even the changing composition of the consumer basket in the PCE deflator has limitations in assessing changes in the average cost of living. As substitution between consumer goods and services occurs, the deflator will tend to underestimate the rate of change in fixed-basket consumer prices; consumer sac-rifices incorporated into the implicit PCE de-flator are calculated on the assumption of about cost-of-living changes. Moreover, be-cause goods and services in the PCE deflator change in every period, comparing indexes for periods other than the base period is mis-leading to those who assume that index changes result purely from changes in price. Index changes between periods contain changes in price and changes in composition of the basket.6 Behavior of the CPI and the PCE deflator can vary widely over short periods of time, although over more lengthy periods the differ-ences are much less pronounced (see chart 2). For the most part, the two price measures moved reasonably parallel between 1977 and 1976. After 1976, the two indexes behaved less similarly; since early 1978 the rate of change in the CPI has been well above that of the PCE deflator. Most of the current de-viations stem from definitional differences in the treatment of the home-ownership costs and the effect of rising interest rates on the CPI. Further, the implicit PCE consumer price indexes from time to time reflect changes in the composition of the consumer basket.

Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>IQ 1976</th>
<th>1976</th>
<th>1978</th>
<th>CPI 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline and oil</td>
<td>3.4</td>
<td>3.0</td>
<td>3.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Fuel oil and coal</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>a. Inclines hot dist. gas.</td>
<td></td>
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</tbody>
</table>

5. The purpose of the experimental home-own-ership measures is to provide CPI users with a range of housing cost possibilities. For a thorough description of the measures and their impact on the CPI, see U.S. Department of Labor, Bureau of Labor Statistics, CPI Issues, Issue 963, February 1980.

6. The theoretical construction of the implicit price deflator approximates the summation

\[ \sum p_i q_i \times 100, \]

where

- \( p_i \) = current prices of item \( i \)
- \( q_i \) = weight of item \( i \) according to current personal consumption expendi-tures.

7. The Department of Commerce constructs a "basket price index" that weights the composi-tion of output in the prior period and, there-fore, reflects the change in prices between two periods. This index, however, is limited to price changes between two consecutive de-riodic periods of "basket" CPI goods, which are constructed, although, fundamentally, it is subject to similar criticism to the CPI in terms of composition-related over-states in prices.

8. For a more thorough discussion of the CPI's fixed basket in periods of changing prices. The weight of energy in the consumer basket, for example, has changed considerably over time. As a result, when a home owner changes homes, the composition of the home owner's outlay will change. The implicit PCE deflator is different from the CPI in that it is able to capture cost-of-living changes. Although the PCE deflator is a useful supplement to the CPI, especially during periods of change, it also has limitations. The implicit PCE deflator is less timely. The accuracy of the rental-equivalence method for measuring housing costs is also questionable, even though it is not subject to the direct effects of sharply changing interest rates. As a cost-of-living guide, the PCE deflator does not account for the sacrifices that the average consumer makes in his consumption basket as he substitutes less expensive alternatives for goods he would have purchased. Experience prior to 1978 suggests that these changes in consumer prices will behave more consistently than the rate of change in prices in goods and services and the effect of in-terest rates on the CPI weaken. It is impor-tant, however, to recognize that the process of measuring cost-of-living changes is difficult. Limitations in data and problems inher-ent in the construction of price indexes in-clude that any product will fall short as an absolute measure of inflation.

In this issue: The Consumer Price Index: Concepts, Construction, and Controversy

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