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# A Comparison of the CPI and the PCE Price Index

By *Todd E. Clark*

In the United States, there are two broad indexes of consumer prices: the consumer price index, or CPI, and the chain price index for personal consumption expenditures, or PCEPI. Because the indexes are similar in many respects, the inflation rates measured with them often move in parallel. There are, however, some important differences, which, at times, can lead to large gaps between CPI and PCEPI inflation rates. In 1998, for example, the CPI rose 1.5 percent, while the PCEPI increased just 0.7 percent. The discrepancy was even larger excluding food and energy prices: the core CPI grew 2.4 percent in 1998, while the core PCEPI rose just 1.2 percent.

Such gaps between CPI and PCEPI inflation rates raise a simple question: Is one index better than the other? From a monetary policy perspective, an index could be superior in two respects. First, one of the price indexes might be a more accurate measure of inflation today and in the very recent past. To gauge progress toward price stability over the past year, for example, a policymaker would like to know if either the CPI

or PCEPI more accurately measures consumer price inflation today. Second, one of the indexes could be a superior measure of historical inflation rates. A policymaker would probably want to use the better historical indicator for gauging long-term price trends and developing inflation forecasting models.

Because some observers have recently suggested the PCEPI may be a better price index, this article examines whether the PCEPI is truly superior to the CPI. The first section reviews the differences in the construction of the indexes. The second section examines the advantages and disadvantages of the CPI and PCEPI. The article concludes that, while some observers might weigh the many pros and cons of the indexes differently, with recent improvements the CPI is the better price index.

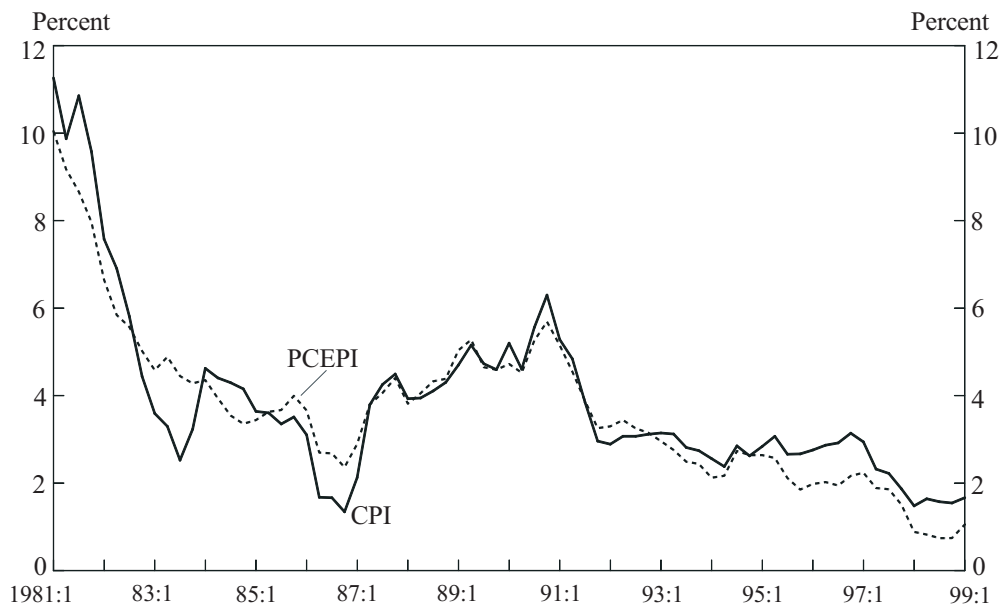
## I. DIFFERENCES BETWEEN THE CPI AND PCEPI

The CPI and PCEPI measure, in different ways, the average change in the prices of goods and services purchased by consumers. Because the indexes are broadly similar, CPI and PCEPI inflation rates generally move together (Chart 1). However, large discrepancies sometimes occur. For example, the largest gap of the 1990s occurred in 1996, when CPI inflation was 0.9

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Chart 1  
INFLATION IN THE CPI AND PCE PRICE INDEX



Note: Data are four-quarter rates of change.

Sources: Bureau of Economic Analysis and Bureau of Labor Statistics.

percentage point higher than PCEPI inflation (Q4/Q4). Such discrepancies in measured inflation are due to differences in the construction of the price indexes. Specifically, the CPI and PCEPI differ in formula, scope, weights, prices, and the treatment of revisions.<sup>1</sup> The core CPI and core PCEPI, often viewed as less volatile indicators of inflation trends, vary in the same ways, so this article focuses on the overall price indexes.

### Formula

The CPI and PCEPI use different formulas to measure average price change. The Bureau of Labor Statistics (BLS) constructs the CPI as a fixed-weight average of prices for individual goods and services, based on a Laspeyres formula defined in the accompanying box (U.S. Department of Labor 1997). In particular, the index

measures the change in the cost of the typical set of goods purchased by consumers in some base period. Historically, the base-period market basket of the CPI has been updated about once every ten years. Since January 1998, the index has been based on 1993-95 purchasing patterns. Beginning in 2002, the BLS will update the market basket every two years (U.S. Department of Labor 1999).

The Bureau of Economic Analysis (BEA) constructs the PCEPI with a chain-weight Fisher Ideal formula (Seskin and Parker).<sup>2</sup> The index is an average of two different fixed-weight measures of overall price change. In measuring inflation from the past year to the current year, one fixed-weight index uses the past year's composition of purchases to weight individual price changes, while the other index uses the current

year's purchases to weight individual price changes. By averaging the two fixed-weight price indexes, the PCEPI allows for broad year-to-year changes in the basket of goods and services purchased by consumers. Particularly, the index allows for shifts across general categories of goods, such as from oranges to apples.

### *Scope*

In addition to using different formulas, the CPI and PCEPI cover distinct sets of goods and services. Reflecting differences in measurement objectives, the PCEPI is broader in scope than the CPI.<sup>3</sup> The BEA produces the PCEPI, along with other data such as gross domestic product, as part of the National Income and Product Accounts. The price index measures the average change in the prices of purchases classified as personal consumption expenditures (PCE). Personal consumption generally refers to spending on goods and services by U.S. residents and the nonprofit institutions, such as welfare and religious organizations, serving them (Seskin and Parker; U.S. Department of Commerce). PCE also includes some consumption funded by government agencies, such as medical expenses covered by Medicare and Medicaid. In addition, PCE is defined to cover the estimated value of certain items consumers obtain without explicit charge. These items include free financial services, such as checking accounts, and employer-funded medical care and insurance.

Because the BLS designed the CPI to approximate the typical urban consumer's cost of living, the index covers only out-of-pocket expenditures by urban households. Accordingly, the CPI excludes some PCEPI items, such as financial services provided without charge and spending by religious and welfare institutions. In total, about 10 percent of PCE spending lies completely outside the scope of the CPI.<sup>4</sup> Moreover, for some items covered in both price indexes, the CPI does not reflect certain sources of spending included in the PCEPI. For example, the CPI excludes spend-

ing by rural households. The CPI also excludes employer-paid insurance and medical care funded by Medicare and Medicaid. In total, about 25 percent of PCE spending is not reflected in the CPI.

### *Weights*

In part reflecting differences in scope, the weights assigned to specific items differ across some components of the CPI and PCEPI. For example, medical care receives a much larger weight in the PCEPI than in the CPI because the PCEPI includes expenditures by employers, while the CPI does not. Physician services, for instance, have a weight of roughly 4 percent in the PCEPI but only 1.5 percent in the CPI.<sup>5</sup>

Even after adjusting for scope, differences in item definitions and source data on expenditures lead to differences in the weights in the CPI and PCEPI. The weights in the CPI are expenditure shares derived from the Consumer Expenditure Survey, which directly asks consumers how much they spend. The weights in the PCEPI are expenditure shares derived from PCE, which is estimated from surveys of sales by businesses. For some goods and services, the Consumer Expenditure Survey and PCE use different item definitions, causing measured spending on the item to vary (Branch). For example, the consumer survey defines spending on new vehicles as the net amount paid, taking trade-in values into account, while PCE defines spending on new vehicles as the gross amount paid. Even for items defined in the same terms, surveys of consumer expenditures and business sales can produce different estimates of spending (Branch). Thus, the weights in the CPI and PCEPI differ for many components, most notably for housing. Owner's equivalent rent, which measures the value of the shelter services an owner receives from his home, has a weight of more than 20 percent in the CPI but only about 11 percent in the PCEPI.<sup>6</sup>

### TECHNICAL FORMULA DETAILS

This box defines three technical elements of the construction of price indexes: the Laspeyres formula, the chain-weight Fisher Ideal formula, and geometric means.<sup>7</sup> In this box,  $p_{i,t}$  refers to the price of good  $i$  in period  $t$ , and  $q_{i,t}$  is the quantity of good  $i$  purchased in period  $t$ .

#### *Laspeyres formula*

The Laspeyres formula used in the CPI compares the cost of purchasing some base-period basket of goods at today's prices to the cost at base-period prices. Formally, using  $t = 0$  to denote the base period, the Laspeyres index  $L_t$  is defined as

$$L_t = \frac{\sum_i p_{i,t} q_{i,0}}{\sum_i p_{i,0} q_{i,0}}.$$

This Laspeyres index can also be expressed as a weighted average of changes in good prices from the base period to today, with weights equal to base-period expenditure shares:

$$L_t = \sum_i w_{i,0} \frac{p_{i,t}}{p_{i,0}}, \quad w_{i,0} = \frac{p_{i,0} q_{i,0}}{\sum_i p_{i,0} q_{i,0}}.$$

#### *Chain-weight Fisher Ideal formula*

The chain-weight Fisher Ideal formula used in the PCEPI averages a measure of price change based on the quantities pur-

chased last period with an index of price change based on the quantities purchased this period. Formally, the chain price index  $F_t$  is

$$F_t = \left[ \frac{\sum_i p_{i,t} q_{i,t-1}}{\sum_i p_{i,t-1} q_{i,t-1}} \times \frac{\sum_i p_{i,t} q_{i,t}}{\sum_i p_{i,t-1} q_{i,t}} \right]^{1/2}.$$

The first ratio in this formula is a Laspeyres index that compares the cost of last period's purchases at today's prices to the cost at last period's prices. The second ratio, known as a Paasche index, compares what the goods purchased this period cost today relative to last period. The PCEPI is a geometric average, or the square root of the product, of Laspeyres and Paasche indexes.

#### *Geometric means*

The BLS constructs the CPI in two stages. In the first, prices for specific products are combined to form price indexes for broad categories of goods, such as apples and oranges. In the second step, the overall CPI is calculated from the price indexes for categories of goods. Although the details of actual CPI procedures are complicated, until recently the BLS essentially used a Laspeyres formula in both the first and second stages. In January 1999, however, the BLS adopted a geometric means approach to forming the first-stage price indexes for

## TECHNICAL FORMULA DETAILS - continued

most components of the CPI. Specifically, the basic formula used to combine prices in the first step of producing the CPI changed from

$$\sum_i w_{i,0} \frac{p_{i,t}}{p_{i,0}}$$

to

$$\prod_i \left( \frac{p_{i,t}}{p_{i,0}} \right)^{w_{i,0}}$$

The old first-stage index is a weighted sum, or arithmetic mean, of price changes. The new index is a weighted product, or geometric mean, of price changes.

*Prices*

Reflecting the same basic factors that cause the weights in the CPI and PCEPI to differ, some of the underlying price information in the indexes varies. The differences are limited to a modest number of items because, generally, the price measure used in the PCEPI is a component index of the CPI.<sup>8</sup> For example, the prices of magazines and newspapers in the PCEPI are measured with CPI indexes for these goods (U.S. Department of Commerce). For items not included in the CPI, however, the PCEPI must rely on other price sources. For example, the BEA constructs price measures for the estimated value of financial services provided without charge and spending by religious and welfare institutions. The PCEPI also incorporates non-CPI price information when the coverage of the indexes differs substantially and an alternative price source has coverage closer to the PCEPI.<sup>9</sup> For example, the PCEPI tracks the prices of physicians' services with a producer price index that reflects all payments to physicians rather than just out-of-pocket expenditures by consumers. Similarly, because private education expenditures are measured very differently in the CPI and PCEPI, the PCEPI uses non-CPI sources to track the price of private education.<sup>10</sup>

For some of the components for which the PCEPI uses non-CPI information, inflation as measured in the CPI can differ substantially from inflation as measured in the PCEPI.<sup>11</sup> For instance, in 1998, the CPI for physicians' services increased 3.4 percent (Q4/Q4), while the comparable PCEPI component rose 2.2 percent. As another example, the price of private elementary and secondary education increased 6.0 percent in the CPI but only 1.3 percent in the PCEPI.

*Treatment of revisions*

Finally, the two price indexes also differ in that the CPI is essentially never revised, while the PCEPI is subject to continual revision. The BLS revises the CPI only to update seasonal adjustment factors, typically with very little effect on measured inflation.<sup>12</sup> When methodological improvements are introduced in the CPI, the changes only affect current and future values of the index. The BLS does not update the historical data to reflect methodological changes. In January 1999, for example, CPI procedures were modified to allow substitution across specific items within general categories, such as from ice cream to frozen yogurt (Dalton, Greenlees, and Stewart). Formally, the BLS adopted a geometric

means approach to calculating price indexes for broad product categories. The change has affected CPI values only since January, because previous values of the index are still based on the old methodology. By producing an index that, apart from seasonal factors, is not revised, the BLS facilitates the use of the CPI for indexing wages and government benefits, such as social security payments.

In contrast, the BEA routinely revises the PCEPI. The initial estimate of the index for a quarter is updated twice in the months immediately following the release, to reflect more complete source data. Then, in the summer of each year, the BEA usually revises PCEPI data for the previous three years, updating the index to incorporate more complete source data and methodological improvements. Such improvements may include changing the source of price information for some particular item when a new, more accurate price measure has become available. Finally, the PCEPI is usually updated about every five years with benchmark revisions of the NIPA accounts. These comprehensive revisions incorporate complete source data and further methodological changes. To the fullest extent possible, any methodological updates are applied to the entire history of the price index. In the benchmark revision of 1995, for example, the BEA shifted the main price index for PCE from a fixed-weight Laspeyres basis to the current chain-weight Fisher Ideal basis. The BEA used the chain-weight formula to produce historical PCEPI data back to 1959.

These routine revisions can substantially affect the PCE price index. Measuring inflation as an annualized one-quarter percent change, from 1976:Q1 to 1998:Q4 the average gap between the initial estimate of inflation and the estimate calculated with the data available today is roughly 0.6 percentage point.<sup>13</sup> With inflation measured as a four-quarter percent change, the gap averages about 0.3 percentage point. Most of the difference between the estimates initially released and the estimates based on today's data is attributable to

annual and benchmark revisions.<sup>14</sup> The two revisions that occur immediately following an initial release have tended to be very small.

Overall, despite sharing price information for many specific items, the CPI and PCEPI differ along many dimensions. Table 1 provides a broad summary. The differences between the CPI and PCEPI may sometimes cause inflation rates measured with the indexes to diverge. Some of the recent gap is due to formula differences in the indexes.<sup>15</sup> Based on Fixler and Jaditz's detailed reconciliation of CPI and PCEPI inflation rates from 1992 to 1996, little of the recent discrepancy can be attributed to the PCEPI's inclusion of some items not covered in the CPI. Much of the gap between inflation rates is likely due to differences in weights and prices.

## II. PROS AND CONS

In light of the many differences between the CPI and PCEPI, is one index clearly superior? Because both indexes have pros and cons, the answer is partly a matter of judgment. This section argues that, although the PCEPI offers some advantages, recent improvements make the CPI the better price index. The formula underlying the PCEPI is somewhat better than the CPI formula. In scope and weights, neither index is clearly better. The price differences between the indexes favor the CPI. Finally, neither the CPI nor the PCEPI has an advantage in the way the indexes are revised over time. Weighing these factors, the CPI's price advantage is more important than the PCEPI's formula advantage. The section concludes by discussing some implications for monetary policy.

### *Formula*

The formula difference gives the PCEPI an advantage over the CPI. The CPI's fixed-weight Laspeyres formula causes the index to systematically overstate inflation.<sup>16</sup> The CPI assumes consumers make no shifts in their broad pur-

Table 1

## A SUMMARY OF THE DIFFERENCES BETWEEN THE CPI AND PCEPI

Category	Differences
<i>Formula</i>	The CPI uses a fixed-weight Laspeyres formula, with weights determined by base-year expenditures. The PCEPI uses a chain-weight Fisher Ideal formula.
<i>Scope</i>	The PCEPI is broader in scope. The CPI covers out-of-pocket expenditures by urban consumers. The PCEPI also covers spending by rural consumers; nonprofit institutions that serve consumers; medical care and insurance funded by government and employers; and imputed financial services.
<i>Weights</i>	Weight differences reflect differences in: scope, item definitions, and sources of expenditure data.
<i>Prices</i>	Although most of the detailed item prices in the PCEPI are CPI indexes, the PCEPI relies on non-CPI price information for items not included in the CPI and items having substantially different coverage in the CPI and PCEPI.
<i>Treatment of revisions</i>	The CPI is essentially never revised, but the PCEPI is continually revised.

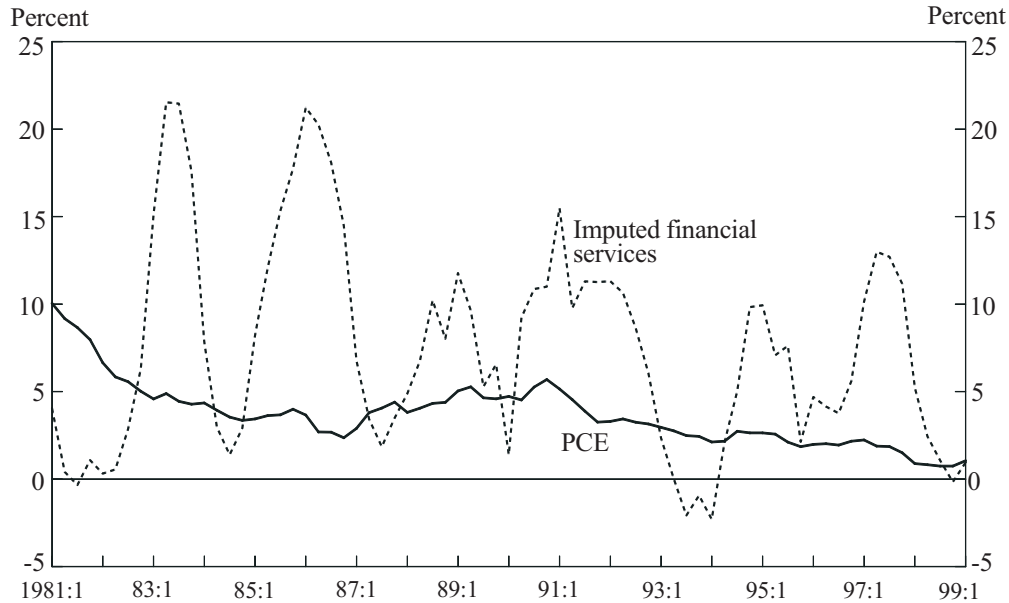
chasing patterns when prices for similar goods and services change by differing amounts. In fact, however, consumers will likely substitute from oranges to apples, for example, if the price of oranges rises relative to the price of apples. As a consequence, the CPI suffers a broad, or so-called upper-level, substitution bias (Advisory Commission to Study the Consumer Price Index). In contrast, the chain-weight Fisher Ideal formula used in the PCEPI allows for changes in broad purchasing patterns. Therefore, the PCEPI is free of upper-level substitution bias and, in this respect, provides a more accurate measure of inflation.

Four factors, though, limit the importance of the PCEPI's formula advantage. First, the upper-level substitution bias in the CPI is small, averaging about 0.2 percentage point per year (Advisory Commission to Study the Consumer Price Index; Shapiro and Wilcox 1996).<sup>17</sup> Second,

the average bias appears to be precisely estimated, in the sense that different studies have yielded similar estimates. So although the bias varies from year to year, on average the substitution bias in the CPI can be corrected by simply subtracting 0.2 percentage point from the measured CPI inflation rate. Third, the accuracy of initial estimates of the PCEPI may be limited by incomplete data. An estimate of the most recent quarter's PCEPI requires data on expenditure patterns in the current quarter and the preceding quarter. In practice, because spending data for many items are only available on an annual basis, the BEA uses judgmental trends to estimate roughly 20 percent of PCE.<sup>18</sup> When the BEA replaces the judgmental trend estimates with source data in each annual revision, the PCEPI for recent quarters could be revised substantially. Finally, in the near future, a version of the CPI that is free of upper-level substitution

Chart 2

### INFLATION IN THE PCE PRICE INDEX AND THE PCE PRICE INDEX FOR IMPUTED FINANCIAL SERVICES



Note: Data are four-quarter rates of change.  
Source: Bureau of Economic Analysis.

bias will become available. The BLS has announced plans to begin publishing in 2002 a version of the CPI based on a formula like the Fisher Ideal.

#### Scope

While the formula difference gives the PCEPI a slight edge, the broader scope of the PCEPI compared to the CPI is neither an advantage nor a disadvantage. In general, as noted by Freedman, broader is not necessarily better. Some analysts might argue monetary policy should focus on the broadest index of consumer prices available because inflation imposes costs that potentially affect all spending by consumers as well as other sources of spending that benefit consumers.<sup>19</sup> By this reasoning, the PCEPI is superior because the index covers both urban and rural consumers, the

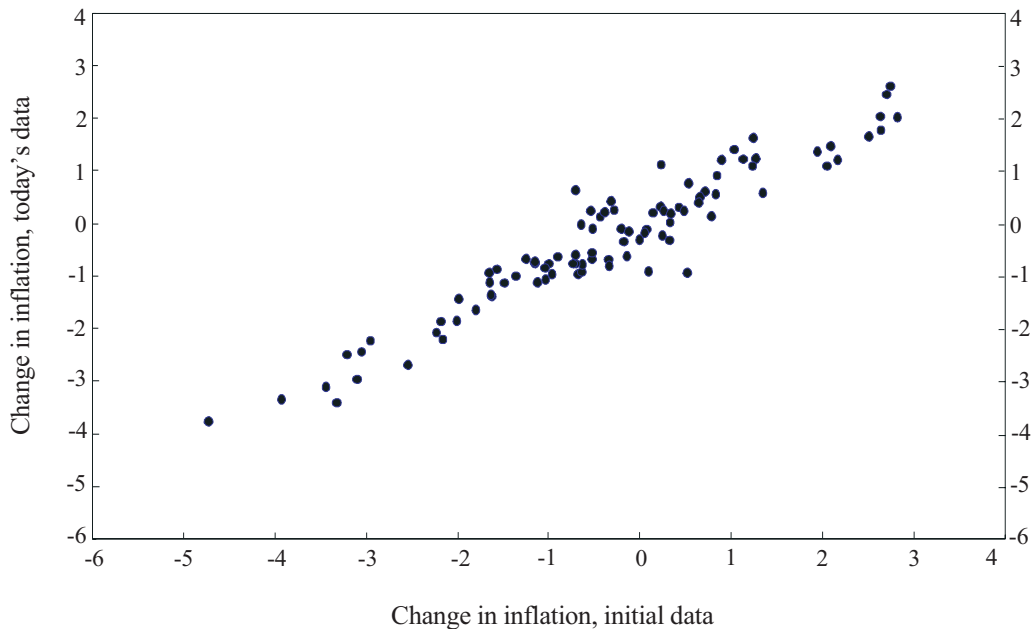
nonprofit institutions serving consumers, and certain services provided for free or by government and employers.<sup>20</sup> Yet other analysts argue monetary policy simply should focus on the most accurate measure of the cost of living (Fortin). This argument may be viewed as suggesting the CPI is superior because, in the opinion of some experts in price measurement, the index provides the best available approximation to the typical consumer's cost of living (Advisory Commission to Study the Consumer Price Index; Shapiro and Wilcox 1996).

More specifically, experts disagree on whether the CPI's narrow medical care coverage or the PCEPI's broad coverage is more appropriate. Some analysts believe the scope of a consumer price index should be defined to make the index appropriate for indexing wage con-



Chart 3

## CHANGES IN PCE PRICE INDEX INFLATION, INITIAL DATA VS. TODAY'S DATA



Notes: Inflation rates are calculated as four-quarter rates of change. Data are inflation over the most recent four quarters less inflation over the previous four quarters.

Sources: Bureau of Economic Analysis and author's calculations.

tracts. Because consumers use their wages to pay for out-of-pocket spending, the price index should cover just out-of-pocket expenditures. Employer-funded medical care, for example, is a benefit, rather than earned income, and therefore should be excluded from the index. In this view, the CPI is superior, because the index limits medical coverage to out-of-pocket expenditures.<sup>21</sup> Some experts, however, argue a consumer price index should provide a comprehensive measure of the cost of living and cover all, not just out-of-pocket, medical expenditures (Advisory Commission to Study the Consumer Price Index; Shapiro and Wilcox 1996). By this reasoning, the broader coverage of the PCEPI is more appropriate.

### Weights

As with scope, neither the CPI nor the PCEPI has a clear advantage in weights. Despite some substantial differences, the weights in one price index are not necessarily more accurate than the weights in the other (Triplett 1997). The CPI offers the advantage that the index's weights are based on direct measures of household expenditures, provided by the Consumer Expenditure Survey. But two problems limit the accuracy of the direct measures of spending patterns. First, respondents to the expenditure survey may deliberately understate spending on so-called sin items such as tobacco products and alcoholic beverages.<sup>22</sup> For example, spending on alcoholic

beverages as measured for the CPI is about 40 percent of spending as measured for the PCEPI (Branch; Triplett 1997). Second, imperfect recall may cause consumers to inadvertently understate spending on some items, although the Consumer Expenditure Survey requires each respondent to keep a diary of small purchases, for which recall problems are likely to be greatest.

Similarly, the weights in the PCEPI have pros and cons. The PCEPI offers the advantage that the index's weights, calculated from PCE, are based on large surveys of sales by businesses, which generally keep careful records. However, PCE is an indirect measure of consumer spending. The BEA estimates consumer spending by subtracting sales to businesses and governments from total sales. At the detailed item level, the available data do not clearly distinguish sales to consumers from sales to businesses and governments.<sup>23</sup> Thus, it is not clear whether the weights in the PCEPI are any more or less accurate than the weights in the CPI.

### *Prices*

In contrast, the price differences between the CPI and PCEPI give the CPI an important edge. The accuracy of some of the PCEPI components that lie outside the scope of the CPI is highly uncertain, and perhaps questionable. One particularly problematic component is financial services provided without charge. At present, the BEA imputes a price for the value of these services by combining data on employment in financial institutions with interest rate revenues net of expenditures (U.S. Department of Commerce). This approach produces a highly volatile price estimate that can significantly affect inflation in the PCEPI (Chart 2). In 1998, for example, a sharp deceleration in the price index for imputed financial services slowed PCEPI inflation. Although the BEA may introduce some improvements to the treatment of financial services in October, the price of the imputed services will remain difficult to estimate because the services are provided without charge.

Moreover, it could be argued the PCEPI's approach to measuring certain components differs from the approach that should be taken by a cost of living index. One of these components is spending by nonprofit institutions such as religious and welfare organizations. In PCE, nonprofits' spending is measured by the operating expenses of the institutions. Therefore, the PCEPI tracks the price of nonprofits' spending with indexes of input costs, principally wages. Arguably, however, an index of the cost of living should rely on price indexes for the value of the services provided to consumers by nonprofit institutions. A second potentially problematic component is private education. Because PCE tracks the operating expenses of private educational institutions, the BEA bases the education price index used in the PCEPI primarily on measures of wages paid by the institutions. Again, though, an index of the cost of living should track education using prices paid by consumers, as the CPI does.

Despite problems with several PCEPI components, the prices of a few goods and services have sometimes been measured more accurately in the PCEPI than in the CPI. Many observers believe that, over much of the 1990s, the medical care price indexes in the PCEPI have been more accurate than the indexes in the CPI. For example, the CPI failed to adequately capture the effects of advancing medical technology on the cost of living, particularly the cost savings associated with a treatment shifting from an inpatient to outpatient basis. The PCEPI's primary source of medical care prices, PPIs, have more fully incorporated the benefits of improved technology (Advisory Commission to Study the Consumer Price Index).<sup>24</sup> Over the past few years, however, the BLS has taken steps to better measure the cost of medical treatment in the CPI. Thus, at present the PCEPI has little or no advantage over the CPI in accuracy of medical care prices. Similarly, over much of the 1990s analysts believed computer prices were measured more accurately in the PCEPI than in the CPI. The PCEPI relied on PPI indexes of computer

prices, which, unlike the CPI, appeared to properly adjust the market prices of computers for quality improvements.<sup>25</sup> However, when the CPI began using appropriate quality adjustment methods last year, the BEA switched to measuring computer prices in the PCEPI with the improved CPI index.

### *Treatment of revisions*

Finally, contrary to appearances, the BEA's approach to revising the PCEPI over time does not give the index an advantage over the CPI. Some analysts believe the PCEPI is superior because, at any point in time, the BEA constructs the historical data for the index using the current, best-available methodology, producing a data series that is measured consistently over time. In contrast, historical CPI data are not revised to reflect methodological improvements, and the index is therefore not measured consistently over time. However, in June 1999 the BLS began making available an estimated CPI series for 1978-98 that is based on current methods (Stewart and Reed). This current-methods index incorporates most, although not all, of the improvements made to the published CPI since 1978.<sup>26</sup> Thus, for the CPI and PCEPI, there exist historical data that reflect, to the extent possible, current methods.<sup>27</sup>

Although some observers may be concerned that large revisions limit the usefulness of a price index to monetary policymakers, evidence from the PCEPI suggests otherwise. Revisions to the PCEPI have little effect on the underlying inflation trends measured with the index.<sup>28</sup> From 1976:Q1 to 1998:Q4, the year-over-year change in inflation measured with initially released PCEPI data is very closely related to the change calculated with the data available today (Chart 3).<sup>29</sup> The direction of change is the same in the initial data and today's data in 87 percent of the quarters of this period.

### *Implications for monetary policy*

Ultimately, differences in the treatment of revisions

and other dimensions give the CPI both advantages and disadvantages compared with the PCEPI. Table 2 summarizes this article's assessment of the pros and cons of each index.

Although some observers might reach a different conclusion, the evidence reviewed in this section indicates the CPI is a better index for monetary policy in two general respects. First, in light of recent improvements, the CPI provides a more accurate measure of inflation today and in the recent past. While the formula difference gives the PCEPI a modest edge, price differences give the CPI an important advantage. Most importantly, the PCEPI includes some item prices of uncertain, and perhaps questionable, accuracy. Second, with the recent publication of the current-methods index, the CPI provides a better measure of historical inflation, although the superiority of the CPI is less clear in historical data than in current data. The price differences that make the CPI a better indicator of current inflation also make the current-methods CPI more accurate than the PCEPI as a measure of past inflation. However, the price advantage of the CPI in historical data is tempered by the inability of the current-methods index to incorporate all of the changes that have improved the accuracy of CPI prices.

## III. CONCLUSIONS

Although the CPI and PCEPI are similar measures of consumer prices, the indexes vary along many dimensions. The CPI and PCEPI use different formulas for computing average price change and cover somewhat different types of spending. Moreover, specific item weights and prices differ between the indexes. Finally, the treatment of revisions over time varies across the CPI and PCEPI.

In this article's assessment, the differences between the CPI and PCEPI make the CPI superior, in part reflecting some recent improvements to the index. The PCEPI has an edge in formula, while the CPI has an advantage in specific item

*Table 2*  
A SUMMARY OF THE PROS AND CONS OF THE CPI AND PCEPI

<i>Category</i>	Pros and cons
<i>Formula</i>	<p>The PCEPI has a modest advantage.</p> <p>The PCEPI avoids the substitution bias that affects the CPI.</p> <p>However, the substitution bias is small, and inflation in the CPI can be readily adjusted for the bias.</p> <p>Moreover, in 2002 the BLS will begin publishing a version of the CPI that uses a PCEPI-like formula.</p>
<i>Scope</i>	<p>Neither index has a clear advantage.</p> <p>Some argue monetary policy should focus on a broad index, which would favor the PCEPI.</p> <p>Others argue monetary policy should rely on the best measure of consumers' cost of living, which would favor the CPI.</p>
<i>Weights</i>	<p>Neither index's weights are clearly more accurate.</p> <p>The CPI weights are based on direct measures of household spending. But consumers may deliberately understate or poorly remember spending on some items.</p> <p>The PCEPI weights are based on surveys of sales by firms. But consumer spending is measured by subtracting sales to business and government from total sales. For specific items, data distinguishing consumer, business, and government sales do not exist.</p>
<i>Prices</i>	<p>The CPI has an important advantage.</p> <p>The accuracy of PCEPI components outside the scope of the CPI – particularly, free financial services – is uncertain and even questionable.</p> <p>If the PCEPI is to be viewed as an index of the cost of living, some components of the PCEPI, such as private education, should be based on the prices paid by consumers rather than an index of operating costs.</p> <p>However, some PCEPI prices, such as medical care prices, have sometimes been more accurate than the corresponding CPI measures. Recent improvements to the CPI have reduced these differences.</p>
<i>Revisions</i>	<p>Neither index has an advantage.</p> <p>The revision process makes the PCEPI historically consistent. Although the published CPI is not historically consistent, a consistent CPI estimate based on current methods is now available.</p> <p>While revisions to the PCEPI can be large, the updates have little effect on the underlying inflationary trends measured with the index.</p>

prices. Neither index is clearly superior in scope, weights, or the treatment of revisions. Although some observers might weigh the pros and cons of the indexes differently, the analysis in this article

suggests the considerable price advantage of the CPI outweighs the modest formula advantage of the PCEPI.

## ENDNOTES

<sup>1</sup> Fixler and Jaditz provide the most recent, comprehensive review of differences between the CPI and PCEPI, for the purpose of investigating the sources of the recent divergence in inflation rates. Clark and Steindel briefly examine the merits of the PCEPI compared with the CPI.

<sup>2</sup> Although the CPI is published monthly, the PCE price index discussed in this article is a quarterly series. The BEA does not publish a monthly version of the PCEPI or, more important, the core PCEPI. While the BEA does release a monthly index comparable to the PCEPI, the PCE deflator, no monthly index comparable to the core PCEPI is available.

<sup>3</sup> At present, the PCEPI excludes only one component of the CPI – fees for lessons and instructions. As of December 1998, these fees had a relative importance of 0.2 percent in the CPI.

<sup>4</sup> In 1998, for example, the Fixler and Jaditz list of PCE components completely excluded from the CPI represented 10.9 percent of nominal PCE spending. The most important of these components were free financial services provided by banks and other financial institutions, which totaled 3.5 percent of PCE.

<sup>5</sup> The share of physicians' services in nominal PCE was 3.7 percent in 1998. The relative importance of physicians in the CPI was 1.5 percent in December 1998.

<sup>6</sup> Adjusting fully for differences in scope raises the importance of housing in PCE. Owner's equivalent rent accounts for about 14 percent of scope-adjusted PCE.

<sup>7</sup> Shapiro and Wilcox (1996) review the construction of the CPI. Seskin and Parker present the basics of the construction of the PCEPI.

<sup>8</sup> As noted by Triplett (1997), PCE components priced with CPI indexes account for about three-fourths of nominal PCE.

<sup>9</sup> For items defined similarly by the indexes, the PCEPI may incorporate non-CPI information if the accuracy of the CPI price index is deemed questionable. Before August 1998, for example, concerns about the accuracy of the CPI for computers led the BEA to use other computer price measures in the PCEPI. At present, airline transportation is the only comparably defined item for which the PCEPI uses non-CPI

information. However, effective with October's benchmark revision the BEA may switch to pricing airline transportation with just the CPI.

<sup>10</sup> The CPI measures consumers' out-of-pocket expenditures on private education. In PCE, however, the value of private education is defined as the schools' operating expenses. Accordingly, in lieu of CPIs for private education, the PCEPI uses indexes constructed from measures of input costs, primarily wages.

<sup>11</sup> Even among PCEPI components based solely on detailed CPI prices, inflation as measured in the CPI and PCEPI can sometimes differ. As noted by Fixler and Jaditz, at present any such gaps would appear to be the result of different seasonal adjustment methods.

<sup>12</sup> The BLS also occasionally revises the CPI to correct data collection or processing errors.

<sup>13</sup> The magnitude of revisions is measured using data obtained from the *Survey of Current Business*. These data are the initial estimate of the price index for each quarter and the estimates available at that time for each of the previous four quarters. The price index is measured on a fixed-weight basis through 1995:Q3 and a chain-weight basis beginning in 1995:Q4. The gap between estimates of inflation is the mean absolute value of the difference in rates.

<sup>14</sup> The recent adoption of the chain-weight Fisher Ideal formula is unlikely to reduce the quantitative effects of benchmark revisions very much. Although the adoption of chain weights has eliminated the updating of the base-year weights that was necessary with the old fixed-weight index, other types of source data updates and methodological improvements seem likely to continue to produce substantial revisions to the PCEPI.

<sup>15</sup> In data prior to 1999, the formula gap between the CPI and PCEPI reflects two differences. One is the formula difference described above. The other is the use of geometric means in the PCEPI but not the CPI.

<sup>16</sup> The practice of updating the weights in the CPI only once every ten years has given the PCEPI another formula-related advantage in the past. Specifically, the PCEPI

has sometimes been faster to incorporate new goods. For example, the PCEPI incorporates the price of VCRs beginning in the late 1970s, about the time the recorders were introduced. The CPI did not cover VCRs until 1987. The delayed introduction of new goods creates an upward bias in the CPI (Advisory Commission to Study the Consumer Price Index; Shapiro and Wilcox).

<sup>17</sup> The 0.2 percentage point estimate is based on CPI estimates using data ending in 1997. Comparing the chain-price PCEPI with the fixed-weight PCE price index still available suggests a somewhat larger bias in the last few years. Because computers had a much lower weight in the CPI than in the PCEPI prior to 1998, steep declines in quality-adjusted computer prices and rapidly growing sales may explain the larger bias evident from the PCE price indexes.

<sup>18</sup> The 20 percent figure is based on the U.S. Department of Commerce list of components estimated by judgmental trend.

<sup>19</sup> Fisher argues the theoretically appropriate price index for monetary policy should cover all transactions made in an economy (Wynne and Sigalla). Alchian and Klein argue monetary policy should be based on price indexes expanded to include measures of asset prices.

<sup>20</sup> The PCEPI may not capture rural consumers' cost of living accurately. Although spending by rural households is reflected in the weights used in the PCEPI, most of the detailed price information in the index is taken from the CPI, which reflects just prices paid by urban consumers.

<sup>21</sup> The CPI limits medical coverage to out-of-pocket expenditures because the index is designed to cover consumer spending related to earned income (Berndt and others 1998).

<sup>22</sup> In addition, the Consumer Expenditure Survey may suffer response bias, because some households drop out before completing the survey, for reasons that are not random. The accuracy of CPI weights is further limited by the small size of the survey sample, which is approximately 7,500 households.

<sup>23</sup> As noted by Triplett (1997), PCE also suffers a so-called birth bias. The retail trade survey underlying PCE fails to introduce new retail outlets into the sample quickly enough.

<sup>24</sup> Berndt and others (1998) survey the CPI and PPI approaches to measuring medical care prices and evidence on the accuracy of the indexes. This evidence indicates even the PPIs overstate inflation in medical care prices.

<sup>25</sup> Berndt, Griliches, and Rappaport (1995) show that the PPI's hedonic adjustment method yields a much lower estimate of quality-adjusted price increase than the CPI's old matched-model method does.

<sup>26</sup> For example, the current-methods CPI adjusts historical computer prices to reflect current methods, but data limitations preclude incorporating any of the recent improvements to medical care prices into the historical price index. In addition, the current-methods CPI does not reflect the 1987 and 1998 updates of the CPI's base-period weights. As noted by Stewart and Reed, however, it is not clear that inflation in some years such as 1980 would be more accurate if based on the current 1993-95 weights rather than on the weights in use in 1980. Like the published CPI, the current-methods index has a disadvantage in formula compared to the PCEPI.

<sup>27</sup> Nonetheless, neither the current-methods CPI nor the PCEPI provide completely consistent historical data. For example, although both indexes consistently use a rental equivalence approach to tracking homeownership costs, the index of rent has some discontinuities. Before 1983, the index of rent incorporated in the homeownership component of the current-methods CPI is based primarily on apartments. Beginning in 1983, when the published CPI switches to a rental equivalence approach, the rent index includes significantly more houses. As noted by Triplett (1981), the PCEPI suffers a similar discontinuity. Before 1973 the PCEPI uses the primarily apartment-based CPI for rent to measure homeownership costs. From 1974 to 1981, the PCEPI relies on some alternative rent data that cover more houses than the CPI does. From 1982 to the present, the BEA again uses the CPI for rent to track homeownership costs in the PCEPI.

<sup>28</sup> The initially released data were obtained from issues of the *Survey of Current Business*. These data are the initial estimate of the price index for each quarter and the estimates available at that time for each of the previous eight quarters.

<sup>29</sup> Although the correlation between the change in inflation measured with the initial data and today's data is 0.95, the initial change is, not surprisingly, a biased predictor of the change as measured today. Regressing the change in inflation measured today on the initial change produces an intercept of -0.03 and slope coefficient of 0.81. Given the major methodological changes introduced over time, bias is to be expected. Results for changes in inflation between the most recent quarter versus the previous year and between the most recent two quarters versus the previous year are qualitatively very similar.

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