Comparing the Consumer Price Index and the Personal Consumption Expenditures Price Index

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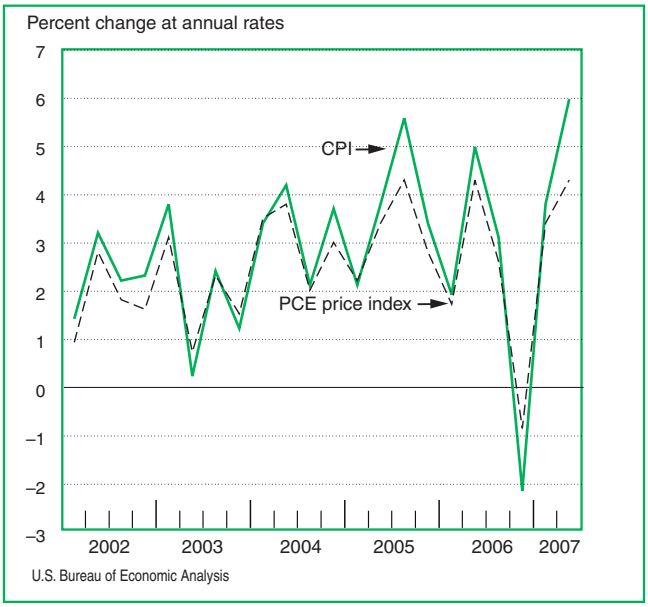
IN THE United States, there are two primary measures of the prices paid by consumers for goods and services. One is the Consumer Price Index for All Urban Consumers (CPI) prepared by the Bureau of Labor Statistics (BLS), and the other is the Personal Consumption Expenditures (PCE) chain-type price index prepared by the Bureau of Economic Analysis (BEA). These two price indexes have different purposes and uses. Thus, they are constructed differently and tend to behave differently over time.[1] Chart 1 shows the quarterly growth rates for the two indexes from the first quarter of 2002 through the second quarter of 2007. Although the magnitude and direction of these differences vary, on average, the CPI grew 0.4 percentage point per year faster than the PCE price index over this period.

1. The CPI measures the change in prices paid by urban consumers for a market basket of consumer goods and services; it is primarily used as an economic indicator and as a means of adjusting current-period data for inflation. The PCE price index measures the change in prices paid for goods and services by the personal sector in the U.S. national income and product accounts; it is primarily used for macroeconomic analysis and forecasting.

Chart 1. The CPI and the PCE Price Index



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In recent years, there has been growing interest in explaining the differences between the CPI and the PCE price index, in part because of the important roles these indexes play in guiding economic policy. This article identifies four primary sources of difference between the two indexes. First, the CPI and the PCE price index are constructed using different index-number formulas. The CPI is based on a modified Laspeyres formula, while the PCE price index is based on a Fisher-Ideal formula. This difference is referred to as the "formula effect." Second, the relative weights assigned to each of the detailed item prices in the CPI and in the PCE price index are based on different data sources. The relative weights used in the CPI are based primarily on household surveys, while the relative weights used in the PCE price index are based primarily on business surveys. These differences are referred to as the "weight effect." Third, the CPI measures the out-of-pocket expenditures of all urban households, while the PCE price index measures the goods and services purchased by households and nonprofit institutions serving households within the framework of the U.S. national income and product accounts (NIPAs). This conceptual difference implies that some items in the CPI are out-of-scope of the PCE price index; that is, some items in the CPI are not included in the PCE price index. Even more importantly, some items in the PCE price index are out-of-scope of the CPI. These differences are referred to as the "scope effect." Finally, there are a variety of other differences, consisting of seasonal adjustment differences, price differences, and residual differences. Collectively, these are referred to as "other effects."

This article reconciles the growth rates between the CPI and the PCE price index for the first quarter of 2002 through the second quarter of 2007. (See the box "Previous Reconciliations Between the CPI and the PCE Price Index.") This article finds that almost half of the 0.4-percentage-point difference in growth rates between the CPI and the PCE price index is explained by the formula effect. After adjusting for formula differences, the weight effect—primarily differences in

the relative weights for "rent of shelter"—more than accounts for the remaining difference in growth rates. The net scope effect, in contrast, partly offsets the weight effect.

This article consists of three sections. The first section provides a detailed discussion of the four sources of difference. The second section introduces the reconciliation framework and discusses highlights of the reconciliation. The final section describes upcoming work that the BLS and the BEA plan to undertake, including plans to publish regular updates to the reconciliation tables.

Previous Reconciliations Between the CPI and the PCE Price Index

The reconciliation presented in this article is an extension of earlier work to detail and quantify the differences between the CPI and the PCE price index. The following is an overview of some of this earlier work.

In 1978, BEA decomposed changes in the CPI and the PCE implicit price deflator for 1970–77.[1] Over that period, the CPI increased 0.5 percentage point per year more than the PCE deflator. Over half of the difference was determined to be the weight effect. The scope effect explained roughly 40 percent of the difference. Differences in the methodologies used by BLS and BEA to estimate price changes for owners' equivalent rent were an important part of the scope effect; these differences were partly offset by other scope differences.[2] The formula effect and "other effects" were small and offsetting.[3]

In 1981, Triplett investigated the differences between the CPI and the PCE implicit price deflator for 1972–80. Over that period, the CPI increased 104.6 percent, while the PCE deflator increased 84.9 percent. The difference between the two indexes was largely driven by differences in the methodologies for estimating price changes for owners' equivalent rent. In fact, these methodological differences accounted for about two-thirds of the difference in growth rates between the CPI and the PCE deflator. Most of the remaining difference was attributed to the weight effect.

In 2002, Fixler and Jaditz analyzed the CPI and the PCE chain-type implicit price deflator for the first quarter of 1992 through the second quarter of 1997.[4] Over that period, the CPI increased 14.1 percent, while the PCE deflator increased 12.5 percent. They identified and quantified differences using the formula, weight, scope, and price effects.[5] Table A summarizes the Fixler-Jaditz results. Much of the difference in growth rates between the CPI and the PCE deflator was attributed to the price and weight effects.[6] The formula effect also accounted for a large share of the difference. The scope effect partly offset the price and weight effects.

Finally, Johnson (2003) extended the Fixler-Jaditz methodology for the fourth quarter of 1997 through the fourth quarter of 2001. Table B summarizes Johnson's results. Most of the effects were similar in magnitude to the Fixler-Jaditz results; the formula effect was somewhat larger.[7]

1. The PCE implicit price deflator was defined as the ratio of current-dollar PCE to constant (1972) dollar PCE.

2. Before 1983, BLS used an asset approach to measure the price change for owners' equivalent rent; before 1983, BEA used the CPI for residential rent to measure this price change. Since 1983, both BLS and BEA have used a rental-equivalence approach to measure the price change for owners' equivalent rent.

3. The formula effect was defined as the difference in growth rates between the "PCE chain index" and the PCE implicit price deflator. The PCE chain index was estimated using a chained Laspeyres price-index-number formula.

4. Fixler and Jaditz completed their analysis in 1998; the resulting paper was published in 2002.

5. In general, a "price effect" accounts for differences that result from using different item-level price indexes to deflate comparable items in the CPI and the PCE price index.

6. Within the price and weight effect, much of the difference was attributed to BEA's use of price measures other than item-level CPIs.

7. In addition to these reconciliations, there have been several papers comparing the CPI and the PCE price index. For example, see Clark (2003), Schultze and Mackie (2002), Lebow and Rudd (2003). Consumer expenditures were compared in Garner et al. (2006).

Table A. Reconciliation Between the CPI and the PCE Implicit Price Deflator

	Line	
PCE chain-type implicit price deflator (percent change)	1	12.5
Minus: Formula effect (percentage points)	2	–0.86
Equals: PCE fixed-weight price index (percent change)	3	13.3
Minus: Price and weight effects (percentage points)	4	–1.80
Minus: Scope effect (percentage points)	5	1.01
Equals: CPI (percent change)	6	14.1

Source: Based on Fixler and Jaditz (2002), table 9.

Table B. Reconciliation Between the CPI and the PCE Implicit Price Deflator

	Line	
PCE chain-type implicit price deflator (percent change)	1	7.2
Minus: Formula effect (percentage points)	2	–1.82
Equals: PCE fixed-weight price index (percent change)	3	9.1
Minus: Price and weight effects (percentage points)	4	–1.79
Minus: Scope effect (percentage points)	5	1.06
Equals: CPI (percent change)	6	9.8

Source: Based on Johnson (2003).

Differences in Growth Rates

This section describes four sources of the differences in growth rates between the CPI and the PCE price index. Although a large number of sources—or "effects"—may be important in explaining differences in growth rates for a given period, the four effects identified below were determined to be the most important for reconciling the CPI and PCE price measures from the first quarter of 2002 through the second quarter of 2007. It is important, however, to keep in mind that there is no "best" set of effects. Likewise, there is no best way of estimating a particular effect. These choices require weighing a variety of factors, including accuracy, transparency, and computational simplicity.

Formula effect

The CPI and the PCE price index are based on different price-index-number formulas. The CPI is based on a modified Laspeyres formula, while the PCE price index is based on a Fisher-Ideal formula. A Laspeyres price relative is defined as

$$L_{t,\ t+1} = \Sigma_i(p^i_{t+1} q^i_t) / \Sigma_i(p^i_t q^i_t),$$

where p^i_t is the price of item i in period t, and q^i_t is the quantity of item i in period t.[2] If a specific base period is set to 0, then the resulting index is referred to as a "fixed-weight Laspeyres price index."

$$\text{Fixed-weight } L_t = \Sigma_i(p^i_t q^i_0) / \Sigma_i(p^i_0 q^i_0)$$

The CPI is based on the fixed-weight Laspeyres price index, where the base period is updated every 2 years.[3]

The PCE price index is based on a Fisher-Ideal price-index-number formula. First, note that a Paasche price relative is defined as

$$P_{t,\ t+1} = \Sigma_i(p^i_{t+1} q^i_{t+1}) / \Sigma_i(p^i_t q^i_{t+1}).$$

The Fisher-Ideal price relative is simply the geometric mean of the Laspeyres and Paasche price relatives, that is,

$$F_{t,\ t+1} = (L_{t,\ t+1} \cdot P_{t,\ t+1})^{1/2}.$$

In general, the Paasche price relative is less than the Laspeyres price relative, implying that the Fisher-Ideal price relative is generally less than the Laspeyres price relative. Next, a Fisher-Ideal chain-type price index is obtained by multiplicatively "chaining" the Fisher-Ideal price relatives, that is,

$$Chained\ F_{t+1} = (Chained\ F_t) \cdot (F_{t,\ t+1}).$$

The PCE price index is based on the Fisher-Ideal chain-type price index.

The fundamental difference between the fixed-weight Laspeyres price index and the Fisher-Ideal chain-type price index involves the extent to which the two indexes reflect consumer substitution among detailed items as the relative prices of those items change. In general, consumers substitute away from those items whose prices rise most rapidly and toward those items whose prices rise less rapidly or decline. In theory, the Fisher-Ideal price index better reflects this substitution; in this regard, the Fisher-Ideal index is referred to as a "superlative" index.[4] In practice, the Fisher-Ideal index is difficult to implement because it requires expenditure data for the most recent period for which the index is being estimated. It is often the case that these data are not available. For example, data on household consumer expenditures that are used to estimate the CPI are not available for the most current period. Therefore, the Laspeyres index—with regular base-period updates—provides a practical alternative to the Fisher-Ideal index.

It also should be noted that the BLS publishes the Chained Consumer Price Index for All Urban Consumers. This price index, like the PCE chain-type price index, is based on a superlative index-number formula that better reflects consumer substitution among item categories.[5] Because both the Chained CPI and the PCE chain-type price index are based on superlative index-number formulas, they tend to behave more similarly over time. The two indexes still diverge because of scope, weight, and other effects.

To estimate the formula effect, the detailed price and quantity data used to estimate the PCE price index were reaggregated using the Laspeyres price-index formula. The base periods used in this calculation were consistent with the base periods used to estimate the CPI: Estimates for 2002–2003 were prepared using a 1999–2000 base period, estimates for 2004–2005 used a 2001–2002 base period, and estimates for 2006 used a 2003–2004 base period. The formula effect was estimated as the percentage-point difference in growth rates between the PCE chain-type price index and the PCE fixed-weight price index.[6]

From the outset, the formula effect was expected to

2. In this article, the term "price relative" refers to an aggregate measure of price change between two adjacent periods.

3. Because the base period is necessarily updated with a time lag, the CPI is said to be based on a "modified" Laspeyres index.

4. The Fisher-Ideal index is just one example of a superlative index; another example is the Tornqvist index. Both of these indexes possess a number of desirable properties that make them preferred over the fixed-weight Laspeyres index. See Diewert (1976) for a discussion of superlative index numbers.

5. The Chained Consumer Price Index for All Urban Consumers is based on the Tornqvist chain-type price index. For more information on the Chained Consumer Price Index for All Urban Consumers, go to <www.bls.gov/cpi/super_paris.pdf>.

6. For the purposes of this analysis, BEA calculated a PCE fixed-weight price index.

be negative because the Fisher-Ideal price relative (on which the PCE chain-type price index is based) is generally less than the Laspeyres price relative (on which the PCE fixed-weight price index is based). In addition, the formula effect was expected to be more important for the categories in which there were large relative price changes, such as gasoline and computers.

Weight effect

The relative weights assigned to comparable item prices in the CPI and in the PCE price index differ because these weights are based on different data sources. The relative weights used in the CPI are based on the Consumer Expenditure Survey, a household survey conducted for BLS by the Census Bureau. The relative weights used in the PCE price index are based primarily on business surveys, such as the Census Bureau's annual and monthly retail trade surveys, the Service Annual Survey, and the Quarterly Services Survey. The differences in response rates and response quality between household and business surveys are well known.[7] These issues, such as "recall bias," may play a key role in explaining differences in the resulting weights. In addition, there are differences in *total* consumer spending that may also affect the relative weights.[8]

To estimate the weight effect, the differences in the relative weights between comparable items in the PCE fixed-weight price index and the CPI are calculated. These differences are then multiplied by the growth rates in the corresponding item price indexes to yield percentage-point contributions; that is, the weight effect is computed as

$$(W^i_{PCE} - W^i_{CPI}) \cdot [(p^i_{t+1} / p^i_t) - 1],$$

where W^i_{PCE} is the average relative weight for item *i* in the PCE fixed-weight price index; W^i_{CPI} is the average relative weight for item *i* in the CPI; and p^i_t is the price for item *i* used in both the CPI and PCE price index calculations.[9] It is important to note that weight differences resulting from different base periods are not accounted for in the weight effect; these differences are accounted for in the formula effect.

Scope effect

The CPI measures the out-of-pocket expenditures of all urban households, while the PCE price index measures the goods and services purchased by individuals and nonprofit institutions within the framework of the NIPAs. As such, there are items in the CPI that are not included in the PCE price index, and there are items in the PCE price index that are not included in the CPI. For example, medical care services in the CPI consist only of those services directly purchased by consumers. In the PCE price index, medical care services include services directly purchased by consumers *and* services paid for on behalf of consumers—for example, medical care services paid for by employers through employer-provided health insurance and medical care services paid for by governments through programs such as Medicare and Medicaid.[10]

The scope effect adjusts for items that are not comparable between the CPI and the PCE price index using a two-stage approach. First, the percentage-point contributions to the growth in the PCE fixed-weight price index for those items that are not included in the CPI are calculated. Second, the percentage-point contributions to growth in the CPI for those items that are not included in the PCE price index are calculated. As will be discussed in the next section, the reconciliation algorithm begins with the PCE price index and ends with the CPI; therefore, the contributions for PCE items that are out-of-scope for the CPI enter the reconciliation with negative signs, and the contributions for CPI items that are out-of-scope for the PCE price index enter with positive signs. A "net" scope effect is also calculated as the difference between the contributions for CPI items that are out-of-scope for the PCE price index and the contributions for PCE items that are out-of-scope for the CPI.

Other effects

There are a variety of remaining differences—including seasonal adjustment differences, price differences, and residual differences—that must be taken into account for a complete reconciliation of the CPI and the PCE price index.

Seasonal adjustment differences result from two factors: Differences in revision cycles and differences in aggregation. First, the BLS and the BEA revision cycles differ. For example, in February 2007, BLS revised the CPI seasonal factors for 2002–2006. In July 2007, BEA revised the NIPAs for 2004–2006; however, because of BEA's revision policy of only revising the 3 most recent years during an annual revision, the revised seasonal

7. See Garner, et al. (2006) for a thorough examination of the differences between the Consumer Expenditure Survey and the expenditure surveys used to estimate the PCE price index.

8. See Appendix Table A in McCully, Moyer, and Stewart (2007) for a detailed list of weight differences.

9. Symmetric to the weight effect is a "price effect." It is estimated as

$$W^i \cdot [((p^i_{PCE,t+1} / p^i_{PCE,t}) - 1) - ((p^i_{CPI,t+1} / p^i_{CPI,t}) - 1)],$$

where W^i is the average relative weight used for item *i* in the CPI calculation; $p^i_{PCE,t}$ is the price for item *i* used in the PCE price index calculation; and $p^i_{CPI,t}$ is the price for item *i* used in the CPI calculation. Empirically, the price effect is small; for this analysis, it is included in "other effects."

10. See Appendix Table A in McCully, Moyer, and Stewart (2007) for a detailed list of scope differences.

adjustment factors for 2002–2003 were not incorporated into the PCE price index. Second, the BEA and the BLS aggregation procedures differ. BEA uses the detailed, item-level CPI price indexes (and their associated seasonal adjustment factors) in constructing the PCE price index. In contrast, BLS uses 73 "selected CPI components" (and their associated seasonal adjustment factors) in constructing the seasonally adjusted CPI. Because the selected CPI components are seasonally adjusted independently of the item-level CPI price indexes, there are often differences in the seasonal adjustment factors used in the CPI and the PCE price index. An adjustment is made to account for these differences.

There are two comparable items used to construct the PCE price index for which BEA does not use an item-level CPI. The price index used to deflate passenger air transportation is an implicit price deflator based on passenger revenues and the number of miles traveled by passengers. Also, the gasoline price index used to construct the PCE price index differs from the gasoline price index used to construct the CPI because of mandated pollution control measures.[11] In these cases, an adjustment is made to account for price differences.

Finally, the remaining sources of difference between the CPI and the PCE price index are not addressed by this analysis. In general, these differences are small. They are computed residually and provide a "balancing item" for the reconciliation.

Reconciliation

This section presents the reconciliation of the CPI and the PCE price index for the first quarter of 2002 through the second quarter of 2007. Table 1 presents the results on a quarterly basis. Notice that the reconciliation begins with the growth rate in the PCE chain-type price index and ends with the growth rate in the CPI.[12] The reconciliation algorithm is summarized in the following seven steps.

1. The quarterly growth rates (at annual rates) in the PCE chain-type price index (line 1) and the quarterly growth rates (at annual rates) in the CPI (line 29) are calculated.

2. The formula effect is estimated. Line 2 shows the percentage-point contribution of the formula effect to the growth rate in the PCE chain-type price index. Lines 3–11 show the percentage-point contributions of selected categories to the growth rate in the PCE chain-type price index.

11. In the CPI, mandated pollution control regulations, such as improving auto emissions, are considered price increases. In the PCE price index, these are considered quality changes. See <www.bls.gov/cpi/cpitreat.pdf> for more information on how mandated pollution control regulations are treated in the CPI.

12. An alternative would be to begin with the growth rate in the CPI and end with the growth rate in the PCE price index. Either way is correct; there is no "best" starting point for the reconciliation.

Table 1. Quarterly Reconciliation Between the CPI and the PCE Price Index

	Line	2002				2003				2004				2005				2006				2007	
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II
PCE chain-type price index (percent change at annual rates)	1	**0.9**	**2.8**	**1.8**	**1.7**	**3.1**	**0.7**	**2.4**	**1.5**	**3.5**	**3.8**	**2.0**	**3.0**	**2.2**	**3.4**	**4.3**	**2.8**	**1.7**	**4.3**	**2.6**	**–0.9**	**3.5**	**4.3**
***Less:* Formula effect (percentage points)**	2	**–0.08**	**–0.17**	**–0.14**	**–0.08**	**–0.25**	**–0.03**	**–0.18**	**–0.11**	**–0.07**	**–0.12**	**–0.16**	**–0.21**	**–0.11**	**–0.26**	**–0.53**	**–0.24**	**–0.09**	**–0.19**	**–0.13**	**0.05**	**–0.21**	**–0.49**
Gasoline and oil	3	0.02	–0.04	0.00	–0.01	–0.08	0.04	–0.03	0.01	–0.02	–0.03	0.00	–0.03	0.00	–0.05	–0.23	0.06	0.03	–0.13	–0.02	0.18	–0.06	–0.27
Computers peripherals and software	4	–0.06	–0.04	–0.05	–0.08	–0.05	–0.07	–0.09	–0.03	–0.02	–0.02	–0.03	–0.06	–0.04	–0.04	–0.06	–0.05	–0.03	–0.05	–0.03	–0.02	–0.01	–0.03
Video and audio goods	5	–0.01	–0.01	–0.02	–0.02	–0.02	–0.02	–0.03	–0.01	–0.01	–0.02	–0.02	–0.01	–0.03	–0.02	–0.03	–0.03	–0.02	–0.02	–0.03	–0.04	–0.04	–0.03
Tobacco products	6	0.00	–0.02	–0.02	0.01	0.00	0.01	–0.01	0.00	0.00	0.00	–0.01	0.00	–0.02	0.00	–0.02	–0.01	0.00	0.00	0.00	0.00	–0.03	0.00
Medical care services	7	0.00	0.01	0.02	0.03	0.02	0.06	0.04	0.04	0.02	0.01	0.01	0.00	0.02	0.00	0.00	0.00	–0.01	–0.01	0.00	0.00	0.02	0.00
Electricity, gas, fuel oil, and other household fuels	8	0.02	–0.01	0.00	–0.01	–0.05	0.02	0.00	0.00	–0.01	0.00	–0.01	–0.03	–0.01	–0.02	–0.06	–0.10	0.02	0.06	0.00	0.02	–0.02	–0.02
Housing	9	–0.01	–0.01	–0.01	–0.02	–0.02	–0.01	–0.02	–0.02	–0.01	–0.01	–0.01	–0.01	–0.01	–0.01	–0.02	–0.01	–0.01	0.00	0.00	0.00	–0.01	0.00
Food	10	–0.01	0.00	0.00	–0.01	–0.01	–0.01	–0.02	–0.05	0.00	–0.01	–0.01	–0.02	0.01	–0.01	0.01	–0.01	0.00	0.00	–0.01	–0.01	0.01	0.00
Other	11	–0.03	–0.04	–0.05	0.03	–0.03	–0.04	–0.03	–0.04	–0.02	–0.04	–0.07	–0.05	–0.03	–0.11	–0.13	–0.09	–0.07	–0.05	–0.03	–0.07	–0.06	–0.14
***Equals:* PCE fixed-weight price index (percent change at annual rates)**	12	**1.0**	**3.0**	**1.9**	**1.7**	**3.3**	**0.7**	**2.5**	**1.6**	**3.6**	**4.0**	**2.1**	**3.3**	**2.3**	**3.6**	**4.8**	**3.1**	**1.8**	**4.5**	**2.7**	**–1.0**	**3.7**	**4.8**
***Less:* Weight effect (percentage points)**	13	**–0.30**	**–0.65**	**–0.49**	**–0.54**	**–1.11**	**–0.15**	**–0.50**	**–0.15**	**–0.51**	**–0.96**	**–0.57**	**–0.86**	**–0.47**	**–0.79**	**–1.29**	**–1.11**	**–0.61**	**–1.07**	**–0.82**	**0.42**	**–0.74**	**–1.49**
Rent of shelter	14	–0.57	–0.47	–0.43	–0.40	–0.38	–0.21	–0.28	–0.36	–0.29	–0.44	–0.35	–0.30	–0.41	–0.35	–0.35	–0.39	–0.50	–0.73	–0.69	–0.63	–0.55	–0.40
Gasoline and oil	15	0.08	–0.36	–0.03	–0.10	–0.45	0.30	–0.19	0.08	–0.31	–0.35	–0.01	–0.27	0.08	–0.32	–0.84	0.14	0.13	–0.59	–0.09	0.77	–0.17	–0.75
Electricity, gas, fuel oil, and other household fuels	16	0.08	0.00	0.00	–0.06	–0.22	–0.18	0.01	0.04	–0.11	–0.06	–0.10	–0.09	–0.12	–0.16	–0.24	–0.68	–0.14	0.23	0.03	0.03	–0.21	–0.07
Other	17	0.11	0.19	–0.02	0.03	–0.06	–0.06	–0.04	0.08	0.21	–0.12	–0.12	–0.20	–0.02	0.04	0.15	–0.18	–0.09	0.02	–0.06	0.25	0.19	–0.26
***Less:* Scope effect—PCE items out-of-scope of the CPI (percentage points)**	18	**0.33**	**0.50**	**0.67**	**0.36**	**0.51**	**0.81**	**0.79**	**1.02**	**1.21**	**1.08**	**0.80**	**0.80**	**0.84**	**0.92**	**0.80**	**0.91**	**0.56**	**0.82**	**0.72**	**0.73**	**1.05**	**0.61**
Physicians	19	–0.13	0.01	0.04	0.04	–0.04	0.18	0.10	0.05	0.13	0.03	0.03	0.04	0.12	0.06	0.05	0.05	–0.04	0.05	0.09	0.04	0.49	0.00
Hospitals and nursing homes	20	0.32	0.23	0.32	0.34	0.40	0.27	0.29	0.31	0.40	0.36	0.30	0.31	0.33	0.28	0.32	0.41	0.27	0.32	0.33	0.28	0.27	0.25
Services furnished without payment by financial intermediaries except life insurance and pension plans	21	0.08	0.02	–0.03	–0.03	–0.02	–0.02	–0.02	0.00	0.03	0.15	0.03	0.06	0.02	0.14	0.15	0.15	–0.06	–0.01	–0.07	0.15	–0.08	–0.07
Foreign travel by U.S. residents	22	0.00	0.10	0.16	–0.03	0.09	0.12	0.02	0.09	0.08	0.09	0.08	0.09	0.05	0.13	0.04	–0.08	–0.03	0.14	0.05	–0.06	0.04	0.09
Other	23	0.06	0.13	0.18	0.04	0.08	0.27	0.40	0.57	0.58	0.45	0.36	0.30	0.33	0.31	0.24	0.37	0.42	0.32	0.33	0.32	0.33	0.34
***Plus:* Scope effect—CPI items out-of-scope of the PCE price index (percentage points)**	24	**0.24**	**0.23**	**0.27**	**0.28**	**0.18**	**0.12**	**0.24**	**0.33**	**0.35**	**0.25**	**0.24**	**0.26**	**0.28**	**0.23**	**0.19**	**0.22**	**0.14**	**0.23**	**0.22**	**0.20**	**0.35**	**0.26**
Physicians	25	0.03	0.01	0.08	0.06	0.02	0.03	0.03	0.05	0.10	0.07	0.04	0.05	0.06	0.06	0.04	0.03	–0.01	0.03	0.03	0.05	0.13	0.03
Hospitals and related services	26	0.13	0.14	0.11	0.14	0.09	0.06	0.13	0.10	0.08	0.07	0.08	0.08	0.10	0.07	0.06	0.10	0.12	0.12	0.09	0.07	0.10	0.12
Other	27	0.09	0.08	0.08	0.08	0.07	0.03	0.08	0.18	0.17	0.11	0.12	0.14	0.12	0.10	0.09	0.09	0.03	0.08	0.10	0.08	0.12	0.11
***Less:* Other effects**	28	**–0.12**	**0.11**	**–0.15**	**–0.19**	**0.27**	**–0.08**	**0.05**	**–0.13**	**–0.22**	**–0.16**	**0.03**	**–0.10**	**0.07**	**–0.12**	**–0.11**	**0.07**	**0.11**	**–0.12**	**–0.11**	**0.24**	**–0.13**	**–0.11**
***Equals:* CPI (percent change at annual rates)**	29	**1.3**	**3.2**	**2.2**	**2.4**	**3.8**	**0.2**	**2.4**	**1.2**	**3.5**	**4.3**	**2.1**	**3.7**	**2.1**	**3.9**	**5.6**	**3.4**	**1.9**	**5.0**	**3.1**	**–2.1**	**3.8**	**6.0**

3. The weight effect is estimated. Line 13 shows the percentage-point contribution of the weight effect to the growth rate in the PCE fixed-weight price index. Lines 14–17 show the percentage-point contributions of selected categories to the growth rate in the PCE fixed-weight price index.

4. The PCE portion of the scope effect is estimated. Line 18 shows the percentage-point contribution to the growth rate in the PCE fixed-weight price index for those items that are out-of-scope for the CPI. Lines 19–23 show the percentage-point contributions for selected components.

5. The CPI portion of the scope effect is estimated. Line 24 shows the percentage-point contribution to the growth rate in the CPI for those items that are out-of-scope for the PCE price index. Lines 25–27 show the percentage-point contributions for selected components.

6. "Other effects" are estimated. Line 28 shows the percentage-point contributions of seasonal-adjustment differences, price differences, and other differences.

7. Finally, the growth rate in the CPI *equals* the growth rate in the PCE chain-type price index *less* the formula effect, *less* the weight effect, *less* the PCE portion of the scope effect, *plus* the CPI portion of the scope effect, *less* "other effects."

Highlights of the reconciliation can be seen in table 2. This table presents average annual estimates. From the first quarter of 2002 through the second quarter of 2007, the PCE chain-type price index (line 1) increased at an average annual rate of 2.5 percent, while the CPI (line 32) increased at an average annual rate of 2.9 percent.

Over that period, the formula effect (line 2) contributed –0.17 percentage point to the 2.5-percent growth rate in the PCE chain-type price index.[13] As expected, the formula effect was negative, reflecting differences between the fixed-weight Laspeyres price index and the Fisher-Ideal chain-type price index.[14] Also as expected, the formula effect had a larger impact for those categories with large relative price changes—for example, gasoline and oil (line 3) and computers, peripherals, and software (line 4). After adjusting for the formula effect, the PCE fixed-weight price index increased at an average annual rate of 2.7 percent (line 12).

13. Recall that the base periods used to estimate the formula effect are consistent with the base periods used to construct the CPI.

14. Recall that BLS publishes another measure of price change, called the Chained Consumer Price Index for All Urban Consumers (C–CPI–U), which employs a superlative index-number formula. The C–CPI–U moves more similarly to the PCE chain-type price index. For example, from the fourth quarter of 2001 through the fourth quarter of 2005 (the last date for which final C–CPI–U data have been published), both the C–CPI–U and the PCE chain-type price index increased 2.5 percent at an annual rate.

The weight effect (line 13) contributed –0.67 percentage point to the 2.7-percent growth in the PCE fixed-weight price index. Within the weight effect, the rent of shelter category (line 14)—which includes owners' equivalent rent—made the largest contribution. The relative weight for rent of shelter in the CPI is consistently and significantly higher than its relative weight in the PCE price index.[15]

The scope effect consists of two parts. First, items in the PCE price index that are out-of-scope for the CPI (line 18) contributed 0.76 percentage point to the 2.7-percent growth in the PCE fixed-weight price index. Second, items in the CPI that are out-of-scope for the PCE price index (line 24) contributed 0.24 percentage point to the 2.9-percent growth in the CPI. Because the first part of the scope effect enters the reconciliation with a negative sign and the second part enters with a positive sign, the net contribution of the scope effect

15. The relative weight for rent of shelter in the CPI is about 32 percent; its relative weight in the PCE price index is about 15 percent. While the data sources for expenditure estimates for rent of shelter and for owners' equivalent rent differ in the CPI and the PCE, the aggregate estimates for expenditures in each are similar. The relative weight of rent of shelter is larger in the CPI than in the PCE because total consumer expenditures (for nonrent of shelter components) reported in the Consumer Expenditure Survey are less than those estimated from business surveys used to prepare the PCE price index. Differences in total expenditure estimates can be attributed to both the different expenditure survey methods used as well as differences in scope. See Garner et al. (2006) for a detailed description of the differences between expenditure estimates derived from the Consumer Expenditure Survey and those estimated for the PCE price index.

Table 2. Reconciliation of Quarterly Percent Changes Between the CPI and the PCE Price Index

[2002 to Second Quarter of 2007]

	Line	
PCE chain-type price index (average annual percent change)	1	**2.5**
***Less:* Formula effect (percentage points)**	2	**–0.17**
Gasoline and oil	3	–0.03
Computers peripherals and software	4	–0.04
Video and audio goods	5	–0.02
Tobacco products	6	–0.01
Medical care services	7	0.01
Electricity, gas, fuel oil, and other household fuels	8	–0.01
Housing	9	–0.01
Food	10	–0.01
Other	11	–0.05
***Equals:* PCE fixed-weight price index (average annual percent change)**	12	**2.7**
***Less:* Weight effect (percentage points)**	13	**–0.67**
Rent of shelter	14	–0.43
Gasoline and oil	15	–0.15
Electricity, gas, fuel oil, and other household fuels	16	–0.09
Other	17	0.00
***Less:* Scope effect—PCE items out-of-scope of the CPI (percentage points)**	18	**0.76**
Physicians	19	0.06
Hospitals and nursing homes	20	0.31
Services furnished without payment by financial intermediaries except life insurance and pension plans	21	0.02
Foreign travel by U.S. residents	22	0.06
Other	23	0.31
***Plus:* Scope effect—CPI items out-of-scope of the PCE price index (percentage points)**	24	**0.24**
Physicians	25	0.05
Hospitals and related services	26	0.10
Other	27	0.09
***Less:* Other effects**	28	**–0.04**
Seasonal adjustment	29	–0.03
Price	30	–0.01
All other	31	0.00
***Equals:* CPI (average annual percent change)**	32	**2.9**

was –0.52 percentage point.

Within the scope effect, the components that made the largest contributions were related to medical care services. These included physician services (line 19 and line 25), hospitals and nursing homes (line 20), and hospitals and related services (line 26). A large portion of the total scope effect is accounted for by the differing concepts of medical care services. Recall that for the CPI, medical care services include only those services directly purchased by consumers. For the PCE price index, medical care services include services purchased directly by consumers *and* services paid for on behalf of consumers—for example, medical care services paid for by employers through employer-provided health insurance and medical care services paid for by governments through programs such as Medicare and Medicaid.

Finally, "other effects" (line 28) was negligible over the period, making only a small negative contribution to the 2.7-percent growth rate in the PCE fixed-weight price index. As mentioned above, this effect includes seasonal adjustment differences, price differences, and residual differences.

In summary, the PCE price index increased at an average annual rate of 2.5 percent over the period, and the CPI increased at an average annual rate of 2.9 percent—a difference of 0.4 percentage point. The formula effect explains almost half of this growth-rate difference. After adjusting for formula differences, the weight effect more than accounted for the remaining difference in growth rates between the CPI and the PCE fixed-weight price index. The large weight effect was primarily explained by the larger relative weight for rent of shelter in the CPI than in the PCE price index. The scope effect, in contrast, partly offset the weight effect. "Other effects" had only a minor impact over the period.

It is important to keep in mind that this reconciliation is not unique; using a different reconciliation framework will lead to different results. For example, by comparing the CPI and the Chained Consumer Price Index for All Urban Consumers, the formula effect could be estimated last rather than first. In this case, using data from the fourth quarter of 2001 through the fourth quarter of 2005 (the last year for which final data for the chained CPI have been published) the formula effect would be –0.33 percentage point (2.46 percent minus 2.79 percent), compared with –0.17 percentage point when the formula effect is estimated first.

Upcoming Work

Beginning in early 2008, BEA plans to begin preparing tables that reconcile the differences in growth rates between the CPI and the PCE price index on an ongoing basis. These tables will be similar to table 1 and will be available on both the BLS and the BEA Web sites. Quarterly and monthly reconciliation tables will be available. Quarterly tables will be available after the release of the "advance" estimates of gross domestic product (GDP) and will be revised after the release of the "preliminary" and "final" estimates of GDP. Monthly tables will be available after the release of the monthly personal income and outlays.

BLS and BEA will also continue to review differences between the CPI and the PCE price index and will adjust the reconciliation procedures as needed. The reconciliation framework presented in this article was determined to be the most relevant for reconciling the CPI and PCE price measures over the specified period. It is possible that sources of difference will change over time, either because of structural changes in the economy or because of changes in data sources and estimation procedures.

In July 2009, BEA plans to introduce a new classification structure for the PCE estimates as part of the 2009 comprehensive revision of the NIPAs. The new PCE classification structure will be more closely aligned with the Classification of Individual Consumption by Purpose (COICOP) and with the Classification of the Purposes of NonProfit Institutions (COPNI). Both the COICOP and the COPNI are recommended by the 1993 *System of National Accounts*. This new PCE classification structure will improve the consistency between detailed PCE items and detailed CPIs used for deflation. While the impact of this new classification on the reconciliation process is not yet known, it is expected that small differences—currently being captured as part of weight effects and "other effects"—will be reduced.

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