

MEASURING CHANGES IN THE GENERAL PRICE-LEVEL

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I. INTRODUCTION-Concepts Behind the CPI

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I. INTRODUCTION- Concepts Behind the CPI

A. What is a Price Index?

B. Weighted Aggregate Price Indices

**C. The Most Reported and Followed
Weighted Aggregate Price Indices**

INTRODUCTION:

What is a Price Index?

- ❖ **Price Index**-A Price Index is a single figure that shows how a whole set of prices has changed [Wonnacott and Wonnacott (1990), Ch. 22, p. 664].
- A more economically oriented definition would define a *Price Index* as a number used to compare living standards in different years [Call and Holahan (1983), Ch. 4, p, 99]
- ❖ We will develop these definitions in much more detail.

INTRODUCTION:

Weighted Aggregate Price Indices

- ❖ In order to overcome a difficulty encountered with a Simple Aggregate Price Index: the units of measurement can have a big influence on the value of the index.
- Several weighted Aggregate Price Indices have been developed, where the effect of the weights is to reflect the importance of the commodity [Pfaffenberger and Patterson (1977), Ch. 19, p. 574]

INTRODUCTION: The Most Reported and Followed Weighted Aggregate Consumer Price Indices

- ❖ *Consumer Price Index* (CPI) published by the U.S. Bureau of Labor Statistics (BLS)

- ❖ *Personal Consumption Expenditures* (PCE) *Price Index* published by the U.S. Bureau of Economic Analysis (BEA)

II. THE CPI

- A. Origin and Evolution of the CPI**
- B. Target Population of the CPI**
- C. The Composition of the CPI**
- D. Shortcomings of the CPI**
- E. Constructing the CPI**
- F. The Chained CPI-U**
- G. Tracking the CPI-U and C-CPI-U**

THE CPI:

Origin and Evolution of the CPI

- ❖ The CPI was initiated during World War I, when rapid increases in prices, particularly in shipbuilding centers, made such an index essential for calculating cost-of-living adjustments in wages [U.S. BLS (Jun 2016), p. 7]
- ❖ Periodic collection of prices was started and, in 1919, BLS began publication of separate indexes for 32 cities. Regular publication of a national index, the U.S. city average, began in 1921, and indexes were estimated back to 1913 (ibid, p. 7)

THE CPI:

Origin and Evolution of the CPI

- ❖ *Three CPI series*-The U.S. BLS publishes CPI data every month (ibid, p. 1). The three main CPI series are
- CPI for All Urban Consumers (CPI-U)
 - CPI for Urban Wage Earners and Clerical Workers (CPI-W)
 - Chained CPI for All Urban Consumers (C-CPI-U)

THE CPI:

Origin and Evolution of the CPI

- ❖ *The CPI for All Urban Consumers (CPI-U)*, which BLS began publishing in January 1978, represents the buying habits of the residents of urban or metropolitan areas in the United States.
- ❖ *The CPI for Urban Wage Earners and Clerical Workers (CPI-W)*, the oldest of the series, covers a subset of the urban population.
- ❖ The prices used for producing these two series are the same. The CPI-U and CPI-W differ only in the consumer spending weights used to combine, or average together, basic indices (ibid, p. 2)

THE CPI:

Origin and Evolution of the CPI

- ❖ *The Chained CPI for All Urban Consumers (C-CPI-U)*, also represents the urban population as a whole.
 - BLS began publishing this series in August 2002 with data beginning in January 2000.
 - The prices used in the C-CPI-U are the same as those used to produce the CPI-U and CPI-W, but the C-CPI-U uses a different formula and different weights to combine basic indices.
 - The formula used in the C-CPI-U accounts for consumers' ability to achieve the same standard of living from alternative sets of consumer goods and services.
 - This formula requires consumer spending data that are not immediately available. Consequently, the C-CPI-U, unlike the other two series, is published first in preliminary form and is subject to scheduled revisions (ibid, p. 2).

THE CPI:

Target Population of the CPI

- ❖ *CPI populations*. A CPI measures the price-change experience of a particular group called its *Target Population*.
- The CPI uses two target populations for its main series:
 - All Urban Consumers (the “CPI-U” population)
 - Urban Wage Earners and Clerical Workers (the “CPI-W” population)
- Both the CPI-U and the C-CPI-U target the CPI-U population. The CPI-U population, which covers about 88% of the U.S. population, covers households in all areas of the United States except people living in rural nonmetropolitan areas, in farm households, on military installations, in religious communities, and in institutions such as prisons and mental hospitals.

THE CPI:

Target Population of the CPI

- ❖ The CPI-W population, the target of the CPI-W, is a subset of the CPI-U population.
 - The CPI-W population consists of all CPI-U population households for whom 50% or more of household income comes from wages and clerical workers' earnings.
 - The CPI-W's share of the total U.S. population has diminished over the years; the CPI-W population is now about 28% of the total U.S. population.
 - The CPI-W population excludes households of professional and salaried workers, part-time workers, the self-employed, and the unemployed, along with households with no one in the labor force, such as those of retirees.

THE CPI:

Calculation of the CPI

- ❖ The CPI is calculated using A *Laspeyres Price Index* Formula.
- A Laspeyres index number is a form of index number where prices, quantities or other units of measure over time *are weighted according to their values in a specified base period* (OECD < <https://stats.oecd.org/glossary/detail.asp?ID=1324> >).

THE CPI: Shortcomings of the CPI

- Buying the base-year basket in the present tends to overstate the rise in the cost of living by *not allowing any substitution between goods to occur**. [Diewert (1998), pp. 47-48]
- In addition, new goods and quality changes will also be missed by a base-year index.

*My emphasis.

THE CPI:

Constructing the CPI

- ❖ In the CPI, the urban portion of the United States is divided into 38 geographic areas called index areas, and the set of all goods and services purchased by consumers is divided into 211 categories called item strata (ibid, p. 3).
- This results in 8,018 (38×211) item–area combinations.

THE CPI:

Publication of the CPI

- ❖ Each month's index value displays the average change in the prices of consumer goods and services since a *base period*, which currently is 1982–84 for most indices.
- For example, the CPI-U for July 2013 was 233.596. One interpretation of this is that a representative set of consumer items that cost \$100 in 1982–84 would have cost \$233.60 in July 2013 (ibid, p. 3).
- ❖ Rather than emphasizing the level of the index in comparison to the base period, the monthly CPI release stresses the CPI's *percent change from the previous month and from the previous year*. The most commonly reported monthly percent changes are the one-month *seasonally adjusted* percent change, and the 12-month not seasonally-adjusted percent change (ibid, pp. 3-4)

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

- The standard CPI is, strictly speaking, a modified fixed-weight price index. That is, the market basket of goods and services is periodically changed to keep it up to date.
- Until a decade ago, however, those updates occurred only about once every 10 years. With the release of CPI data for January 2002, the market basket was updated to reflect spending patterns reported in the *Consumer Expenditure (CE) Survey* for the 1999-2000 period.
- Since then, BLS has updated the expenditure weights every two years. For example, with the release of the January 2010 CPI, the weights were updated to reflect spending patterns in the 2007-2008 period.

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

TABLE 4: Updated Weights for the CPI-U: 2000 to 2015

CPI EXPENDITURE CATEGORY	2000	2005	2010	2015	2000 - 2005	2005 - 2010	2010 - 2015
	(1993-95 Wts)	(2003-04 Wts)	(2007-08 Wts)	(2013-14 Wts)	(Pet Pt Diff)	(Pet Pt Diff)	(Pet Pt Diff)
ALL ITEMS	100.00	100.00	100.00	100.00	-----	-----	-----
FOOD AND BEVERAGES	16.20	15.05	14.79	14.97	-1.15	-0.26	0.18
HOUSING	39.98	42.38	41.46	42.24	2.40	-0.92	0.77
APPAREL	4.45	3.79	3.60	3.10	-0.67	-0.19	-0.50
TRANSPORTATION	17.57	17.42	17.31	15.26	-0.15	-0.11	-2.05
MEDICAAL CARE	5.81	6.22	6.63	8.38	0.41	0.41	1.75
RECREATION	5.91	5.64	6.29	5.73	-0.27	0.66	-0.56
EDUCATION AND COMMUNICATION	5.31	6.05	6.42	7.15	0.74	0.37	0.72
OTHER GOODS AND SERVICES	4.77	3.46	3.50	3.18	-1.31	0.03	-0.32

SOURCE: U.S. BLS, TABLE 1: Relative importance of components in the Consumer Price Indexes: U.S. City Average, December 2000, 2005, 2010, and 2015

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

❖ *The C-CPI-U* [CRS (2013), pp. 5-6]

- In an effort to better estimate the effect of consumer substitution on the CPI, BLS introduced a supplemental measure known as the *Chained Consumer Price Index for all Urban Consumers* (C-CPI-U). It does not replace either the CPI-W or CPI-U, and has not to date affected any indexing provisions of Federal programs

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

❖ Calculation of the C-CPI-U

- The C-CPI-U is calculated using a *Törnqvist Price Index* formula.
- The Törnqvist Index is a weighted geometric average of the price relatives using arithmetic averages of the value shares in the two periods as weights (OECD <
<https://stats.oecd.org/glossary/detail.asp?ID=2711>
>).

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

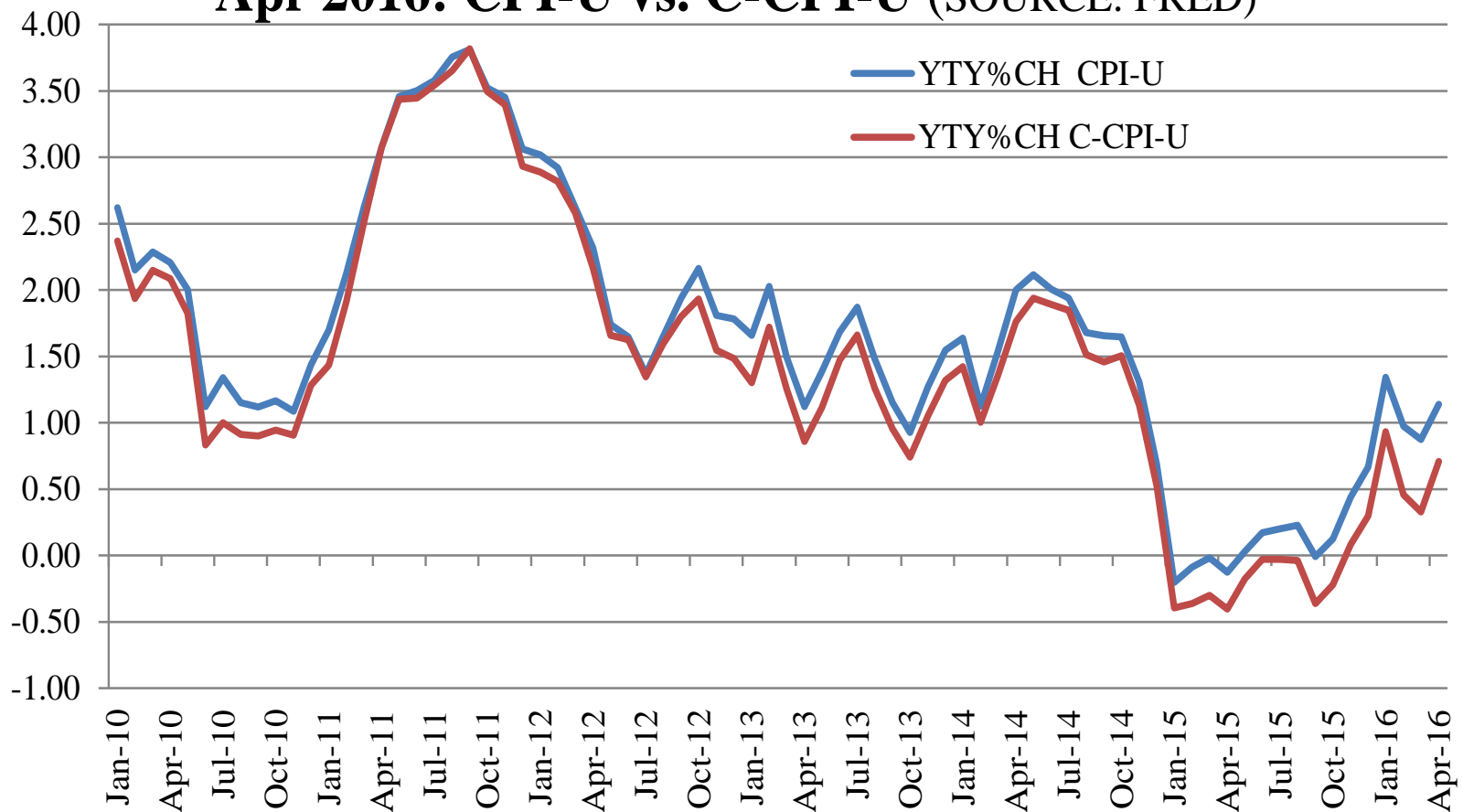
- ❖ The aim of the C-CPI-U is to produce a measure of change in consumer prices that is free of *Substitution Bias*.
- *Substitution* refers to consumers changing their spending between categories in the market basket (e.g., buying more chicken and less fish due an increase in the price of fish compared with chicken from one month to the next) (ibid).

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

- ❖ The final release of the C-CPI-U relies on consumer expenditure data for the current and prior months as a means of accounting for any substitution across categories made by consumers in response to changes in relative prices.
- In other words, “the final version of the C-CPI-U is based on actual consumer behavior, rather than assumptions about consumer substitution”
[Johnson, Reed, and Stewart, MLR (May 2006), p. 12]

THE CPI: Differences in the CPI-U and C-CPI-U Price Indices

**GRAPH 1: U.S. Monthly YTY % Change, Jan 2010-
Apr 2016: CPI-U vs. C-CPI-U (SOURCE: FRED)**



III. THE CPI-U vs. PCE PI

THE CPI-U vs. THE PCE PI

- ❖ *The Personal Consumption Expenditures Price Index* (PCE PI) is published by the U.S. Bureau of Economic Analysis (BEA).
- The PCE PI measures price changes for goods and services within the framework of the National Income and Product Accounts (NIPA's), a comprehensive set of figures for the total value of output and income in the U.S. economy.

THE CPI-U vs. THE PCE PI

Table 5: Comparing The CPI and The PCE Price Index

PCE Price Index	CPI
Produced by BEA using BLS price indexes and other data sources.	Produced by BLS using surveys of consumer prices and other data sources.
Reflects the price of expenditures made by households, including those made on behalf of households.	Reflects the price of out-of-pocket expenditures made by consumers.
Composition of expenditures changes from quarter to quarter.	Composition of the market basket remains fixed (updated every two years).
Derived using a chained Fisher index formula.	Derived using a Laspeyres-type index formula.
Weights are derived from business surveys.	Weights are derived from household surveys.

SOURCE: Moyer, Brian C., U.S. BEA, *Comparing Price Measures—The CPI and the PCE Price Index* (March 13-14, 2006) NABE Conference

THE CPI-U vs. THE PCE PI

❖ Calculation of the PCE PI

- As noted in Table 5 (previous slide), the PCE PI is derived using *Fisher's Ideal Price Index*.
- *Fisher's Ideal Index* is the Geometric Mean (GM) of the *base-year weighted, Laspeyres Price Index* (see Slide 15), and the *current-year weighted Paasche Price Index*.
- The *Paasche Price Index* finds the cost of purchasing a fixed basket of goods representing the present and then the cost of buying the same basket in the past.
- While the Laspeyres Price Index tends to *overstate* inflation, the Paasche Price Index tends to *understate* inflation.
- *Fisher's Ideal Price Index* compensates for the over-, and under-estimation of inflation, since it is the GM of the two indices.

THE CPI-U vs. THE PCE PI

- ❖ Further advantages of *Fisher's Ideal* using the Geometric Mean include:
 - The *Geometric Mean* (GM) is very useful in averaging ratios, which frequently arise in computing index numbers [[Pfaffenberger and Patterson (1977), Ch. 19, p. 574].
 - In addition, the GM, in general, is less effected by extremely large, or small, values than is the Arithmetic Mean (ibid, p. 579).

THE CPI-U vs. THE PCE PI

❖ FACTORS ACCOUNTING FOR DIFFERENCES IN THE CPI-U AND PCE PI [U.S. BEA (November 3, 2010)

http://www.bea.gov/faq/index.cfm?faq_id=555&searchQuery=]

- *The Formula Effect* accounts for the different formulas used to calculate the two indices. The PCE PI is based on the Fisher-Ideal formula, while the CPI is based on a modified Laspeyres formula.
- *The Weight Effect* accounts for the relative importance of the underlying commodities reflected in the construction of the two indices.
- *The Scope Effect* accounts for conceptual differences between the two indices. PCE measures spending by and on behalf of the personal sector, which includes both households and nonprofit institutions serving households; the CPI measures out-of-pocket spending by households. The "net" scope effect adjusts for CPI items out-of-scope of the PCE PI less items in the PCE PI that are out-of-scope of the CPI.
- *"Other Effects"* include seasonal adjustment differences, price differences, and residual differences.

THE CPI-U vs. THE PCE PI: Weight Effect

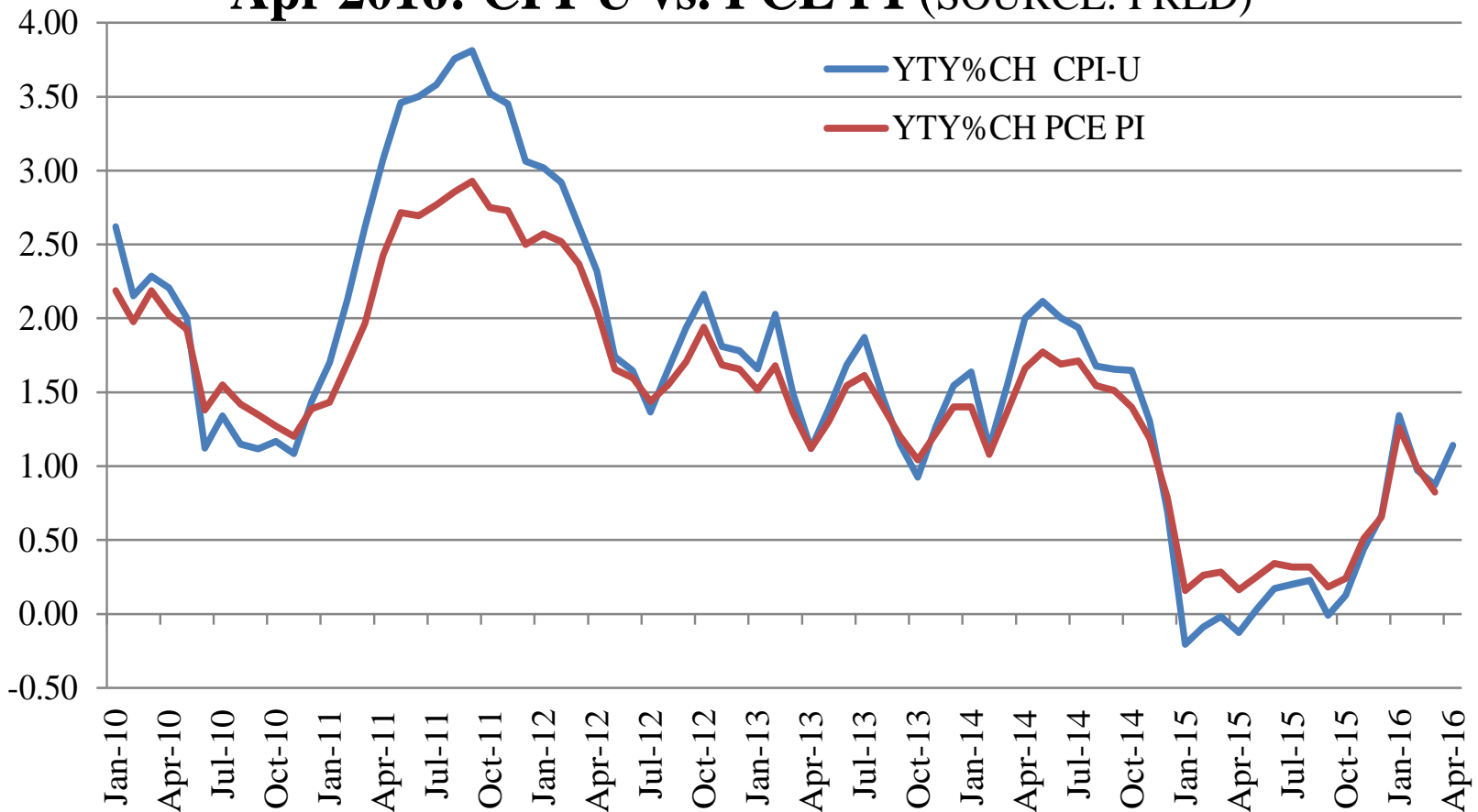
TABLE 3: Differences in Weights: CPI vs. PCE PI

CPI EXPENDITURE CATEGORY	Dec-04		
	PCE Weights	CPI Weights	PCE less CPI (Pct Pt Diff)
ALL ITEMS	100.00	100.00	-----
FOOD AND BEVERAGES	13.70	15.30	-1.60
HOUSING	23.20	42.00	-18.80
Shelter	15.00	32.70	-17.70
Other Housing	8.30	9.30	-1.00
APPAREL	4.60	3.80	0.80
TRANSPORTATION	11.90	17.40	-5.50
MEDICAL CARE	20.30	6.10	14.20
RECREATION	8.00	5.70	2.30
EDUCATION AND COMMUNICATION	5.10	5.80	-0.70
OTHER GOODS AND SERVICES	13.20	3.80	9.40

SOURCE: Moyer, Brian C., U.S. BEA, *Comparing Price Measures—The CPI and the PCE Price Index* (March 13-14, 2006) NABE Conference, Slide 5.

THE CPI-U vs. THE PCE PI:

**GRAPH 2: U.S. Monthly YTY % Change, Jan 2010-
Apr 2016: CPI-U vs. PCE PI (SOURCE: FRED)**



IV. THE CORE CPI-U AND CORE PCE PI

THE CORE CPI-U AND CORE PCE PI

- ❖ The *Core CPI-U* and *CORE PCE PI* remove the more volatile components of *Food* and *Energy*.
- The idea is to remove the more volatile components to get a clearer picture of the underlying inflationary, or deflationary, pressures on the Economy.
- Further, spikes in food and energy prices usually reverse themselves after a while.

THE CORE CPI-U AND CORE PCE PI

**GRAPH 3: U.S. Annual Inflation Rate, 1960-2015:
Core CPI-U vs. Core PCE PI (SOURCE: FRED)**

