The Chained CPI-U: Methods and Issues

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Outline

- Background on the Chained C-CPI-U
- Final C-CPI-U Values
- Preliminary C-CPI-U Values
- Use of the C-CPI-U in indexation

Three Official CPIs

- The CPI-U, the Consumer Price Index for All Urban Consumers: the "headline" CPI
- The CPI-W, the CPI for Urban Wage Earners and Clerical Workers: the index used to compute COLAs for Social Security, federal retirement, and other benefit programs
- The C-CPI-U, the Chained CPI for All Urban Consumers: the subject of my presentation

The C-CPI-U

- The Chained CPI-U differs from the CPI-U in formula and weighting
- Released monthly in preliminary form, with several scheduled revisions
- In final form, uses a Törnqvist formula, monthly-chain weighting
- BLS considers it a closer approximation to a cost-of-living index (COLI)

The C-CPI-U: Publication

- Published C-CPI-U values begin with January 2000 (December 1999=100)
- As of October 2014, final indexes are available through 2012; indexes through March 2014 will become final with the February 2015 CPI release
- Published only at the All-US level, for All Items, All Items Less Food and Energy, 8 Major Groups, and 18 other aggregates
- Unlike CPI-U and CPI-W, C-CPI-U series are not seasonally adjusted

The C-CPI-U: Usage

- Since first released in 2002, the C-CPI-U has not supplanted the CPI-U or CPI-W in public attention or usage
- Revisability is a drawback for many uses
- Outside researchers have done relatively little analysis of the C-CPI-U
- Interest periodically heightens in the context of Federal tax and budget reform

The C-CPI-U: Today

- We now have 13 years of evidence on the behavior of the final Chained CPI, and 12 years of experience on revisions
- In 2015 the CPI program will introduce a New Estimation System that will allow more options and greater flexibility:
  - In calculation of final indexes
  - In calculation of preliminary indexes

C-CPI-U Documentation

- BLS *Handbook of Methods*, Chapter 17, pages 33-38, at www.bls.gov/opub/hom/pdf/homch17.pdf
- "Introducing the Chained Consumer Price Index," by Cage, Greenlees and Jackman, at www.bls.gov/cpi/super_paris.pdf
- Also see www.bls.gov/cpi/superlink.htm and the announcements on page 5 of http://www.bls.gov/news.release/pdf/cpi.pdf

C-CPI-U Final Index

- Employs a “superlative” Törnqvist formula; requires both base-period and current-period expenditure weights
- Uses monthly “chaining”; the base period is the previous month
- Uses the same 8,018 CPI area/item indexes as in the CPI-U and CPI-W
- Monthly expenditure weights are “smoothed” across areas

C-CPI-U Törnqvist Formula

$$IX^{TQ}_{t,t-1}$$

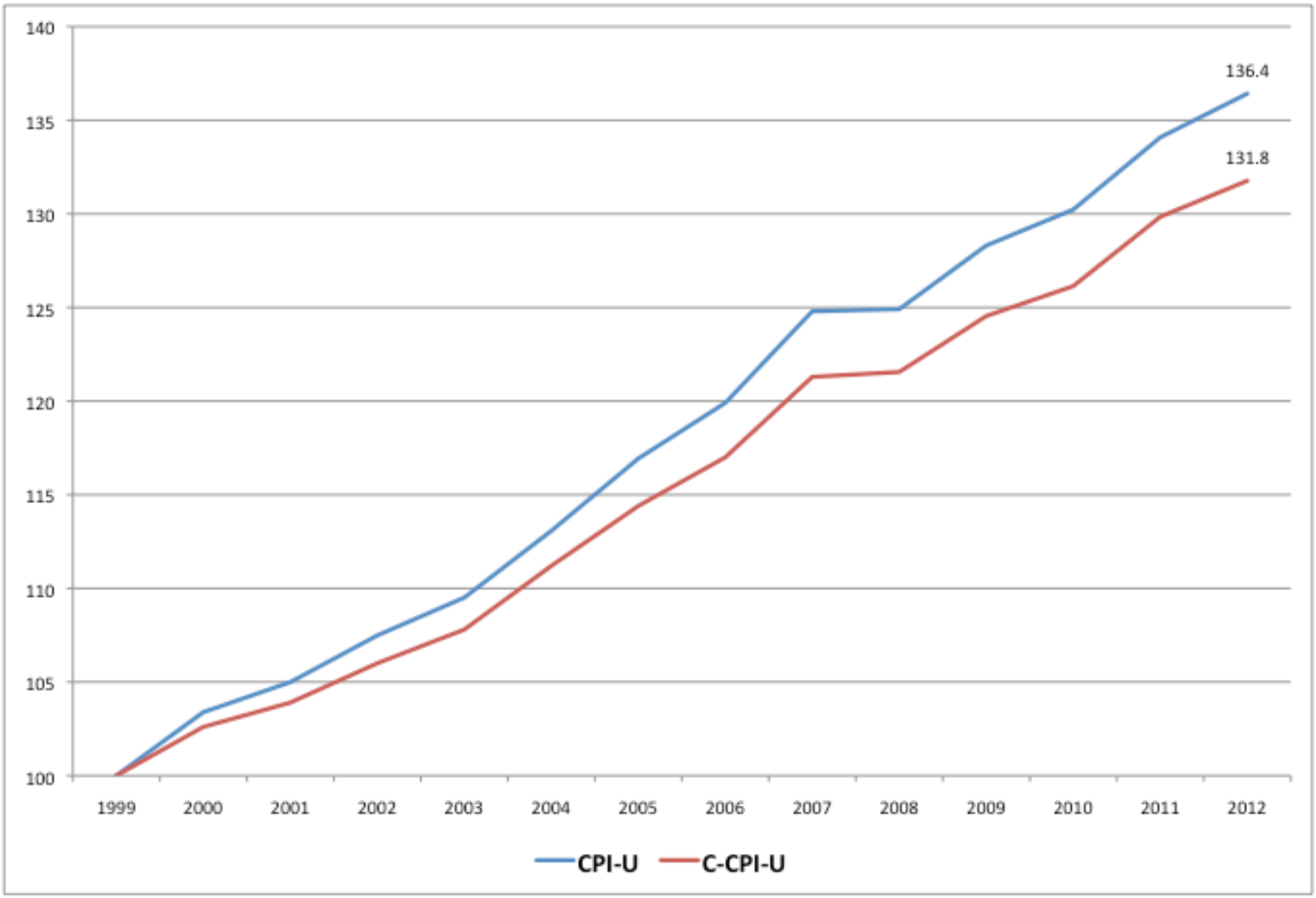
$$= \prod_{a,i} \left(p_{t,a,i} / p_{t-1,a,i} \right)^{0.5\left(s_{t-1,a,i} + s_{t,a,i}\right)}$$

$$= \exp\left(\sum_{a,i} 0.5 \left(s_{t-1,a,i} + s_{t,a,i} \right) \ln \left(p_{t,a,i} / p_{t-1,a,i} \right) \right)$$

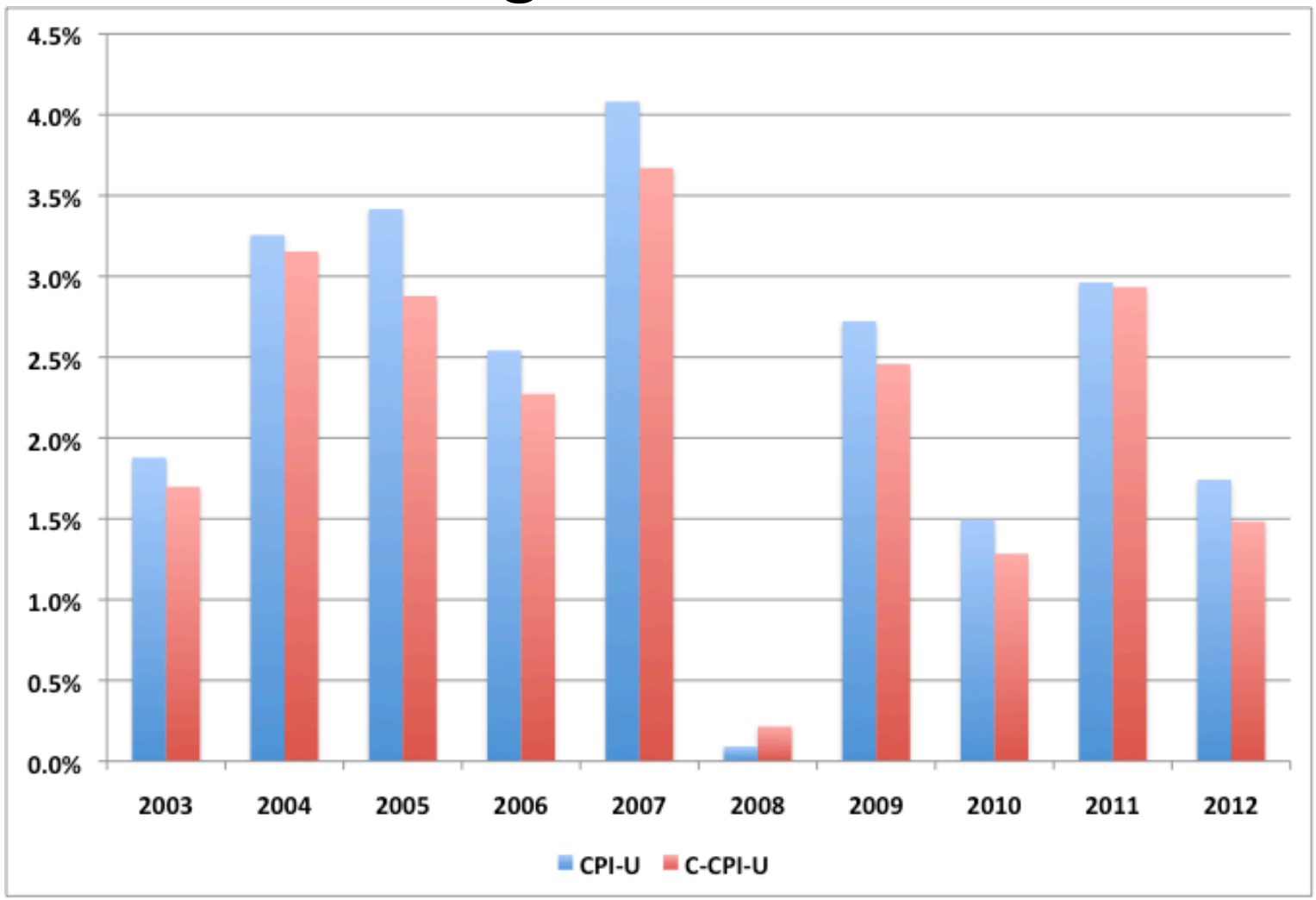
Index Differences

- Over the 10 years from 2003 to 2012, C-CPI-U 12-month changes have averaged between 0.2 and 0.3 index points below those of the CPI-U
- This is roughly in accord with expectations prior to the C-CPI-U's introduction
- CPI-U 12-month changes have not always been higher, however

CPI-U vs. Final C-CPI-U: December Index Levels 2000-2012 (Dec. 1999=100)



CPI-U vs. Final C-CPI-U: Dec. to Dec. Changes 2003-2012



Issues with Final C-CPI-U

- Lack of timeliness; 13-24 month lag
- Chain drift due to monthly chaining?
- Weighting issues:
  - Sampling error in monthly weights
  - Impacts of smoothing weights

Timeliness

- Final values for year *y* have not been published until February of year *y+2*
  - Due to time required to obtain year *y* data from Consumer Expenditure (CE) survey
- The CE program now produces data for CPI on a quarterly instead of annual cycle
- Permits quarterly updating of final C-CPI-U indexes, enhancing timeliness

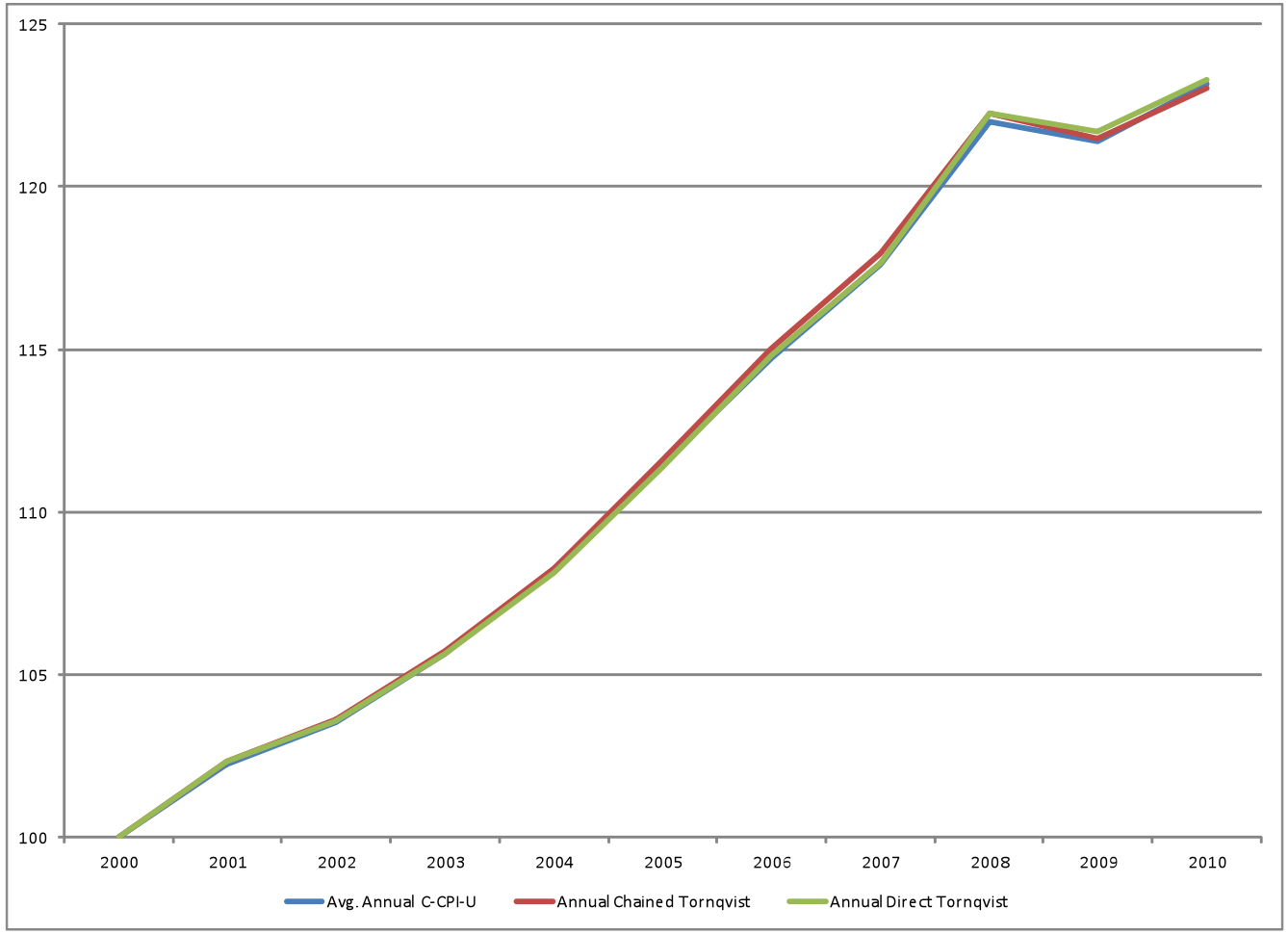
Quarterly C-CPI-U Release Schedule

Index Month	Release Month
January 2013 – March 2014	February 2015
April – June 2014	May 2015
July – September 2014	August 2015
October – December 2014	November 2015

Chain Drift

- Potentially, chaining monthly Törnqvist index changes could create an upward or downward bias due to seasonality, lags in consumer response, etc.
- However, comparing the C-CPI-U to an chained or fixed-base annually Törnqvist shows little or no evidence of such a drift

Annual C-CPI-U vs. Chained and Direct Törnqvists: Index Levels 2000-2010



Weighting Issues

- Reported monthly CE weights have small sample sizes and high volatility
- For the C-CPI-U, the total US monthly weights in each item category are "smoothed": prorated to geographic areas based on the last 12 months of data

Smoothing Impact

- "Smoothing" could have unintended effects on index movements
- Using unsmoothed weights would have almost no effect between December 1999 and December 2010, however
  - C-CPI-U change: 26.14 percent
  - Alternative index change: 26.09 percent

C-CPI-U Preliminary Indexes

- During year *y*, the current-month indexes have been termed "Initial" values; the values for year *y-1* were "Interim"
- These preliminary indexes do *not* use a superlative formula
- They have employed a geometric mean formula (as opposed to arithmetic in CPI-U)
  - But with allowance for an "adjustment factor"

C-CPI-U Preliminary Indexes

- Initial and Interim indexes use the same item/area weights as the CPI-U
  - Currently these are 2011-2012 weights
  - Weights updated biennially, next in 2016
- Preliminary indexes are linked onto the most recent final C-CPI-U values, currently December 2012
  - In February 2015, will link onto March 2014 values

Current Preliminary Index Formula

$$IX^{P}_{t,t-1,b}$$

$$= \lambda \prod_{a,i} \left(p_{t,a,i} / p_{t-1,a,i} \right)^{s_{b,a,i}}$$

$$= \lambda \exp\left(\sum_{k} s_{b,a,i} \ln\left(p_{t,a,i} / p_{t-1,a,i} \right) \right)$$

The Adjustment Factor

- Based on research prior to 2002, the final C-CPI-U was expected to be close to a geometric mean index
  - The adjustment factor λ was originally set equal to 1
- Revisions have been larger than expected, but not consistent in sign
- BLS continued to use 1 in each year for lack of strong evidence on optimal λ

December Revisions, Initial to Final C-CPI-U, 2002-2010

	Initial	Final	Revision
2002.12	105.809	106.046	0.237
2003.12	107.499	107.821	0.322
2004.12	110.709	111.156	0.446
2005.12	114.036	114.418	0.382
2006.12	117.059	117.016	-0.043
2007.12	121.088	121.295	0.207
2008.12	120.661	121.557	0.896
2009.12	123.965	124.544	0.579
2010.12	126.866	126.045	-0.821

Issues with Preliminary C-CPI-U

- Formula only allowed a single upward or downward adjustment to geometric mean:
  - In both initial and interim indexes
  - In all months of the year
- Also, BLS desired the ability to adjust the preliminary values toward or away from the CPI-U, not necessarily up or down

New Preliminary Index Formula

In 2015, BLS will replace the adjusted geometric mean with the CES, or Lloyd-Moulton, formula

$$IX_{t,b}^{LM} = \left[\sum_{a,i} s_{b,a,i} \left(p_{t,a,i} / p_{b,a,i} \right)^{1-\eta} \right]^{1/1-\eta}$$

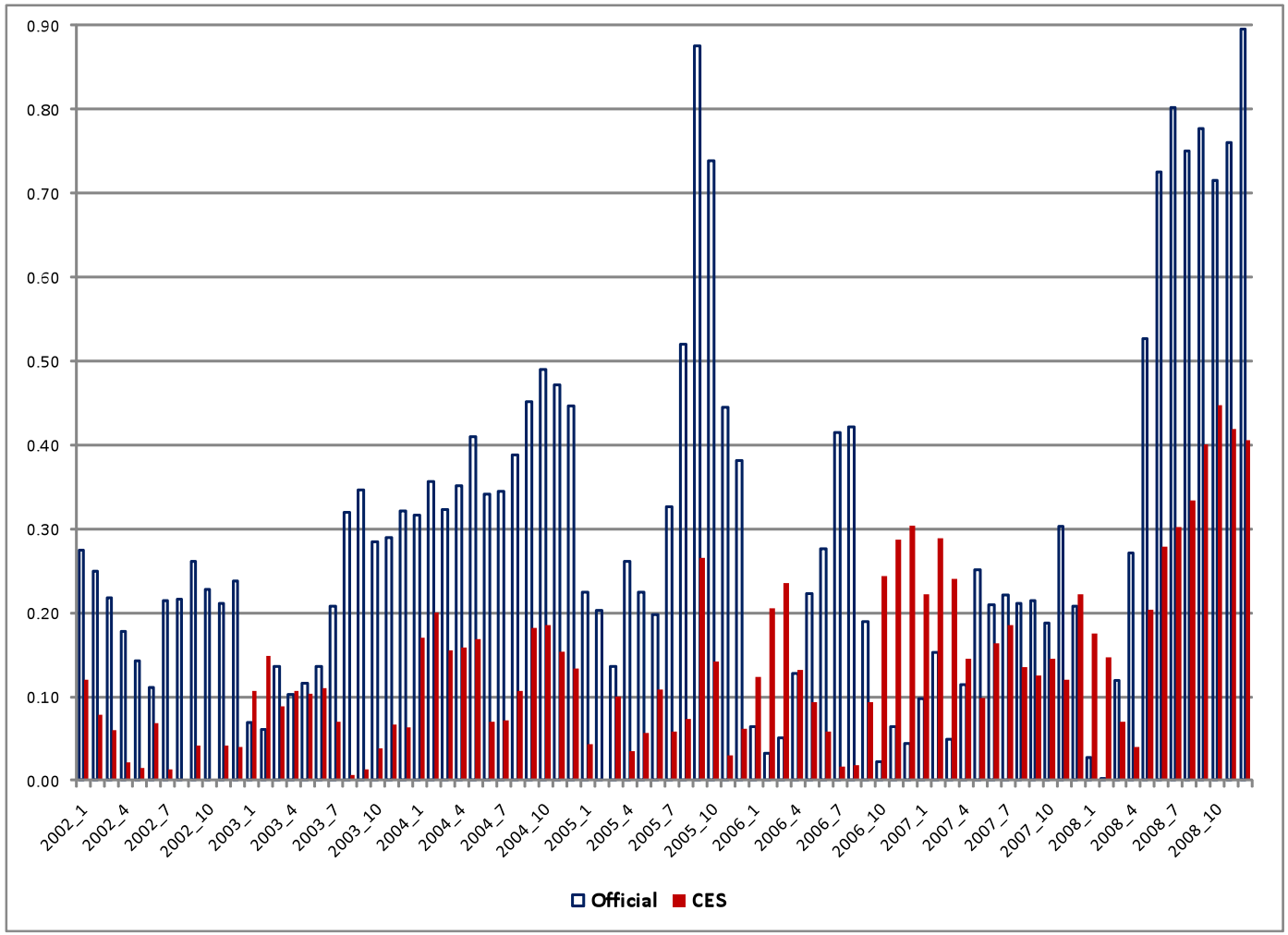
The CES formula

- The CES formula is, in effect, a weighted average of the current preliminary formula and the formula used in the CPI-U
  - When η=1, the CES reduces to a geometric mean
  - When η=0, it equals a Laspeyres
- In practice, the optimal η is usually between 0 and 1

Evidence for the CES

- Reported in Greenlees *JESM* 2011, and at www.bls.gov/osmr/pdf/st100060.pdf
- The CES (Lloyd-Moulton) formula had significant value in improving C-CPI-U preliminary estimates
- Bias and MSE were substantially improved

Absolute Errors of Initial Forecast: Official and CES



Implementing the C-CPI-U in Indexation Programs

- Discussed in detail in "Using a Different Measure of Inflation for Indexing Federal Programs and the Tax Code" (Congressional Budget Office, 2010):
- The most convenient formula uses the Initial C-CPI-U values to determine COLAs

Using the Initial C-CPI-U

- The problem in using the C-CPI-U is that it is subject to revision
- Use of the initial estimates automatically adjusts for past errors (with a lag):

$$(I^{I3} - I^{N2}) + [(I^{N2} - I^{F1}) - (I^{I2} - I^{N1})]$$

$$+ [(I^{F1} - I^{F0}) - (I^{N1} - I^{F0})]$$

$$= I^{I3} - I^{I2}$$