Adjusting CPI (and related government statistics) for potential biases from quality change and new goods in an age of digital technologies

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Meeting of the Group of Experts on Consumer Price Indices – Session 3
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Agenda

1. Background – *Journal of Economic Perspectives* Spring 2017 Symposium
2. Main points from Groshen/Moyer/Aizcorbe/Bradley/Friedman article
3. CPI research & improvements
4. New products in CPI
5. Conclusions

Three articles in Spring 2017 issue include:

Underestimating the Real Growth of GDP, Personal Income, and Productivity - Martin Feldstein
  ▶ Asserts there’s a huge measurement problem

Challenges to Mismeasurement Explanations for the US Productivity Slowdown - Chad Syverson
  ▶ Refutes many mismeasurement explanations

- Current processes, issues, adjustment strategies, bias estimates, measurement strengths
- Focus on all BLS price indices including CPI
Price indexes “in the trenches”

Goal

- Best possible monthly indexes of price changes that meet measurement objectives and the needs of data users

Constraints on methodology

- Compatible with resources (e.g. funding, skill set)
- Doable within monthly cycle
- Preserve respondent confidentiality
- Avoid undue burden on respondents
- Changes in methods should prove to reduce bias in statistically significant manner
Importance of Matched Model Concept

- “Matched Model” = cornerstone of price measurement
- Focus on pricing “identical” items over time with procedures to deal with replacements, etc.

CPI C&S Items Dec 2013-Nov 2014

- Matched: 73%
- Temporarily Missing: 22%
- No longer available: 5%
When an Item is No Longer Available

- Attempt to identify replacements
  - If comparable, new item replaces old item directly
  - For rest, attempt quality adjustment (including imputation as needed)
  - Results here for all items; can be higher or lower for specific categories

CPI C&S, 12/2013 thru 11/2014

[PERCENTAGE]

- Matched: 22%
- Temporarily Missing: 2%
- Comparable substitutes: 3%
- Quality adjustment or substitution (relative impute): 5%
## Methods to account for new and improved goods and services

<table>
<thead>
<tr>
<th>Method</th>
<th>Requires demand estimation</th>
<th>Based on characteristics, product or other</th>
<th>In production</th>
<th>Reason not in production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality adjustment from producer</td>
<td>No</td>
<td>Characteristics</td>
<td>Yes; PPI, MXP, CPI***</td>
<td></td>
</tr>
<tr>
<td>Input from other surveys</td>
<td>No</td>
<td>Characteristics</td>
<td>Yes; primarily PPI</td>
<td></td>
</tr>
<tr>
<td>Explicit hedonic quality adjustment</td>
<td>No</td>
<td>Characteristics</td>
<td>Yes; CPI*, PPI**, MXP**</td>
<td></td>
</tr>
<tr>
<td>Time dummy hedonic index</td>
<td>No</td>
<td>Characteristics</td>
<td>Recent for PPI#; No otherwise</td>
<td>Restrictive assumptions</td>
</tr>
<tr>
<td>Imputed hedonic index</td>
<td>No</td>
<td>Characteristics</td>
<td>No</td>
<td>Requires larger sample sizes</td>
</tr>
<tr>
<td>Discrete choice</td>
<td>Yes</td>
<td>Characteristics</td>
<td>No</td>
<td>High computational intensity and cost; poor timeliness</td>
</tr>
<tr>
<td>Consumer surplus</td>
<td>Yes</td>
<td>Product</td>
<td>No</td>
<td>Endogeneity problems (under investigation); high cost</td>
</tr>
<tr>
<td>Disease-based price indexes</td>
<td>No</td>
<td>Treated disease</td>
<td>Partial; BEA and BLS experimental indexes</td>
<td>Do not yet adjust for differences in outcomes</td>
</tr>
</tbody>
</table>

* See [https://www.bls.gov/cpi/quality-adjustment/home.htm](https://www.bls.gov/cpi/quality-adjustment/home.htm) for CPI items that are quality adjusted using hedonic models.
** PPI and MXP do explicit hedonic quality adjustment for computers.
*** Most prevalent method for PPI & MXP; only used in CPI for new vehicles & computers where deemed to be best QA method.
# PPI recently introduced BLS first use of time dummy variable in building hedonic QA model for use with desktop microprocessors.
JEP paper estimate of biases

- GDP impact on Personal Consumption Expenditures (PCE) + Private Fixed Investment (PFI): -0.4 percentage point
  - Reduction in measured real GDP growth from biases (2015); PCE -0.26 & PFI -0.15
  - Little change over time
  - Looms larger when growth is slow

- BLS & BEA perspective
  - Not alarmed, nor satisfied
  - Helps focus improvement efforts
CPI Research & Improvements

- Focus on new data sources/ division of labor (collaboration with BEA)
- “Digital economy” focus:
  - Wireless telephone services
  - Cell phones
  - Cable, internet, & landline (“wireline services”)
- Importance of medical care
- Ongoing research into expanded use of hedonic methods
CPI Wireless Telephone Services

- Refined quality adjustment process in early 2017, reducing the rate of non-comparable substitution
  - Better estimation of price of data plans with included data amounts not offered to customers in previous period using data from Whistle Out site
- Work with JD Household data shared by BEA
  - Potential to guide field item selection procedures & substitution frequency
- Research Whistle Out data for potential data collection replacement
Smartphones in CPI

- Within cell phones index, recognized need to do better job of quality adjusting smartphones due to rapid rise of technological advancements
- Using alternative data, BLS built a new QA hedonic model—introduced in production in January 2018
- Directed substitutions 2x/year, as major new smart phone models are released (used for first time with April 2018 data – indexes published in May – upcoming release this Thursday!)
- QA hedonic models will be updated twice yearly to correspond with release dates
CPI: Cable, Internet, & Landline ("wireline services")

- Researching alternative data set shared by BEA
  - Cover standalone and triple-play bundled versions of these wireline services
  - Potential for development of QA models if viable
  - Potential for replacing/supplementing data collection

- JD Household data may be helpful here too
  - Improve field procedures (item selection & substitution frequency)
Observations from experience so far

- One potential drawback – offer prices vs. transaction prices in data sources
- Many similar challenges to use of other alternative data sources (cost of data to refresh models, can be labor intensive, etc.)
- Obtaining corporate data may still be the best answer if possible
- Will continue efforts to improve our price measurement of digital economy-related products but tend to be mixed in with other products in similar categories (e.g. smart appliances are part of appliances category)
Focus on Medical Care Sector

- Medical care services make up a large & growing part of US economy – almost three times as large as BEA preliminary estimate for the “digital economy”

- Pricing medical care is particularly challenging, especially when it comes to quality change & new goods
  - BLS researching use of Medicare claims data for quality adjustment
  - Experimental disease-based price indexes
  - Use of MEPS to maintain appropriate proportions for payer types
  - Research use of claims data to improve medical care indexes
Identifying and introducing new products in the CPI

- Since 2002, weights derived from Consumer Expenditure Survey updated every two years
- CPI sample rotation uses 4-year rotation scheme (instead of former 5-year scheme)
- Housing sample now on continuous 6-year basis
- Use of directed substitution and similar procedures as needed
- Regular environmental scan to ensure new products can be captured in CE, CPI, and outlet survey
Conclusions

**Price index measurement → understated real output growth**
- From rapid innovation and globalization
- Affects healthcare, possibly areas using IT/comms technology
- Stable over time

**Producing official stats: not for the rigid or fainthearted**
- Put out timely monthly data, within budget
- Biases will be addressed over time; promise of alternative data sources

**Official statistics**
- Error inherent to measurement process; we strive to minimize it but realize we can’t completely eliminate it
- Uniquely accurate, objective, relevant, timely and accessible
- Infrastructure supporting efficient markets, helping policymakers and citizens make decisions
- Need active support in today’s environment
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