Making Greater Use of Transactions Data to compile the Australian CPI

Presented by:
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Background

• ABS in a transformation environment – seeking ways to utilise ‘big data’ for compilation of economic statistics

• *Enhancing the Australian CPI: a roadmap* (ABS 2015) sets out four research priorities
  • Frequency of weight updates
  • **Transactions/scanner data**
  • Monthly CPI
  • Other enhancements

• Transactions data contains detailed information about individual transactions, date, quantities, product descriptions, and values of products sold
Background

• Transactions data used to compile ~ 25% of CPI

• Stock keeping unit (SKU) defines a product

• Current method directly replaces field collected prices with unit values derived from transactions data within elementary aggregates (Jevons formula)

• Quality benefits: average unit value, increased respondent coverage, informed sampling choices

• Cost benefits: less labour intensive
Multilateral methods

• While the current method is a significant improvement for the CPI, further enhancements are possible. These enhancements include:
  • Using census of products
  • Weighting prices at the product level
  • Automated processes

• ABS (2016) undertook research into a selection of multilateral and extension methods. This presentation will cover:
  • Key findings of ABS (2016)
  • Feedback received from users
  • Subsequent research toward a recommendation for the Australian CPI
Multilateral methods

- One option the ABS has considered is a weighted bilateral index formula (e.g. Törnqvist, Fisher)

- Could use ‘direct’ or ‘chained’ weighted bilateral indexes

- Dynamic nature of transactions data can make these methods perform badly

- ‘Direct’ bilateral indexes suffer from a ‘matching’ problem (i.e. item attrition)

- ‘Chained’ bilateral indexes suffer from a ‘chain drift’ problem

- Multilateral methods a solution to these issues
Multilateral methods

- Four multilateral methods:
  1. Gini, Eltetö and Köves, and Szulc (GEKS-Törnqvist)
  2. Weighted Time Product Dummy (TPD)
  3. Geary-Khamis (GK)
  4. Quality Adjusted Unit Value using TPD (QAUV_TPD)

- Results in this presentation focus on GEKS-Törnqvist and TPD

- The ABS Data Quality Framework (ABS 2009) used to guide choice of multilateral method
Extension methods

- When a multilateral method is extended an additional period, previous price movements are revised.

- To deal with this revisions problem, the ABS is researching a selection of extension methods.

- These extension methods tested are characterised as:
  2. Direct annual extension (Chessa 2016).

- Window size of 2 years + 1 period (i.e. 25 months, 9 quarters) for rolling window extension methods.
## Framework for assessing methods

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Considerations</th>
<th>Quality dimensions</th>
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</thead>
<tbody>
<tr>
<td>Resources</td>
<td>Facilitates automation? Makes good use of information?</td>
<td><em>Institutional Environment, Timeliness</em></td>
</tr>
<tr>
<td>Theoretical properties</td>
<td>Axiomatic and economic approaches to index numbers</td>
<td><em>Accuracy</em></td>
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<td>Transitivity</td>
<td>Risk of drift over time</td>
<td><em>Accuracy, Coherence</em></td>
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<tr>
<td>Characteristicity</td>
<td>Relevance of bilateral price comparisons to periods at hand</td>
<td><em>Accuracy, Relevance</em></td>
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<tr>
<td>Flexibility</td>
<td>Scope for adaptation for new products or data sources</td>
<td><em>Coherence, Institutional Environment</em></td>
</tr>
<tr>
<td>Interpretability</td>
<td>Ease of understanding method in general and price movements it calculates</td>
<td><em>Interpretability</em></td>
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Findings of ABS (2016)

- Modified aggregation structure than traditional CPI
- Price aggregation directly to EC level for each respondent
- Respondents weighted by market share to produce published level indexes
Findings of ABS (2016)

• All multilateral methods produced similar price indexes

• No method consistently higher/lower relative to others

• GEKS-T price movements susceptible to small quantities in some instances
Findings of ABS (2016)

- Results more sensitive to extension method

- Across various commodities, half splice (on average) reported results closest to a revisable/transitive series
Findings of ABS (2016)

- Results at the published level similar to current CPI
Feedback on ABS (2016)

- Users support the use of multilateral/extension methods for the aggregation of transactions data
- Users preferred GEKS-Törnqvist for multilateral method
- Users recognise empirical results more sensitive to the choice of extension method
- The ABS has pursued some additional empirical work using GEKS-Törnqvist on the following:
  1) Elementary aggregation direct to EC level
  2) Comparing mean splice (Diewert and Fox 2017) to other extension methods
  3) Review of 9 quarter (25 month) estimation window
  4) Definition of product using SKU for certain commodities (“relaunch” issue)
Multilateral methods at different levels of aggregation

- Multilateral methods applied at a more homogenous product groupings (consumption segments)
- Aggregated to EC level using Lowe and Törnqvist formula
- Small differences comparing EC vs EA aggregation using Törnqvist
Comparing mean splice

- ABS (2016) empirically assessed three rolling window extension methods
- Diewert and Fox (2017) recommend a “mean splice” extension method
- Empirical testing of “mean splice” looks promising
Length of estimation window

- GEKS-T using a “mean splice” for different estimation window lengths (i.e. 13, 14, 18, 25) months

- Longer estimation window usually produced “flatter” price series
Future developments

• ABS to release a paper mid-2017 recommending a preferred multilateral/extension method for implementation

• At this stage, the ABS will likely recommend the following:
  • GEKS-Törnqvist as preferred multilateral method; and TPD as a secondary method.
  • Aggregate below the EC level using respondent classes as the primary method
  • Aggregate respondent classes together using Törnqvist index formula
  • Mean splice with a rolling window of 9 quarters (i.e. 25 months)

• Some commodities show signs of “relaunch” problem using SKU

• Will consult further with users following the release of recommendation. Pending feedback, will implement this change in the Australian CPI in DQ17
References


- ABS, 2015. Enhancing the Australian CPI: A roadmap. cat. no. 6401.0.60.001. ABS, Canberra.

- ABS, 2016. Information Paper: Making Greater Use of Transactions Data to compile the Consumer Price Index. cat. no. 6401.0.60.003. ABS, Canberra.


References

• de Haan, J. 2015, Rolling Year Time Dummy Indexes and the Choice of Splicing Method, 14th meeting of the Ottawa Group, May 22, Tokyo.
