

Making Greater Use of Transactions Data to compile the Australian CPI

Presented by:
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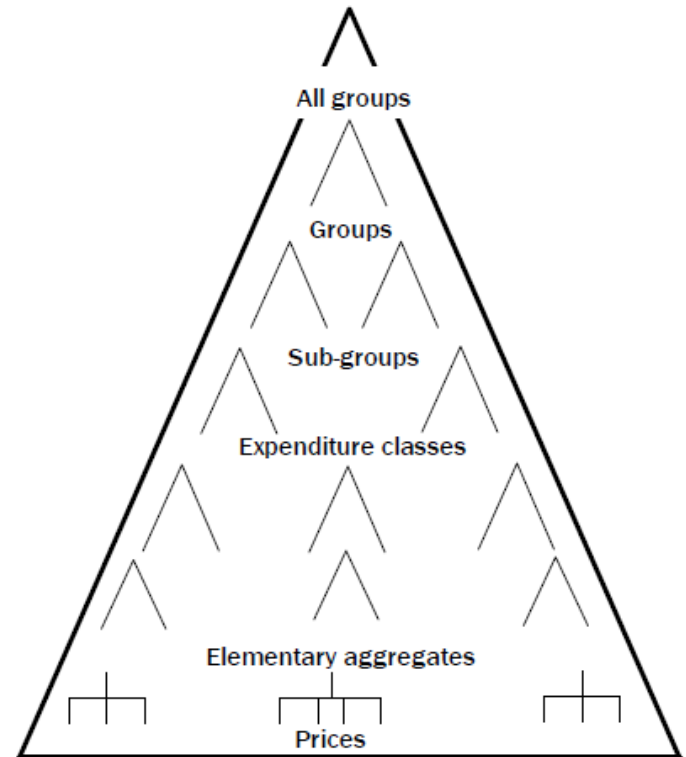


Background

- 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



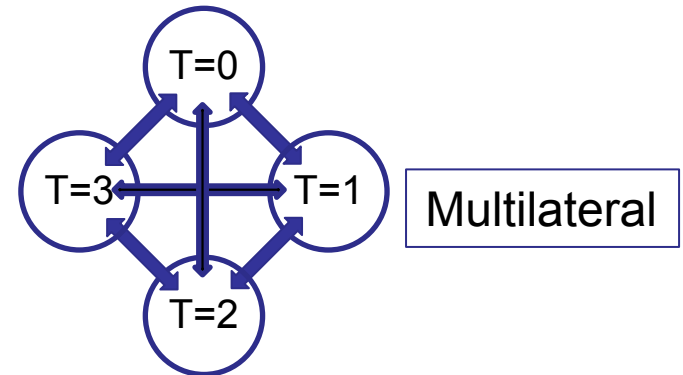
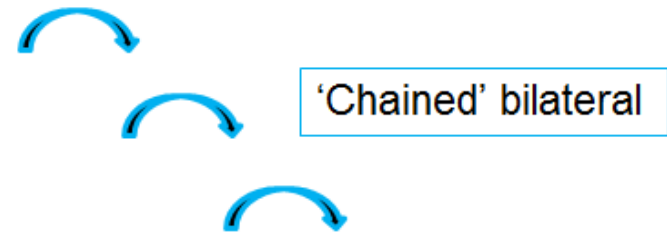
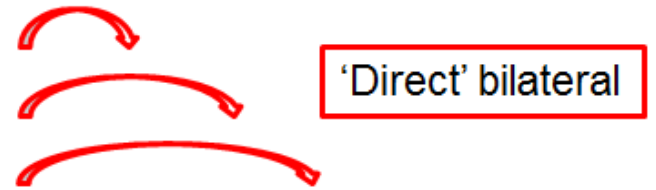
Multilateral methods

- 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

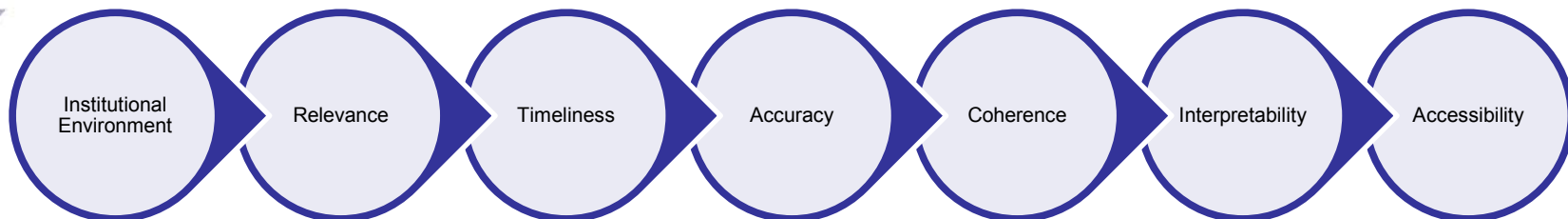
- One option the ABS has considered is a weighted bilateral index formula (e.g. Törnqvist, Fisher)
- Could use 'direct' or 'chained' weighted bilateral indexes
- Dynamic nature of transactions data can make these methods perform badly
- 'Direct' bilateral indexes suffer from a 'matching' problem (i.e. item attrition)
- 'Chained' bilateral indexes suffer from a 'chain drift' problem
- Multilateral methods a solution to these issues

0 1 2 3 → (time)



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

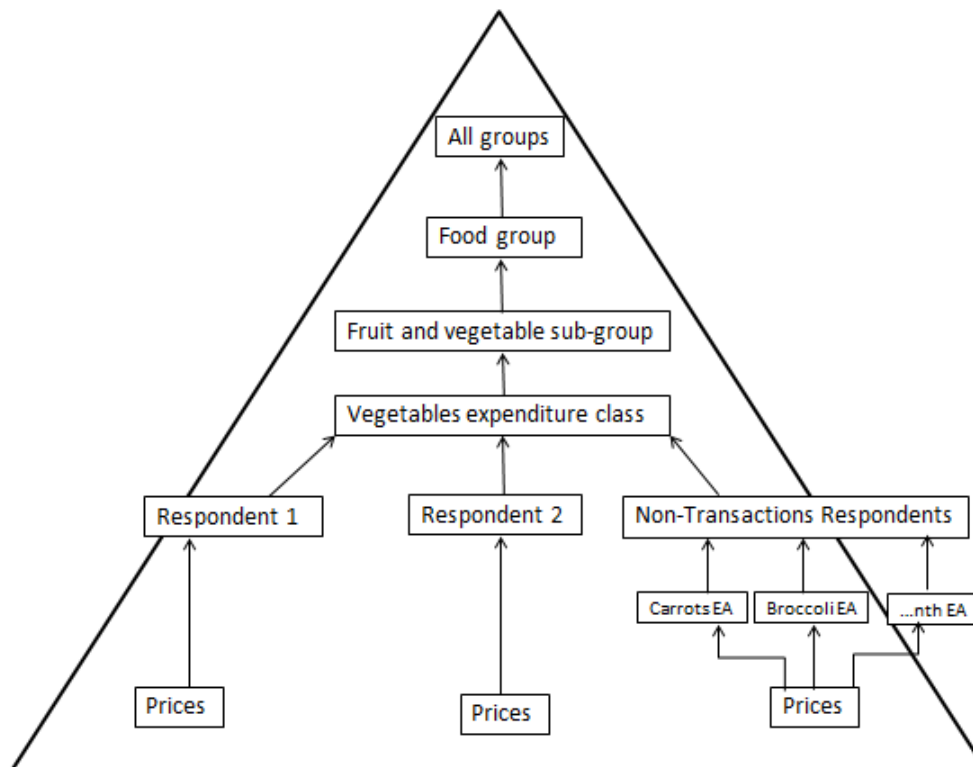
- When a multilateral method is extended an additional period, previous price movements are revised
- To deal with this revisions problem, the ABS is researching a selection of extension methods
- These extension methods tested are characterised as:
 1. Rolling window approaches (Ivancic, Diewert and Fox 2011, Krsinich 2016, de Haan 2015)
 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

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

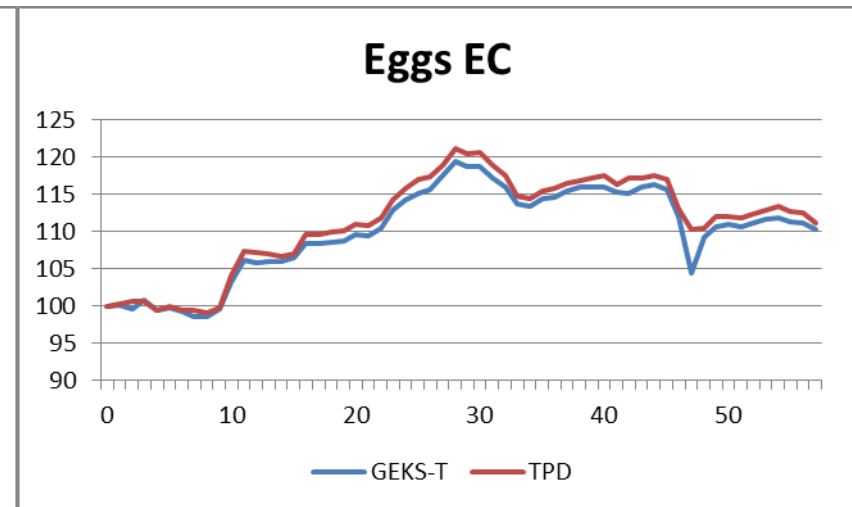
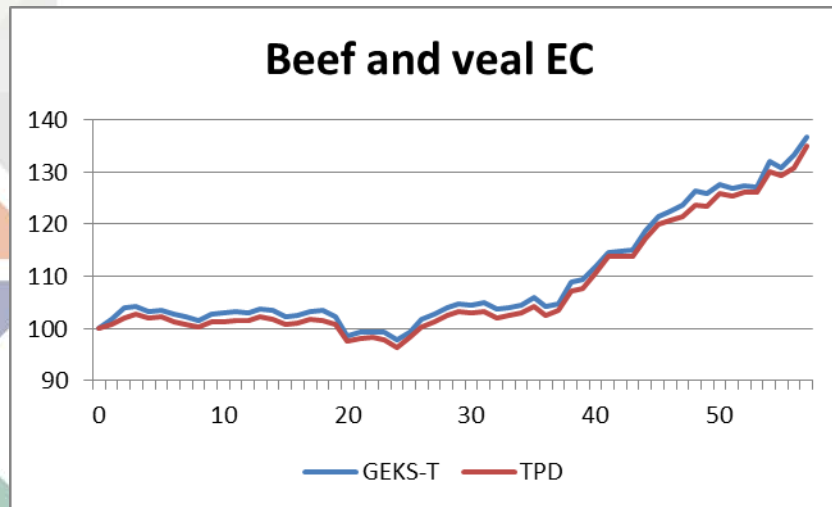
Findings of ABS (2016)

- 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



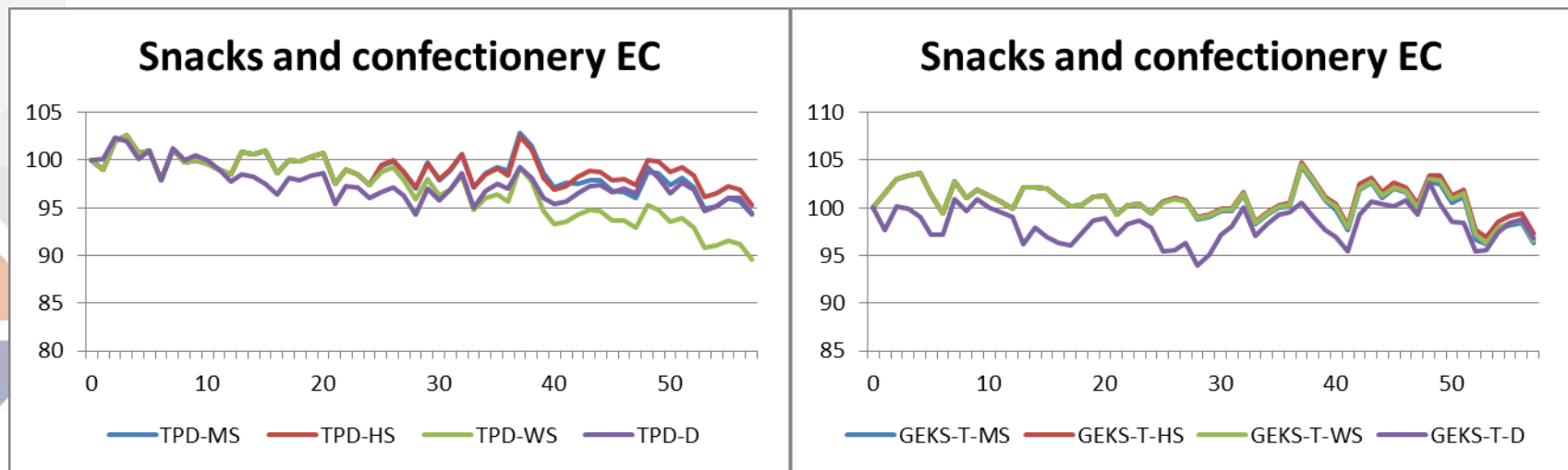
Findings of ABS (2016)

- 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



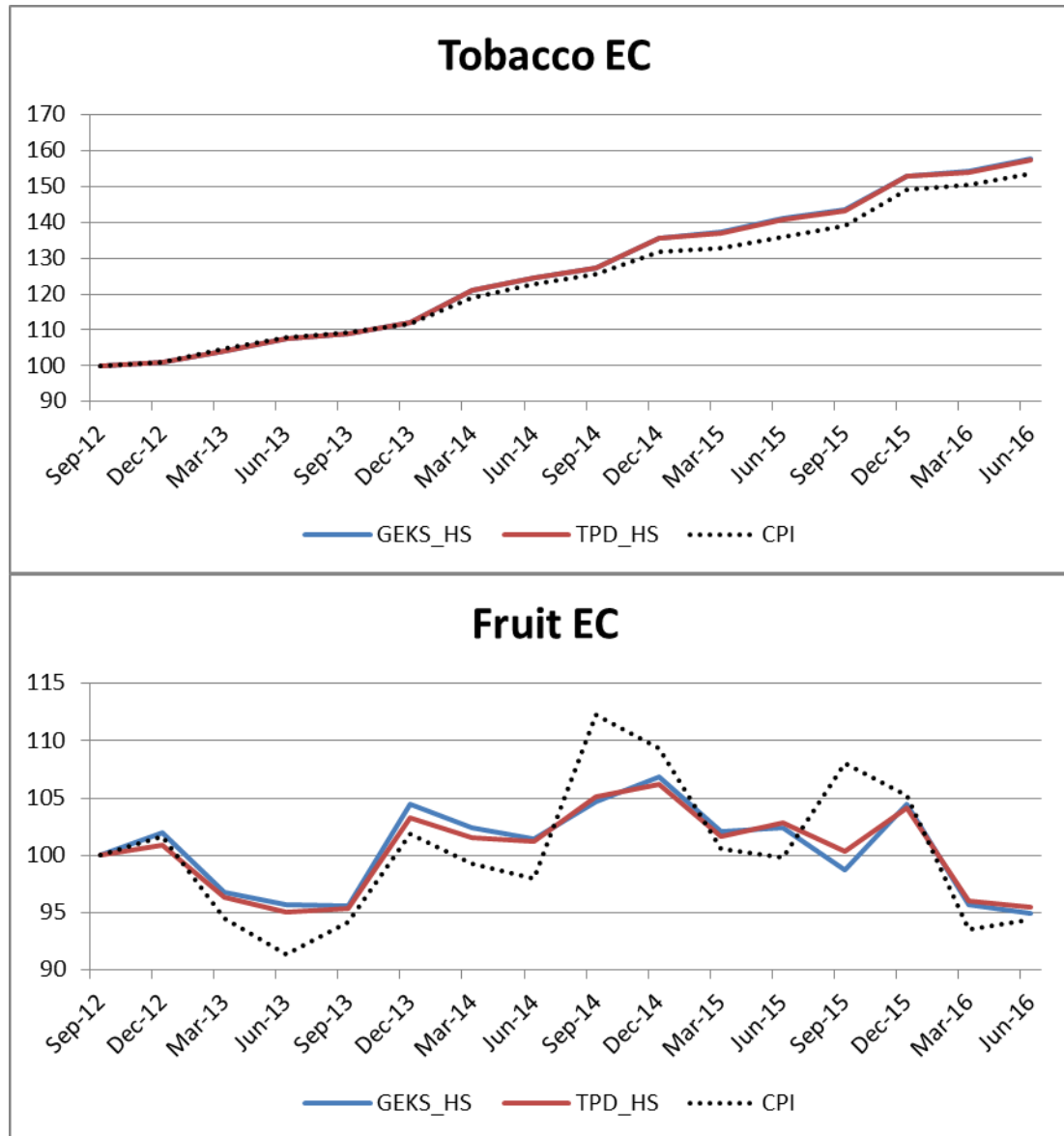
Findings of ABS (2016)

- 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

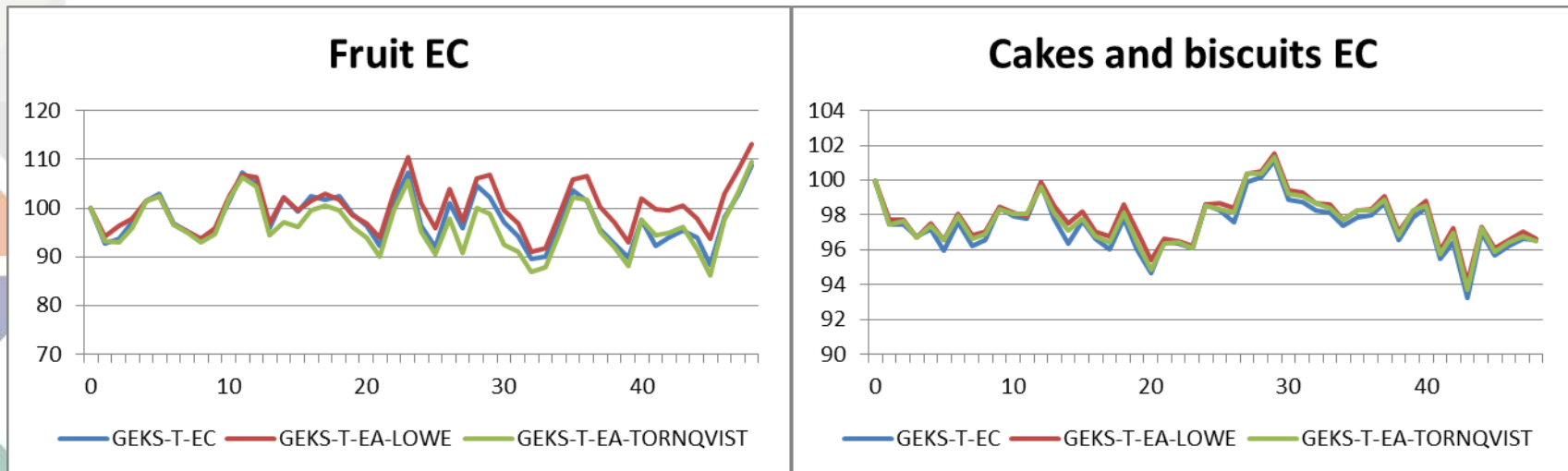


Feedback on ABS (2016)

- 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)

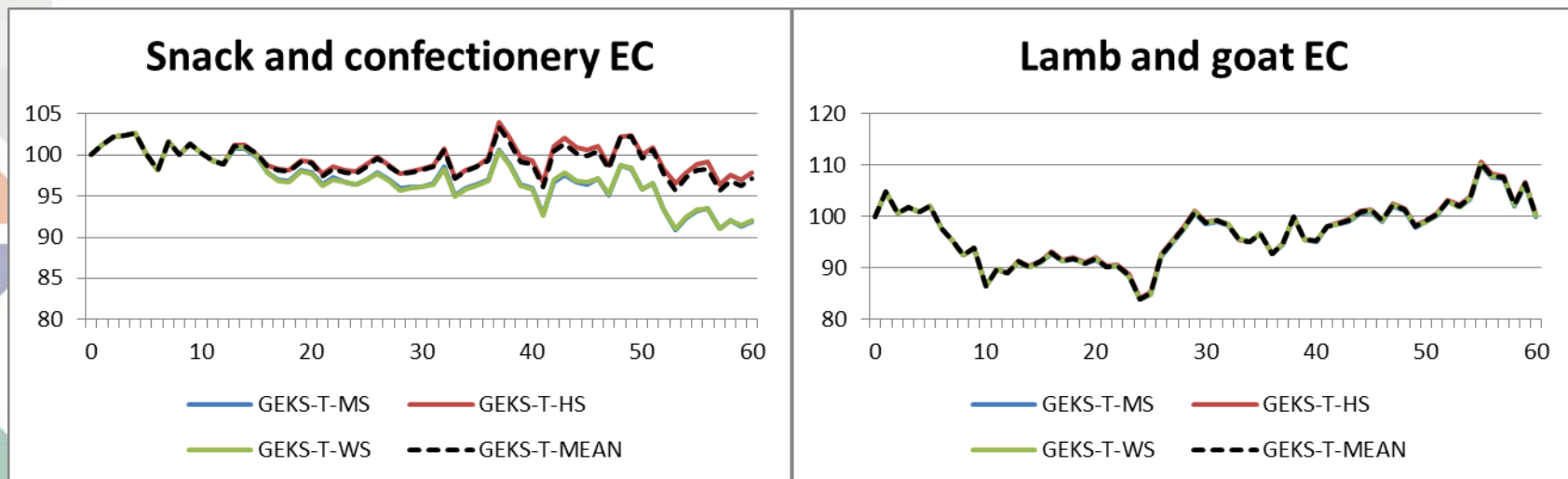
Multilateral methods at different levels of aggregation

- 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



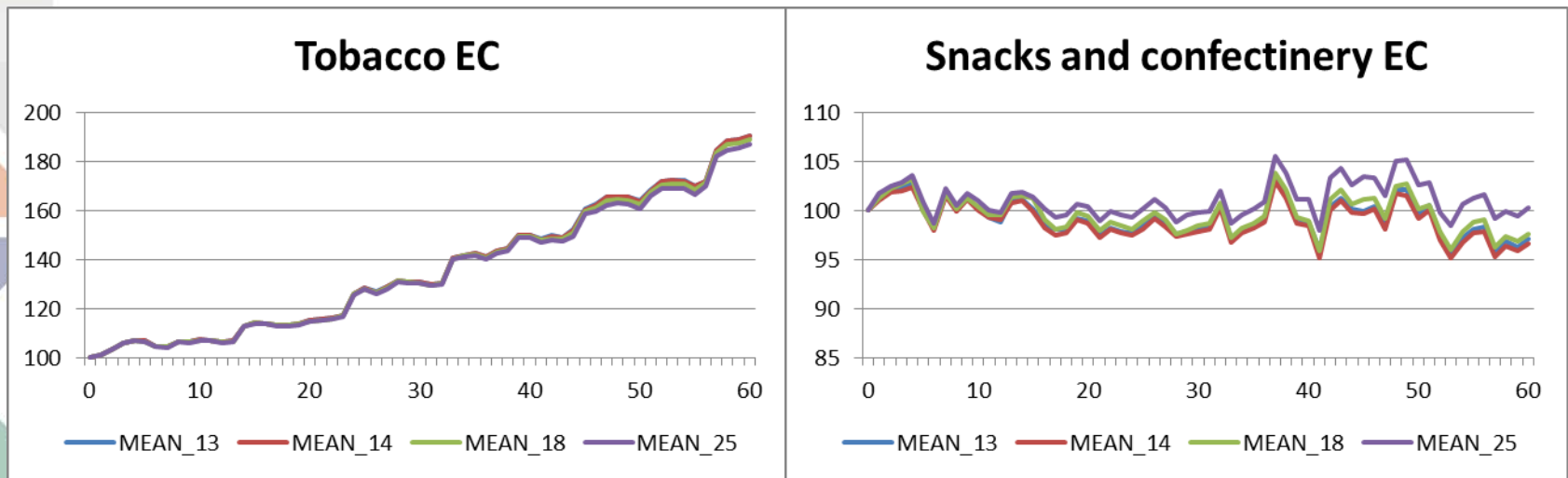
Comparing mean splice

- 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

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- Ivancic, L., Fox, K. J. & Diewert, E. W. 2011. Scanner data, time aggregation and the construction of price indexes. *Journal of Econometrics*, 161, 24-35.
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