

# Enhancing the Australian CPI

- Marcel van Kints & Michael Holt

Prices Branch, ABS

- Views expressed in this presentation are those of the authors and do not necessarily represent those of the Australian Bureau of Statistics



# Enhancements

- Enhancement program since 2014
- Focus on topics high-lighted in 16<sup>th</sup> Series CPI review

# Enhancements

- Transactions (scanner) data since 2014
- Enhancement roadmap paper (Aug 2015)
  - weights
  - making greater use of transactions data
  - spatial price indexes
  - a path to a monthly CPI
  - other enhancements to CPI series (e.g. samples, methods, etc)

# Enhancement papers

- Roadmap (Aug 2015)
- Annual re-weighting of the CPI (July 2016)
- Making greater use of transactions data (Nov 2016)
- More to come, input from academics and NSOs

# Making greater use of transactions data

## Summary of session

- Multilateral and extension methods
- Assessing methods
- Empirical findings
- Conclusions

# Multilateral methods

1. Gini, Eltetö and Köves, and Szulc (GEKS): geometric mean of all ratios of bilateral (Törnqvist) indexes where each entity is taken in turn as base

$$P_{GEKS}^{0,t} = \prod_{l=0}^T \left[ \frac{P^{l,t}}{P^{l,0}} \right]^{\frac{1}{T+1}} = \prod_{l=0}^T [P^{0,l} \times P^{l,t}]^{\frac{1}{T+1}}$$

2. Time product Dummy (TPD): WLS regression of (log) price against time and product dummy variables

$$\ln p_i^t = \alpha^0 + \sum_{t=1}^T \delta^t D_i^t + \sum_{i=1}^{N-1} \gamma_i D_i + \varepsilon_i^t$$

# Multilateral methods

3. Geary-Khamis (GK): standardised unit value index where adjustment factors are expressed as a quantity weighted average of deflated prices

$$P_{GK}^{0,t} = \frac{V^{0,t}}{Q_{GK}^{0,t}} = \frac{\sum_{i \in U^t} p_i^t q_i^t / \sum_{i \in U^t} v_{i/b} q_i^t}{\sum_{i \in U^0} p_i^0 q_i^0 / \sum_{i \in U^0} v_{i/b} q_i^0}$$

$$v_{i/b} = \sum_{z \in T} \varphi_{i,z} \frac{p_{i,z}}{P_{GK}^z}$$

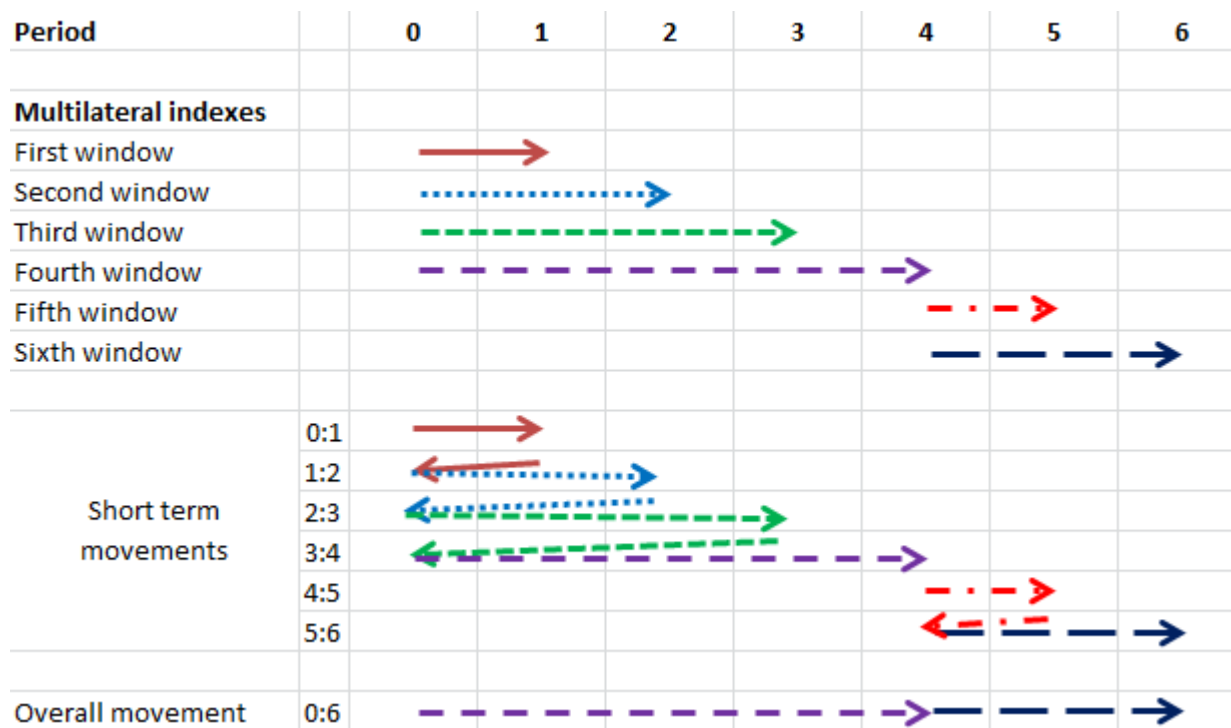
$$\varphi_{i,z} = \frac{q_{i,z}}{\sum_{s \in T} q_{i,s}}$$

4. Quality adjusted unit value using TPD (QAUV\_TPD): standardised unit value index where adjustment factors are derived product effects from the TPD regression

$$v_{i/b} = \frac{\hat{p}_i^t}{\hat{p}_b^t} = \frac{\exp(\hat{\Psi}_i)}{\exp(\hat{\Psi}_b)}$$

# Extension methods

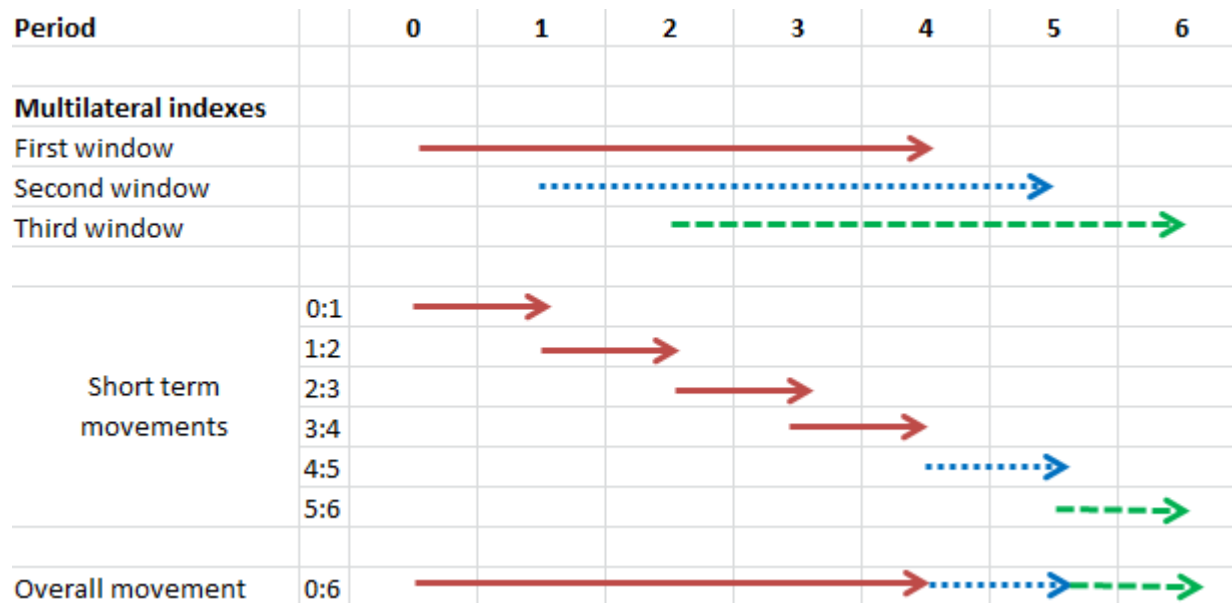
1. Direct (annual) extension: use a fixed base period (e.g. December quarter) as the pivot for direct multilateral comparisons





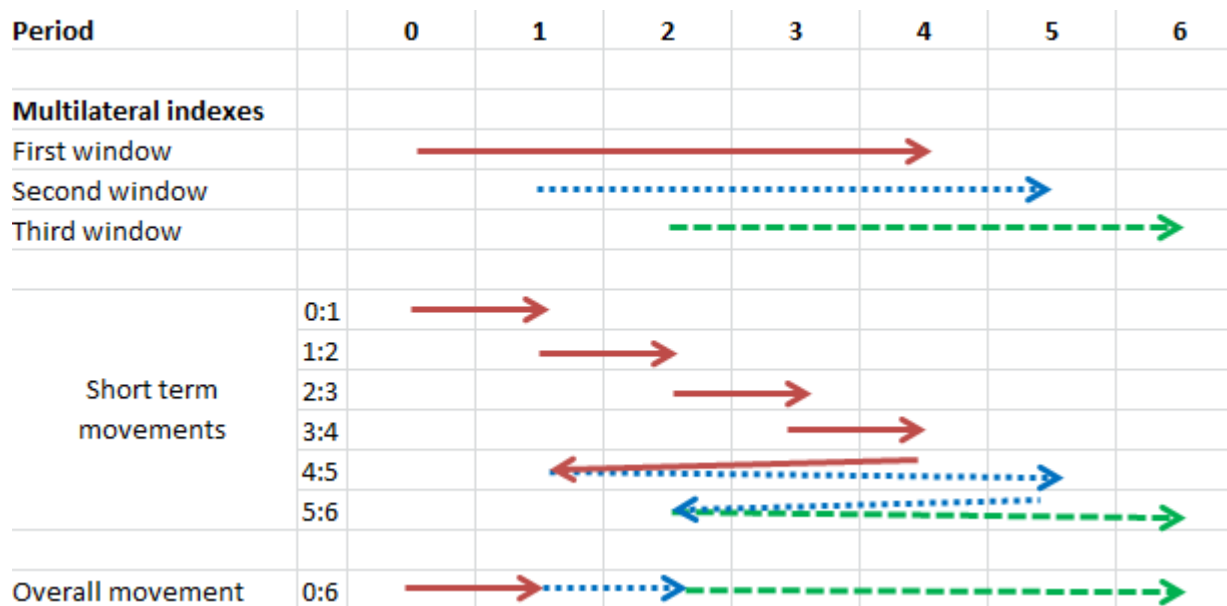
# Extension methods

2. Movement splice (rolling window): use the previous period price index as the pivot, and apply the price movement estimated from the new multilateral window



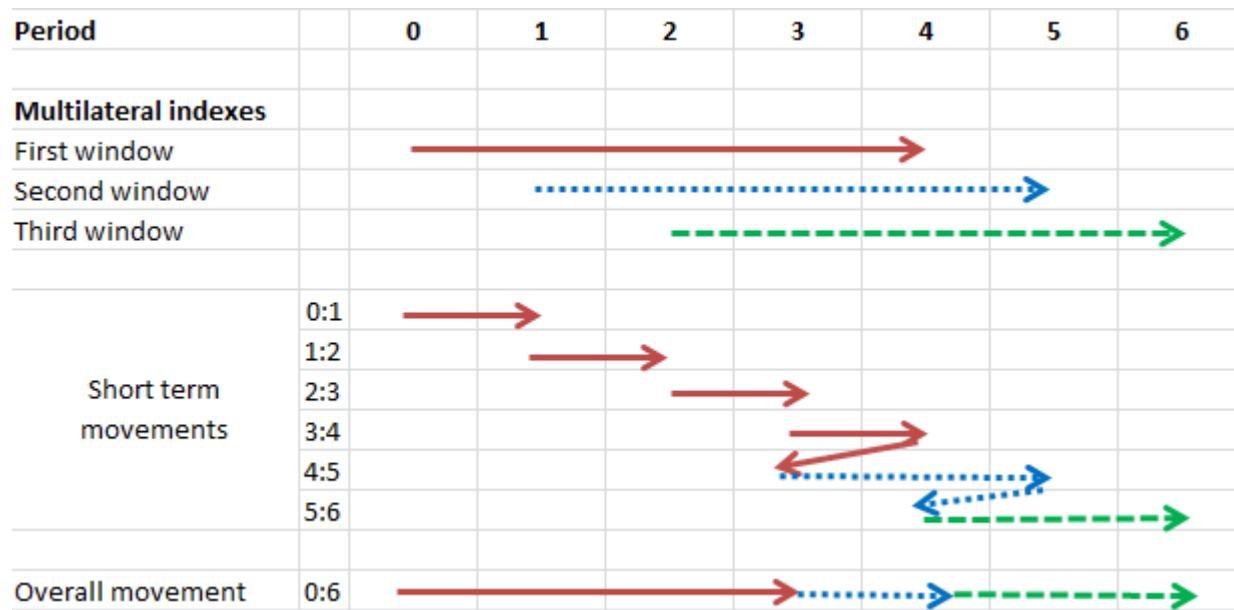
# Extension methods

3. Window splice (rolling window): use the period at start of the splicing window as the pivot, and apply full price movement across the new multilateral window



# Extension methods

4. Half splice (rolling window): use a period in the middle of the splicing window as the pivot, and apply half of the price movement from the new window



Test	GEKS	TPD	GK	QAUUV_TPD	Preserved after extension
1 Positivity and continuity test: price and volume indexes are normalised, positive and continuous functions of (positive) prices and (nonnegative) quantities	Y	Y	Y	Y	Y
2 Weak proportionality test: if prices and quantities in all periods are proportional, price and volume comparisons depend only on those proportions (Balk only)	Y	Y	Y	Y	Y
2x If quantities in all periods are proportional, volume comparisons depend only on those proportions	Y	N	Y	Y	Y
2p If prices in all periods are proportional, price comparisons depend only on those proportions	Y	Y	Y	Y	Y
3 Homogeneity in quantities test: rescaling the quantities in some period does not alter the price comparisons if relative prices are unchanged	Y*	Y	N	Y	Y
4 Monetary units test: rescaling the prices in some period does not alter the volume comparisons if relative quantities are unchanged	Y	Y	Y	Y	Y
5 Commensurability test: changing the units in which all prices and quantities are measured does not alter the system of comparisons	Y	Y	Y	Y	Y
6 Symmetric treatment of entities test: reordering the periods does not alter the system of comparisons	Y	Y	Y	Y	N
7 Symmetric treatment of commodities test: reordering the commodities does not alter the system of comparisons	Y	Y	Y	Y	Y
8 Partitioning test: if there is a group of two or more periods with proportional prices and quantities, those proportions determine price and volume comparisons within the group, and aggregating price and quantities across periods within the group does not alter comparisons between periods outside the group	N	N	Y	N	?
9 Irrelevance of tiny periods test: as the aggregate volume in a period approaches zero, its influence on comparisons between other periods vanishes	N*	N	Y	N	Y
10 Monotonicity in quantities test: each period's volume share is an increasing function of its quantities	Y	?	N	?	?
11 Bilateral consistency in aggregation test: if we can group all periods into two groups such that prices and quantities in all periods in a group are proportional to a group-specific pair of reference price and quantity vectors, aggregate price and volume comparisons between groups are equal to Fisher price and quantity comparisons between the pairs of reference vectors (Diewert only)	Y	?	N	?	?
12 Additivity test: the system of comparisons is additive (Diewert only)	N	N	Y	Y	N

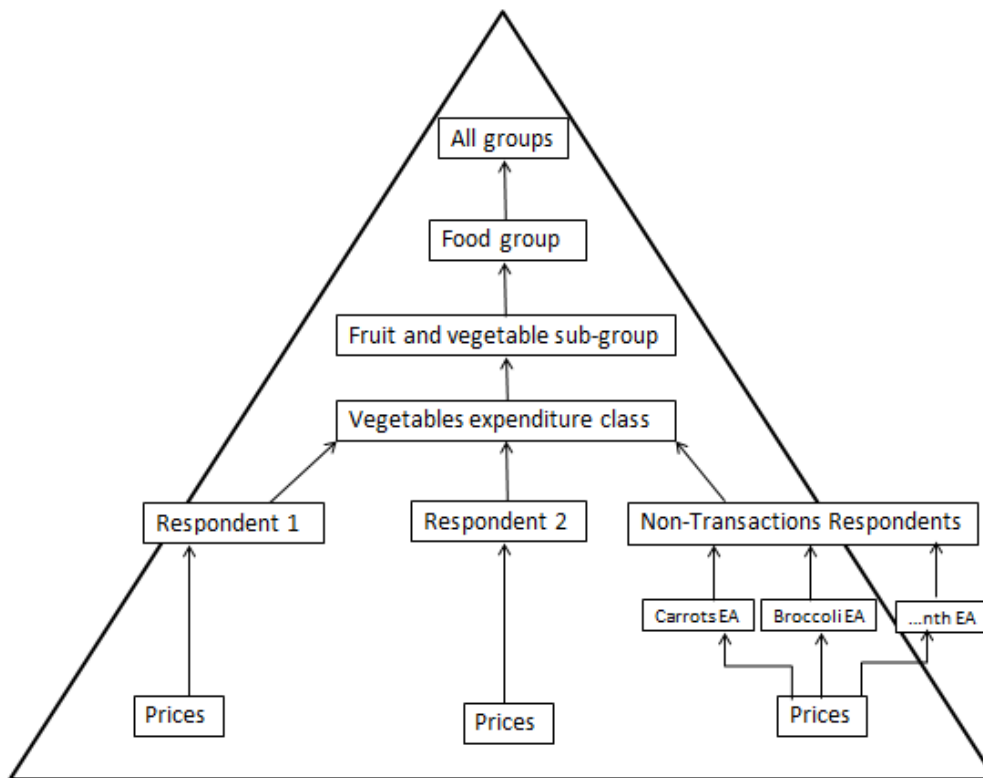
Note: \* Balk (2001) considers a weighted GEKS, which satisfies test 9 but not test 3, whereas the opposite is true for the unweighted GEKS considered in this publication.

# Assessing methods

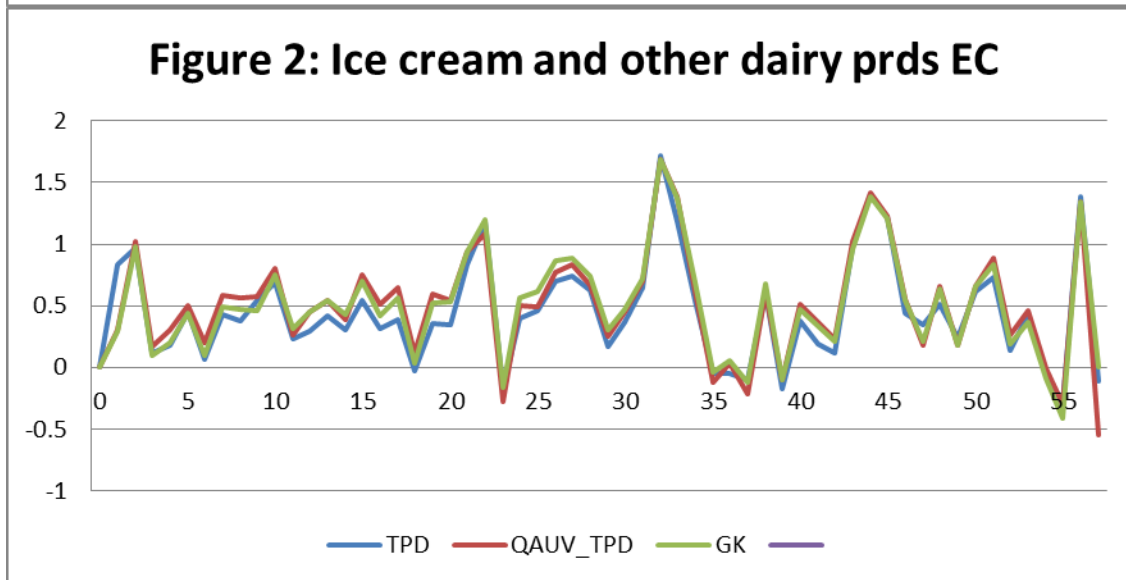
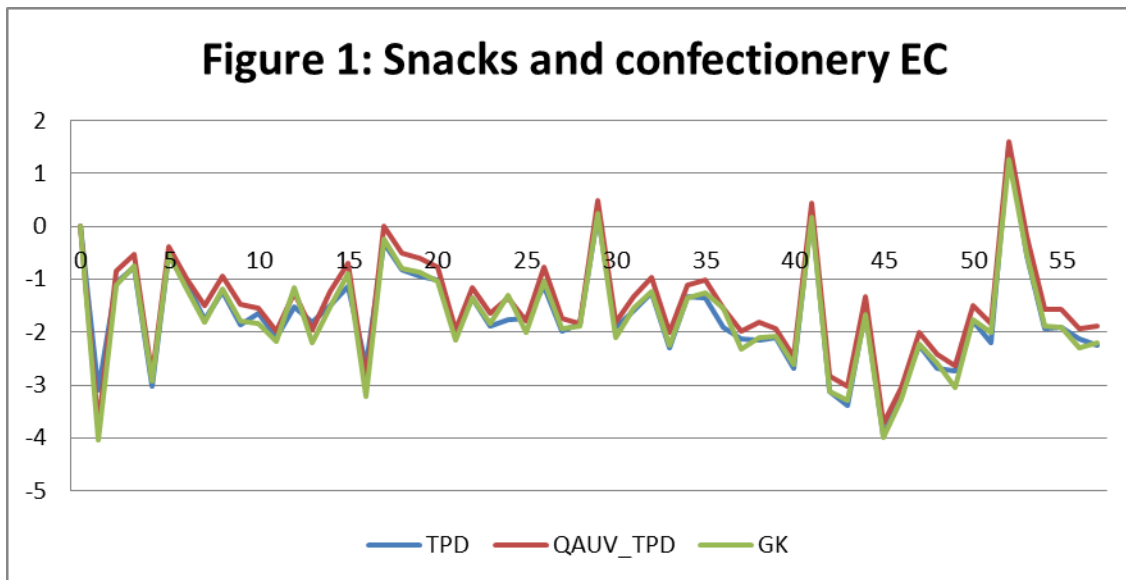
- **Test/axiomatic assessment** reveals multilateral methods have some different properties but no method wins hands down (Diewert 1999, Balk 2001)
- **Economic assessment** suggests GEKS requires weaker assumptions than reference price methods, but methods of the latter type may have other advantages in temporal context
- **Adaptability:** TPD has a simple modification for hedonics, which can be used to modify GEKS and QAUV; unclear that GK can use the same approach
- **Interpretability:** GEKS is slightly easier to explain than other methods, but none is prohibitively complicated. TPD has a simple decomposition; GEKS more complicated; QAUV and GK yet to be explored

# Empirical results

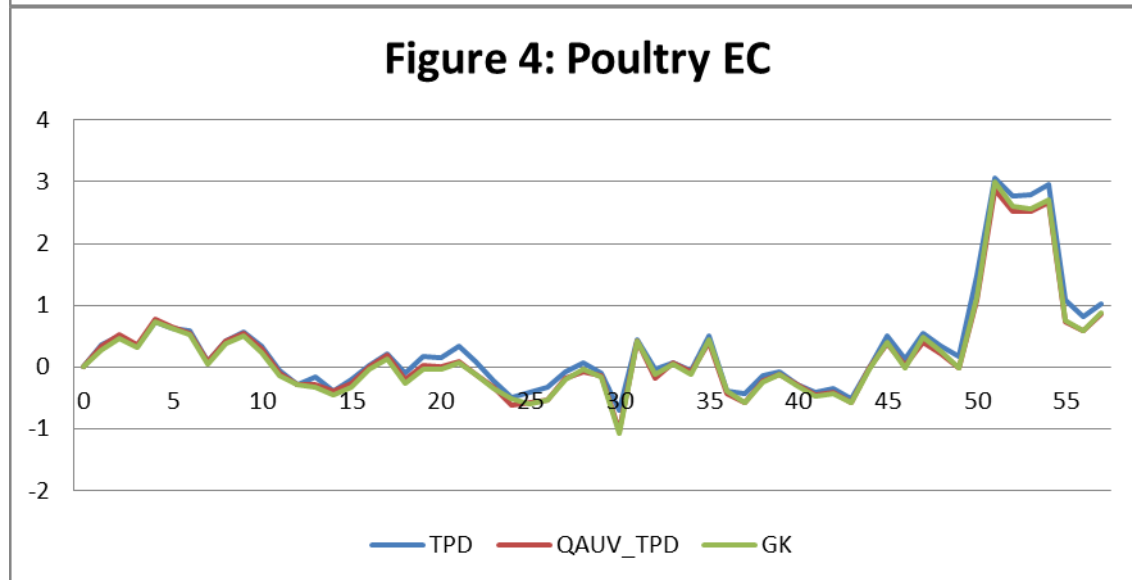
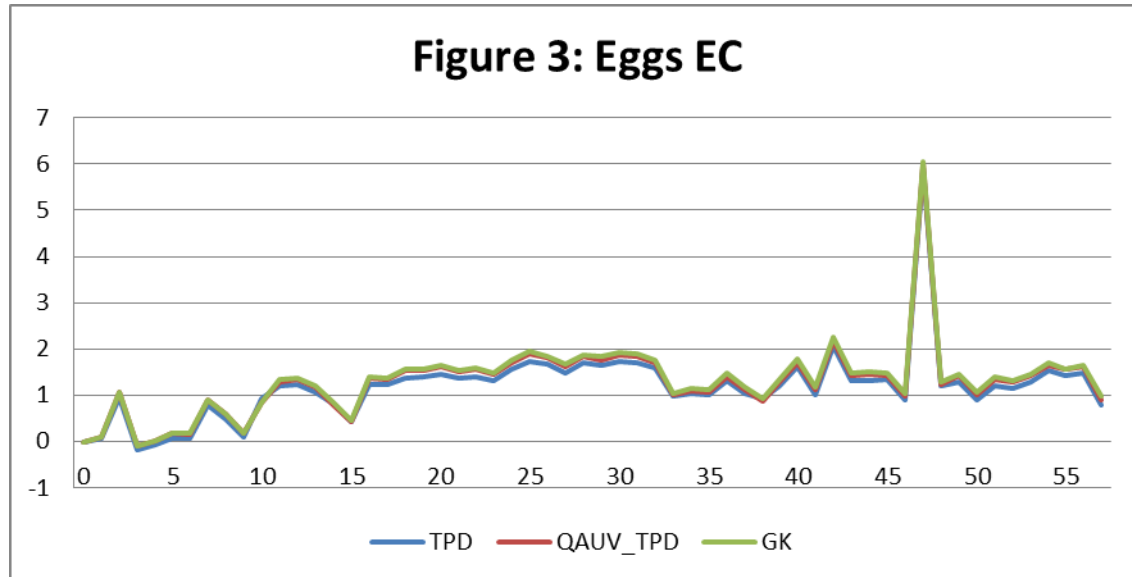
- Empirical results presented at two levels of aggregation:
  1. 'Respondent x city x EC' level
  2. Published level (weighted eight capitals)



# Empirical results: 'respondent x city' level

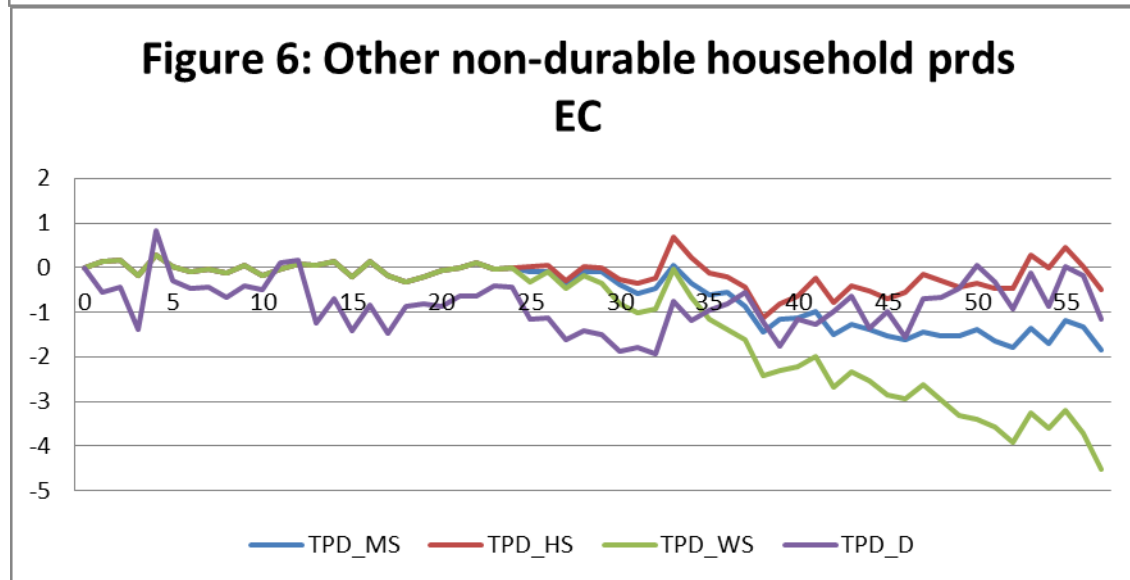
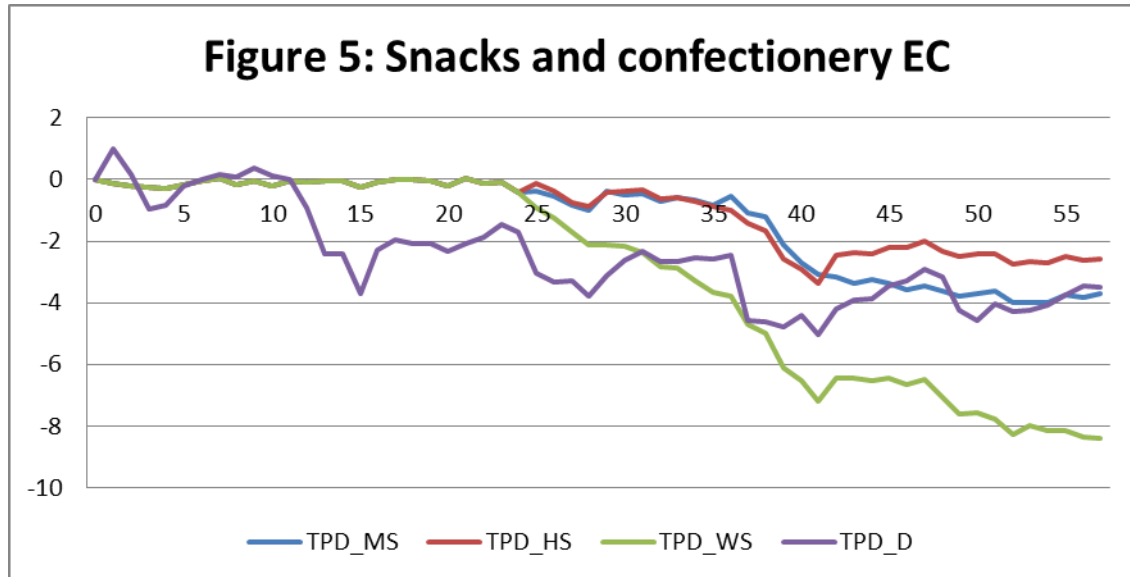


# Empirical results: 'respondent x city' level

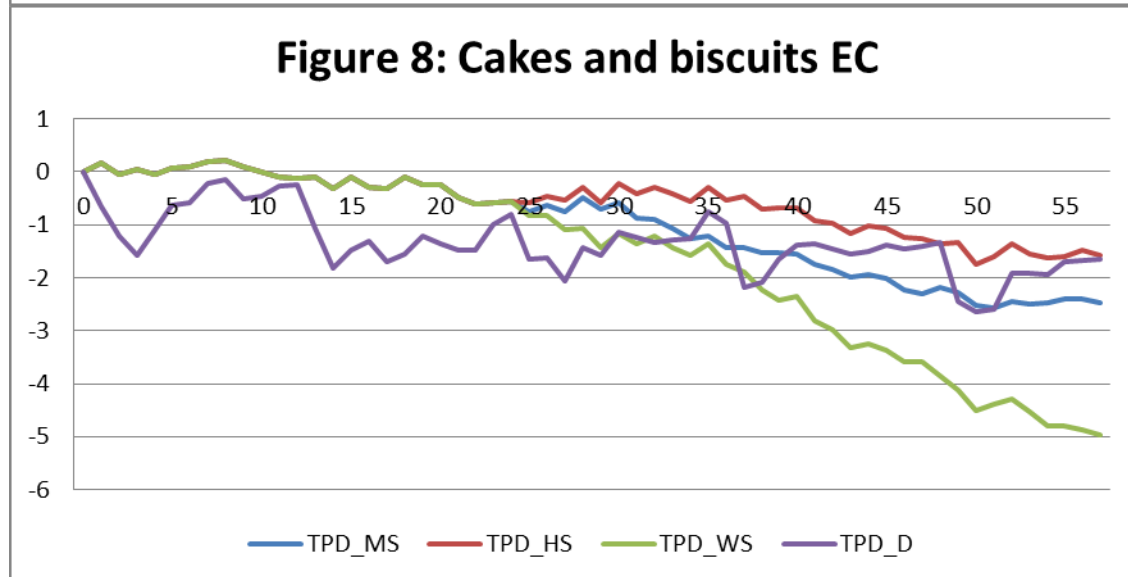
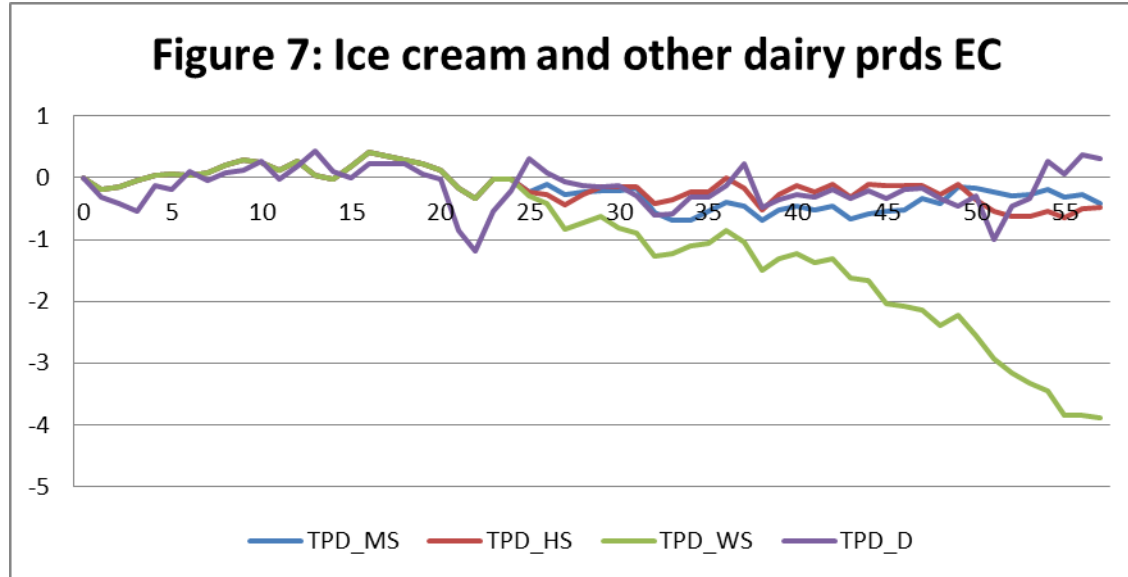




# Empirical results: 'respondent x city' level

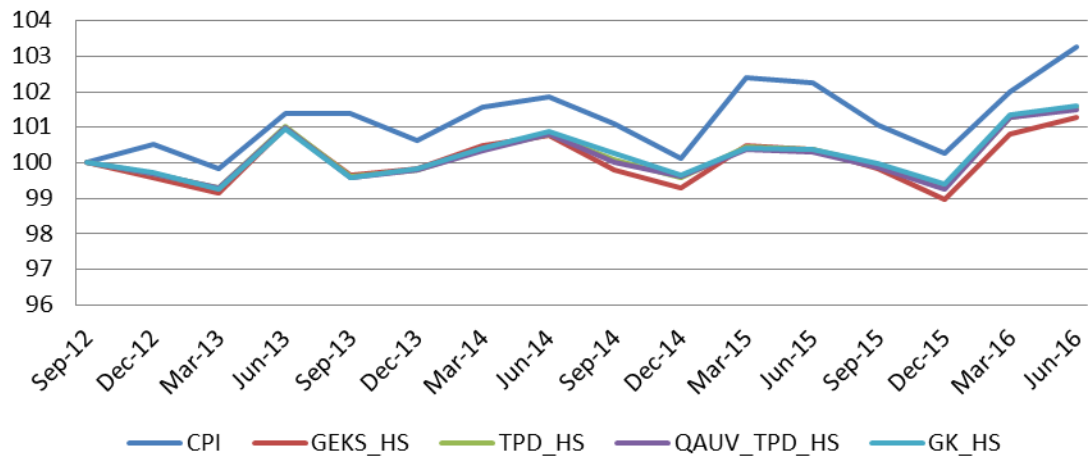


# Empirical results: 'respondent x city' level

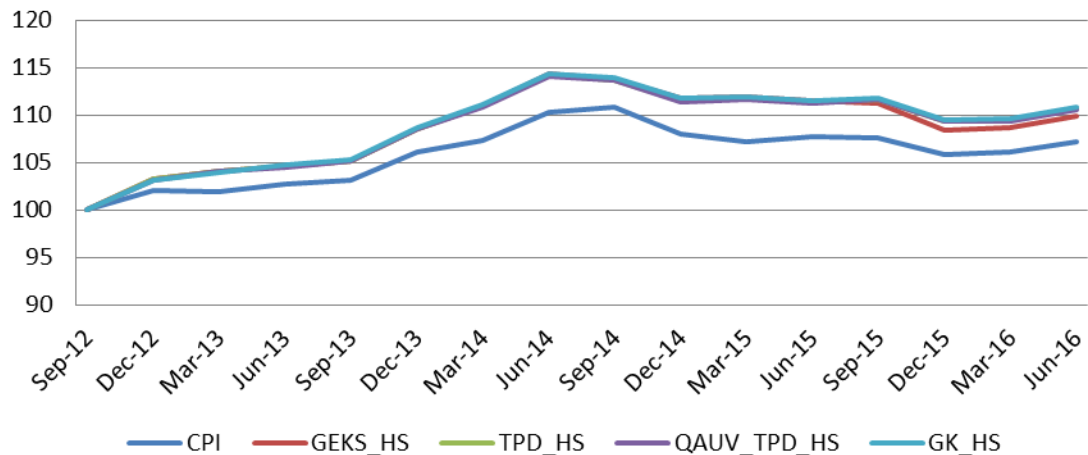


# Empirical results: published level

## Figure 9: Oils and fats EC

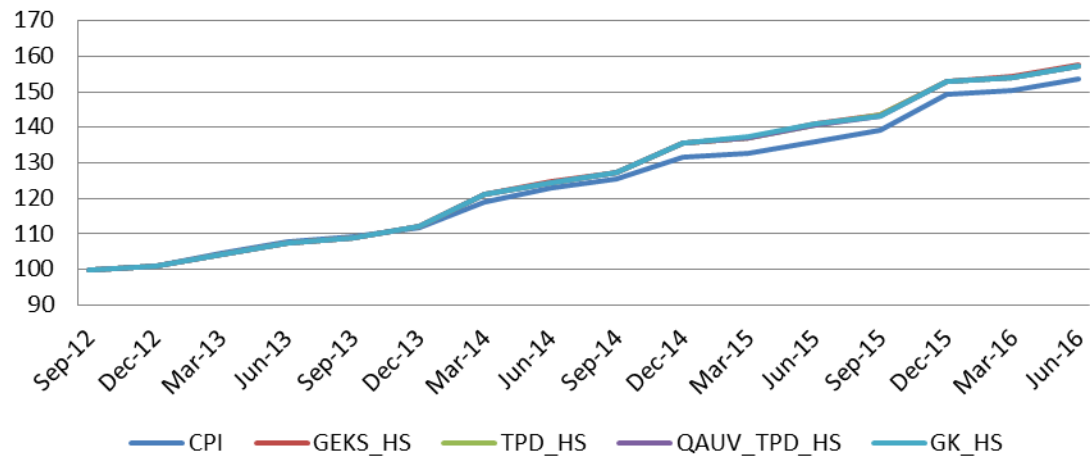


## Figure 10: Eggs EC

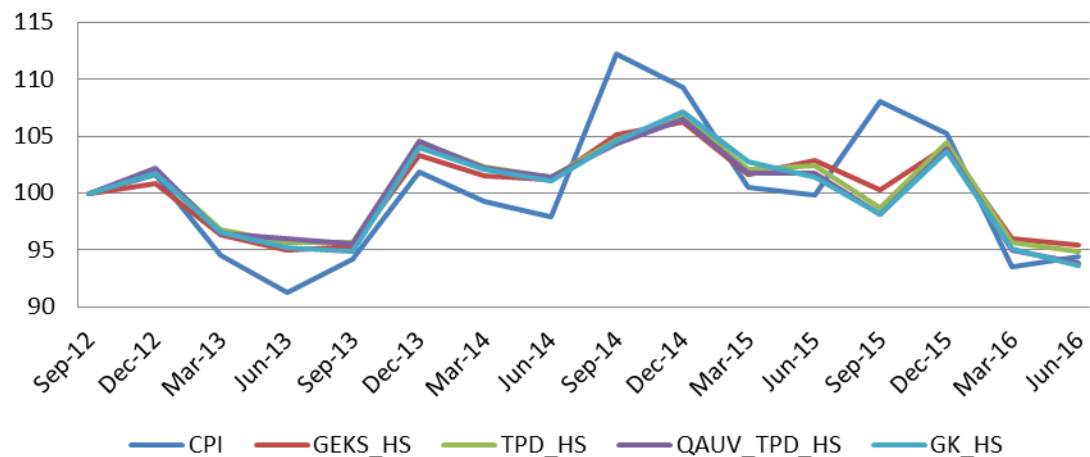


# Empirical results: published level

**Figure 11: Tobacco EC**



**Figure 12: Fruit EC**



# Conclusions

- ABS committed to implementing a multilateral method for elementary aggregation in the CPI (ABS 2016)
- ABS are yet to recommend a specific multilateral/extension method – plan to develop a stronger position on this during 2017
- Results show different multilateral methods produce similar price trends, short-term differences are primarily due to different use of expenditure shares
- HS method favoured based on the products examined