A comparison of multilateral price index methods: Scanner data and stockpiling during the COVID-19 pandemic.

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Acknowledegement

- Catherine Smyth, ABS CPI
- Joel Liffner, ABS Methodology
- Julian Whiting, ABS Methodology
Data sources used in the CPI

- **Webscraped**: 5% - Alcohol, Clothing, Car parts
- **Scanner Data**: 16% - Groceries, Tobacco
- **Other Admin Data**: 22% - Electricity, Gas, Child care, Fuel, Pharmaceuticals, Insurance
- **Manual Collection**: 57% - Takeaway food, Clothing, Furniture, Appliances, Travel, Household services, Rents, New dwellings
Scanner data in the CPI – a brief history

2011: Acquired scanner data from major supermarket chains

2014: Introduced in production of CPI using direct replacement approach

2017: Introduced automated methods, accounting for 16% of the CPI
Multilateral methods

- Use an entire census of data
- Contribution within a component varies depending on relative expenditure
- Provides insight into consumer behaviour

Currently used for the following Expenditure Classes:
- Bread
- Cakes & biscuits
- Breakfast cereals
- Other cereal products
- Beef & veal
- Pork
- Lamb & Goat
- Poultry
- Other meats
- Fish & other seafood
- Milk
- Cheese
- Ice cream & other dairy products
- Fruit
- Vegetables
- Eggs
- Jams, honey & spreads
- Food additives & condiments
- Oils & fats
- Snacks & confectionery
- Coffee, tea & cocoa
- Waters, soft drinks and juices
- Tobacco
- Cleaning and maintenance products
- Personal care products
- Other non-durable household products
- Pets and related products
Limitations of fixed weighted approach

Fruit & CPI annual movement (%)

- 2006 cyclone
- 2011 cyclone

Has the banana's impact on the CPI been overestimated?

We're told that the banana price blow-out has hit the Consumer Price Index. According to the Australian Bureau of Statistics, fruit contributed 0.6 percentage points to the 4.0% through-the-year Consumer Price Index increase. And the rise in fruit prices was mainly attributable to an increase of approximately 250% in the price of bananas during the [...]
Fixed weighted vs. multilateral

Fruit Price Index

- Published CPI
- CPI with scanner data
Beginning of COVID-19: Stockpiling and panic buying

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Mince</td>
<td><img src="BeefMinceGraph.png" alt="Graph" /></td>
<td></td>
</tr>
<tr>
<td>Canned Tuna</td>
<td><img src="CannedTunaGraph.png" alt="Graph" /></td>
<td></td>
</tr>
<tr>
<td>Toilet Paper</td>
<td><img src="ToiletPaperGraph.png" alt="Graph" /></td>
<td></td>
</tr>
<tr>
<td>Meat Pies</td>
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<tr>
<td>Canned Tomato</td>
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<td></td>
</tr>
<tr>
<td>Pasta</td>
<td><img src="PastaGraph.png" alt="Graph" /></td>
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</table>
Atypical, and in some cases, extreme changes in spending patterns at the onset of the pandemic provides a unique opportunity to ‘stress test’ the multilateral methods. The methods reviewed were:

1. GEKS-Tornqvist
2. Weighted Time Product Dummy (TPD)
3. Geary-Khamis (GK)
4. Quality Adjusted Unit Value using TPD (QAUV TPD)
Key findings

1. Multilateral index methods perform well under extreme changes to spending patterns.
2. All four multilateral methods tested performed similarly at the aggregate level.
3. Some differences evident at lower (EA) levels.
4. GEKS-Tornqvist is less sensitive to large changes in product expenditure shares than the other multilateral methods.
Multilateral methods produced similar results at the aggregate level (all supermarket products)
Larger differences at Non-food level
Differences at product level

Toilet paper

- GEKS-Tornqvist
- GK
- QAUV TPD
- TPD

[Graph showing differences in product level for Toilet paper from January to May 2020 with months gen-20, feb-20, mar-20, apr-20, mag-20 along the x-axis and values ranging from 0.8 to 1.6 along the y-axis.]
Product X_3’s expenditure share increased from 0.88% to 10.78% resulting in a large difference between GEKS (1.0174) and TPD (1.0524) (using decomposition from Webster and Tarnow 2019)

<table>
<thead>
<tr>
<th>Product</th>
<th>Feb exp share (%)</th>
<th>Mar exp share (%)</th>
<th>Price relative</th>
<th>Exp share relative</th>
<th>GEKS-Tornqvist</th>
<th>TPD</th>
<th>Difference</th>
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<tbody>
<tr>
<td>X_1</td>
<td>12.37</td>
<td>18.76</td>
<td>1.8430</td>
<td>1.5161</td>
<td>1.1016</td>
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<td>8.43</td>
<td>1.8418</td>
<td>1.0196</td>
<td>1.0526</td>
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<td><strong>X_3</strong></td>
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<td>Y_2</td>
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<tr>
<td>X_6</td>
<td>1.28</td>
<td>1.67</td>
<td>1.5277</td>
<td>1.3034</td>
<td>1.0061</td>
<td>1.0063</td>
<td>0.0002</td>
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Multilaterals sensitive to large changes in expenditure shares

- Product Y_6 TPD index <1 even though price relative >1

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<td>Y_3</td>
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Multilateral index vs. fixed weight index

Other non-durable household products (e.g. toilet paper)
Multilateral index vs. fixed weight index

Other cereal products (e.g. pasta, rice)
Multilateral index vs. fixed weight index

Fruit

- GEKS_Tornqvist
- Lowe_fixed_weight
Multilateral index methods performed similarly to the unusual consumer behaviour, and differences are largely attributable to one product class which exhibited particularly extreme behaviours.

The GEKS-Tornqvist method was observed to behave more conservatively and arguably more favourably in this extreme scenario because it was less influenced by the extreme changes to expenditure shares of individual products.

Products that were found to contribute more to TPD than GEKS-Tornqvist in most cases had large increases in expenditure shares.

Following the one-off shock of stockpiling and panic buying, the indexes converged to similar levels for each of the multilateral methods.