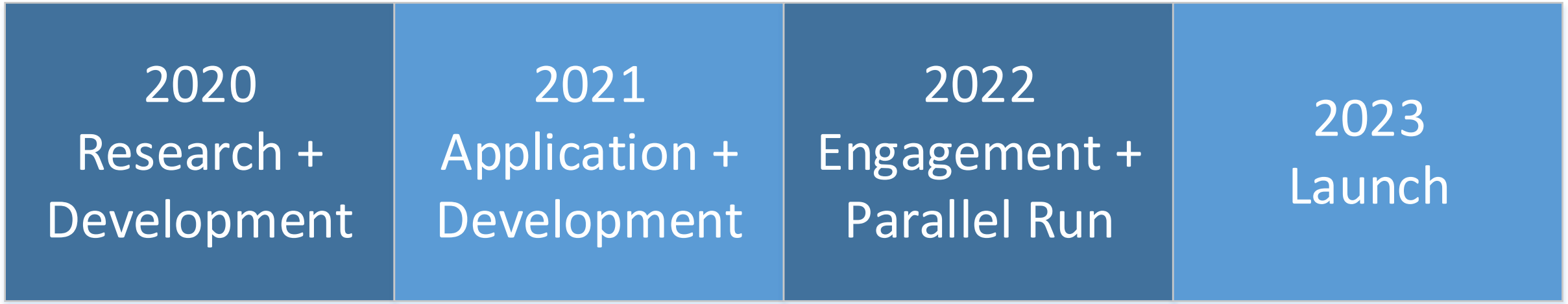
A framework for assessing the quality of new index number methods

Alex Rose
Methodologist
Economics Hub
ONS

28th April 2021

ESWG and Cemmap Conference on Prices

Timelines for ADS implementation



Priority item categories

Groceries
CPIH weight: 11.4%

Used Cars
CPIH weight: 1.4%

Chart Items
CPIH weight: <1%

Clothing
CPIH weight: 4.1%

Air Fares
CPIH weight: <1%

Rail Fares
CPIH weight: <1%

Tech Goods
CPIH weight: <1%

Package Holidays
CPIH weight: 3.4%

Why change index method?

Traditional data

UPC	Product Name	Size	Price (£)	Date
001	Kingsmill White Loaf	800g	0.79	14/10/2020
002	Warburtons White Loaf	800g	1.35	14/10/2020
003	Hovis White Loaf	800g	1.10	14/10/2020

- Representative Basket
- Selective Collection Dates
- No Expenditure Information

Alternative Data Sources

UPC	Product Name	Size	Price (£)	Date	Quantity Sold
001	Kingsmill White Loaf	800g	0.79	14/10/2020	45
002	Warburtons White Loaf	800g	1.35	14/10/2020	22
003	Hovis White Loaf	800g	1.10	14/10/2020	30
…	…	…	…	…	…
147	Burgen Soya & Linseed	800g	1.25	14/10/2020	6

- Census Basket
- Increased Collection Frequency
- More Detailed Characteristics
- Expenditure Information

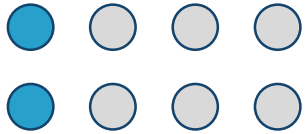
But traditional index methods…

- Perform poorly or break down due to the dynamic nature of ADS
- Fail to utilise the additional information

Multilateral vs Bilateral

Bilateral methods (● = base month; ● = current month):

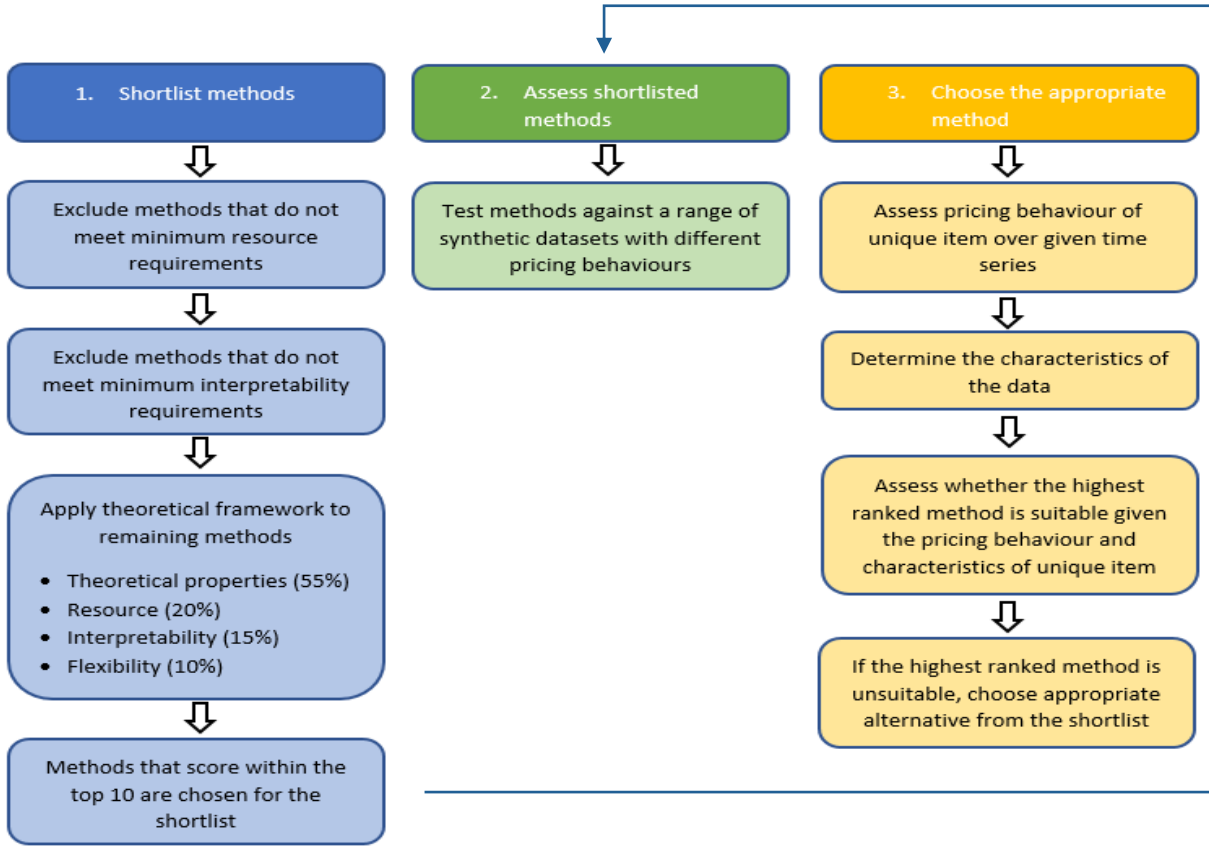
- Fixed-base
- Chained



Multilateral methods

How to choose a new method?

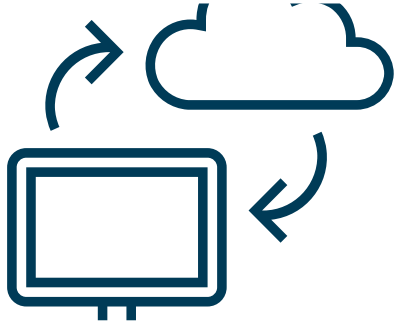
Process for choosing an index method



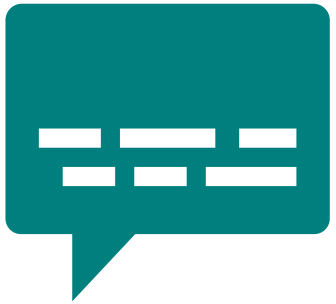
Rank	Method
1	Quality adjusted Geary Khamis (QU-GK) using a Fixed Base Monthly Expanding window (FMBE)
2	GEKS-Törnqvist using a Movement Splice
3	GEKS-Fisher using a Movement Splice
4	**GEKS-Jevons using a Movement Splice**
5	GEKS-Törnqvist using a Geometric Mean Splice
6	GEKS-Fisher using a Geometric Mean Splice
7	GEKS-Törnqvist using a Window Splice
8	GEKS-Fisher using a Window Splice
9	GEKS-Jevons using a Geometric Mean Splice
10	GEKS-Jevons using a Window Splice

Framework Criteria

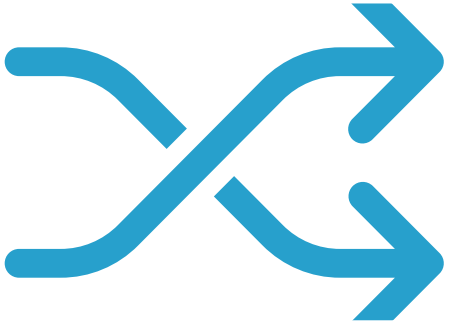
Theoretical properties



Resource



Interpretability



Flexibility

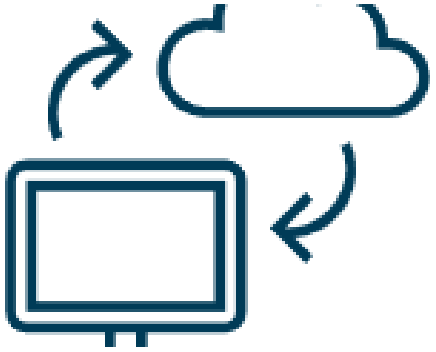
Cohesion

Framework Criteria

Theoretical properties

- 55% of total weight, split across three key areas:
  - Axiomatic approach
  - Transitivity
  - Characteristicity

Framework Criteria



- 20% Weight
- Are the processing requirements manageable?

Framework Criteria

Interpretability

- 15% Weight
- Do users understand the method?
- Can price movements be easily interpreted?

Framework Criteria

- 10% Weight
- Purpose
- Data Sources
- Items

Framework Criteria

Cohesion

- Unweighted – secondary filter
- Across items, categories and data sources
- With NSI and statistical institutes

Shortlist

Rank	Method
1	Quality adjusted Geary Khamis (QU-GK) using a Fixed Base Monthly Expanding window (FMBE)
2	GEKS-Törnqvist using a Movement Splice
3	GEKS-Fisher using a Movement Splice
4	**GEKS-Jevons using a Movement Splice**
5	GEKS-Törnqvist using a Geometric Mean Splice
6	GEKS-Fisher using a Geometric Mean Splice
7	GEKS-Törnqvist using a Window Splice
8	GEKS-Fisher using a Window Splice
9	GEKS-Jevons using a Geometric Mean Splice
10	GEKS-Jevons using a Window Splice

Overview of the multilaterals

QU-GK

Geary Khamis

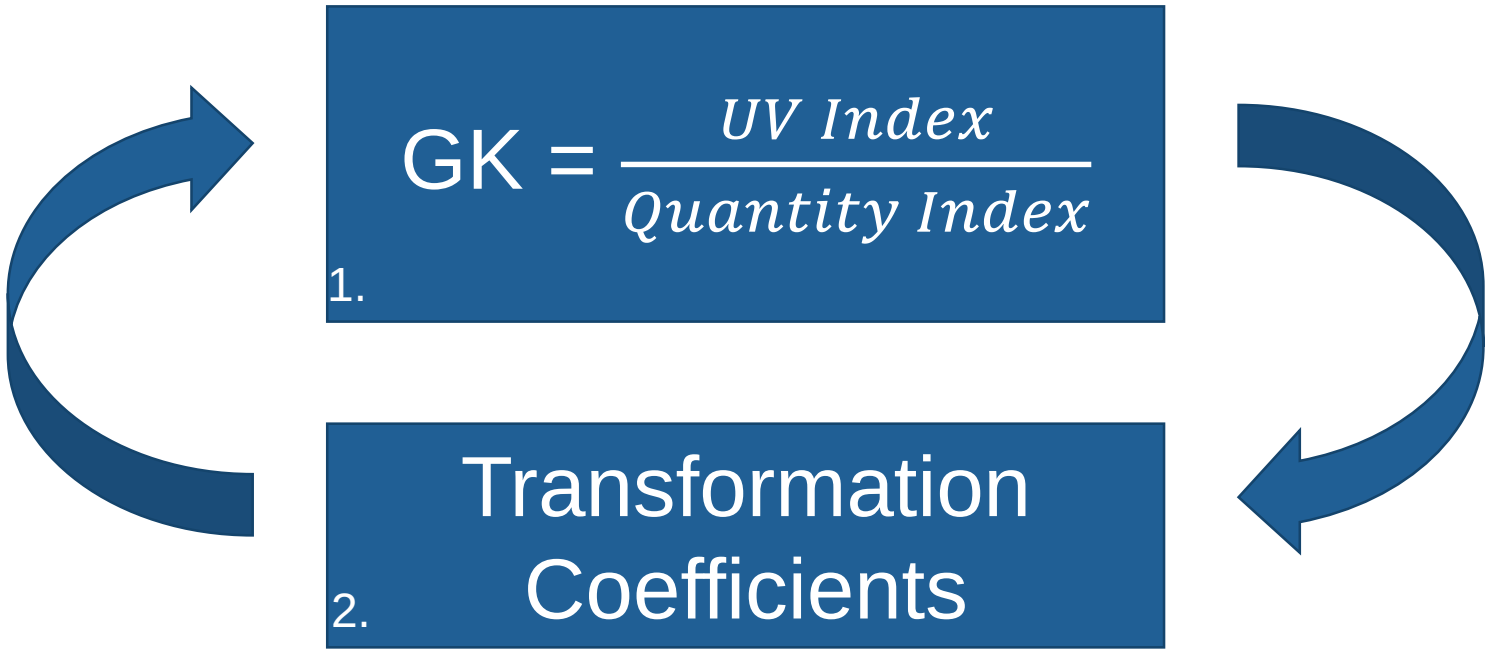
Geary-Khamis (GK)

Can be expressed in terms of a ‘quality adjusted unit value index’

The “Unit Value” of a set of (homogeneous) products is calculated as:

$$\frac{\text{Total value of purchases or sales}}{\text{Sum of quantities}}$$

Geary-Khamis (GK)



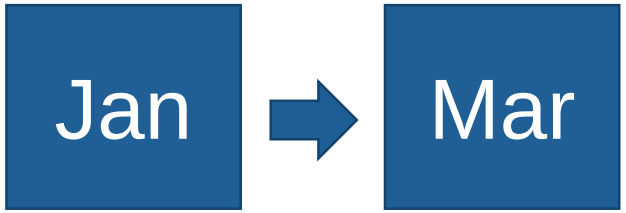
GEKS

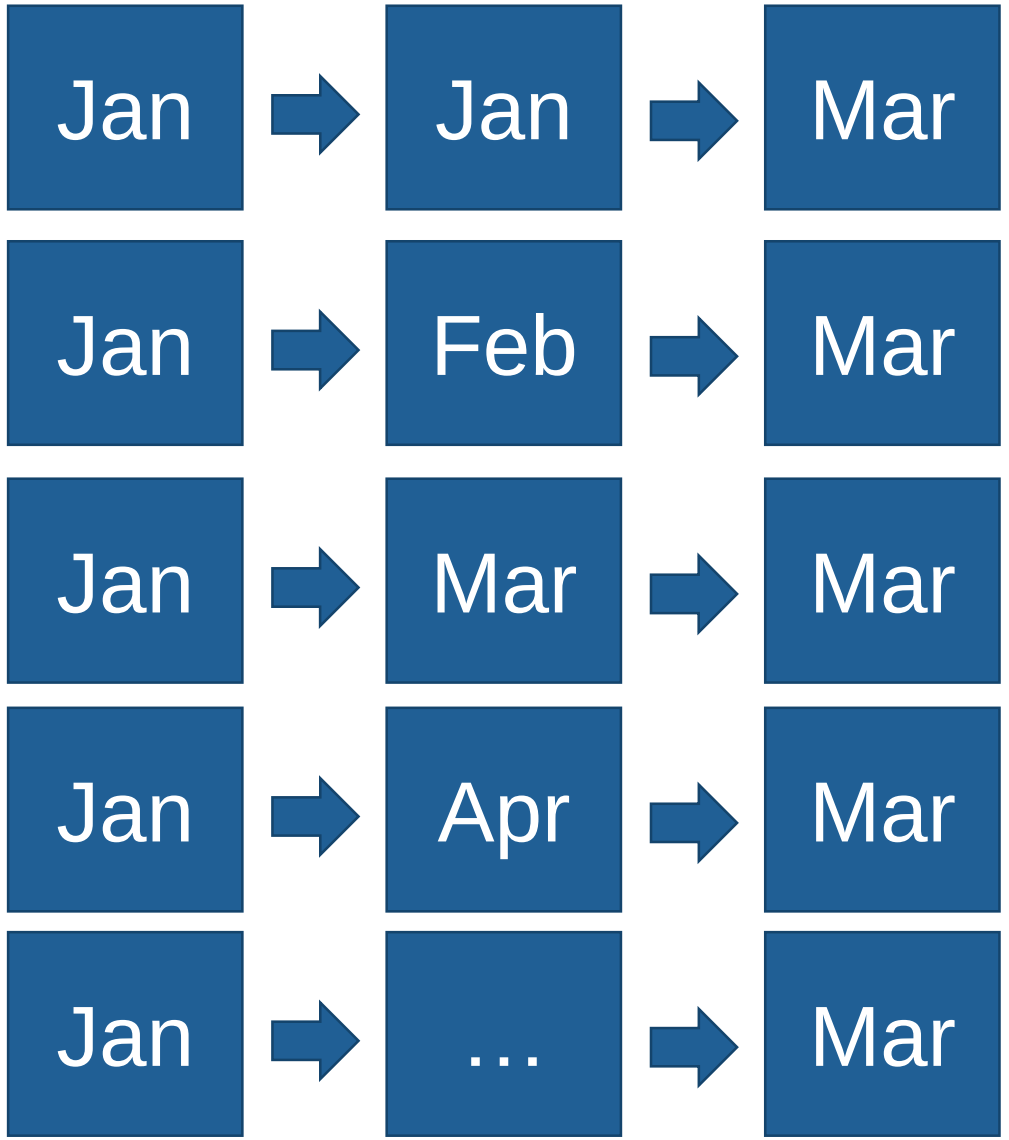
Gini, Eltetö and Köves, and Szulc

GEKS is a family of methods

Whenever a GEKS is calculated, it is paired with a bilateral index method. This leads to many variants of the GEKS (e.g. GEKS-Fisher, GEKS-Tornqvist, GEKS-Jevons).

GEKS:





What is the problem?

April needed to calculate March… but April isn't available when publishing March!

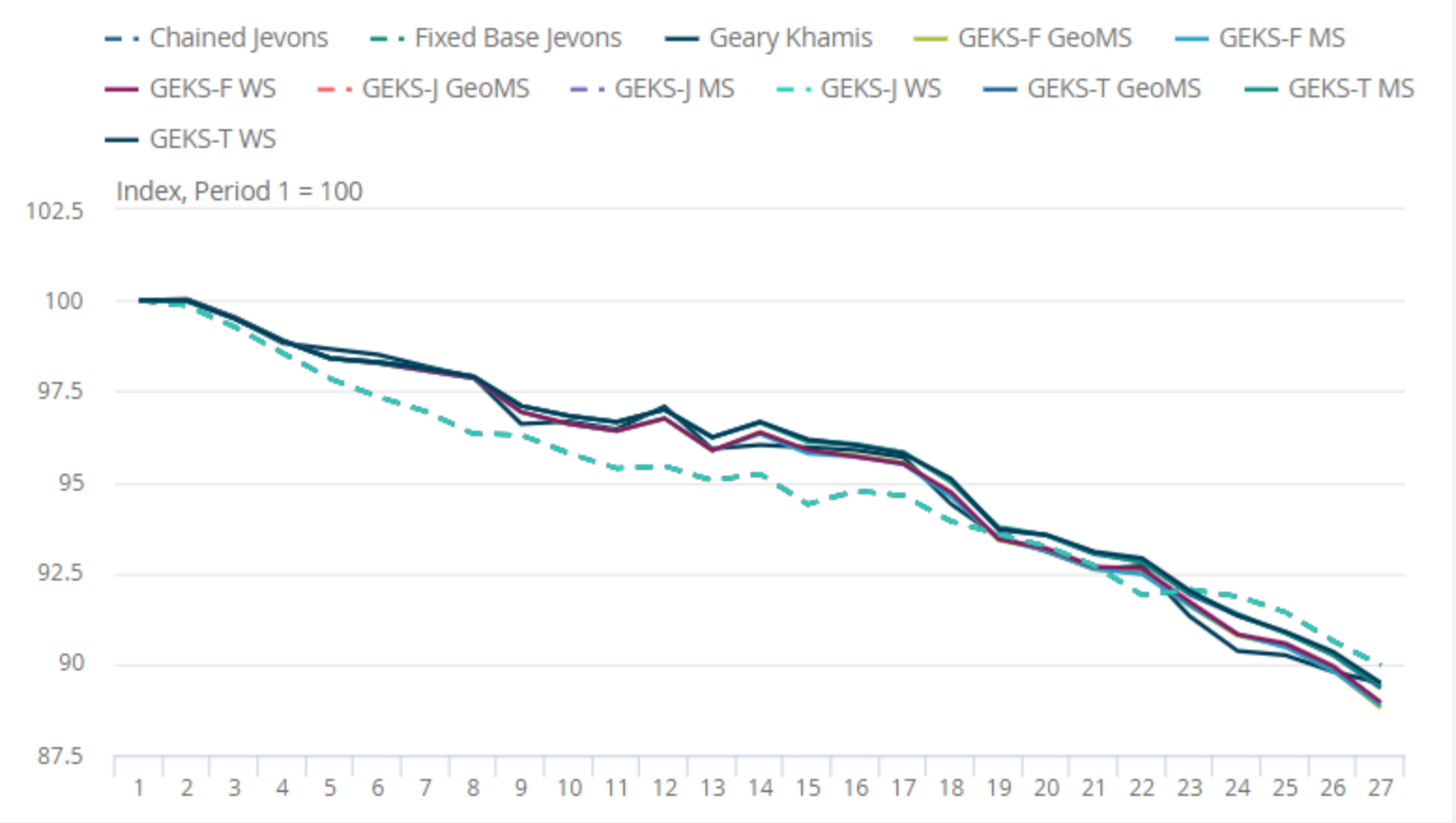
You could publish what you have but then will need to revise when each month of data comes in. Known as the revision problem.

Splicing

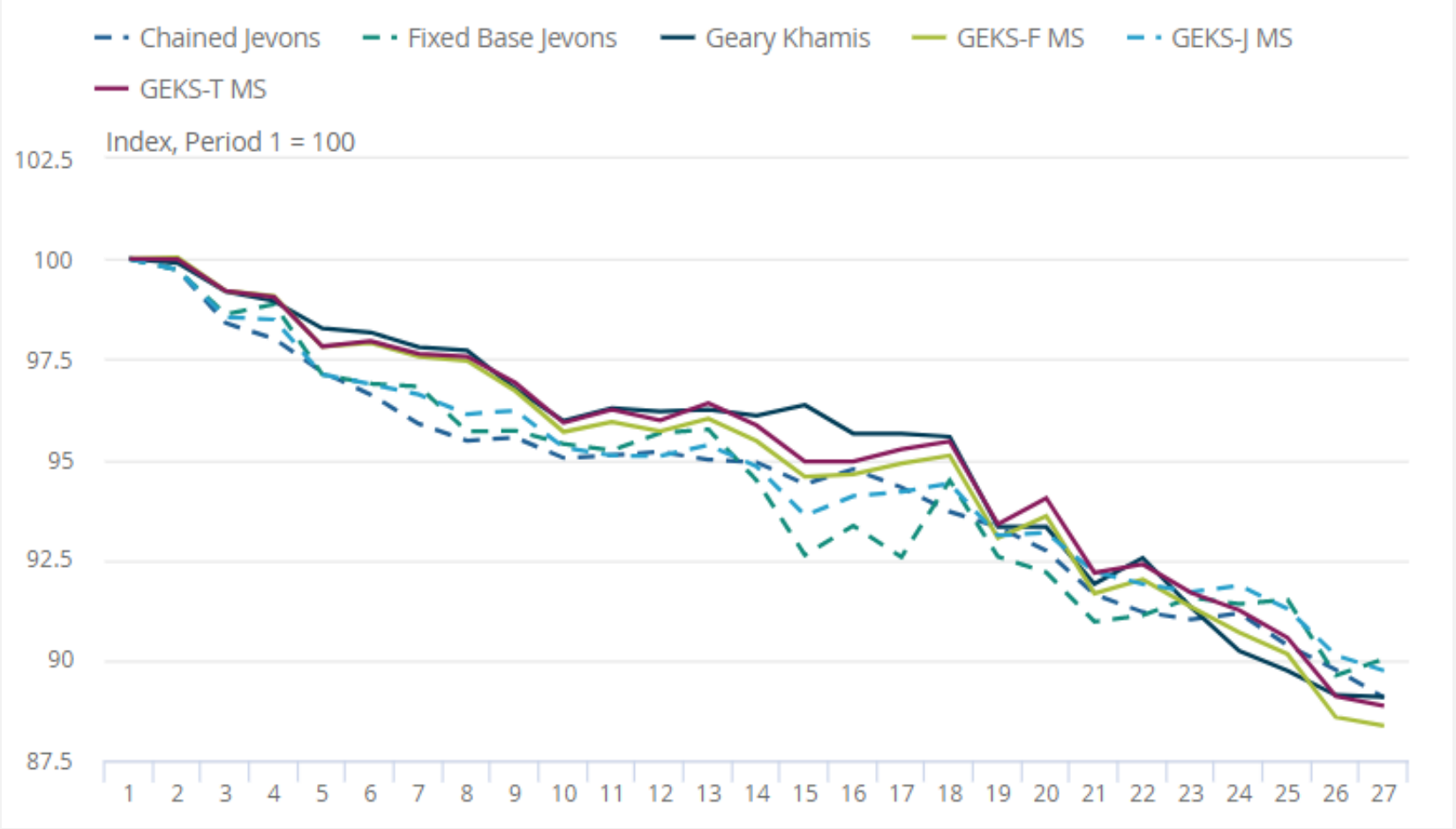
Period	Jan 19	Feb 19	Mar 19	Apr 19	…	Dec 19	Jan 20	Feb 20	Mar 20
1st compilation (Jan 20)	100.0	100.7	100.6	101.6	…	106.0	103.8		
2nd compilation (Feb 20)		100.0	100.2	101.1	…	105.5	103.3	104.6	
3rd compilation (Mar 20)			100.0	101.0	…	103.5	105.3	104.4	104.1
Published Index	**100.0**	**100.7**	**100.6**	**101.6**	**…**	**106.0**	**103.8**	**?**	**?**

Testing our shortlist

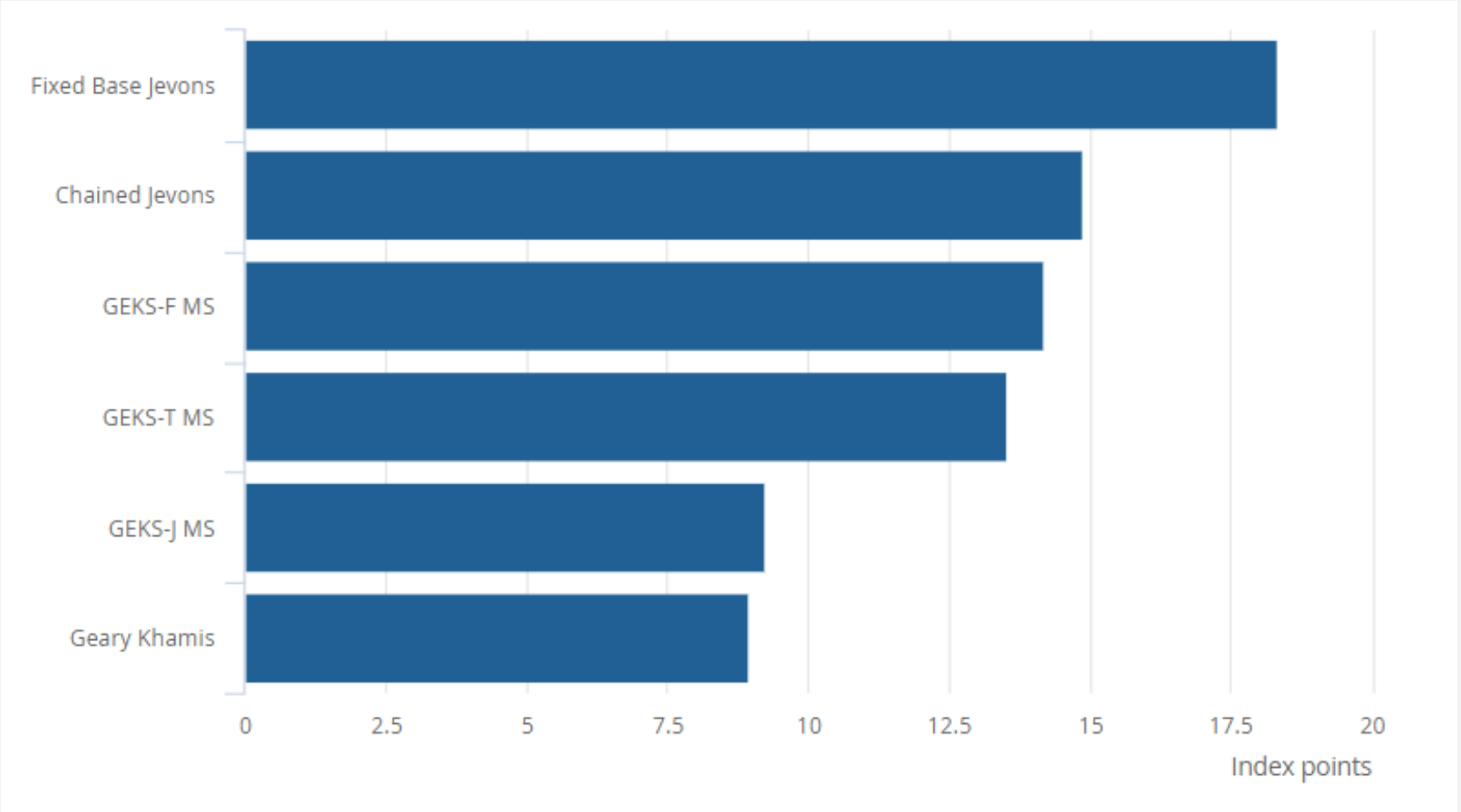
Base Synthetic Data



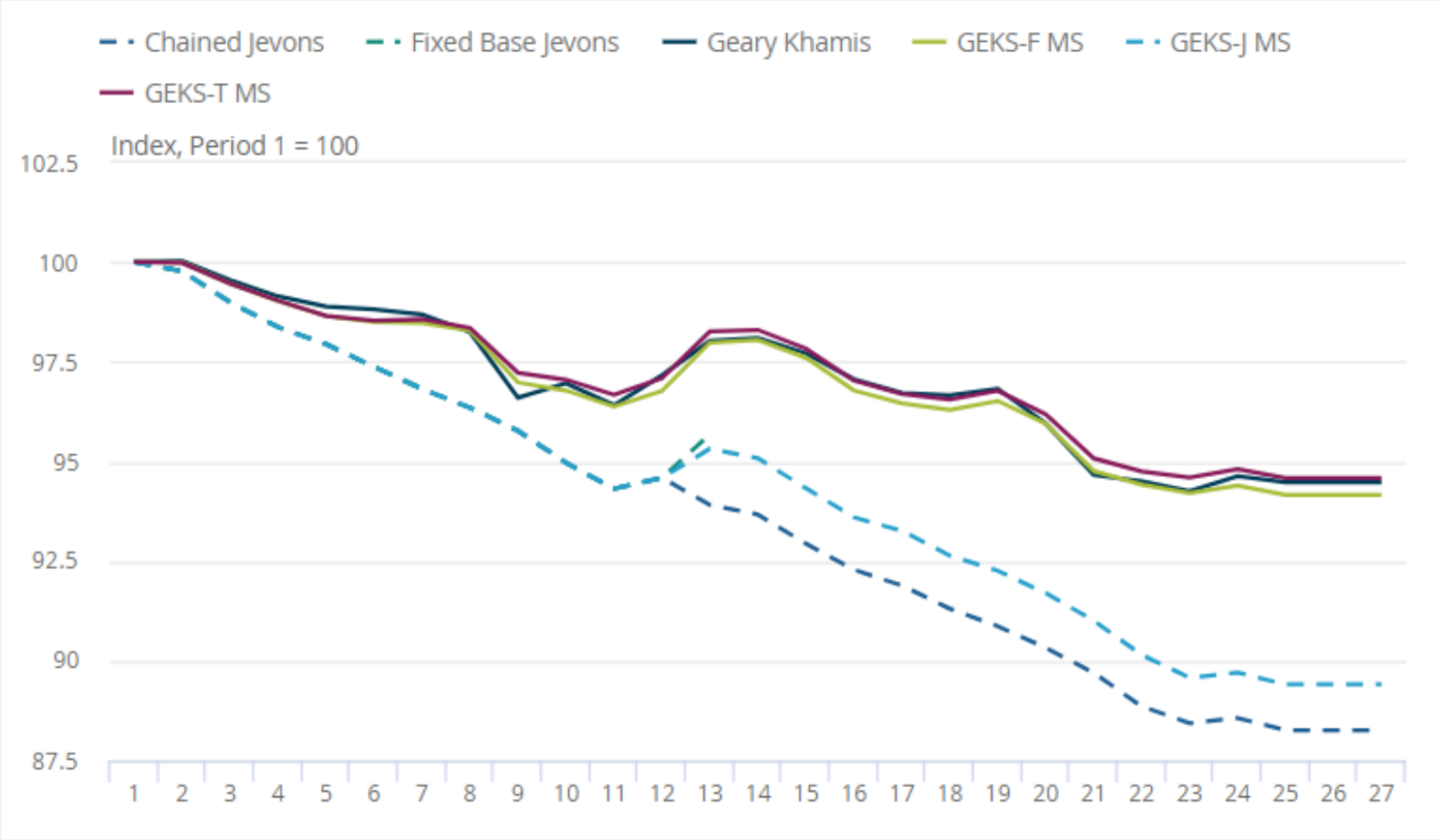
High Attrition Rate



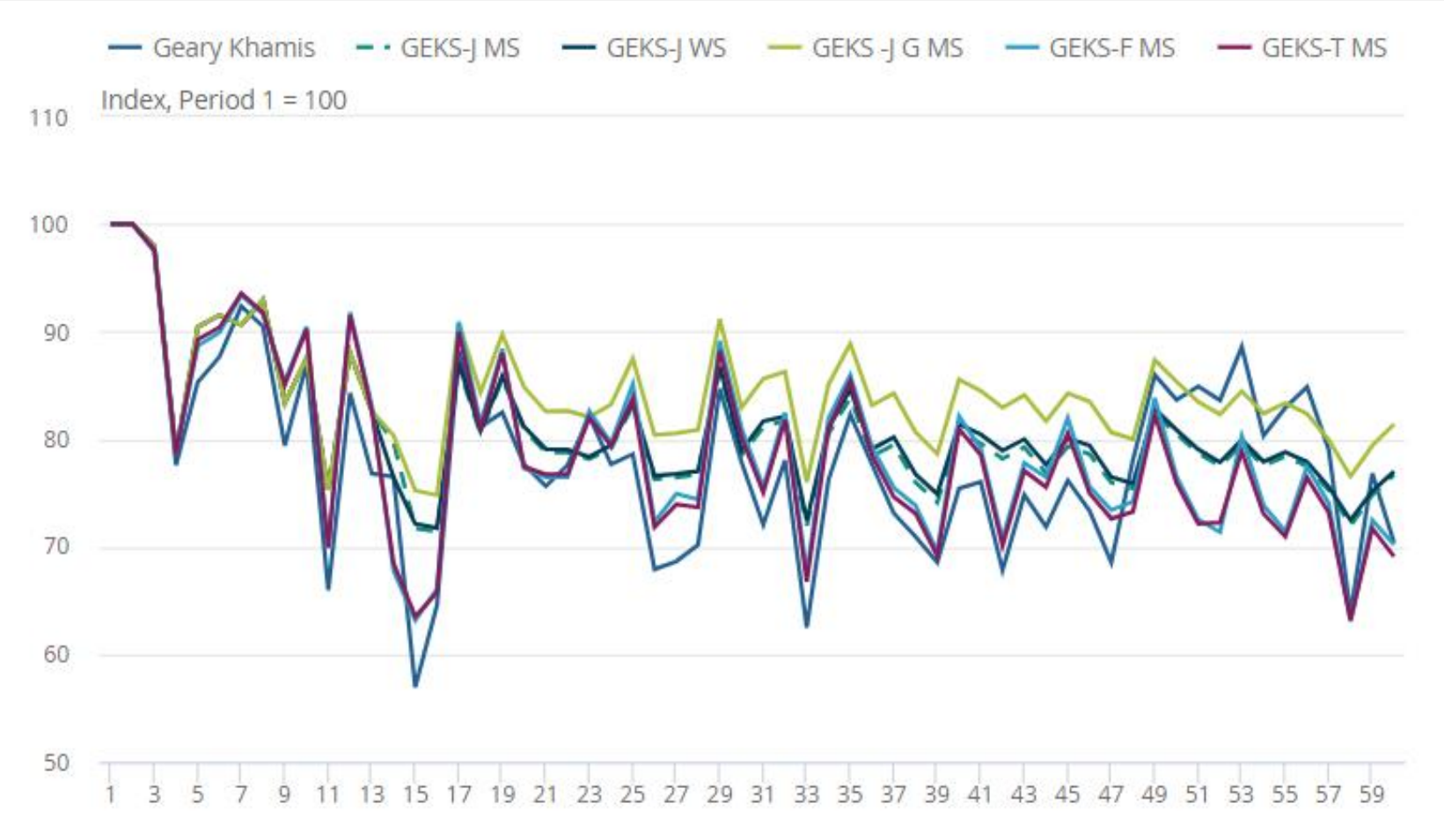
High Attrition Rate



Product Obsolescence



Real World Data – Soft Drinks



Office for National Statistics

Next steps

- External review of framework by Kevin Fox, Martin O’Connell and Peter Levell
- Update framework based on review recommendations
- Further research into extension methods and impact of window length
- Continued testing on real world data

Take home messages

- Multilateral indices more suitable than bilateral methods
- QU-GK & GEKS approaches are suitable
- Weighting important
- Extension method choice has impact