Exploring methodologies to integrate new scanner data in the French CPI:

Making use of multilateral methods

Insee

Measuring, understanding

1 CONTEXT AND GOALS

2 THEORY

3 RESULTS : BY VARIETY (COICOP 7 DIGITS)

4 RESULTS : BY COICOP 6 DIGITS(MAKE UP)

5 RESULTS : CONTRIBUTIONS

01 INTRODUCTION

- We are starting to receive data from 2 hard discounters.
- We already have and use in production (since Jan 2020) scanner data from other retailers
- Our current methodology with scanner data requires an external referential allowing us from GTIN/EAN to have
  - Additional characteristics (volume, unit, label, color ...)
  - Nomenclature
    - With classification rules and using the characteristics we classify at the variety level (level 7 of COICOP, French specificity).
  - We are able to group EAN into equivalence classes to follow products better, avoid basket churn and catch the relaunches.
  - We compute a Geometric Laspeyres, the methodology is similar than with the field collected data and the quality adjustment is slightly different since we can use the price history for the replacement product.
- Hard discount data has for now a low match rate with the referential (17 % of expenditure share according to 1 test file for one retailer and 39% for the other)
- We will experiment multilateral methods mainly to check what we could do without the referential and with the constraints of avoiding chain drift and basket churn.

- We will use our already possess scanner data (not enough history with hard discounters)
- Our product definition will vary between using GTIN/EAN or a article grouping methods (extended article number)
- We will compute micro indexes at the outlet level.
- We follow the average price of each product per month.

- **Scanner data from January 2020 to December 2022, from 6 retailers (without hard discount because we don’t have background data).**
- **3 varieties & their corresponding 6 digits COICOP level**
  - **Whole milk & whole milk=> few replacements**
  - **Foie gras & canned meat=> a high seasonality and 85% of replacement during the year**
  - **Lipstick & make up and care products => a lot of distinct GTIN/EAN.**

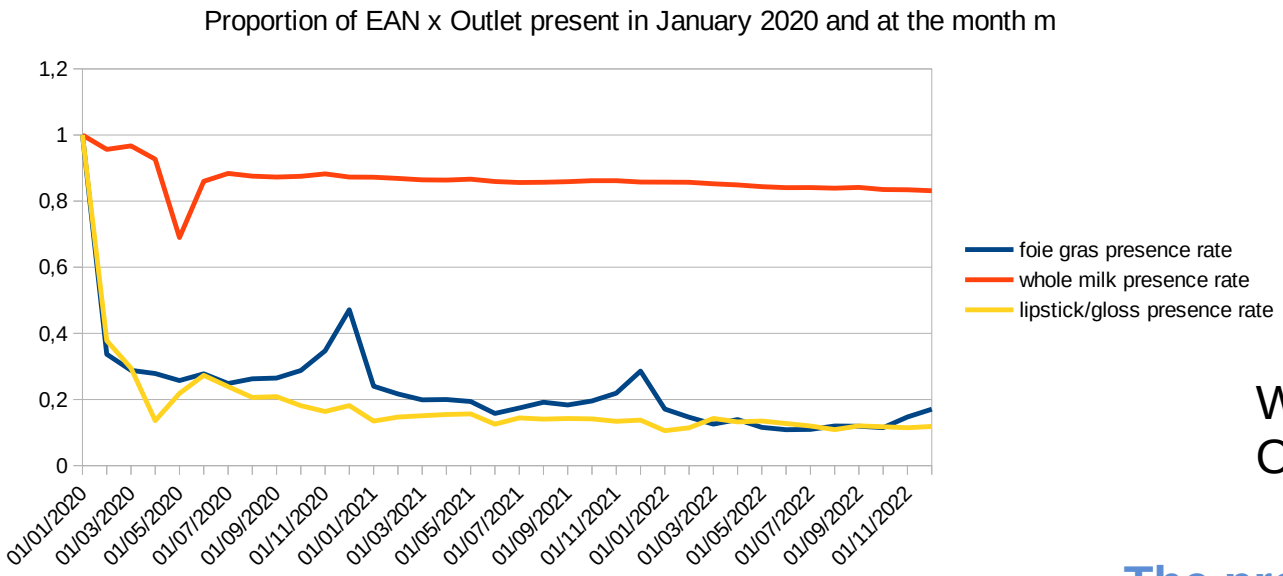
02 MULTILATERAL METHODS

- We focus on GEKS-Törnqvist $$I_{GEKS}^{0,t} = \prod_{l=0}^{T} \left(\frac{I^{0,l}}{I^{t,l}} \right)^{\frac{1}{T+1}} = \prod_{l=0}^{T} \left(I^{0,l} * I^{l,t} \right)^{\frac{1}{T+1}}$$

  where $$I_T^{0,t} = \prod_{i \in S} \left(\frac{p_i^t}{p_i^0} \right)^{\frac{s_i^0 + s_i^t}{2}}$$ and $$s_i^t = \frac{p_i^t q_i^t}{\sum_{j \in S} p_j^t q_j^t}$$

- The sample S can be a COICOP 6 digit level or a variety
- The product i can be the GTIN/EAN or an Extended article number
  - Choice of the window size and splicing:
    - Rolling window of size 13 and mean splice
    - Rolling window of size 25 and half splice
- Using R and IndexNumR package

03 RESULTS : VARIETY



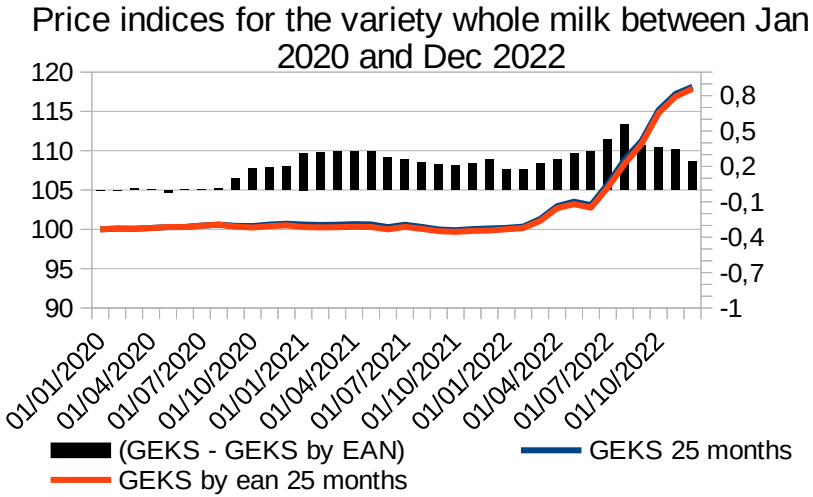
The presence rate is computed as

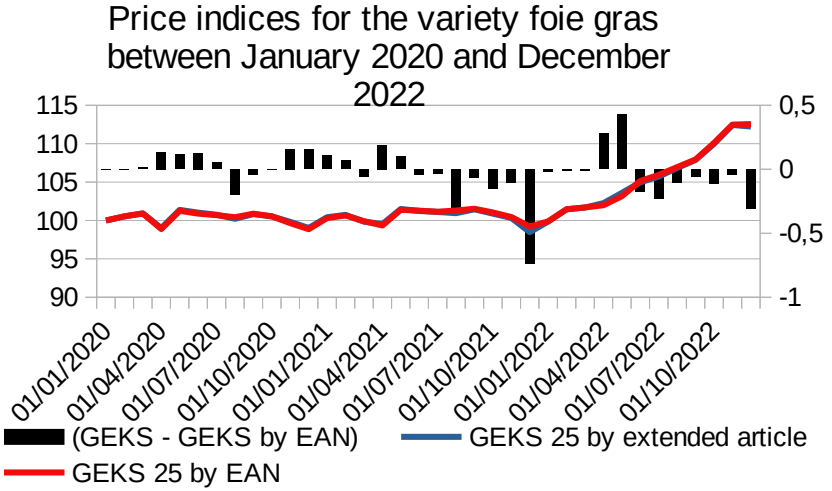
$$\frac{|N_i \cap N_1|}{|N_1|}$$

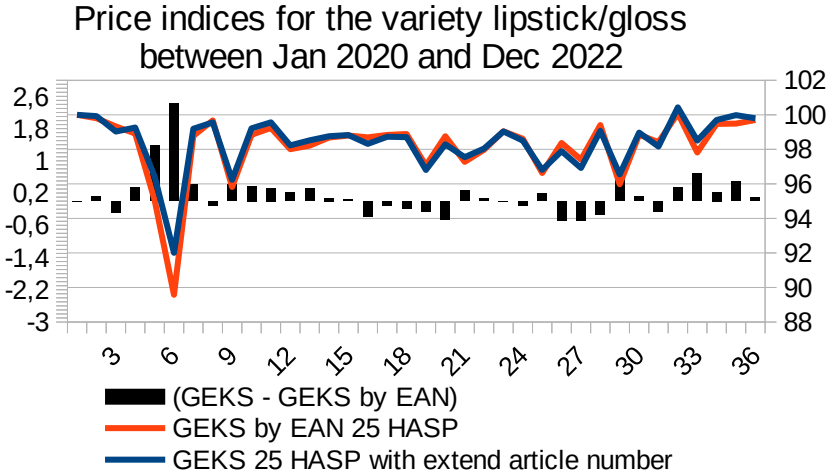
Where N_i are the products (EAN X Outlet in our case) sold in period i.

- The presence rate is low for foie gras and lipstick
- There is a seasonality for foie gras

USING GTIN OR EXPENDED ARTICLE GROUP



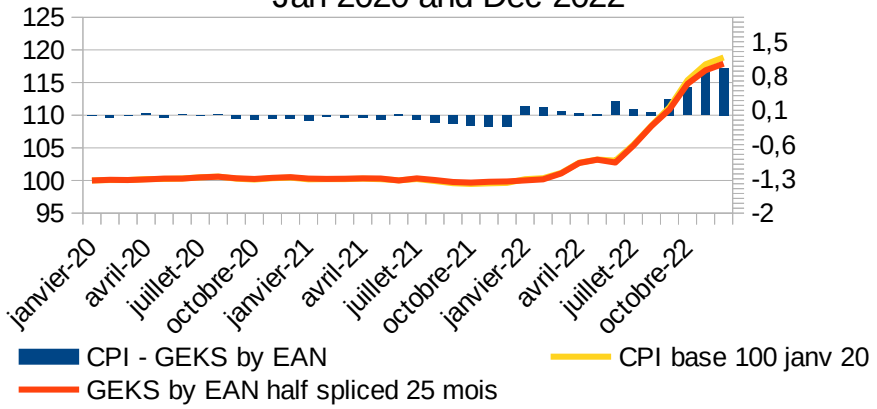




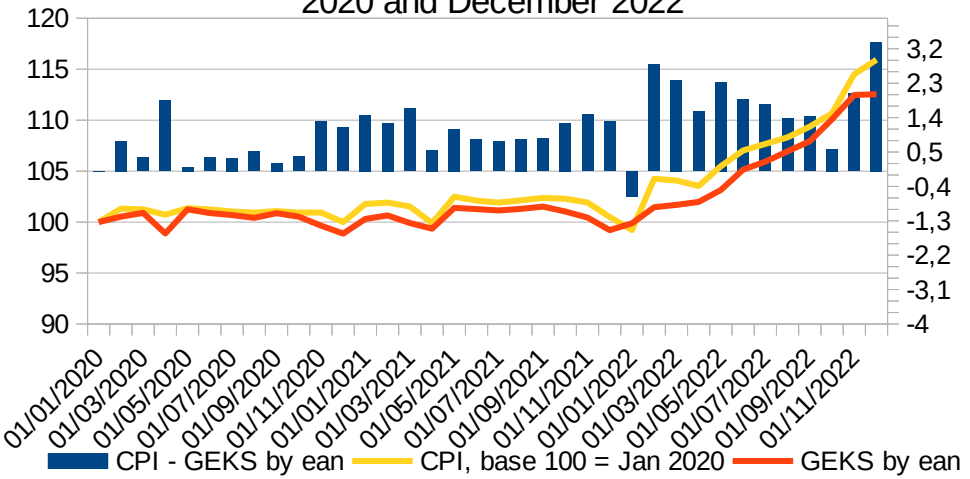
Indexes using EAN or extended article number are very close for milk and foie gras.

There is more volatility for lipstick.

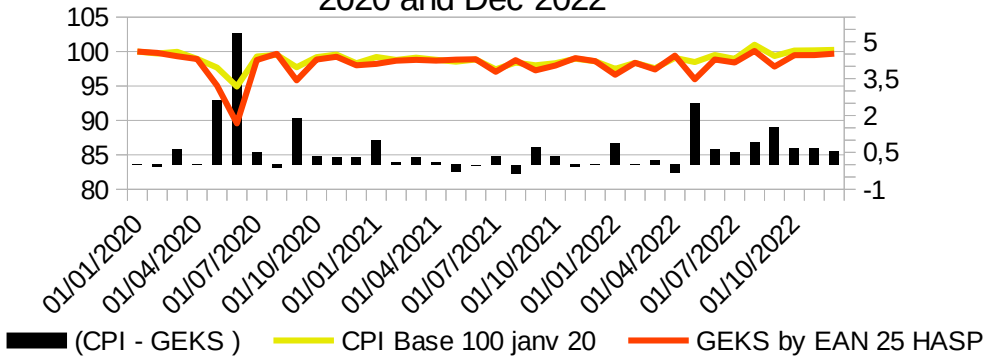
Price indices for the variety whole milk between Jan 2020 and Dec 2022



Price indices for the variety foie gras between January 2020 and December 2022



Price indices for the variety lipstick/gloss between Jan 2020 and Dec 2022

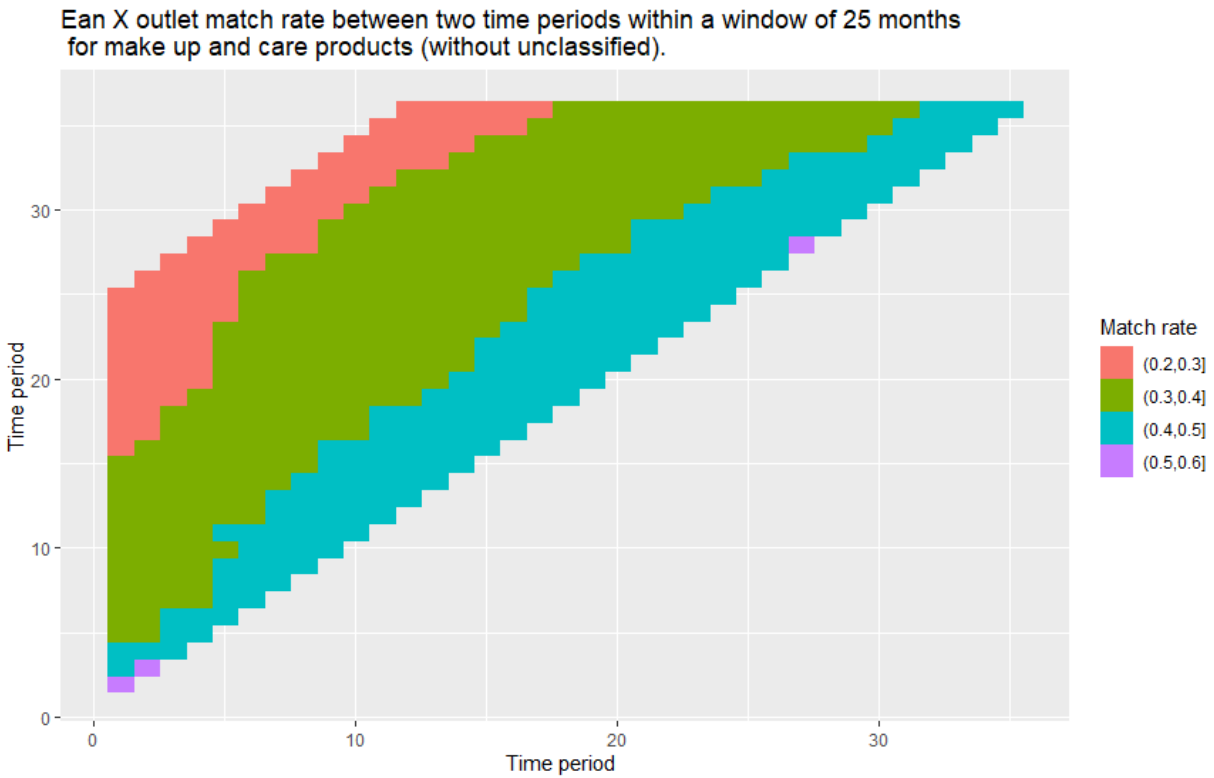


There is more difference between GEKS and CPI than between two GEKS.

A highest volatility in some period (June 2020 for lipstick for instance)

04 RESULTS: COICOP 6 DIGITS (MAKE UP)

MAKE UP AND CARE PRODUCT PRESENCE RATES



The match rate is computed as

$$\frac{|N_i \cap N_j|}{|N_i \cup N_j|}$$

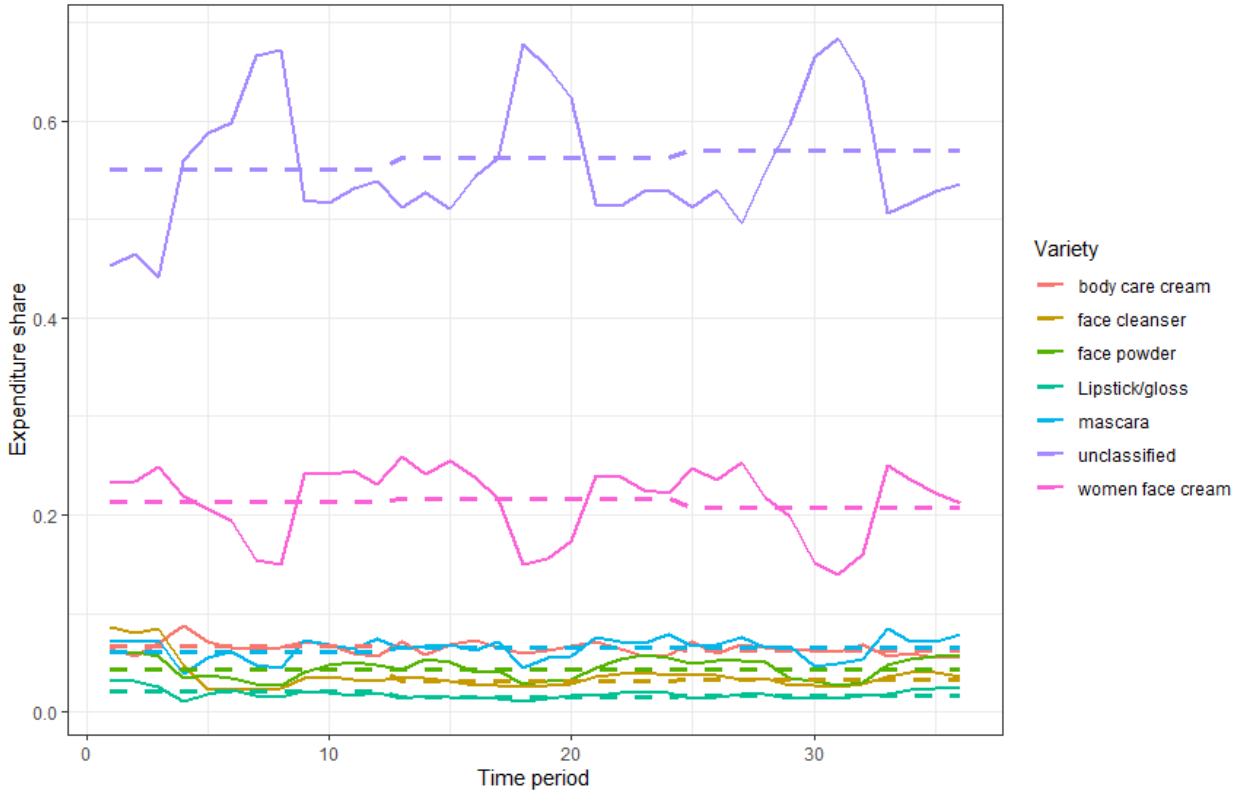
Where N_i are the products (EAN X Outlet in our case) sold in period I.

There might be lockdowns effects in some periods.

Even for two consecutive periods, the match rate is quite low.

UNCLASSIFIED DATA AT THE COICOP 6 DIGITS LEVEL

Expenditure share by variety for the poste make up and care product between Jan 2020 and Dec 2022

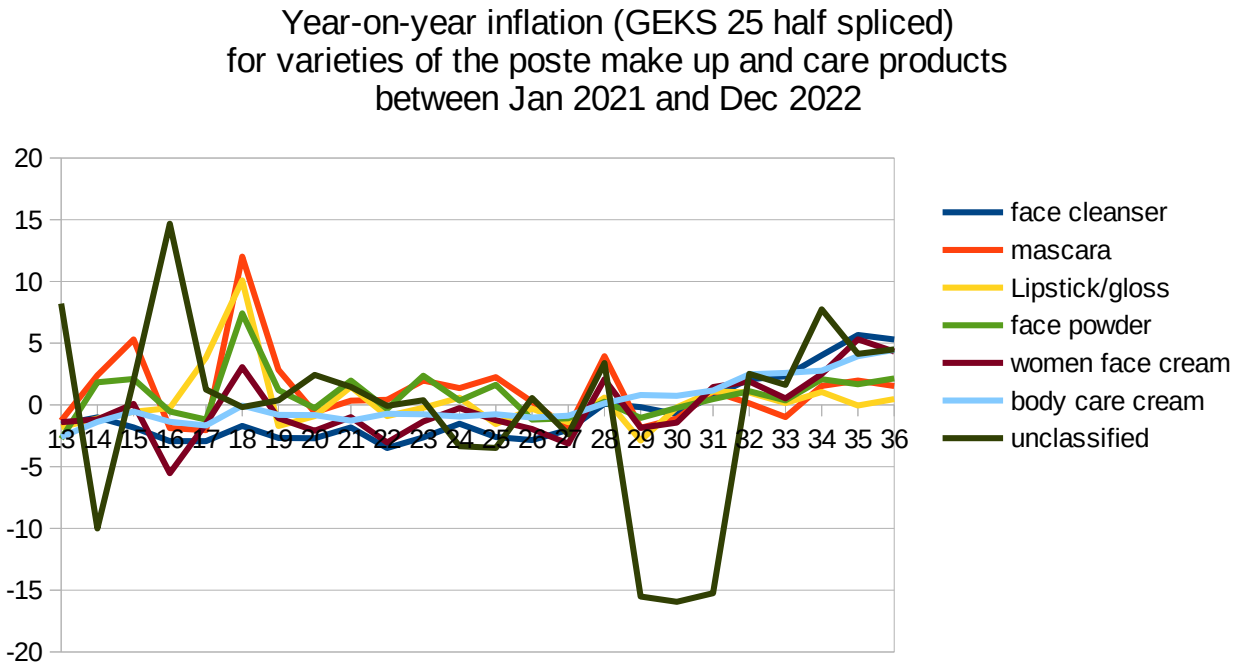


- **In some COICOP 6 digits level we have a high proportion of unclassified data they can be**
  - Linked to field varieties (we do not have yet a corresponding scanner data variety) : nail make up for instance
  - Do not correspond to the classification rules (a canned meat with honey flavour for instance)

They aren't followed taken into account our current CPI.

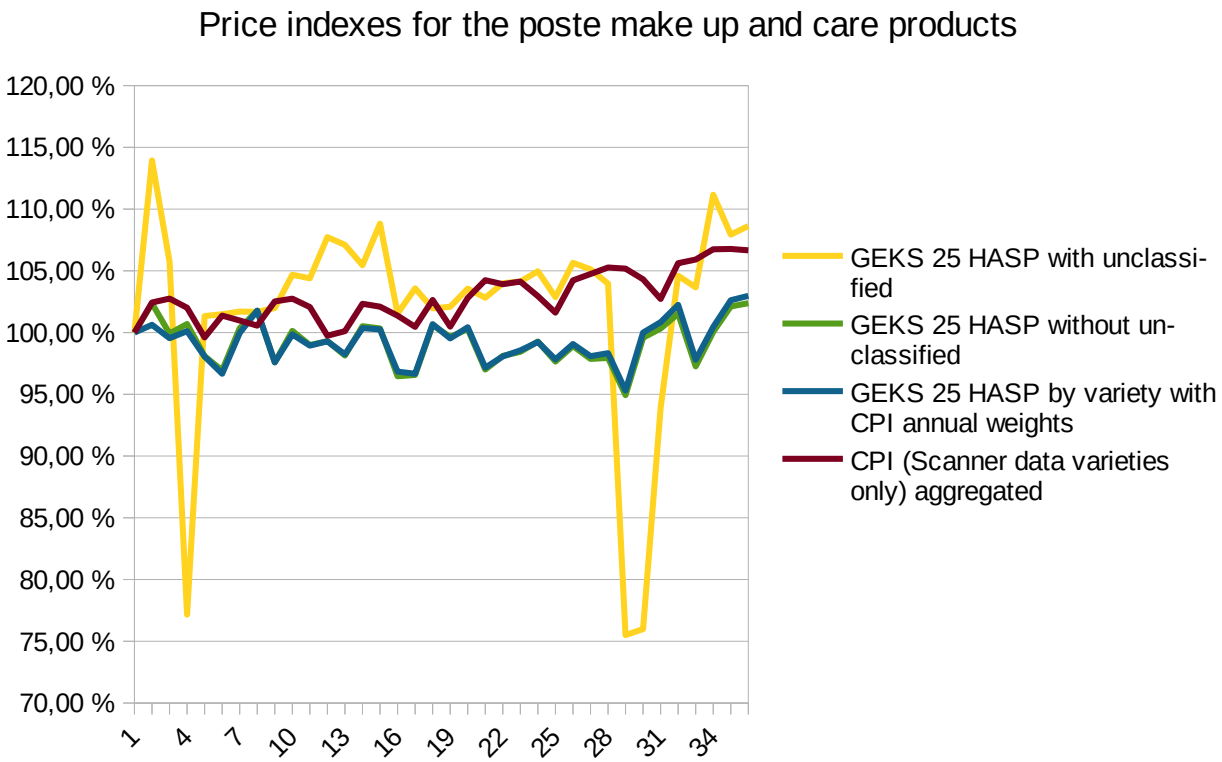
- **What would be the impact of keeping them ?**

YEAR-ON-YEAR INFLATION PER VARIETY



- **The index for unclassified data is more volatile**
  - **Beginning of 2021**
  - **Summer 2022**

UNCLASSIFIED DATA AT THE POSTE LEVEL



The trend is kept with unclassified data but there is a high volatility

05 RESULTS : CONTRIBUTIONS

- **Goal : understand and explain the index variation from the observations**

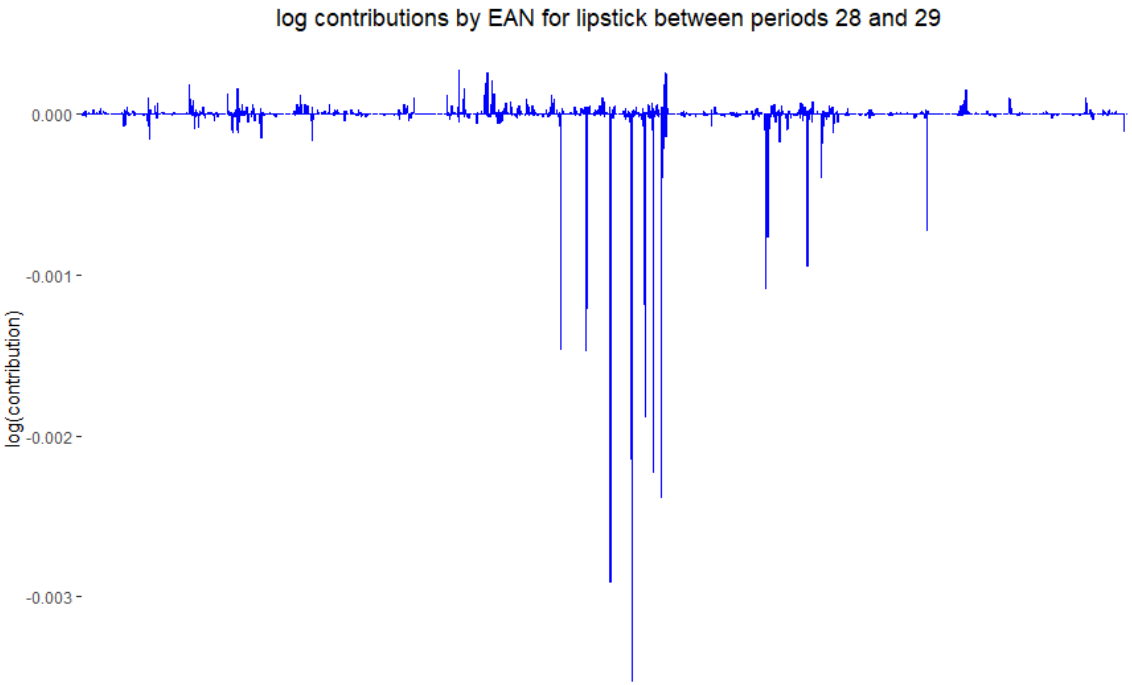
$$I_{GEKS-TQ}^{t1,t2} = \prod_{i \in N} \frac{\left(p_i^{t2}\right)^{w_i^{*,t2}}}{\left(p_i^{t1}\right)^{w_i^{*,t1}}} \prod_{t \in W} \left(p_i^{t}\right)^{\frac{w_i^{t,t1} - w_i^{t,t2}}{card\ W}} \qquad I_{GEKS-TQ}^{t1,t2} = \prod_{i \in N} contribution_i^{t1,t2}$$

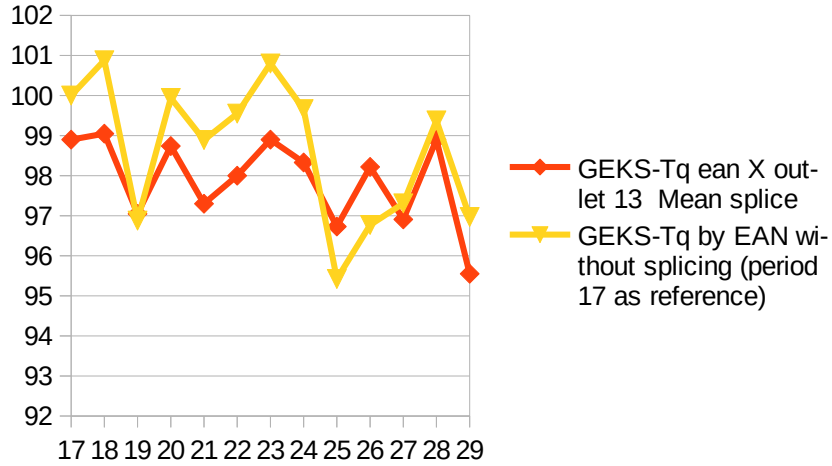
$$\ln\left(I_{GEKS-TQ}^{t1,t2}\right) = \sum_{i \in N} \ln\left(contribution_i^{t1,t2}\right)$$

with unspliced indexes we can use the transitivity : $$I_{GEKS-TQ}^{12,13} = \frac{I_{GEKS-TQ}^{1,13}}{I_{GEKS-TQ}^{1,12}}$$

- **We could also make sub groups (retailer, geo) to sum log(contrib)**

Using R and GEKSDecomp package





The decrease of the index between period 28 (June 2022) and 29 is carried by few products

- **Learnings**
  - At a really fine scale (GTIN/EAN), the GEKS indexes behave quite closely to our current methodology
  - At a more aggregate scale, there is more volatility and we have to progress in our understanding and tools including classification issues.
- **Future works**
  - Classification tools
  - Theoretical understanding of the link with micro-economic theory

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