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Estimating shrinkflation in the traditional data collection and using scanner data

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Abstract

Shrinkflation is a term used to describe the business practice of changing the physical weight of a product, while keeping its price constant. If products “shrink” in size while the price stays the same, the price has inflated (consumer pays the same amount of money for less). Shrinkflation is not new and is not limited to times of high inflation, but, when inflation is rising, the practice increases as companies face rising costs for ingredients, packaging, labor, and transportation.

Shrinkflation may be related to product relaunches in certain business strategies especially when companies are making changes to products to manage costs or improve competitiveness. For example, if a company is implementing shrinkflation as part of a cost-cutting measure, a relaunch can be an opportunity to rebrand the product and communicate changes to consumers more positively. In this case, the relaunch might highlight improvements or innovations, to mitigate potential negative perceptions related to size reductions. Companies may use a relaunch to reposition a product in the market. If they are making changes to the product size, they might rebrand it as a "new and improved" version without explicitly highlighting the reduction in size.

Often old and relaunched products may coexist in the market over time. The simultaneous presence of old and relaunched products is not uncommon. This coexistence serves several purposes and considers different consumer preferences, inventory management, and the transition period required for the relaunched product to gain traction.

With the aim of estimating the number of unique products that shrank and to measure the impact of shrinkflation on CPI, the Italian national statistical Institute (Istat) has elaborated the data referred to some processed food products between 2012 and 2017 when these products were collected in the traditional way through the monthly visits to the shops and also between 2018 and 2021 for the part of data collection of grocery prices still conducted in the traditional way. After an introduction (**section 1**), the main results obtained are indeed illustrated in the **second section**.

When using scanner data in the compilation of the Consumer Price Index (CPI) and matched-model methods, that are based on GTINs or stock keeping units to compare the same product over time, it is difficult to capture shrinkflation thus resulting in a potential downward bias in the CPI. The price change between the old and the new product is not detected when using these product identifiers. Van Loon et al (2023) examined whether multilateral index methods that use hedonic quality adjustments, such as the Imputation Törnqvist GEKS or Time Dummy Hedonic method, can successfully capture product relaunches or shrinkflation. Under hedonics, products with similar characteristics could be considered as the same product (or correctly quality or quantity adjusted for), and the product relaunch would indeed be captured. However, in the case of simultaneous presence of old and relaunched products in the market, quality adjustment methods are not able to adequately capture shrinkflation.

In this paper two potential solutions to detect shrinkflation are explored. The first (illustrated in **section 3**) is an approach where price for a standard quantity is calculated considering similar packaging and an index is compiled. The second approach (discussed in **section 4**) is to group GTINs together to create homogeneous products (avoiding creating a unit value bias), that should consider the relaunch problem more or less automatically, since the new SKU/GTIN and its predecessor would then be combined in the same homogeneous product. Some concluding remarks (**section 5**) will be finally traced.

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1. Introduction

Shrinkflation is a term used to describe the business practice of changing the physical weight of a product, while keeping its price constant.

Over the last years, studies and research have been carried out to analyze and measure the contribution to inflation of this practices and to improve the statistical tools to detect prices increases hidden by changes in packaging. In 2017 in the web site of the UK Office for National Statistics (ONS), a paper titled "the impact of Shrinkflation on CPIH, UK: January 2012 to June 2017" was released (Ochirova, 2017). In the ONS paper an analysis of the spreading of shrinkflation phenomenon in UK is conducted and a simulation of an index that does not consider shrinkflation estimation is carried out to estimate its impact if not considered. About the spreading of shrinkflation, the analysis of micro data highlighted that, as expected, mainly food products were affected by shrinkflation and specifically those in the category of sugar, jam, syrups, chocolate, and confectionary products. For both food and non-food products the reduction of packages prevailed on the increases. About the impact, it was assessed that the UK Consumer Prices Index including owner occupiers' housing costs (CPIH) was largely unchanged (between the adjusted and non-adjusted all-item CPIH, the difference was about 0.03 percentage points since 2012 to 2017). The impact was locally stronger given that in the case of the CPI for sugar, jam, syrups, chocolate, and confectionary products, the index officially released (and adjusted) was greater than the non-quality adjusted one by 1.22 percentage points over the period 2012-17. Some of these results were confirmed in 2019 (Corless, 2029).

The analysis was conducted by ONS researchers in the frame of traditional price data collection. In that frame, the control on data collection by National Statistical Institutes (NSIs) was complete and all the information related to the characteristics of each elementary product offer (that we could define as a combination of brand, variety, quantity, and outlet that specify the elementary item belonging to a product in the CPI basket and about which prices are monitored monthly).

The approach adopted by ONS was resumed by Istat in the analysis of microdata for the period 2012-2021, focusing the attention on the data coming from the traditional data collection also in the years (2018-2021), when scanner data started to be used for CPI compilation.

As a matter of fact, in the recent year the adoption of alternative data sources, and specifically of scanner data, for CPI aims compilation has increasingly taken place. This innovative approach to estimation of inflation has changed the perspective of the analysis or economic phenomenon as shrinkflation, for the characteristics of these new data sources.

This paper proposes a way to overcome this paradox (alternative data sources, more difficulties in detecting shrinkflation), by exploring a way to capture shrinkflation also in the new context but starting from the results of the analysis of the data collected in the traditional way.

2. Prices and information from traditional data collection (2012-2017)

In order to estimate the number of products that have shrunk and to measure the impact of shrinkflation on CPI, Istat analyzed data referred to some processed food products between 2012 and 2021, with reference to the data coming from the traditional way to collect prices.

Analysis focused on prices collected on a monthly basis by the Municipal Offices of Statistics (MOS) in the sample of towns of the CPI survey (the local survey is one of the sources used that contribute to the calculation of monthly consumer price indices). The analysis has focused on more than 20,000 quotations from January 2012 to March 2021, considering that the scope of this analysis was reduced by the introduction of scanner data to compile CPIs for grocery products since January 2018 for super and hypermarkets, extended to hard discount since January 2020.

With regard to the replacements for changes in the quantity of the elementary item, from January 2012 to March 2021, the **CHART 1** shows the monthly number of replacements due exclusively to quantity changes, in absolute value, carried out for the products collected monthly by the MOS: increases in quantity are identified with the POS label (red) and decreases with the NEG

label (blue). There are more cases of packaging changes with reduction in quantity than changes with increase in quantity.

CHART 1. Total number of monthly replacements of elementary items for quantity changes by increasing (POS) and decreasing (NEG) quantity. January 2012 - March 2021 (absolute values)

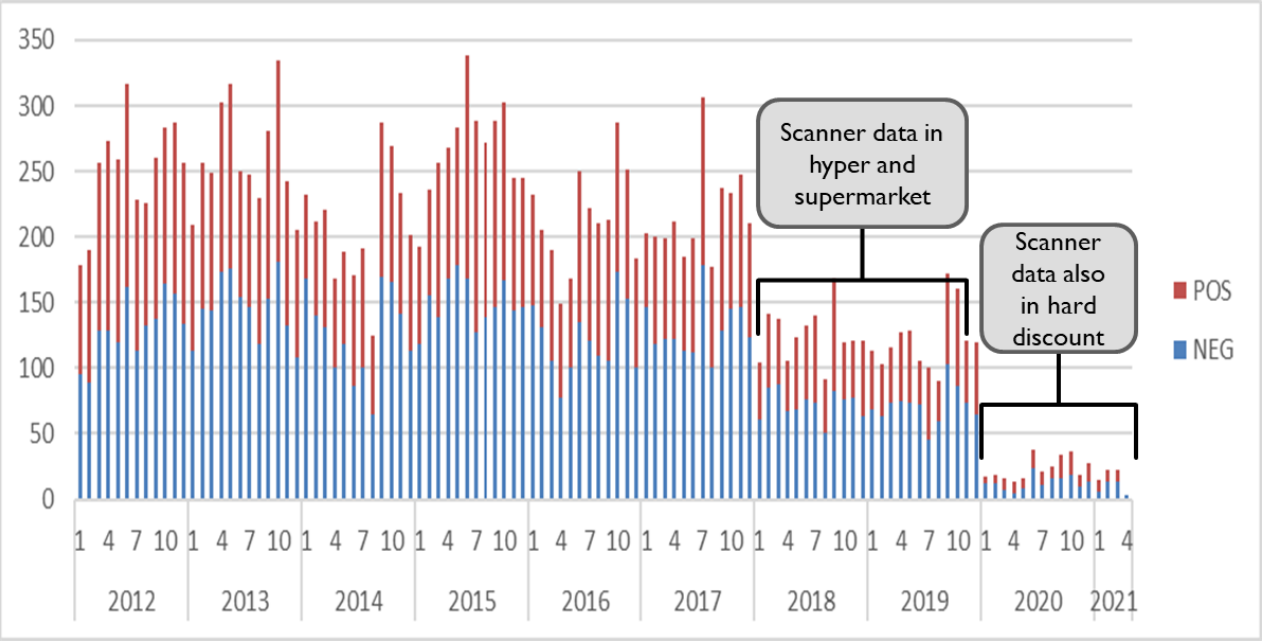
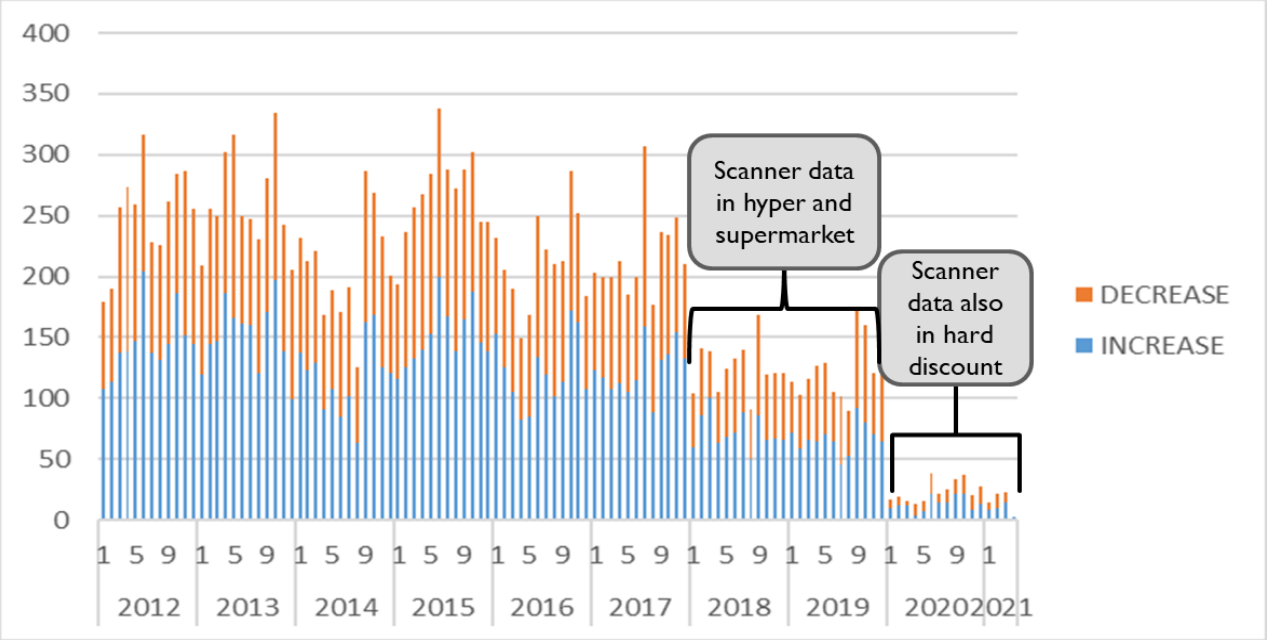


CHART 2 shows, from January 2012 to March 2021, the monthly distribution of replacements in absolute value recorded for the products surveyed monthly by all the MOS, indicating with the INCREASE label (blue) the replacements that brought an increase of the index (and as such with an "implicit" price increase) and with the DECREASE label (red) those that brought a decrease in the index. There are more cases of packaging changes with a price increase than packaging changes with a price reduction. As aforementioned, from January 2018 the reduced number of cases observed is due to the use of prices from scanner data.

CHART 2 - TOTAL NUMBER OF MONTHLY REPLACEMENTS OF ELEMENTARY ITEMS FOR QUANTITY changes by decrease or increase in the price index. January 2012 - March 2021 (absolute values)



With a focus on the classes with the highest number of replacements for quantity and price changes, from January 2012 to March 2021, **CHART 3** shows the distribution of quantity changes by COICOP 1999 classes that recorded a number of changes greater than 250. The label POS identifies the exchange rates with an increase in quantity (orange) and the label NEG identifies those with a decrease in quantity (blue). Looking at the series with a price change that come with a packaging change, the largest number of changes occurs in products as Bread and cereals, Vegetables and Milk, cheese, and eggs with higher percentages of changes with decreasing quantity.

CHART 3 - Total number of replacements for quantity change of elementary items by decrease or increase in the price index. From January 2012 to March 2021 (absolute values)

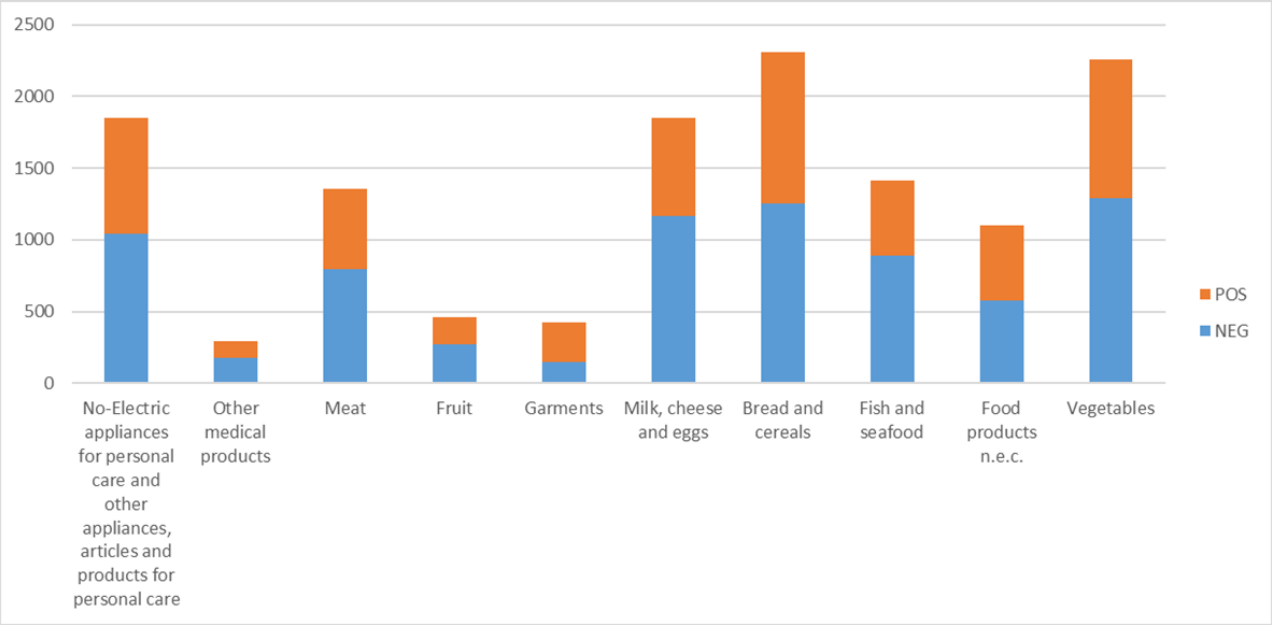
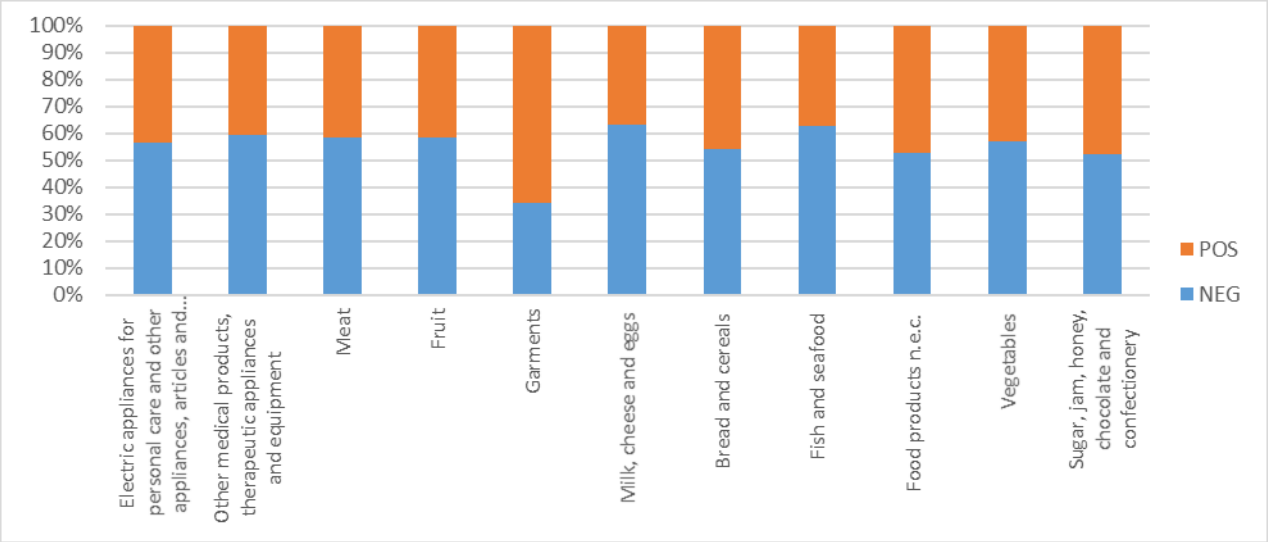


CHART 4 shows the distribution, for the products collected monthly by MOS, of the total number of replacements due exclusively to quantity changes observed between January 2012 and March 2021 (percentage values), for the 10 product classes with more than 500 replacements of this nature. Given that the absolute figure of the changes occurring within a given product class is related to the total number of elementary product offers surveyed within the same class, we considered the data in percentages.

The Chart shows as quantity decreases are greater in percentage terms than quantity increases with the sole exception of Garments class. The classes with the greatest number of quantity decreases are Milk, Cheese and eggs and Fish and seafood.

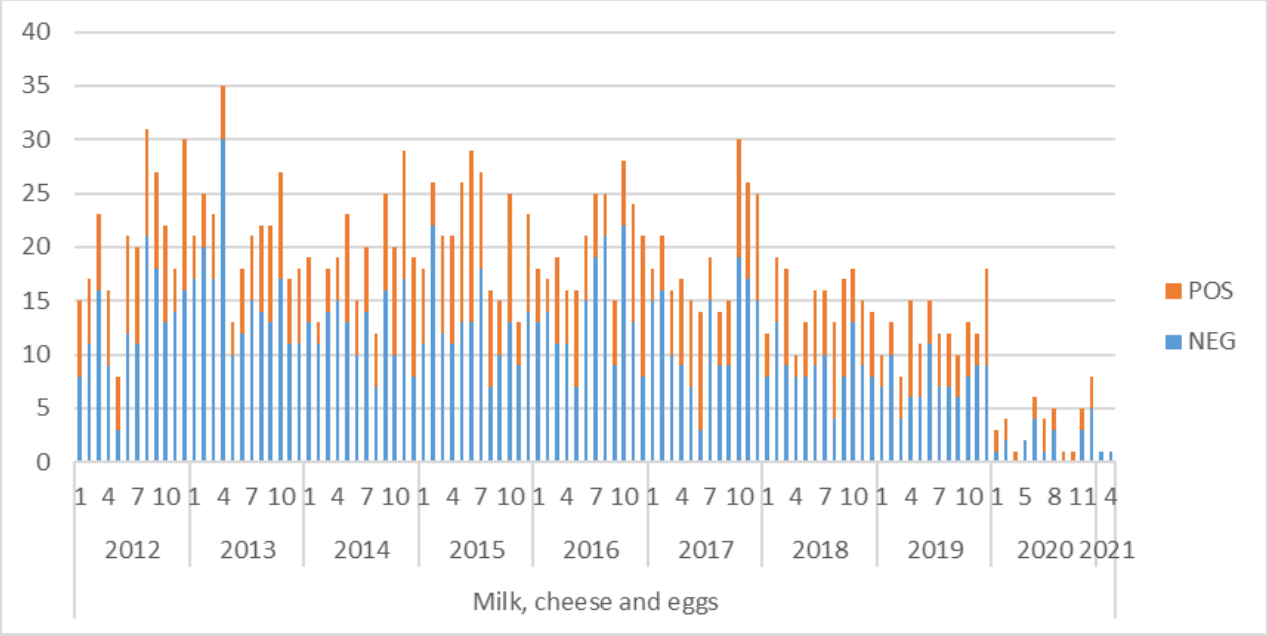
CHART 4 - Total number of replacements exclusively due to quantity changes by COICOP product class and by quantity increase (POS) and decrease (NEG). January 2012 - March 2021 (percentage values)



Considering on the one side the results illustrated in **CHART 4** and on the other side the results obtained by ONS, the analysis was focused on a couple of COICOP classes: Milk, Cheese and eggs and Sugar, jam, honey, chocolate, and confectionery.

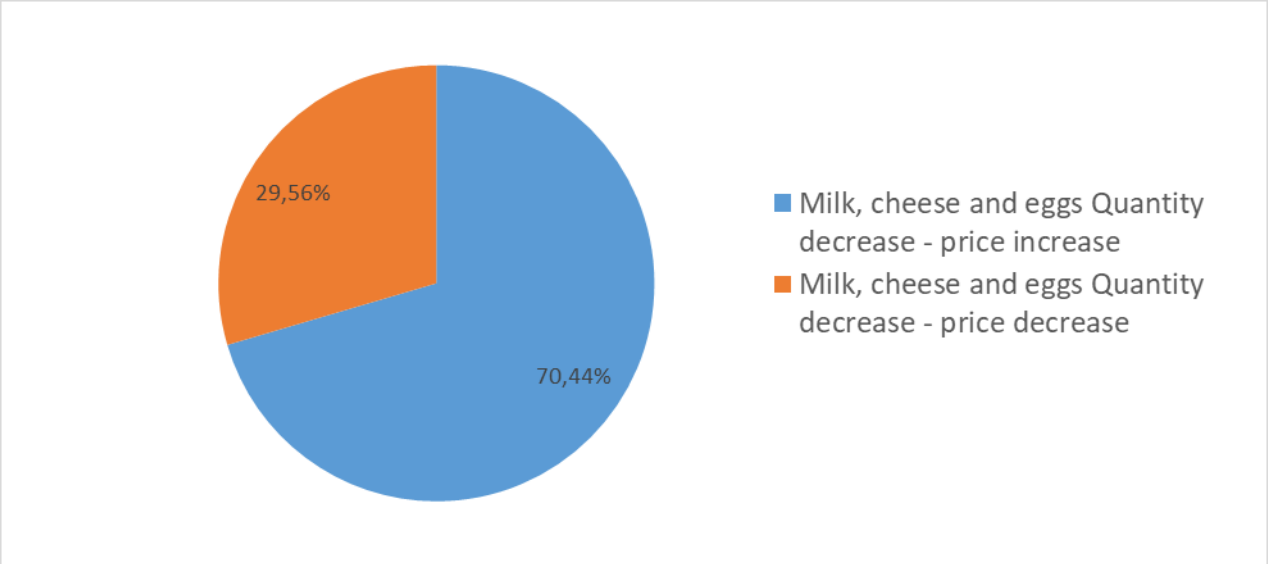
As regards the COICOP class of Milk, Cheese and eggs and Sugar (that is amongst the 10 product classes with more than 500 replacements with the highest percentage of quantity decreases), in **CHART 5**, it can be seen how in the replacements exclusively due to changes in quantity, those with quantity decrease (NEG label in blue) prevail on those with quantity increase (POS label in red) over the entire period of analysis with a few exceptions.

CHART 5 - Total number of replacements for quantity changes, by decreases (NEG) and increases (POS) in quantity. COICOP class of Milk, Cheese, and Eggs. January 2012 - March 2021 (absolute values).



Then, if we consider, amongst the cases of replacements due to quantity decrease, the percentages of those that produced an increase in the consumer price indices of the elementary product offers belonging to Milk, cheese, and eggs, clearly prevailed (70.44%; **CHART 6)**.

CHART 6. Consumer price index increases or decreases amongst elementary product offers with replacements due to quantity decreases in the class of Milk, cheese, and eggs. January 2012 - March 2021 (percentage values)



Same results emerged for the COICOP class of Sugar, jam, honey, chocolate, and confectionery. This also is one of the 10 product classes with more than 500 replacements with the highest percentage of quantity decreases, and in in **CHART 7**, it can be seen how in the replacements exclusively due to changes in quantity, those with quantity decrease (NEG label in blue) prevailed on those with quantity increase (POS label in red) over the entire period of analysis (from 2012 to 2019 because since 2020 the prices of this class of products are entirely collected through scanner data) with some exception in 2015. But what is interesting, in the case of this class is that, amongst the cases of replacements due quantity decrease, the percentage of those producing an increase in the consumer price indices is higher than that recorded for Milk, cheese, and eggs (78.44%; **CHART 8)**.

CHART 7 - Total number of replacements for quantity changes, by decreases (NEG) and increases (POS) in quantity. COICOP class of Sugar, jam, honey, chocolate, and confectionery. 2012 - 2019 (absolute values).

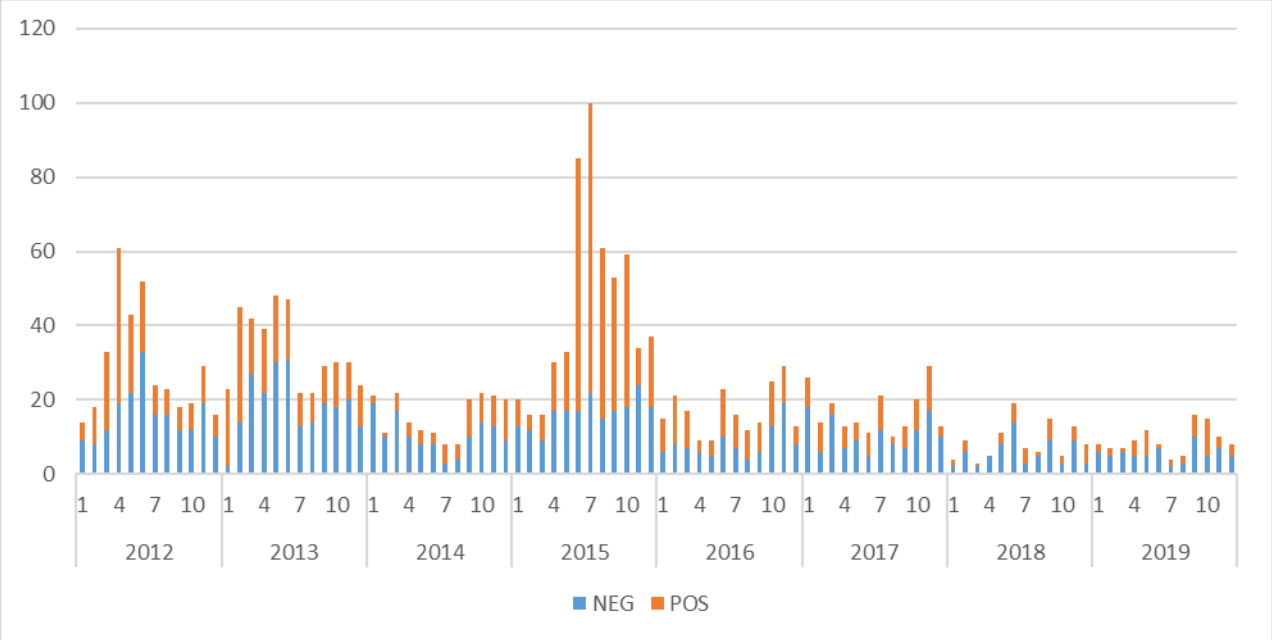
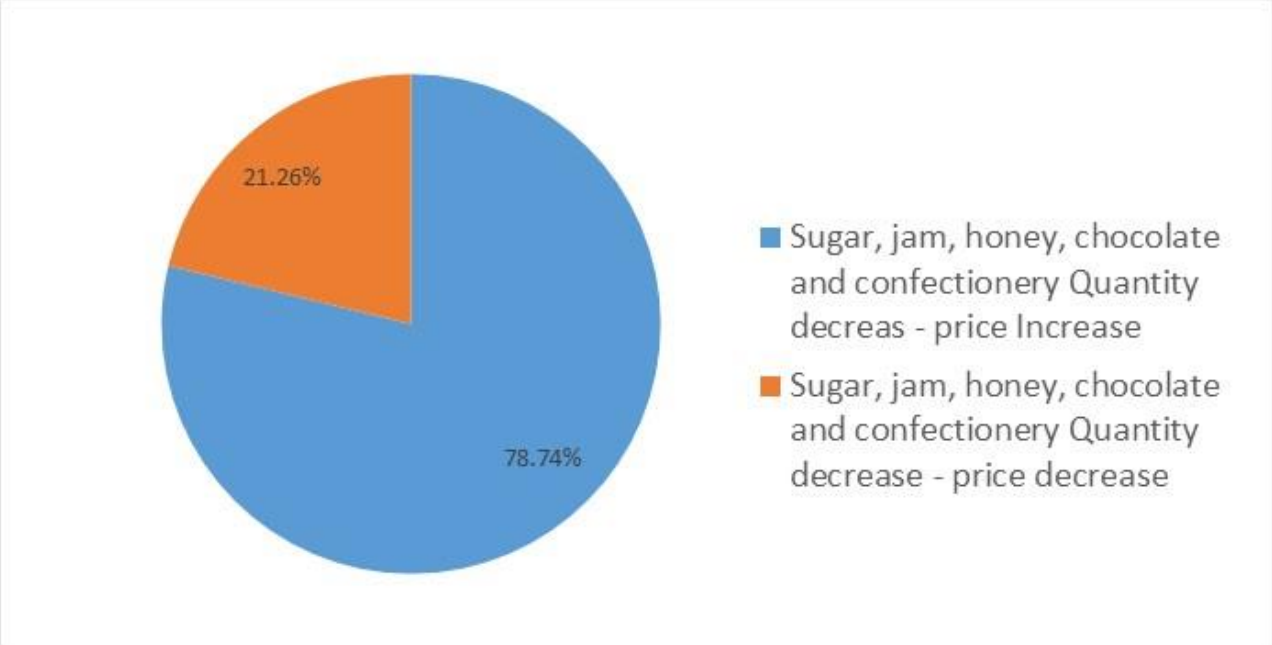


CHART 8. Consumer price index increases or decreases amongst elementary product offers with replacements due to quantity decreases in the class of Sugar, jam, honey, chocolate, and confectionery. 2012 - 2019 (percentage values)



3. Shrinkflation and scanner data: average prices for standard units

The new scenario for the analysis of the shrinkflation derives from the introduction of scanner data. As it is known, scanner present several advantages in the CPI compilation, but, in the analysis of shrinkflation, their characteristics, although the availability of big amount of data, make more difficult a detailed analysis. The different techniques to sample the GTINs to be followed over the time to compile CPI are fundamentally based on the matched model approach. If a GTIN disappears and another one appears, techniques to detect the so-called product relaunches have been designed but they bring two main drawbacks:

- These techniques are not always able to capture relaunches and considering that the information about packaging is within the GTIN description, the treatment of relaunches, where detected, has difficulties to properly account of shrinkflation phenomenon.
- Often old and relaunched products coexist in the market over time. The simultaneous presence of old and relaunched products is not uncommon, and it serves several purposes and considers different consumer preferences, inventory management, and the transition period required for the relaunched product to gain traction.

This second issue may be related to product relaunches in certain business strategies especially when companies are making changes to products to manage costs or improve competitiveness. For example, if a company is implementing shrinkflation as part of a cost-cutting measure, a relaunch can be an opportunity to rebrand the product and communicate changes to consumers more positively. Companies may use a relaunch to reposition a product in the market. If they are making changes to the product size, they might rebrand it as a "new and improved" version without explicitly highlighting the reduction in size. The messaging around the relaunch can influence consumer perceptions and the traditional technique of dynamic sampling but also multilateral indices without considering quality adjustment issues could fail in detecting case of shrinkflation.

A way that has been tested for the aims of this analysis has been that of considering an approach where price for a standard quantity is calculated considering similar packaging and compiling and index based on the average prices calculated.

A preliminary experiment has been conducted on some groups of food products as pasta and coffee by analyzing Italian data, producing controversial results.

Similar experiment on hand dishwashing liquid has brought to detect relevant impact of shrinkflation that the dynamic sample approach was not able to capture.

The data considered are referred to the province of Rome and they are from January 2021 to December 2023. Average prices have been monthly calculated for 1,000 milliliters, by including all the cases of packaging equal to 1,000 ±100 milliliters. Prices per 1000 milliliters by GTIN were compiled (reporting price to the standard quantity of 1,000 milliliters for every GTIN in the interval 1,000 ±100 milliliters, including packaging with more than a bottle within that range) within each outlet and then aggregating via unweighted geometric mean within the outlet; afterwards, aggregation via weighted arithmetic mean was carried out considering the sampling weights of the outlets and arriving at a time series of monthly prices of 1,000 milliliters of hand dishwashing liquid recorded in the modern distribution in the province of Rome from January 2021 to December 2023. Based on these monthly average prices, an index was re-compiled.

The result highlights a relevant phenomenon of shrinkflation. In particular, a sharp increase of the gap between the index compiled by using the dynamic sampling approach (and adopted in the compilation of inflation measure) and the re-compiled index starts from Mid 2022 during the inflation crisis (**CHART 9**).

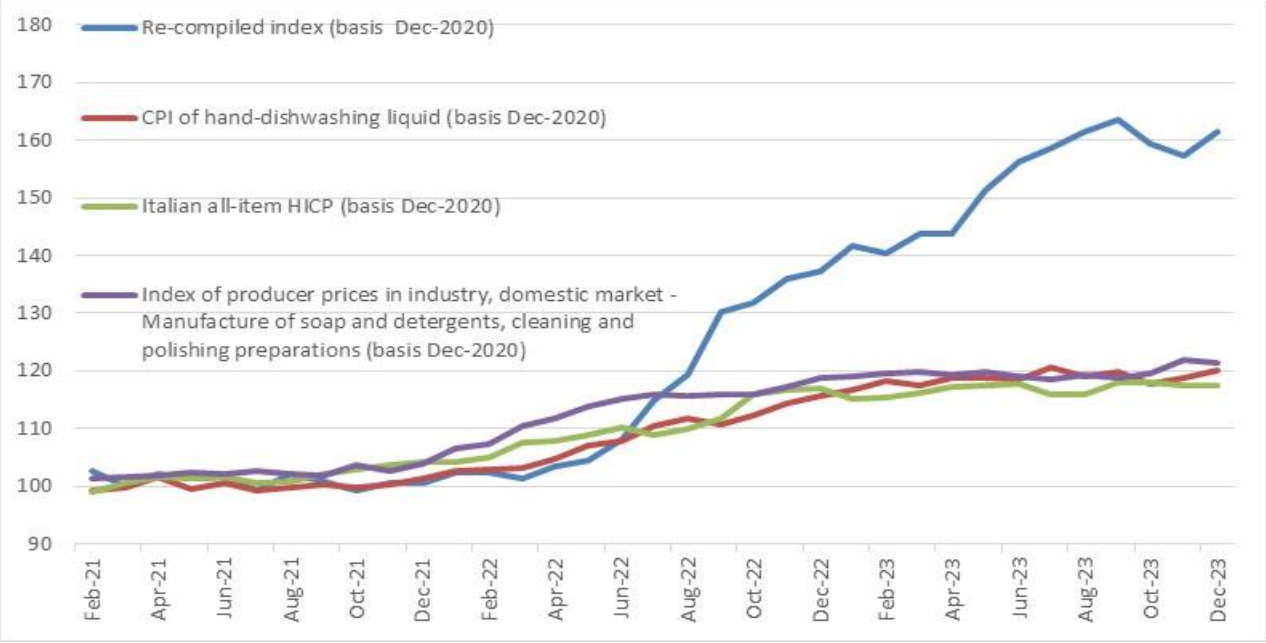
To correctly interpret this result, it has to be pointed out that when we focus the attention on hand dishwashing liquid, we are talking of one of the several markets belonging to elementary aggregates dishwashing detergents (hand and in the dishwasher), that is one out of five elementary

aggregates belonging to the subclass of household cleaning and maintenance products whose weight in the Italian HICP is lower than 1%. If we consider that we also have movements in the opposite direction for other products (increases in quantity as it was assessed in the study on the data coming from the traditional data collection), it means that it can be assumed that the impact of shrinkflation should be limited, even if this assumption deserves to be further investigated and quantified.

Anyway, this sharp increase occurred in the summer of 2022 when general inflation (represented by all-item HICP in **CHART 9**) was also accelerating but by a much slower pace that is also the pace of the index compiled for the prices of hand dishwashing liquid in Rome and used for the all-item index compilation. In the same period the producer prices in industry, domestic market, referred to Manufacture of soap and detergents, cleaning and polishing preparations recorded an important increase but, also in this case, with a pace slower than that one the re-compiled index of consumer prices of hand dishwashing liquid.

Therefore, the reasons of this sharp increase have to be further investigated even if other approaches to detect shrinkflation were tested, in particular multilateral methods applied to a different way to aggregate GTINs and to a specific case of homogeneous products (both illustrated in the next section), confirming, although on a lower scale, the results obtained.

CHART 9. Rome consumer price indices by dynamic sampling approach and by quantity unit prices. Hand dishwashing liquid February 2021 - December 2023 (Dec 2020=100)



4. Shrinkflation and scanner data: simulations with multilateral indices

Also in this case the exercise has concerned the market of hand dishwashing liquid and the data are those referred to the province of Rome and detected through scanner data in the period 2021 -2023. The multilateral indices calculated are GEKS-TQ and WTPD and the two methods were used for two different simulations. In both simulations the multilateral indices are calculated considering the entire period as a single window (Dec2020 - Dec2023), that means that there is no problem of choosing the splicing method. The difference between the two simulations is represented by the different ways to aggregate the elementary data to calculate the multilateral indices.

In **simulation 1** the turnover and quantities of the GTINs considered are aggregated by type of outlet (supermarket, hypermarket, hard discount, outlets with surface between 100 and 400 square meters, specialist drugs). In the dataset obtained, the single record (considered as elementary data) is given by GTIN by type of outlet and the average price is the average price of the GTIN sold in outlets of the same type as well as the quantity is the total quantity of sales of the GTIN in the outlets

of the same type. Therefore, in simulation 1, if a GTIN is sold in many outlets of two different outlet types, the dataset has two records for the same GTIN (specified as GTIN-type1 and GTIN-type2). Moreover it is important to underline that GEKS-TQ and WTPD are not calculated separately by type of PV (even if this is a possible option that has not been considered in the simulation) and the two records (GTIN-type1 and GTIN-type2) are processed in the same multilateral. Overall, the database used for simulation 1 contains 655 records.

In **simulation 2**, the GTINs (turnover and quantities sold) are aggregated by type of outlets, brand, class, and number of pieces. Class is a variable that refers to the packaging of each GTIN, the variable number of pieces refers to the number of pieces in the package sold (for instance three bottles of hand dishwashing liquid of 1,000 milliliter and the variable goes from 1 to 5). In this simulation the following 13 classes of packaging (defined on the basis of reasonable amplitude) were considered (**Table 1**).

TABLE 1. Classes of packaging of hand dishwashing liquid used in simulation 2

Class of packaging	Lower bound (milliliter)	Upper bound (milliliter)
1	0	350
2	350	450
3	450	550
4	550	650
5	650	750
6	750	900
7	900	1,150
8	1,150	1,400
9	1,400	1,550
10	1,550	1,750
11	1,750	2,100
12	2.100	2,600
13	>2,600	

In this case the average price is computed using all the different GTINs of the same brand sold in stores of the same type, which belong to the same class of packaging, and available with the same number of pieces in the package. The average price is obtained, indeed, by the ratio between the total turnover and the quantities (expressed in standard units of measurement) of the GTINs that belong to these "homogeneous group" (given by brand, type of outlet, class of packaging and number of pieces). Of course the database for simulation 2 contains less records (294) than the database used in simulation 1.

The results obtained by using multilateral methods in the two simulation cases described, are illustrated in **CHART 10**.

It is interesting to note that also in the contest of the use of more advanced index methodologies, as those represented by multilateral indices, it is confirmed that in the summer of 2022 a fast increase of prices took place for "Hand dishwashing liquid" and seems largely due to shrinkflation given the comparison with the index based on the dynamic sampling approach.

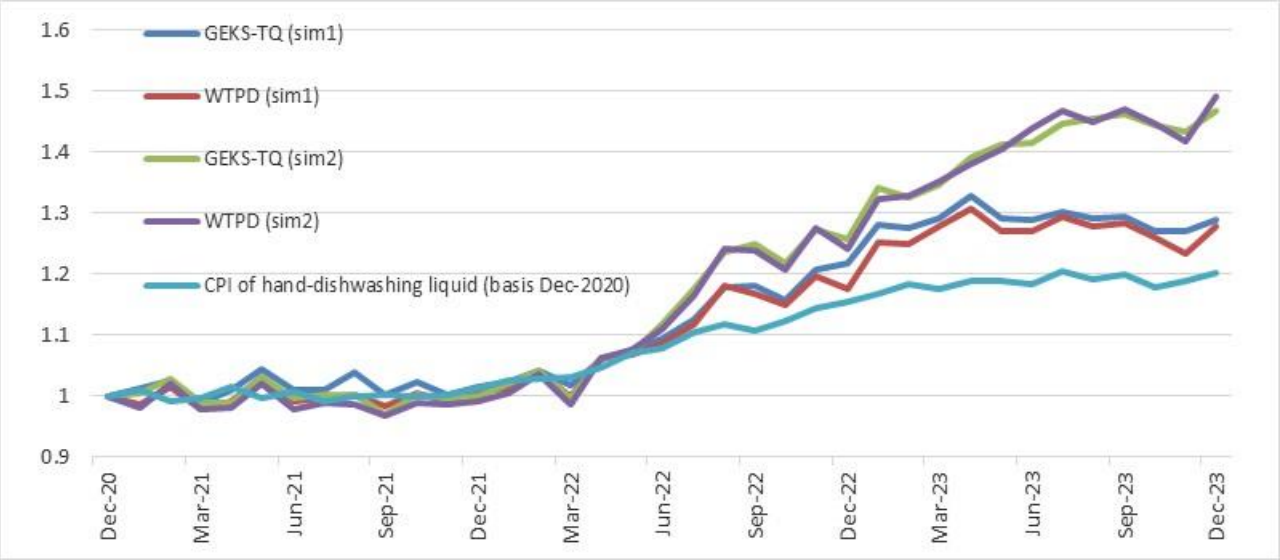
In the simulation 1, when the average prices are calculated GTIN by GTIN, the gap between the index based on the dynamic sampling approach (and bilateral indices) and GEKS-TQ and WTPD is not negligible but lower than that recorded in the exercise reported in section 3 (the highest differences is observed in April 2023 when the GEKS index was 14 percentage points higher than the index based on the matched model approach).

In the simulation 2, this gap further enlarges reaching, in December 2023, 29 percentage points in the level of the indices between WTPD and the index based on the dynamic sampling approach. Even if this difference does not arrive at the peak of almost 44 percentage points in

September 2023 recorded in the case of the index based on average prices for standard units (described in section 3), highlights how a different approach to the compilation of CPI by using scanner data could detect potential areas of shrinkflation.

This approach has to be tested for other products, and for other territorial areas to assess its capability to capture shrinkflation and it should be extended to the cases of quantity increases in GTIN, to have a complete picture of the hidden effects on the inflation measures deriving form policies related to the handling of packaging. Nevertheless, it looks promising and worthy to be further explored.

CHART 10. Rome consumer price indices (GEKS-TQ and WTPD). Hand dishwashing liquid – simulation 1 and 2. December 2020 - December 2023 (Dec 2020=1)



5. Conclusions

Shrinkflation typically takes place more frequently when companies have to manage increasing costs in phases of general growth of prices (Durbin, 2022). The recent sharp increase of inflation, and the revamping of the debate and of the consumers' experiences has relaunched the topic of shrinkflation, whose impact is now to be analyzed in the "scanner data and alternative data sources age".

Movements in the quantities of packaging are not only in the sense of decrease but also in the direction of increase, even if some evidence show that decreases tend to prevail on the increases and within the quantity decreases, the cases of implicit (or hidden) price increases.

A quality improvement in the inflation estimation (scanner data, adoption of alternative data sources) should allow (and not neglect) a better analysis of such a kind of economic attitude of companies in the policies of pricing that could hide some inflation dynamics.

For processed food and grocery the use of dynamic sampling approach does not achieve (except for a few cases) the objective of detecting this hidden dynamics, in particular for the frequent coexistence of old and relaunched GTIN.

The use of homogeneous products in the multilateral approach to index compilation, which identify these homogeneous products by classes of packaging, looks a promising approach to be further explored to have a clearer picture of the impact of this economic behavior of the companies, that, with high probability, has a limited impact on aggregate figures but potentially relevant for specific markets.

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