

ADVISORY PANEL ON CONSUMER PRICES – TECHNICAL

**Retailer stratification analysis**

Status: Draft of future publication

Expected publication: TBC

**Purpose**

1. In this paper we summarise the current multiple/independent retailer type stratification strategy to aggregate price quotes for the calculation of our consumer prices, CPI, CPIH and RPI.
2. We discuss some potential limitations to this strategy due to the change in consumer behaviour, mainly due to the increase in online shopping, and the potential misrepresentation of online retailers with a large market share and limited outlets.
3. We summarise two potential solutions to improve on the current retailer type stratification. Given the panel's feedback in April, we have explored the market share stratification as an alternative, and this paper summarises the findings of that analysis.
4. The analysis focuses mainly on the traditional data collection, and it focuses on three main areas: weights change, impact on indices and annual growth rates, and change in the proportion of quotes within each retailer stratum.
5. The main result from this paper is to show that the market share based retailer type stratification introduces notable volatility in the lower aggregates, which makes the method unsuitable for introduction in March 2026.
6. We want to improve the multiple/independent method for March 2026, so we are now proposing two simpler short-term alternatives which we think we may be able to deliver in time. We will report back to the APCP-T panel in September.

**Actions**

7. Members of the panel are invited to:
  - a. Provide feedback on our proposed short-term improvements to the current retailer type stratification strategy
  - b. Provide feedback on our proposed future work improvements to the retailer type stratification strategy
  - c. Provide general feedback on the results of the analyses presented in the paper.

**Introduction**

Currently, low-level elementary aggregates are stratified in a combination of region and retailer type. Therefore, each representative item in the basket can be either:

- d. Not stratified by region or retailer type
- e. Stratified by region only
- f. Stratified by retailer type only
- g. Stratified by both region and retailer type.

The analysis presented in this paper impacts approximately 50% of the basket items, which are items stratified by type (c) and (d).

8. Retailers are currently stratified based on the number of open locations in the UK territory: retailers with fewer than 10 outlets are classified as “independent”, while those with 10 or more are classified as “multiple”.
9. We believe this approach has become increasingly differentiated from changes in the retailer sector, for instance the increase in online shopping, which raises some potential limitations:
  - a. It equally weights potentially different retailers, e.g. small newsagent chains, discount stores and large national chains of supermarkets
  - b. It equally classifies all items sold by the retailer, regardless of the market share of the product sold, e.g. a large supermarket that sells only a small number of pharmaceuticals and a large share of food items would have all items classified under the “multiple” category
  - c. It misrepresents online retailers with a large market share and limited outlets. This is becoming increasingly relevant as more consumers are shifting towards online shopping.

### **Alternative approaches**

10. To try and solve the limitations of the current approach, we proposed exploring two more stratification strategies:
  - a. No stratification
  - b. Market share based stratification, also referred to as “big/small”
11. The two stratification strategies are relevant for those consumption segments that are stratified by retailer type, and for which only traditionally collected data is available. For the grocery consumption segments for which we also collect scanner data, we will have some form of retailer stratification regardless of the stratification strategy we choose, as we discuss in the next section.
12. The no stratification method groups all price quotes together, removing de facto the retailer type stratification for non-ADS categories. The items are then weighted based on the implicit weight of each retailer, which is the number of instances of a specific item sampled for any retailer. Implicit weight would give larger weights to shops that are sampled more frequently, especially after considering replication factors.
13. Replication factors are applied to retailers that apply a one-nation pricing policy or regional pricing strategies, to give that retailer and item a corresponding collection frequency.
14. The no stratification strategy was presented to the panel in April ([minutes](#)) where the Panel broadly supported our recommendation not to pursue this approach. The panel however suggested that there was value in taking a holistic view of the CPI stratification and consider what the optimal approach would be if starting from scratch. We will consider this for future work. This paper focuses on the impact of introducing a market share based stratification.
15. With the market share based stratification, retailers are classified as “big” or “small” based on a 2% threshold on market share, as discussed in our [previous paper](#). The threshold is applied to all categories, as it should provide a good split between larger and smaller retailers while minimising the risk of having different types of retailers in the same stratum.

### **Integration with ADS**

16. For both the current (multiple/independent) and proposed (big/small) retailer type stratification strategies, retailer type weights are calculated from the Annual Business Survey (ABS) dataset. The most recent ABS file has a three-year gap, which means that the retailer weights used for the 2024 index calculation are calculated from the ABS data for 2021.

17. Retailer type weights are calculated as the proportion of turnover of the retailers falling under any specific stratification for each of the 45 ABS categories. The ABS categories are currently mapped to a specific item in the basket. For the big/small stratification, the ABS categories are mapped to a COICOP4 class level and then propagated down to the consumption segment level using our aggregation structure. Therefore, all the consumption segments within the same COICOP4 category are mapped to the same ABS category. All items stratified by retailer type can be mapped to an ABS category.
18. When introducing grocery scanner data, for retailers where both collection types (traditional and scanner) are available, double counting must be avoided. This can be achieved by dropping quotes in traditional data where scanner data is available and then subtracting ADS weights from the retailer type weights, for each retailer type, according to:  $w_{other\ type} = w_{type} - w_{type,ADS}$  [1].
19. Equation 1 works for both stratification methods, just adapting the retailer type. In the case where an item is not stratified by retailer type, double weighting is avoided by subtracting the ADS retailer weight from the total of the weights, as per  $w_{other\ type} = 1 - w_{ADS}$  [2].

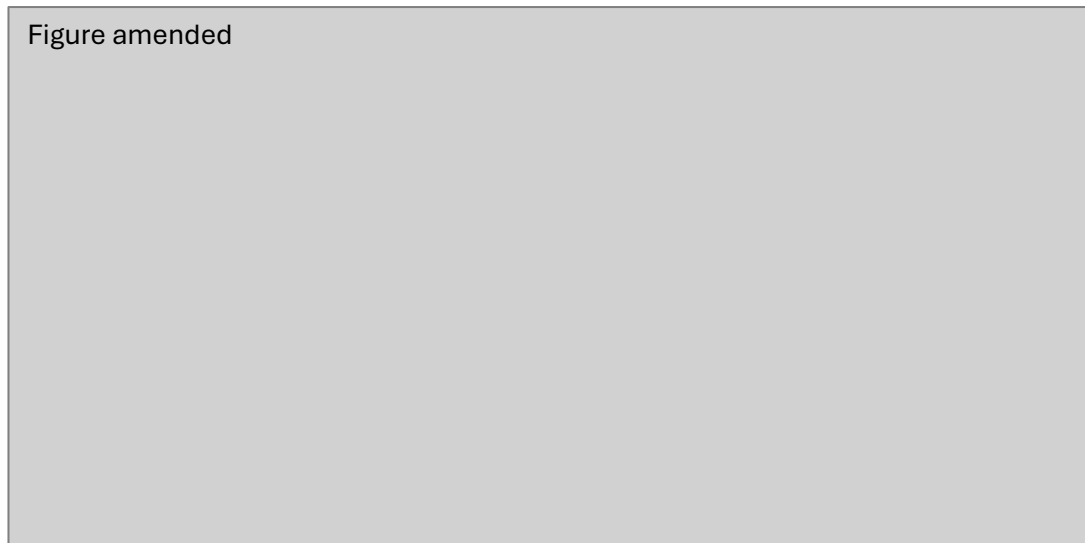
### Summary of the analysis

20. In the remainder of the paper, we present the studies on the impact of potentially introducing the market share based stratification against the benchmark methodology based on the number of shops. We performed several studies, summarised as follows:
  - a. Change in weights. We describe how the weights change moving from the multiple/independent to the big/small stratification over the whole span of the analysis
  - b. Impact on the aggregated indices. We show the impact on the index and annual growth rate for the whole span of the analysis at various levels of aggregation, together with some metrics to estimate the similarity of the two timeseries and some metrics to try capture the volatility of the indices at more disaggregated levels
  - c. Change in stratum sample sizes
21. The analysis discussed is based on local collection data only. The methodology does not depend on the introduction of scanner retailers as discussed in paragraphs 16-19. The analysis only applies to the traditionally collected items which are stratified by retailer type. We performed the analysis on a timespan ranging from January 2019 to June 2024, so for the index analysis we assume the index to be 100 in January 2019.
22. Many case studies focus on the 'clothing and footwear' category, since all items therein are stratified by retailer only.

### Change of weights

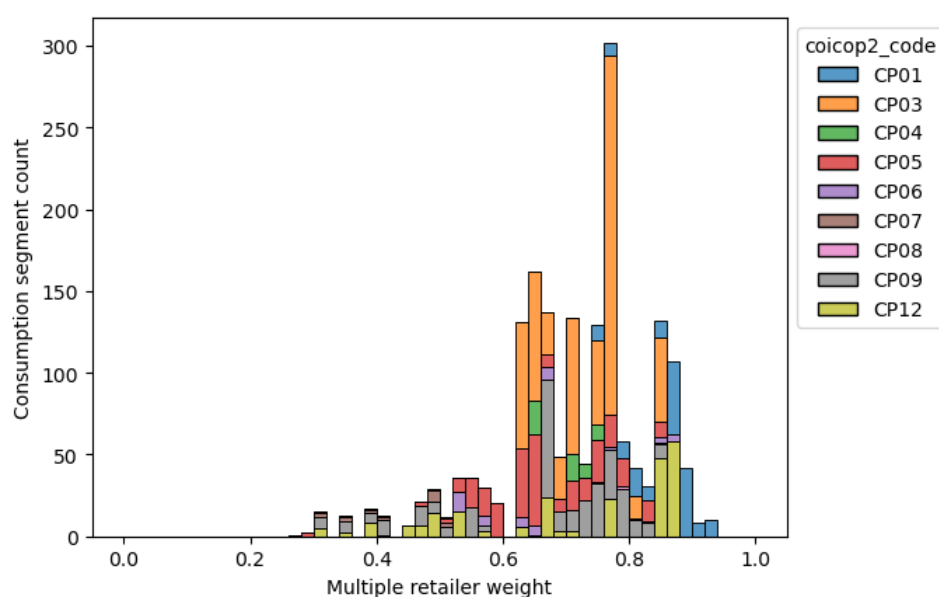
23. In this section we focus on the change introduced to the retailer type weight when changing the retailer type stratification. Because of the different definition, we anticipate that a potentially notable shift will happen for some categories. Moving from the multiple/independent to the big/small classification of retailers implies that a notable number of retailers have changed their classification, mainly from the 'multiple' to the 'small' category. The reason is that most of the retailers with more than 10 locations have a small market share, often smaller than the 2% threshold. This can be seen exemplified in Figure 1.

Figure 1- Distribution of ABS retailers on a number-of-shops vs market share plane (Amended)



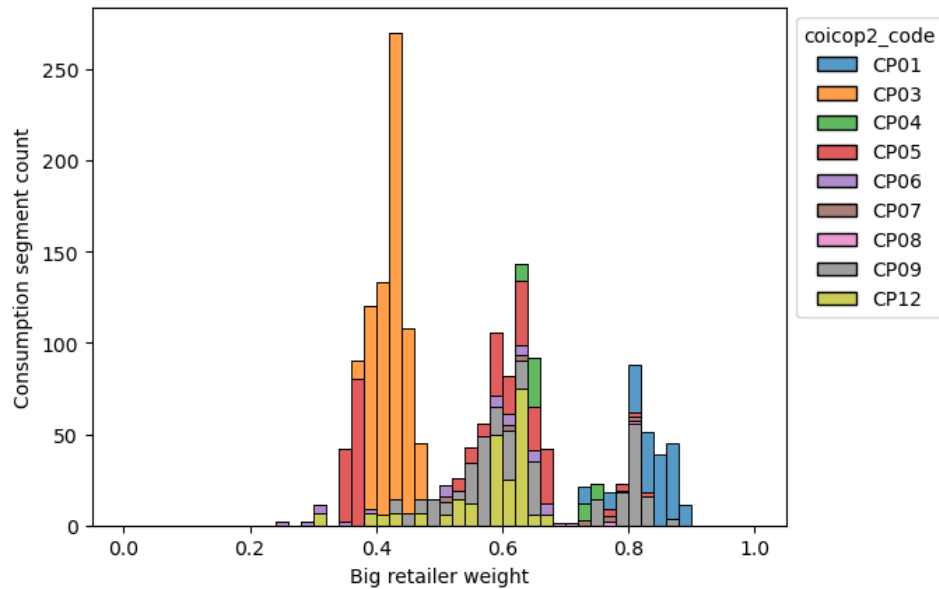
24. For example, for shoes and footwear COICOP4 division in 2023 we observe that many retailers classified as multiple have a small market share, causing them to change their retailer classification with the proposed new method. This is expected as the clothing and footwear sector is characterised by a large number of retailers with a relatively small market share.
25. Figures 2-3 show the distribution of weights for the two different classification strategies. Because the weights add up to 1 for each consumption segment, we only show multiple and big weights in the two figures respectively. The different colours represent the COICOP2 categories. COICOP2 categories CP02 (alcohol and tobacco), CP10 (education) and CP11 (restaurants and hotels) do not appear on the figures because none of the consumption segments within these categories are stratified by retailer type. The distributions aggregate the weights from the entire time span of the analysis for each consumption segment with any kind of retailer type stratification. The figures show a shift towards lower weights when considering the big/small retailer type stratification.

Figure 2 - 'Multiple' weights distribution by COICOP2 category



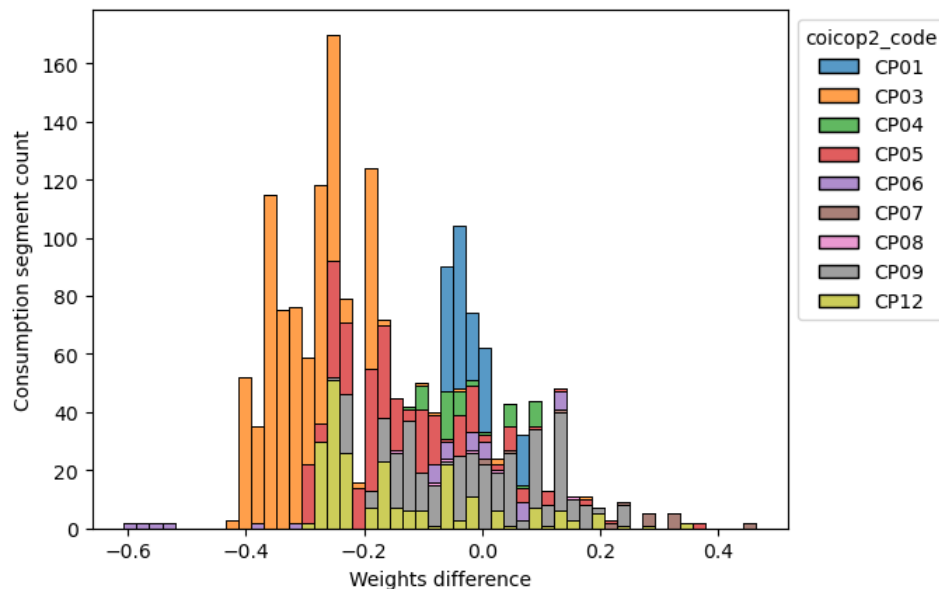
26. The big/small retailer type stratification seems to cluster the weight, in particular for the COICOP2 categories CP01 (food and non-alcoholic beverages) and CP03 (clothing and footwear), while the other categories seem to have weights that are more broadly distributed.

Figure 3 - 'Big' weights distribution by COICOP2 category



27. Figure 4 shows the histogram of the differences between the big and multiple weights. The distribution is slightly skewed towards negative values, which is in line with the expectation that 'big' retailers weights would be smaller than 'multiple' retailers weight following the introduction of the market share based stratification as it can be anticipated from Figure 1.

Figure 4- Difference of 'multiple' and 'big' weights, by COICOP2 category



### Aggregated indices

28. In this section we compare the indices and growth rates at various levels of aggregation for the two stratification methods, where the “multiple/independent” method is taken as benchmark, while the “big/small” method is the comparison time series. The benchmark index and annual growth rate shown in this paper are slightly different from the published impact analysis in December and April as a result of further quality improvements to the pipeline.
29. In the two panels within each figure, we show two time series comparisons: on the top panel, the index or growth rate at a specific aggregation level for both stratification methods; in the bottom panel we show the difference between the two time series. The difference between the two time series is calculated as the comparison minus the benchmark time series. The benchmark difference is therefore a horizontal line at 0. A positive difference in any period indicates the benchmark time series being smaller than the comparison one.
30. Figures 5 and 6 display the comparison between the two retailer type stratifications for the headline index and the annual growth rate respectively. It can be observed that the two time series have a similar trend, with the maximum absolute difference smaller than 0.2 index points in any period of the series. The difference between the two annual growth rates is more pronounced over the period of high inflation. The introduction of the market share based stratification does not seem to introduce any bias in the index or the growth rate, as the two measures intersect each other over the time span of the analysis.
31. We want to use a metric to measure the similarity of the two time series, to avoid comparing them only by looking at the index and annual growth. The metric we use is the RS3, proposed in an [article](#) by Bernhard Goldhammer from the European Central Bank. The metric is similar to the variance between the monthly changes of the two timeseries, and it can be interpreted as the average distance in percentage points of growth rates. We calculated the RS3 metric at various level of aggregation, to identify areas of the basket most affected by the change of retailer type stratification method.

Figure 5 - Comparison of headline CPI index for both stratification methods

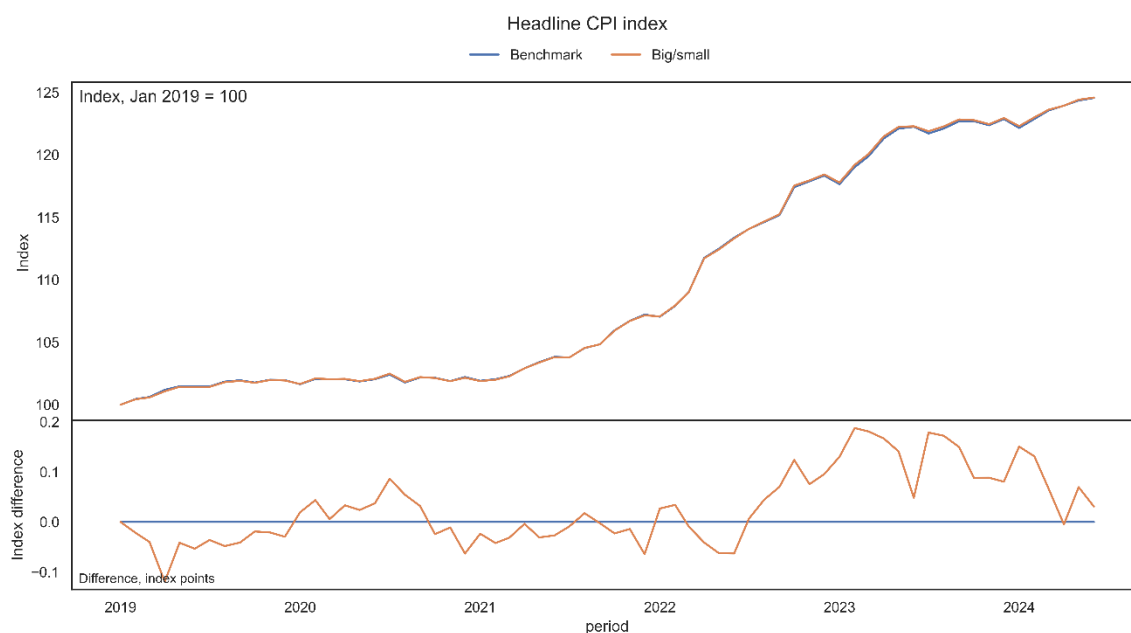
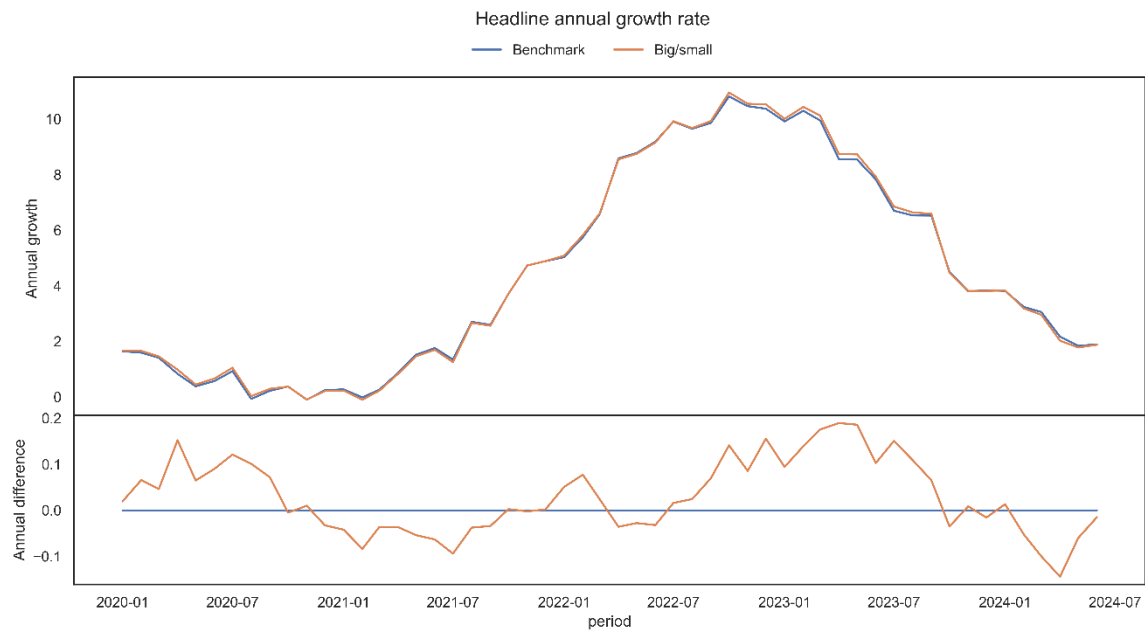


Figure 6 - Comparison of headline CPI annual growth for both stratification methods



32. In Table 1 we show the RS3 metric for the headline index and the COICOP2 indices. A RS3 score of 0.01 represents a 1 percentage point (p.p.) average distance between the two time series. The Table shows scores smaller than 1 p.p. distance, suggesting that the change in the retailer type stratification keeps the two time series broadly very similar, although absolute differences up to 0.2 are observed, at least at a high level of aggregation.

33. Looking in more detail at the scores for the COICOP2 divisions, we also notice:

- a. Divisions CP02, CP10 and CP11 all have scores of 0, which means the two timeseries are the same. This result is expected because none of the items in these divisions are stratified by retailer type. Therefore, changing the retailer type stratification does not affect the indexes and growth rates for those divisions.
- b. The largest RS3 score, but still smaller than 0.5 p.p. distance, is recorded for division CP03, clothing and footwear. This result is also expected because all the items in that division are stratified by retailer type. Even though the impact is the largest, the score is still relatively small, indicating a good level of similarity between the two timeseries.

Table 1- RS3 for headline and COICOP2 CPI index

coicop2_code	coicop2_name	RS3
CP00	Headline	0.0003806
CP01	Food and non-alcoholic beverages	0.0003847
CP02	Alcoholic beverages and tobacco	0
CP03	Clothing and footwear	0.0047632
CP04	Housing, water, electricity, gas and other fuels	0.0001280
CP05	Furnishings, household equipment and maintenance	0.0024188
CP06	Health	0.0026658
CP07	Transport	0.0003896
CP08	Communications	0.0006852
CP09	Recreation and culture	0.0011721

CP10	Education	0
CP11	Restaurants and hotels	0
CP12	Miscellaneous goods and services	0.0022767

34. We present more analyses focused on the clothing and footwear (CP03) division as, by design, it is the most affected by the retailer type stratification change.

Figure 7- Comparison of Clothing and footwear CPI annual growth for both stratification methods

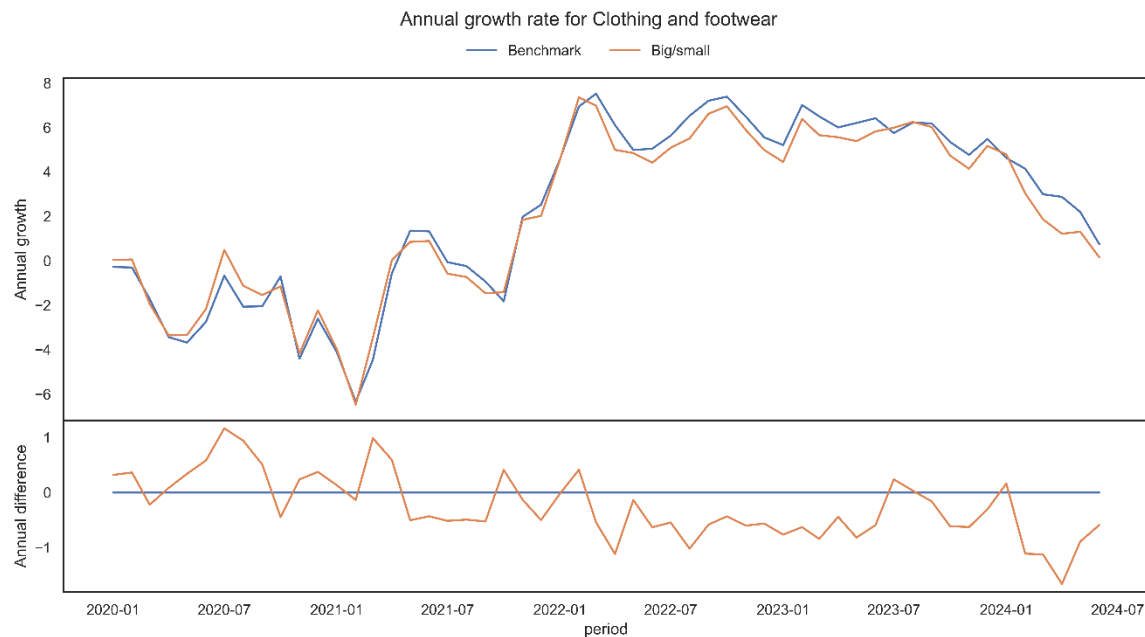


Figure 7 shows the comparison of the annual growth rate for the CP03 division. Similar comments to the headline case can be made, as the two growth rates seem to be similar in shape, and there does not seem to be any obvious shift between the two over the time span explored. One thing to notice is that the maximum absolute difference between the two annual growth rates increased to about 1 percentage point.

35. Table 2 shows the RS3 scores for the clothing and footwear division (CP03) at more disaggregated levels, down to COICOP4 level. It can be observed that as anticipated the score increases at lower levels of aggregation.

Table 2- RS3 for clothing and footwear CPI index by COICOP3 category

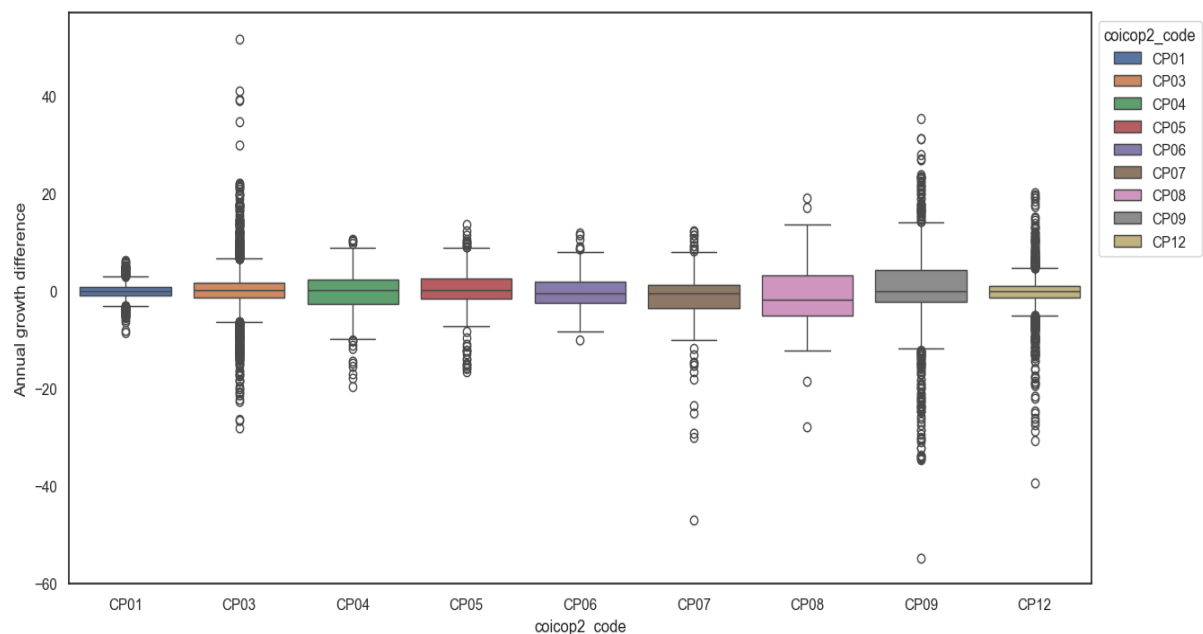
coicop2_code	coicop3_name	coicop4_name	RS3
CP03			0.0047632
CP03	Clothing		0.0058650
CP03	Clothing	Garments	0.0063808
CP03	Clothing	Other clothing and clothing accessories	0.0104355
CP03	Clothing	Cleaning, repair and hire of clothing	0
CP03	Footwear including repairs		0.0083703
CP03	Footwear including repairs	Shoes and other footwear	0.0083703



### Lower-level aggregate analysis

36. In the following, we present some summary results on the impact of the retailer type stratification method on lower-level aggregates. As observed in the previous section, there is greater volatility between the different stratification methods at lower levels of aggregation. We are interested to see the impact at the consumption segment level, as it is the lowest level of aggregation we publish (as a supplementary analytical dataset). Because of the large number of consumption segments, we need some summary statistics to understand any trend in data.

Figure 8- Box plot of the differences of annual growth.



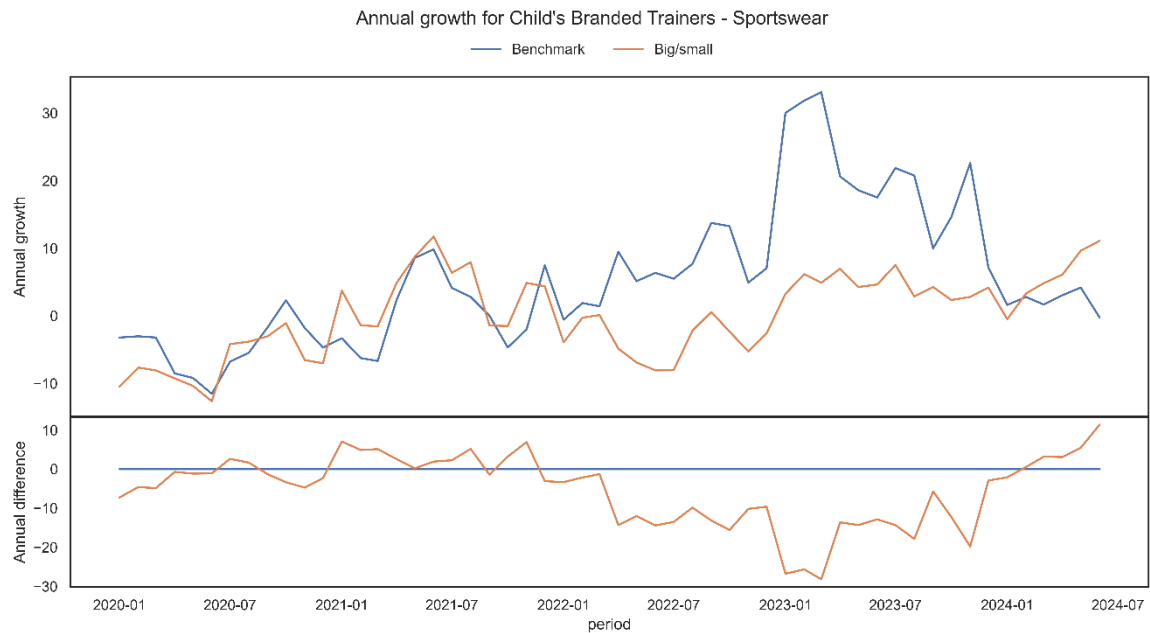
37. Figure 8 displays the distribution of the difference of the annual growth between the two retailer type stratification methods for the entire time span investigated in the analysis, grouped by COICOP2 code. The points visualised outside the box plot bars have a difference larger than 1.5 times the interquartile range.

38. Figure 8 depicts a scenario in line with the previous results:

- Divisions CP02, CP10, CP11 are not shown because all the consumption segments within those divisions are not stratified by retailer type
- Most of the distributions are narrowly distributed with a median value close to 0, even though some extreme differences in the annual growth rates are observed.

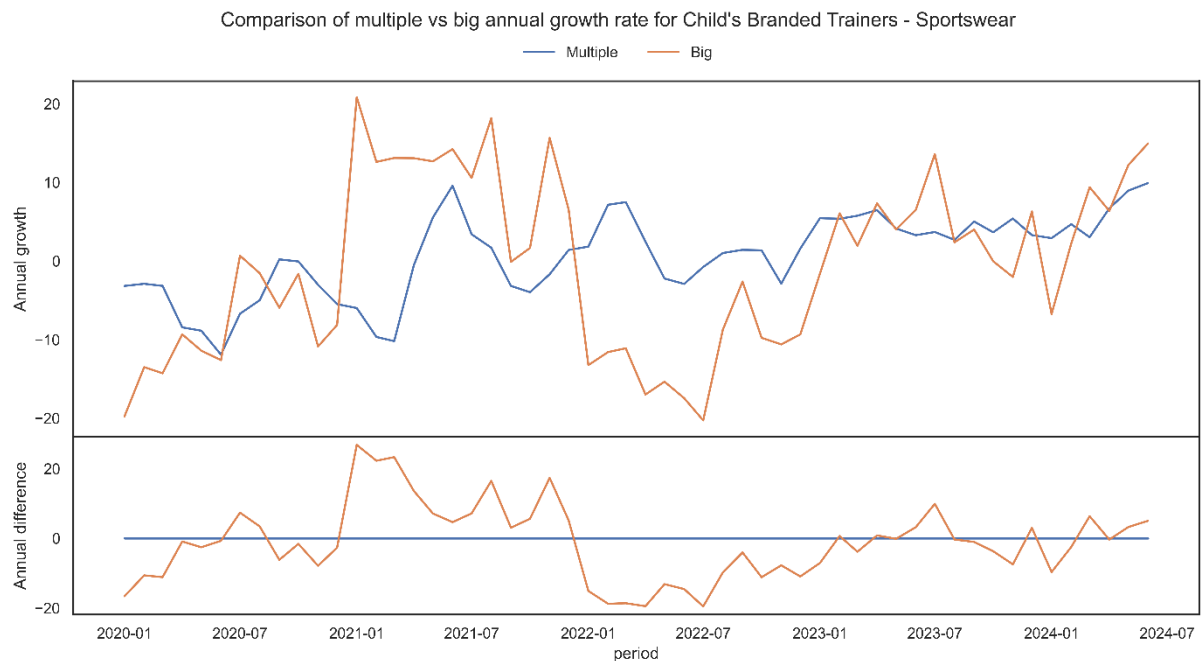
39. Given the results shown in Figure 8, we performed some comparisons of the growth rates for some of the consumption segments with the largest difference. One example of such a comparison is presented in Figure 9, which shows that the annual growth rates for both the benchmark and the market share based retailer type stratifications display a high level of volatility. This is particularly true for the benchmark annual growth from January 2022.

Figure 9 - Comparison of CPI annual growth for both stratification methods for a footwear consumption segment



40. We want to understand the origin of the difference in volatility observed between the two annual growths in Figure 9, as the different volatility observed in the annual growth rates is only due to the change in the retailer type stratification. A reason for the difference observed might be a different volatility at the disaggregated level. To test this hypothesis, we want to look at the comparison of disaggregated annual growths by retailer stratification type. This comparison is presented in Figures 10-11.
41. Figure 10 presents the comparison of annual growths for the “multiple” (in blue) and “big” (in orange) retailers. The annual growth rate for the big retailers presents a larger variance compared with the multiple especially between January 2021 and July 2022, after which the two annual growths tend to be in better agreement. The largest absolute difference between the two different retailer type stratifications is about 20 index points in both directions.

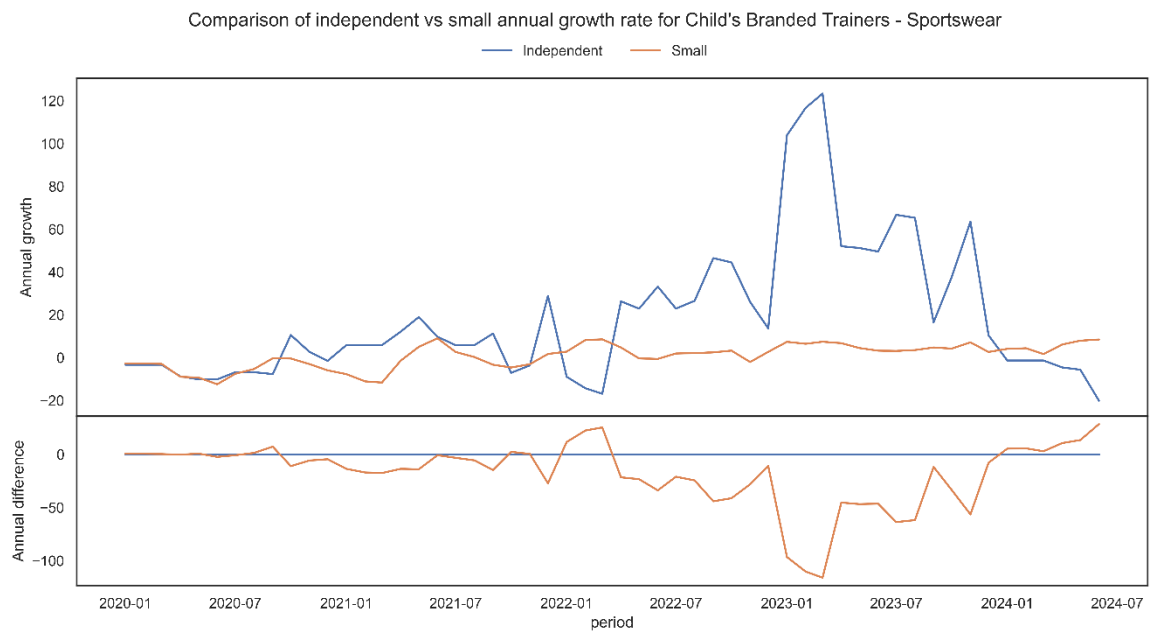
Figure 10 - Comparison of CPI annual growth for a footwear consumption segment for multiple and big retailers



42. Figure 11 presents the comparison of the annual growths for the “independent” (in blue) and “small” (in orange) retailers. In this case the growth rate for the independent retailers presents a larger variance, which becomes rather extreme in 2023, with an annual growth rate of 120 percentage points. As consequence, the largest absolute difference between the two annual growth rates is of the order of 100 index points.
43. Comparing the two Figures 10-11, it is possible to explain the variance observed in the consumption segment level annual growth rate shown in Figure 9:
- Up until January 2022 the differences in growth rates observed in Figures 10-11 are roughly of the same order of magnitude, but of a different sign. In Figure 10 the difference tends to be negative, while in Figure 11 tends to be positive. The two different trends compensate each other, resulting in the relatively small difference observed in Figure 9.
  - From January 2022 until January 2024, the differences in growth rates observed in both Figures 10-11 are positive. From January 2023 the difference is extremely marked due to the increase in the annual growth rate for the independent retailers. This seems to dominate the trend observed in Figure 9, causing a larger difference compared to the previous period.

It is important to understand the origin of the difference in the volatility of the retailer level annual growth rates. One possible cause is a notable shift in the sample size. The remainder of the analysis tries to address this last question.

Figure 11 - Comparison of CPI annual growth for a footwear consumption segment for independent and small retailers



### Change in retailer classification

44. The volatility observed at the lowest level of aggregation discussed above prompted us to investigate how the proportion of quotes changes with the different retailer type stratification.
45. Table 3 shows the proportion of quotes falling into each retailer type stratification, grouped by COICOP2 division. The percentages are only shown for categories with items stratified by retailer type.

Table 3 - Comparison of the percentage of quotes stratified by retailer type for the two stratification methods

coicop2_code	Multiple retailers	Big retailers
	Sample size (%)	Sample size (%)
CP01	79.63	51.90
CP03	88.31	26.78
CP04	85.72	24.30
CP05	82.70	28.56
CP06	96.28	35.88
CP07	69.12	2.87
CP08	91.68	25.15
CP09	91.74	28.02
CP12	91.56	47.32

46. The Table shows a notable change in the proportion assigned to the multiple or big classification. This is particularly accentuated in specific divisions, such as CP03, where the proportion of quotes almost inverts moving from the multiple/independent to the big/small retailer type stratification.
47. For the clothing and footwear division (CP03), the change in the proportion of quotes might explain the different volatility observed in the growth rates in Figures 9-11.

48. While some level of shift is anticipated, as discussed in the weights change section, the impression is that the level of change observed in the stratification type is too extreme. There might be some factors that could cause this behaviour:
- a. The price quotes are not always sampled proportionally to the market share. The sampling frequency uses the square footage of the outlet sampled in the field collection as a proxy for expenditure, and therefore market share. Furthermore, the price data is collected to accurately capture the price movements. These arguments were the basis of the choice not to pursue the no-stratification method, as discussed during the April APCP-T meeting.
  - b. The current sampling strategy might miss some large online-only retailers, which is particularly relevant for the clothing market. This is relevant because some of the largest shifts observed in the weights is linked to online-only retailers changing their classification.
  - c. Some quotes might be wrongly assigned to a retailer classification.
49. We need to conduct additional analyses on the way the sample size is affected by the change of retailer type stratification. The work will focus on additional quality assurance on the way the different retailer type stratification is applied to the price quotes, and a deeper investigation on the retailers currently sampled for the prices collection.

### **Conclusions**

50. This paper summarises the retailer type stratification work we undertook. The paper briefly summarises some of the discussions and decisions taken during the last APCP-T panel in April.
51. We briefly summarise the current retailer type stratification strategy, based on the number of physical locations each retailer has in the UK territory. As this methodology has some potential limitations, we provide some potential alternatives:
- a. No-stratification, based on the implicit retailer weights in the price quotes. Following the last panel in April, we do not investigate this option further.
  - b. Market share based retailer type stratification. This is the stratification we explore in detail in this paper, and it is compared against the current retailer type stratification strategy.
52. We performed the analysis of the impact of changing the retailer stratification type on the traditional locally collected dataset.
53. The paper presents the impact of the different retailer type stratification on three main areas:
- a. Impact on the retailer type weights
  - b. Impact on the index and annual growth rate at different levels of aggregation
  - c. Impact on the sample size of the quotes.
54. The impact observed is mostly coherent with the expectation that the change in retailer type stratification wouldn't introduce any bias or large shift at the headline and higher aggregate levels. However, we observe some unanticipated levels of volatility in the annual growth rates for more disaggregated levels, namely at consumption segment and retailer level.
55. We investigated how the proportion of price quotes in each stratum changed with the retailer type stratification. The results showed a much bigger change in the sample proportions than we anticipated and therefore further investigation is required before any recommendation can be made.

### **Avenues of investigation**

56. We aim to perform more in-depth analysis to better understand the index volatility at consumption segment and retailer type level, and the unexpected shift in sample size proportions.
57. Given the results presented in this paper, we are not confident we can introduce the market share based retailer type stratification approach, as we need more investigations to understand the results. We are therefore pausing the combined run with grocery scanner data until we find a more suitable retailer type stratification methodology. We propose some potential short-term improvements to the current retailer type stratification strategy:
- a. Expand the multiple retailer category by including more online only retailers with a large market share or total turnover.
  - b. Explore a different retailer type stratification, splitting retailers based on a threshold on the total turnover.
58. Note the implementation of groceries scanner data in March 2026 is independent of the choice of retailer type stratification methodology. The impact analysis of the integration of scanner retailers for grocery scanner data using the current retailer type stratification methodology can be found at this [link](#).

#### **Future work**

59. In the longer term, we will consider taking a more holistic approach to the retailer type stratification, including but not limited to exploring a multi-threshold market share based retailer stratification. This work will need to be prioritised against other internal work.
60. We aim to share the short- and long-term improvements presented in this paper and the feedback provided by this Panel to our internal decision forums. This will guide the choices on the improvements to be applied to the current retailer stratification approach based also on our internal timelines. We will present an update at the next APCP-T meeting in September.