

Article

# Re-weighted consumer prices basket – adjusting for consumption changes during lockdown: July 2020

Additional economic analysis of the latest Consumer Prices Index including owner occupiers' housing costs (CPIH), Producer Price Index (PPI), and long-term trends.

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# 1 . Main points

- Experimental series that update the Consumer Prices Index, including owner occupiers' housing costs (CPIH) and Consumer Prices Index (CPI) baskets monthly throughout Quarter 2 (Apr to June) 2020 to account for changing consumption patterns, results in annual inflation rates of just 0.1 percentage points higher, on average, than consistently calculated versions of the official rates.
- Adjustments to the underlying weights based on the Retail Sales Index, payment processing and transaction data, and other data sources suggest that consumer expenditure shares for food and drink, housing, education, and communication increased during the lockdown period, while expenditure shares for restaurants and hotels, transport, clothing and recreation and culture fell.
- Changing consumption patterns had an impact on the contributions from different categories of spending to inflation, however these are largely offsetting, resulting in minimal differences at the aggregate level.
- Throughout our analyses, we have shown that re-weighting the basket, reducing the sample size and using imputations in our statistics has a very small overall impact on our official measures of UK consumer price inflation.

This exploratory analysis is experimental and should not be used instead of our [official measures of consumer price inflation](#). Updating consumer price statistics to account for monthly changes in consumption is technically challenging within the current consumer prices framework. While we have aimed to use reliable and robust data sources and methods to understand the impact of changing consumption patterns on inflation, we must note that this approach has notable limitations and if introduced into our official measures, could compromise both the timeliness and accuracy of our statistics.

## 2 . Background

Following the implementation of social distancing policies and movement restrictions brought into effect on 23 March 2020 in response to the ongoing coronavirus (COVID-19) pandemic, we put exceptional measures in place to maintain the quality, consistency and international comparability of our headline consumer price inflation statistics. Details of our plans for data collection, compilation and publication of our various price statistics can be found in the article [Coronavirus and the effects on UK prices](#).

There were three notable challenges with producing consumer price statistics during the UK lockdown. Firstly, approximately 80% of the prices used in consumer price statistics are collected in stores across the UK, and this was not possible because of movement restrictions. Secondly, there were a varying number of unavailable goods and services where consumers could no longer access the market because it had effectively shut down. Finally, but importantly, we have seen large changes in the consumption patterns of UK households as a result of the coronavirus pandemic.

An international framework for producing consumer price statistics was agreed to ensure the continued accuracy and consistency, both over time and across countries. Fundamentally, it was decided that a fixed basket concept should be maintained. Therefore, changes in the consumption of goods and services were not explicitly accounted for, and only changes in prices of available items influence the official rate of inflation.

While the approach taken to calculate the Consumer Prices Index including owner occupiers' housing costs (CPIH) and the Consumer Prices Index (CPI) is the most appropriate approach for a number of reasons, it does not necessarily reflect all changes in consumption patterns that have occurred as a result of the coronavirus pandemic and the subsequent UK Government policies. This has prompted research into alternative inflation measures that use expenditure shares closer to those expected to have been the case in the earlier months of the lockdown period. [Cavallo \(2020\) \(PDF, 305KB\)](#) and [Dixon and Levell \(2020\) \(PDF, 132KB\)](#) have studied the impact of changes in consumption shares on UK inflation, both noting a positive impact on UK inflation in the early months of lockdown.

This article builds on previous work [constructing an alternative measure that removed the impact of unavailable items](#) and seeks to take account of changes in consumer spending patterns over Quarter 2 (Apr to June) 2020 as the UK lockdown and subsequent easing took hold. For each month, we continue to remove items that were deemed to be unavailable during the lockdown months and adjust the expenditure used to calculate weights for the remaining items, based on a range of available evidence of consumption change. We then use these new weights to construct alternative estimates of consumer price inflation.

### 3 . Introduction to re-weighting consumer price indices

The official published Consumer Prices Index including owner occupiers' housing costs (CPIH) and Consumer Prices Index (CPI) series (referred to in this article as "Official CPIH" and "Official CPI" respectively) use weights based on expenditure shares to account for the relative importance of different goods and services in household budgets. For example, in normal times, a household will likely spend more on fuel than apples, so fuel will receive a higher weight and exert a greater influence on the official rate of inflation. These weights are traditionally updated at the beginning of the year to reflect changes in general spending patterns, while otherwise remaining unchanged throughout the year to allow for comparisons of price movements within the year.

For this experimental analysis, we make some further adjustments to the weights within-year to account for the unprecedented changes in consumption patterns and the availability of certain goods and services. We define unavailable items as goods and services that consumers can no longer access because the market has effectively been shut down (for example, hairdressers and leisure centres). We update the weights of the baskets for CPIH and the CPI monthly to reflect changing consumption patterns during Quarter 2 (Apr to June) 2020. The methodology and assumptions behind these weight adjustments and the methods used to construct the price indices are detailed further in [Sections 5](#) and [Section 6](#).

We use a range of data sources to make our adjustments, including official measures, such as [the Retail Sales Index](#), payment processing data from Barclays PLC and transaction data from Revolut, and expert judgements. Some categories of expenditure underlying the weights calculation have been left unchanged. This is where there is insufficient evidence to make an adjustment, and we believe spending within the category has been largely unimpacted as a result of the pandemic, such as for Council Tax and education. More information on the data sources used and the impact on the resulting weights can be found in [Section 5](#).

In order to introduce a new set of weights each month, it is necessary to use a monthly chain-link<sup>1</sup>. This involves calculating the price change between the new month (for example, April 2020) and an overlap month (for example, March 2020) and linking that movement on to the old series (ending March 2020), using the new set of weights. While we traditionally use expenditure shares from the base period to construct weights for consumer price indices, for the purposes of this analysis we use monthly expenditure shares from each current period to form an index. Given the rapidly changing nature of consumer spending patterns throughout 2020, we felt that this was the most appropriate way to weight consumer spending when calculating alternative inflation estimates for the months of interest. The limitations of this method are discussed further in [Section 6](#).

As we have used a chain-link to introduce weight changes in the experimental series, we also calculate the impacts on the official series had a chain-link been introduced, as this process itself can change the value of the rate.

#### Notes for Introduction to re-weighting consumer price indices

1. More information on chain-linking can be found in Section 3.6 of our [Consumer Price Indices Technical Manual](#).

## 4 . Results

Tables 1 and 2 show 12-month growth rates between April and June 2020 for the Consumer Prices Index including owner occupiers' housing costs (CPIH) and the Consumer Prices Index (CPI), respectively, under the following scenarios:

- [official published CPIH and CPI series](#) (referred to as "Official")
- official CPIH and CPI series, chain-linked monthly from March 2020 (referred to as "Chain-link", for details see [Section 6](#))
- CPIH and CPI chain-linked monthly from March 2020 with new weights that account for changes in consumption patterns observed between April and June 2020 (referred to as "Re-weighted" - for details see [Section 5](#))

Table 1: Annual growth rate values for adjustments to the CPIH, UK, April to June 2020

	<b>April 2020</b>	<b>May 2020</b>	<b>June 2020</b>	<b>Quarter 2 2020</b>
Official CPIH	0.9%	0.7%	0.8%	0.8%
Chain-link CPIH	0.9%	0.7%	0.9%	0.8%
Reweighted CPIH	1.0%	0.8%	1.0%	0.9%

Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

Table 2: Annual growth rate values for adjustments to the CPI, UK, April to June 2020

	<b>April 2020</b>	<b>May 2020</b>	<b>June 2020</b>	<b>Quarter 2 2020</b>
Official CPI	0.8%	0.5%	0.6%	0.6%
Chain-link CPI	0.7%	0.5%	0.7%	0.6%
Reweighted CPI	0.7%	0.6%	0.7%	0.7%

Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

Compared with the CPIH, re-weighting the index monthly has a small upwards impact of no more than 0.2 percentage points in all 3 months analysed. Compared with the official CPI, re-weighting the index monthly has a slightly smaller effect, with a difference no greater than 0.1 percentage points each month. In April the re-weighted CPI is lower than the official rate, while it is higher in May and June. On average over the second quarter of 2020, the re-weighted basket shows a 0.1 percentage point increase for both the Re-weighted CPIH and the Re-weighted CPI, relative to our measure.

These results [differ from those calculated in our published re-scaled analysis](#), which had 12-month growth rates lower than those of the official series throughout the period. This largely reflects the role of transport, which has had a downward pull on consumer price inflation throughout the UK lockdown period. By removing unavailable items, such as international transport, the usual upward pull of seasonal movements are missing.

Meanwhile, rescaling the basket to account for unavailable items, without further weight adjustments, increases the weight of motor fuels, which have seen unusually large price falls over recent months. While the absence of international travel components also has an effect on the re-weighted basket, this is more than offset by the re-weighting of other components of the basket, such as food and non-alcoholic beverages, which have had an upward pull on the annual growth rate.

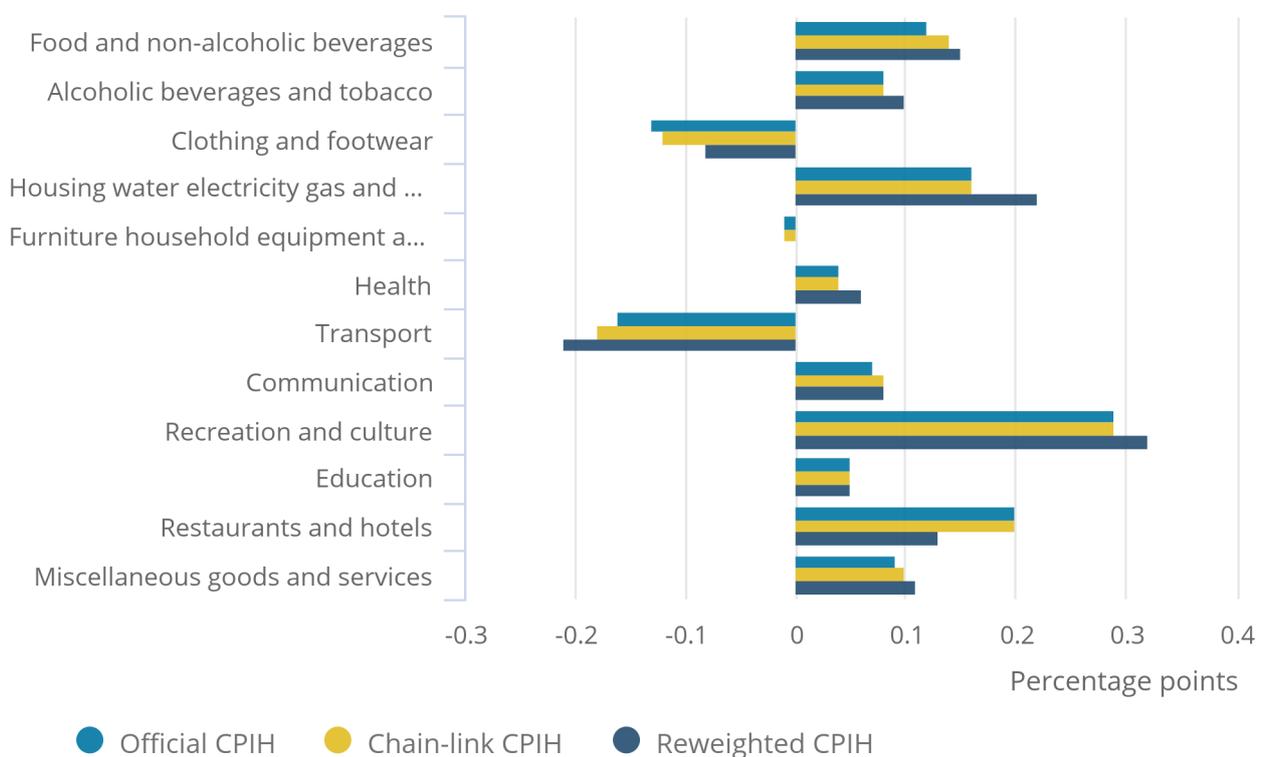
While these appear to be somewhat insignificant differences between the measures at the aggregate level, there are differences in the contributions to the annual growth rate arising from each spending category in each scenario. However, these largely offset each other. These differences are displayed in Figure 1, which shows the division level contributions for each scenario averaged over the second quarter of 2020.

**Figure 1: Six divisions made larger upward contributions to the annual growth rate of the CPIH in the reweighted series than in the official series**

Division-level contributions to the experimental CPIH annual growth rates, UK, Quarter 2 (Apr to June) 2020

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Division-level contributions to the experimental CPIH annual growth rates, UK, Quarter 2 (Apr to June) 2020



Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

From Figure 1, we can see that when we adjust the weights to account for changing consumption patterns in the second quarter of 2020 ("Re-weighted CPIH"), contributions from categories such as clothing and footwear, and restaurants and hotels are reduced relative to the official series and the chain-linked index constructed using the official weights.

Conversely, contributions from categories such as food and non-alcoholic beverages, and housing, water, electricity, gas and other fuels have increased as they have higher weights. The difference in contributions from these items is primarily driven by the adjustments that we have made to the expenditure underlying the weights calculations, as is explored further in [Section 5](#).

Transport is an outlier in this regard, as the weight for transport has been largely reduced in the re-weighted series, as consumers reduced spending on motor fuels and international travel during the second quarter of 2020. However the downward contribution from transport to the annual rate has increased slightly compared with the official series. This is because the downward drag that arises from removing international travel items from our alternative estimates of inflation, which generally provide upward monthly contributions at this time of year, because of unavailability as explored in our quarterly [Prices economic analysis](#) in May 2020, more than offsets the reduced negative contributions that come from decreasing the weight for motor fuels.

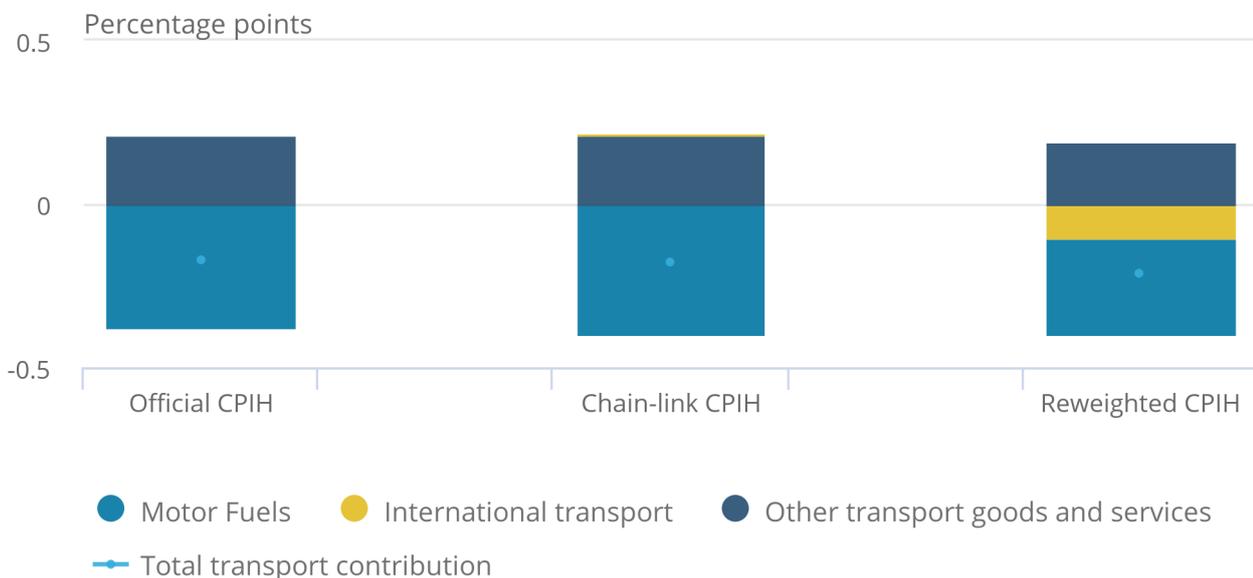
This is demonstrated in Figure 2, which breaks down the contributions from transport into motor fuels (including petrol, diesel and oil), international travel (including air fares, sea fares and Euro tunnel fares), and other transport goods and services (including purchase of vehicles, maintenance and repairs of vehicles, domestic transport fares and other charges). The contributions from motor fuels and other transport goods and services are smaller for the re-weighted CPIH than for their counterpart using the official weights (Chain-link CPIH and official CPIH). But the downward pull from international transport is greater, owing to the decrease in price between Quarter 2 2019 and the Quarter 1 (Jan to Mar) 2020, reflecting seasonal effects (demand typically pushes prices up for international travel in the late spring and prices fall back as demand weakens over the winter months). This downward pull is absent from the official series as prices have been imputed to limit the effect of missing items on the annual growth rate.

**Figure 2: The negative contribution to the annual growth rate from international transport more than offset the reduced contribution from motor fuels in the reweighted series**

Contributions of transport categories to the experimental CPIH annual growth rates, UK, Quarter 2 (Apr to June) 2020

Figure 2: The negative contribution to the annual growth rate from international transport more than offset the reduced contribution from motor fuels in the reweighted series

Contributions of transport categories to the experimental CPIH annual growth rates, UK, Quarter 2 (Apr to June) 2020



Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

In Figure 1, we also see that the contribution from recreation and culture has increased in our re-weighted basket, despite several recreational activities and cultural events being shut down as a result of the coronavirus (COVID-19) pandemic, reducing the weight for this spending category. This is because we [implemented methods](#) to prevent unavailable items having an impact on the headline rate of official inflation, so unavailable items contribute very little to the annual growth rate of both the official and re-weighted series. However, the weight for items that were available during the second quarter of 2020, such as pet food, computer games and TV streaming services, had increased expenditure shares and, therefore, contributed slightly more to the annual rate of growth in our experimental re-weighted basket series.

## 5 . Weight adjustments

### Methods

The Consumer Prices Index including owner occupiers' housing costs (CPIH) and Consumer Prices Index (CPI) basket weights are traditionally updated at the turn of each year (in December and January) to account for changing consumption patterns and to ensure the sample of items collected each year remain representative of ongoing consumer purchases.

The weights are based on lagged expenditure from Household Final Consumption Expenditure (HHFCE) data that are price updated to the most recent period. For example, the weights used to calculate our official measures of consumer price inflation in 2020 are based on HHFCE data in 2018, price updated to January 2020. These lagged expenditure data are used because of a lack of reliable information being available in a timely enough manner for use. HHFCE data are available for more recent periods but are likely to be revised over time, hence the lagged data are less susceptible to these revisions. Given that expenditure shares typically evolve slowly, in normal times this method is practical and produces reliable estimates of consumer price inflation.

As these are not normal times, in this alternative series we apply estimates of monthly growth in expenditure to over 250 unique expenditure subclasses that make up the CPIH and CPI. We then reappportion these weights to over 700 items used to construct the CPIH and CPI. Finally, we remove the weight of unavailable items, and rescale the weights so that they sum to 1000 parts as has been done previously as part of our last edition of the [Prices economic analysis, quarterly](#).

Making weight adjustments at this level of detail ensures that we can control for expenditure changes in categories where some items may show increases in expenditure while others have been in decline. For example, in the recreation and culture category, activities such as cinema trips and package holidays experienced a large reduction in consumption during Quarter 2 (Apr to June) 2020. However, within the same category, items including TV streaming services and computer games experienced an increase in consumption.

As the new weights are rescaled to sum to 1000 parts, a higher weight in the rescaled basket does not necessarily mean that consumers have spent more on the item in question. Rather, it reflects the relative weight of the item towards overall consumer expenditure in the period in question. This can be seen for some parts of the basket for which expenditure is assumed to be unchanged, such as education and energy bills, the weights for which have increased because the same assumed level of expenditure accounts for a larger proportion of overall consumer expenditure during lockdown, [which is assumed to be lower than pre-lockdown \(PDF, 531KB\)](#). The [June 2020 retail sales bulletin](#) notes that "in June, while non-food stores and fuel sales show strong monthly growths in the volume of sales at 45.5% and 21.5% respectively, levels have still not recovered from the sharp falls experienced in March and April".

### Data sources

A variety of data sources were used to inform our expenditure adjustments of the CPIH and CPI subclasses. The majority of the adjustments are based on Office for National Statistics (ONS) and other government sources, such as the [Retail Sales Index \(RSI\)](#), the [Monthly Business Survey \(MBS\) results on construction and allied trades](#), the [Department for Transport statistics on transport use](#) and the [Department for Education statistics on Attendance in education and early years settings during the coronavirus outbreak](#).

Where we were unable to find appropriate official data sources for spending categories, we have used alternative sources such as The Society of Motor Manufacturers and Traders [new car registrations](#) and data from companies such as Barclays PLC and Revolut. We have also made some informed judgements for subclasses where expenditure information was lacking, for example, we found limited data on expenditure for veterinary services, although we knew that they had [limited services over the initial period of lockdown](#).

For some categories, where we did not have any data to inform adjustments or where we thought expenditure levels would not have changed significantly as a result of the coronavirus pandemic, we have carried forward the underlying expenditure used to calculate the weights. For example, we had little evidence to suggest that the cost to own or rent a home had changed significantly over the second quarter of 2020.

We also had limited data for electricity and gas over this period, and made the assumption that consumer spending would likely have picked up because of the proportion of the population staying at home, but that this would likely be offset by the warmer months meaning that consumers may use less energy for heating. It should be noted that these data only account for changes to expenditure and do not necessarily reflect other conditions faced by consumers, such as reduced incomes. ONS analysis on the [social impacts of the coronavirus](#) has found that an increased proportion of adults have found it difficult to pay their utility bills since lockdown.

Table 3 provides, for CPIH and CPI, the range of different data sources used, the number of subclasses that they have been used for, and the approximate corresponding weight of those subclasses in February 2020. Differences between CPIH and CPI arise because of the inclusion of owner occupier housing costs (OOH) and Council Tax in the CPIH, which account for a notable proportion of household spending.

Table 3: Data sources used to adjust subclass weights in the re-weighted CPIH analysis, including the approximate weight that these subclasses accounted for in February 2020, for the CPIH and CPI, UK

<b>Data source</b>	<b>Count</b>	<b>CPIH weight %</b>	<b>CPI weight %</b>
<b>RSI</b>	186	35.3	43.7
<b>Kept the Same</b>	57 (55 in CPI)	39.6	25.2
<b>Unavailable</b>	24	7.7	9.6
<b>Transaction data / informed judgements</b>	9	11	13.6
<b>MBS - Construction and Allied Trades</b>	6	0.2	0.2
<b>Department for Transport</b>	4	1.6	2
<b>SMMT</b>	3	3.4	4.2
<b>Department for Education</b>	1	1.2	1.5

Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

## Impact of expenditure adjustments on weights

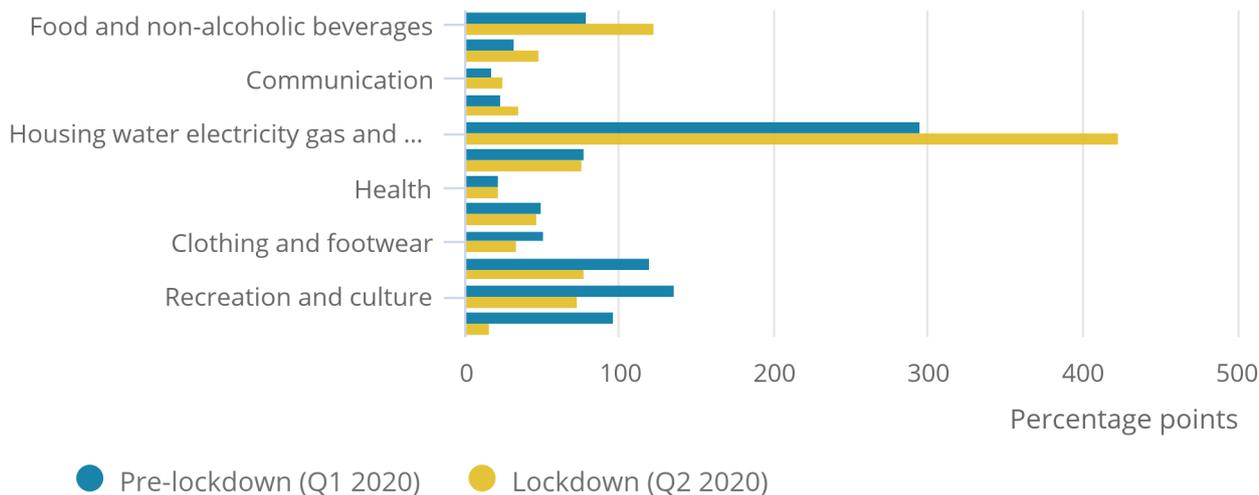
Figure 3 shows the impact that adjustments to expenditure using these data sources had on our CPIH weights for the second quarter of 2020. There were only small differences between the new weights between March and June, therefore we present the average CPIH weight pre-lockdown in Quarter 1 (Jan to Mar) 2020 relative to the average CPIH weight during lockdown in Quarter 2 2020 for our 12 high (division) level spending categories. Categories are ordered by the percentage difference between the pre-lockdown and lockdown weights.

**Figure 3: Five divisions had higher expenditure shares during lockdown than before the lockdown**

Average expenditure shares used in the CPIH, UK, Quarter 1 (Jan to Mar) and Quarter 2 (Apr to June) 2020

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Average expenditure shares used in the CPIH, UK, Quarter 1 (Jan to Mar) and Quarter 2 (Apr to June) 2020



Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

During lockdown, we estimate that consumers spent a larger proportion of their outgoings on food and drink, communication, education and housing, and a lower proportion of their outgoings on restaurants and hotels, recreation and culture, transport, and clothing.

## 6 . Index number methods

### Index calculation of official UK consumer price statistics

To calculate a consumer price index, a sample of products and retailers is chosen that is considered representative of consumer spending in each region and country of the UK. Prices for this same sample of products are collected each month and an average of price changes is calculated to produce an initial price index, known as an elementary aggregate (EA) index.

For example, a price collector will observe the price of a commonly bought loaf of white bread in London every month. An EA index is created for bread, based on the average price movement of all loaves of bread sampled in London. Above this EA level, weights are used to aggregate price movements of London bread together with price movements of bread in other regions and countries of the UK. Price movements for all bread are then weighted together with price movements of all other goods and services in the UK, in calculating the headline rates of inflation.

For more information of how prices are collected and how price indices are constructed in our current measures of consumer price inflation, please refer to our [Consumer Prices Indices Technical Manual](#).

For weighted indices like the Consumer Prices Index including owner occupiers' housing costs (CPIH) and Consumer Prices Index (CPI), we need to decide from which period expenditure shares should derive. For example, to calculate inflation between January and February, the price movements can be aggregated based on expenditure shares in either January, February, or an average of both. Using the first period (in this case, January) would result in a "base weighted" index number method, such as a Laspeyres. Using the second period (in this case, February) would result in a "current-period weighted" index number method, such as a Paasche.

In normal economic conditions, consumers tend to substitute towards cheaper products. In a base weighted index, the weights are calculated before this substitution has occurred, meaning that a base weighted index could overstate the true cost of living. The reverse is true for a current-period weighted index as the weights are calculated after substitution away from more expensive products has taken place.

Current-period weighted indices have not been used historically in UK consumer price indices because of a lack of reliable and timely expenditure information in the latest period. Our official UK consumer price statistics use a Laspeyres-type index, as already discussed in [Section 5](#), they use lagged expenditure from before the base period, price updated to the base period to reflect base-period prices.

## Index calculation of the re-weighted basket

For our re-weighted basket analysis, the contemporaneous weights used for each month in the Quarter 2 (Apr to June) 2020 bring us more in line with a Paasche index methodology. However, to ensure only the lockdown period is affected by the change in weights and consumption patterns, we have chained the indices calculated using Paasche-type weights onto our published (Laspeyres-type) index from March 2020 onwards. This has the potential to cause some downward bias in our results, because of the Laspeyres method's tendency to overstate inflation and the Paasche method's tendency to understate it. However, in recent months substitution was not occurring as a result of falling prices but as a result of enforced restrictions onto parts of the economy. As the months over the lockdown period did not reflect normal economic conditions, it is hard to judge how big the formulae bias may have been, if it exists at all.

## Chain drift

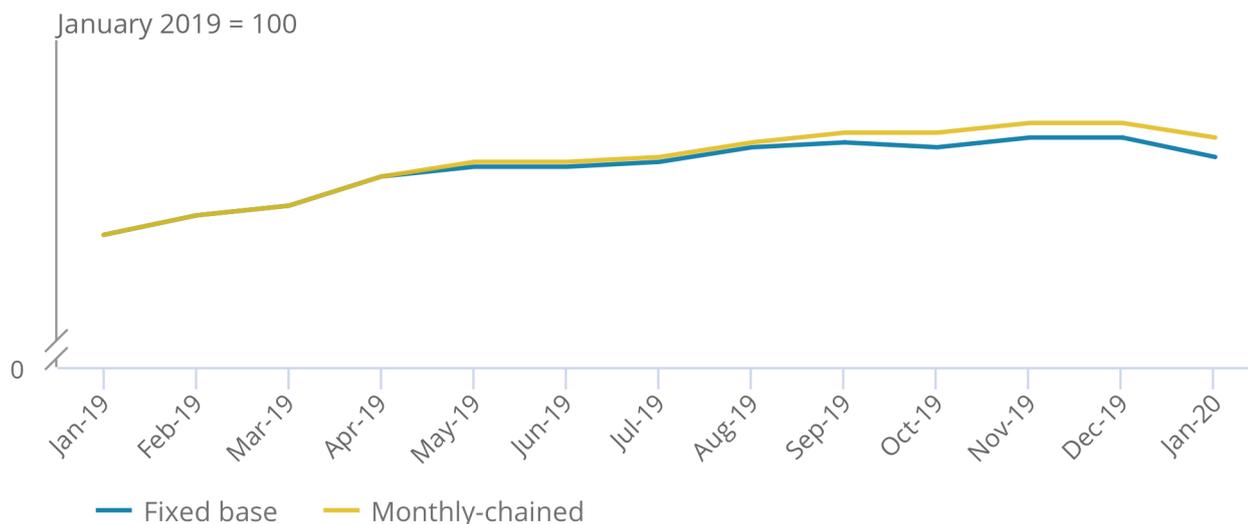
Another option would have been to produce a monthly chained Paasche index but repeat this methodology historically, at least back to January 2019. This would have kept the annual growth rates and contributions on a consistent basis throughout the period studied, ensuring that no bias was introduced from the change in methodology. However, our analysis has shown that this could have led to considerable chain-drift. Figure 4 provides a simulation exercise using a monthly chained index throughout 2019, compared with an index using a fixed base, as is typically used for consumer price statistics. The same weights are used for both series throughout.

**Figure 4: Over time, the difference between the fixed base and monthly-chained index grows because of chain drift**

Comparison of a fixed base index and a monthly chained index, UK, January 2019 to January 2020

Figure 4: Over time, the difference between the fixed base and monthly-chained index grows because of chain drift

Comparison of a fixed base index and a monthly chained index, UK, January 2019 to January 2020



Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

Here we see that use of a monthly chain-link can lead to an upward bias in our inflation measures, therefore in our analyses we have tried to minimise the number of monthly chain-links needed. We also compare the re-weighted CPIH to an alternative version of CPIH that uses the same chaining methodology, to avoid any methodological impacts on the comparison.

## 7. Limitations

Timely and reliable access to detailed consumer expenditure information is necessary to fully understand the impact of changing consumption patterns on our measures of consumer price inflation. Usual methods and data sources used to weight the Consumer Prices Index including owner occupiers' housing costs (CPIH) and Consumer Prices Index (CPI) basket are unfeasible in this respect, and while alternative estimates of expenditure are timelier, their concepts and coverage do not align as readily with our consumer price statistics.

The method of calculating a price index that accounts for monthly changes in consumption is technically challenging within the current consumer price inflation framework. Our method has the potential to introduce some slight downward bias into the results, as discussed in [Section 6](#). It is, however, hard to judge the extent of this bias given that we have not been in a period of somewhat normal economic conditions where typical substitution behaviours could be observed.

While our re-weighted basket analysis shows only a minor increase relative to the official rates, there are other factors that may have caused the true cost of living to be higher than either the official measures of inflation or our alternative re-weighted measure. For example, the Institute for Fiscal Studies found an [Inflation spike and falling product variety during the Great Lockdown](#). Their analysis showed a greater increase in food prices in April than indicated by our Official measures.

This can partly be explained by a reduction in multibuy offers, that are not accounted for in consumer price statistics currently because of the lack of information on how many consumers take up multi-buy offers. We also do not account for consumer substitution below the item level. For example, consumers struggling financially may switch to economy toilet paper from a more premium brand, but this decline in price would not be reflected in our official measures or our alternative re-weighted measure as we follow the price of a fixed basket of goods and services rather than aiming to reflect the true cost of living.

Furthermore, there were other procedures implemented into our official measures over the lock-down period to ensure the consistency of and maintain the ongoing collection of prices for our headline consumer price inflation statistics. The potential impact of some of these measures is explored further in [Section 8](#).

## 8 . Sensitivity analysis of consumer price indices during UK lockdown

In the previous sections we have looked at how changing consumption patterns over the recent period of movement restrictions have affected our consumer price inflation statistics. To some extent, this deals with any biases that arise from using a fixed basket. However, there were further procedures that were implemented over the period of movement restrictions<sup>1</sup> to deal with collection difficulties associated with switching the mode of price collection and being unable to access many outlets.

Specifically, these were:

- the impact of having a smaller sample size than usual
- the impact of having to impute various stratum-level indices as a result of not being able to collect any prices, or only a handful of unrepresentative prices

This section attempts to estimate the impact that these interventions would have by considering how this would have affected our consumer price inflation statistics had they been applied between April and August 2019.

### Simulation exercise

The first part of this contingency analysis assesses the impact of having a reduced collection on consumer price indices during the coronavirus (COVID-19) pandemic, using a simulation exercise.

Only items collected from physical stores (locally collected data) during 2019 were used for this analysis. This was because the coverage for items collected centrally (by visiting websites, phoning business, or receiving data directly from providers) was reasonably high and therefore these items did not require the same level of assessment as the items collected locally.

The analysis was conducted using locally collected data from 2019 and aimed to replicate what was happening during the pandemic period in 2020. The period January to March was largely unaffected by the coronavirus and we assumed that from September onwards, price collection would have resumed fully. Therefore, no adjustments were made for these periods. For the period from April to August, however, we assumed two different levels of coverage: 25% and 50%.

In the first instance a random sample of 50% of the usual price quotes was drawn for each item. Item indices were then calculated and aggregated up to headline level and compared with an index constructed using the full data set. This process was then subsequently repeated but assuming that coverage was only 25% of its usual level for each item. Initially, a series of 20 random samples were drawn for each experiment and the average of these samples was to be compared with the full sample, however, it was later decided that this was not representative of what was happening in practice and may give a result that is closer to the full sample than it would be in reality. Therefore, only a single randomly drawn index was used in each case.

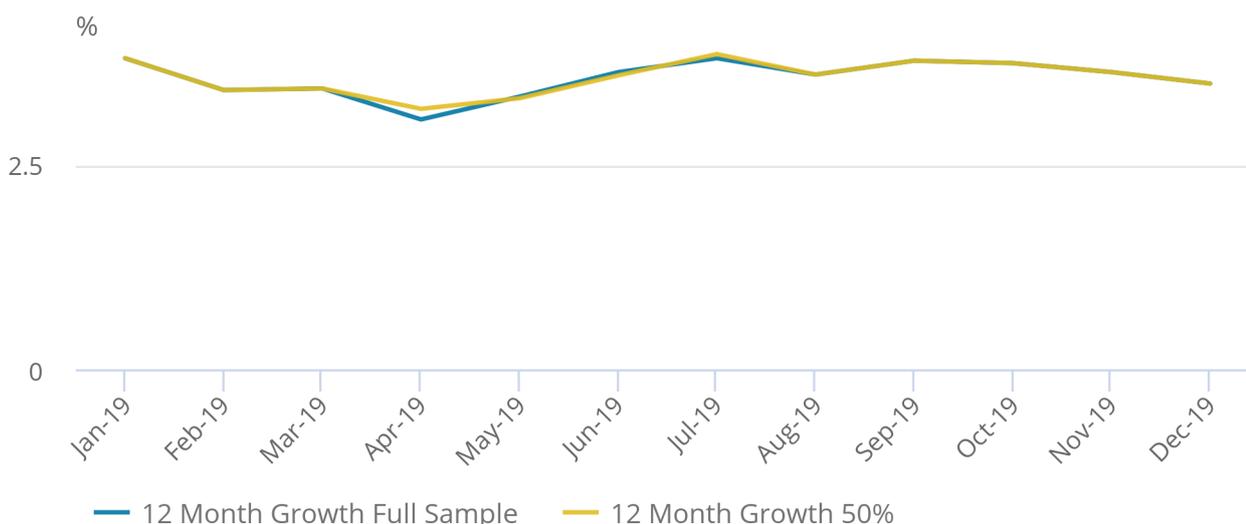
Figures 5 and 6 show the results of this exercise compared with the aggregated full sample of locally collected price data used to calculate CPIH over the period. The largest difference for the 50% sample was 0.13 percentage points on the annual growth rate in April but with other impacts 0.05 or less, and for the 25% sample it was 0.15 percentage points in August with other impacts 0.10 or less.

**Figure 5: Reducing the sample size by 50% has little impact on the locally collected 12-month growth rate**

50% local sample compared to full local sample, 12-month percentage growth, UK, January 2019 to December 2019

Figure 5: Reducing the sample size by 50% has little impact on the locally collected 12-month growth rate

50% local sample compared to full local sample, 12-month percentage growth, UK, January 2019 to December 2019



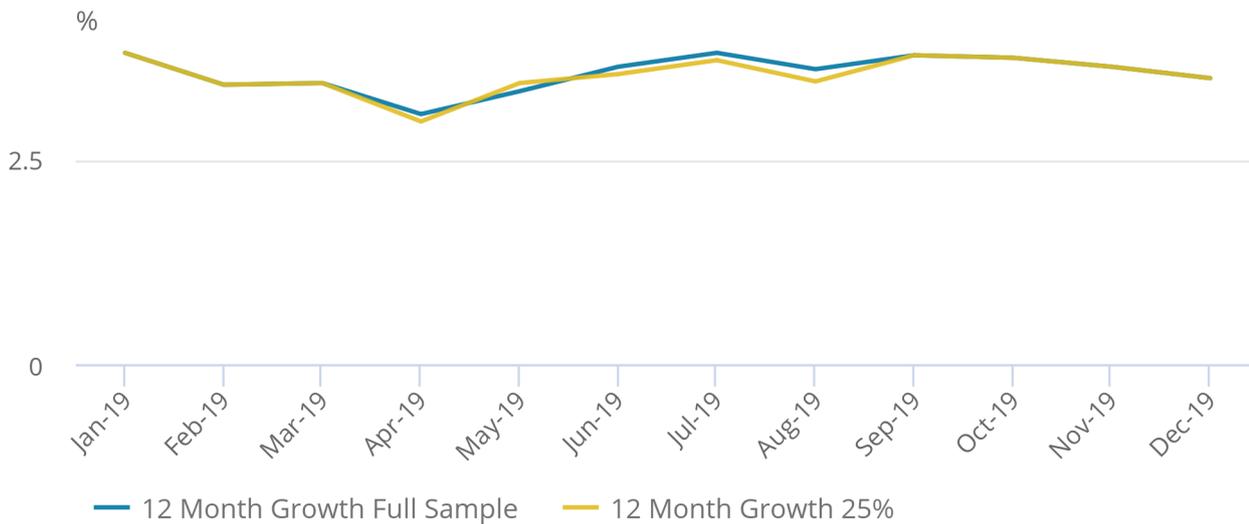
Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

## Figure 6: There is limited impact on locally collected data from reducing the sample size to 25%

25% local sample compared to full local sample, 12-month percentage growth, UK, January to December 2019

### Figure 6: There is limited impact on locally collected data from reducing the sample size to 25%

25% local sample compared to full local sample, 12-month percentage growth, UK, January to December 2019



Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs (CPIH)

## Impact on different strata

The second part of the analysis was to assess the impact of missing stratum indices resulting from being unable to collect data to compile them. Below item level, elementary aggregates are calculated using price quotes and weights for four different types of strata that are used to try and improve the overall accuracy of CPIH and CPI. The four different strata are: Region, Shop-Type, Region and Shop-Type combined and No Strata. They essentially give details about which of the 12 statistical regions a price quote came from and/or whether it came from a multiple retailer (a retailer with 10 or more outlets) or an independent retailer (fewer than 10 outlets).

Reduced collections over the lockdown period resulted in some missing strata. For example, price quotes could be obtained for large, multiple retailers online during the period of movement restrictions but were more difficult to obtain for smaller retailers as many were closed or do not have websites. To address this issue, we either imputed a value for the missing strata from other similar strata (typically the parent level index) or carried forward the missing stratum value from the last period for which it was available. More information on the imputation process is provided in the article, [Coronavirus and the effects on UK prices](#).

For April 2020 there were 90 unavailable items (covering 16.3% of the CPIH basket), which were excluded from this analysis. Including them in this analysis would not be informative because the published consumer price inflation data does not provide a reasonable counterfactual for the situation where elements of the basket were unavailable for consumption. The analysis presented earlier in this article best describes the impact that changing consumption patterns would have had on our official measures.

For those locally collected items that were available, if they had a missing stratum in April 2020's index then the data were replaced using the imputation method from April 2020 and 100% coverage assumed for all other available items. This resulted in 142 items having one or more stratum indices replaced with an imputation in the April to August 2019 analytical series. Of these, 17 were imputed by rolling prices forward, and the remainder were imputed from the parent level price movement, consistent with the April 2020 CPI.

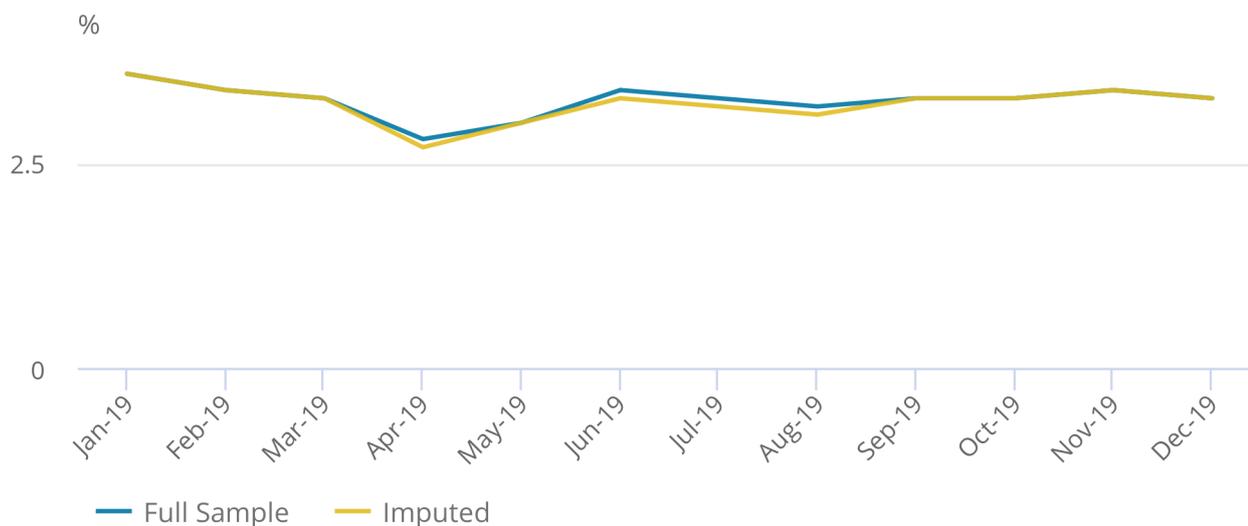
Figure 7 shows the impact on the headline 12-month growth rate from making imputations below the item level. The biggest differences were 0.10 percentage points in April and 0.08 in August. All other differences were very low which was an expected result because of the index being used to impute a new value for the missing strata being deemed to be reasonably closely correlated to it.

**Figure 7: Imputations have relatively little impact on the 12-month growth rate of the locally collected CPIH**

Published locally collected CPIH versus locally collected CPIH with coronavirus (COVID-19) imputations, 12-month percentage growth, UK, January to December 2019

Figure 7: Imputations have relatively little impact on the 12-month growth rate of the locally collected CPIH

Published locally collected CPIH versus locally collected CPIH with coronavirus (COVID-19) imputations, 12-month percentage growth, UK, January to December 2019



Source: Office for National Statistics – Consumer Prices Index including owner occupiers’ housing costs (CPIH)

**The combined impact**

For the final part of this analysis we considered what the combined impact would be of both low sample sizes and the need to impute for missing strata. For available items that were not imputed, coverage was set at 64.1%, reflecting average realised sample sizes from the consumer price collection for April 2020. The sample size was correct at the time of analysis; this later increased to 77.8%, which we would expect to result in slightly smaller impacts than those presented here. Also, to note that coverage generally improved over the period of movement restrictions, however, for this analysis we have kept it fixed at 64.1% over April to August 2019.

For available items that were imputed, we have used the imputed items from the analysis in the previous section. As with the previous section, unavailable items were again excluded from the analysis.

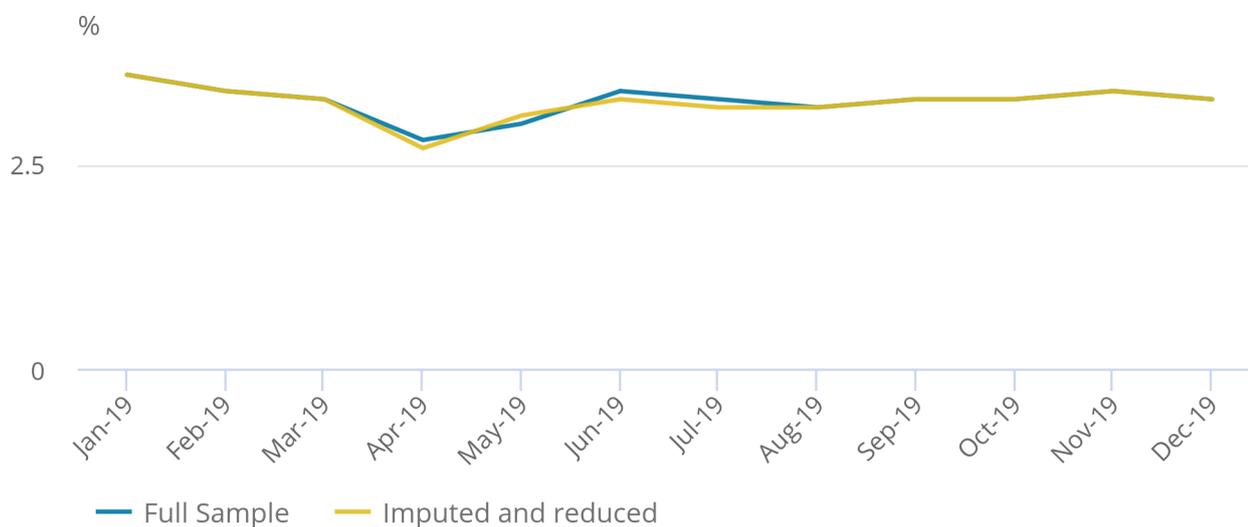
Figure 8 presents the combined impact on the locally collected sample. The maximum impact on the 12-month growth rates was 0.07 percentage points in both April and June with all other differences being 0.05 percentage points or less.

**Figure 8: Even with imputations and a reduced sample, the 12-month growth rate of the locally collected CPIH remains relatively unchanged**

Published locally collected CPIH versus locally collected CPIH with coronavirus (COVID-19) imputations and 64.1% local sample for non-imputed items, 12-month percentage growth, UK, January to December 2019

Figure 8: Even with imputations and a reduced sample, the 12-month growth rate of the locally collected CPIH remains relatively unchanged

Published locally collected CPIH versus locally collected CPIH with coronavirus (COVID-19) imputations and 64.1% local sample for non-imputed items, 12-month percentage growth, UK, January to December 2019



Source: Office for National Statistics – Consumer Prices Index including owner occupiers’ housing costs (CPIH)

In each experiment, the differences between the full sample and the adjusted growth rates were generally fairly small with the largest difference across all the analysis being 0.15 percentage points. For the reduced samples, the higher the coverage percentage, the closer the reduced coverage index tended to be to the full sample index. Even though the chosen coverage levels turned out to be lower than the actual level of coverage of 77.8%, this 77.8% is an average across all items and so the actual level of coverage for some items was lower than this. The chosen levels of coverage are therefore a reasonable representation of some of the worst affected items with the overall results likely to be showing marginally bigger differences than was the case in practice. The results for the imputation analysis also showed only slight differences and suggests that the parent indices used to make the imputations were a good representation of the missing strata.

**Notes for Sensitivity analysis of consumer price indices during UK lockdown**

1. These are described in detail in the article [Coronavirus and the effects on UK prices](#).

## 9 . Conclusions

Throughout our analysis, we have shown that re-weighting the basket, reducing the sample size and using imputations in our statistics has a very small overall impact on our official measures of UK consumer price inflation. While we cannot account for every bias that may occur within our statistics during these unprecedented times, in this article we have demonstrated the minimal impact that the recent economic disruption has had on the consistency and integrity of our official consumer price statistics.

We continue to monitor the impact of the coronavirus (COVID-19) pandemic on our statistics, while also undertaking our transformation programme to modernise the measurement of consumer price statistics in the UK through use of [alternative data sources and new methods](#). The use of these new data sources are enabling us to understand price movements during times of economic uncertainty in a way that we have never been able to before, including through our [online price change for high demand products](#) section in the Faster Indicators release that uses web-scraped data and innovative methods to calculate weekly consumer price indices for select products.

Use of retailer scanner data will also further our understanding of price change and consumption patterns during these times, enabling us to better understand any potential biases that may arise from our current methods of producing consumer price statistics, particularly during these uncertain times.