

Compendium

# Volatile components and their role in the Consumer Prices Index

Investigates whether the most volatile components of the Consumer Prices Index (CPI) basket make a larger contribution to the change in the 12-month growth rate of CPI in periods of relatively stable headline CPI growth.

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# 1 . Main points

- This article investigates whether the most volatile components of the Consumer Prices Index (CPI) basket make a disproportionately large contribution to the change in the 12-month growth rate of CPI; while these movements may offer limited insights into the underlying inflationary picture, they can play an important role in how we communicate headline movements in inflation to the wider public.
- These volatile components of CPI include transport insurance, sea and air fares, and also gas and fuels, and have a combined weight of 6.4% of the total basket in 2019; but on average account for around 10% of the monthly change in the headline 12-month CPI rate, although these components were not found to have a more pronounced effect in periods of relatively “non-volatile” headline CPI growth.
- The prices of these components exhibit volatility for a variety of different reasons, such as their pricing mechanisms as well as their exposure to the wider economy.

## 2 . Introduction

The [Consumer Prices Index \(CPI\)](#) is one of the leading measures of the overall change in the price of consumption goods and services in the UK. It aims to represent price movements for a basket or a sample of items that are purchased by the average household in the UK.

Overall, prices for over 700 items are collected around the middle of every month, with price collectors visiting outlets across the UK to record 100,000 prices for around 520 items. Price quotes for remaining items have national pricing so are collected centrally by our office-based collection teams. Prices for each item in this representative basket are used to calculate an average price, with each item’s price weighted using the composition of that month’s national expenditure.

Every month we report on price movements for the entire basket, to explain what has been driving changes in the headline Consumer Prices Index including owner occupiers’ housing costs (CPIH) inflation rate. The CPIH has the same coverage as CPI with the addition of owner occupiers’ housing costs (OOH) and Council Tax, which together account for 19.1% of the CPIH basket in 2019.

As the inclusion of additional components - such as OOH - in CPIH reduces the weighting of the other CPI basket items, potentially masking some of the volatility in these components, we have focused on CPI for the purposes of this analysis.

Each month we highlight particular drivers that explain movements in the headline 12-month inflation rate, so that users are able to identify which components of the basket are the largest drivers of change in that period. This analysis provides additional context around such movements, which at times can be volatile in nature.

This article will focus on movements within the CPI and will provide further insight into the monthly changes in the 12-month CPI inflation rate. In particular, we will examine the most volatile components of the CPI basket to see if these components play a disproportionate role in explaining such changes.

In assessing the drivers of these movements, we typically highlight the components of the basket that have made the largest contribution to the change in CPI. While there is often some focus on the underlying inflation rate to examine the extent to which there are inflationary pressures in the economy, volatility can also play a large role in explaining how the headline CPI inflation rate moves from month to month.

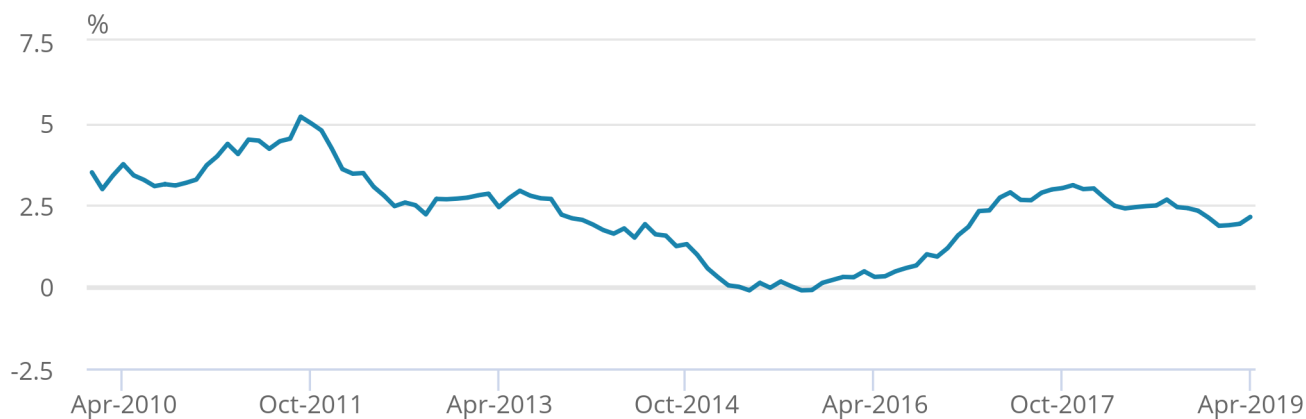
Figure 1 shows the 12-month growth rate of CPI for every month between January 2010 and April 2019. Over this period, the average rate of CPI inflation has been 2.6%.

**Figure 1: 12-month growth rate of CPI has experienced periods of stability and instability since 2010**

12-month growth rate of Consumer Prices Index, UK, January 2010 to April 2019

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12-month growth rate of Consumer Prices Index, UK, January 2010 to April 2019



Source: Office for National Statistics – Consumer Prices Index

The components that have caused some of the short-term fluctuations in headline CPI may have a relatively small weight in the basket but can have a disproportionate impact on the monthly changes in the 12-month CPI rate. While these movements may offer limited insights into the underlying inflationary picture, they can play an important role in how we communicate changes in the annual rate of CPI.

### 3 . Methodology

Figure 2 shows the monthly percentage point [change in the 12-month Consumer Prices Index \(CPI\) inflation rate](#). Between January 2010 and April 2019, given the periods of downward movement in the CPI annual rate, the mean change was negative 0.012 percentage points. These movements can be particularly pronounced in certain months, showing up to 0.7 percentage point changes. These movements can be particularly pronounced in certain months, showing up to 0.7 percentage point changes. Over the period, it is apparent that contribution to change in CPI rate has become less variable in the more recent months (mid-2015 onwards).

To provide more context around these monthly changes, we look to capture whether the contributions to these are related to the underlying volatility in the change in the headline CPI inflation rate. For the purpose of this analysis, monthly changes above or below 0.5 standard deviations from the mean change have been identified as “volatile” and all those within half a standard deviation of the mean have been identified as “non-volatile”. In other words, more extreme movements are those that fall outside these thresholds, while steady movements are those which are within the threshold.

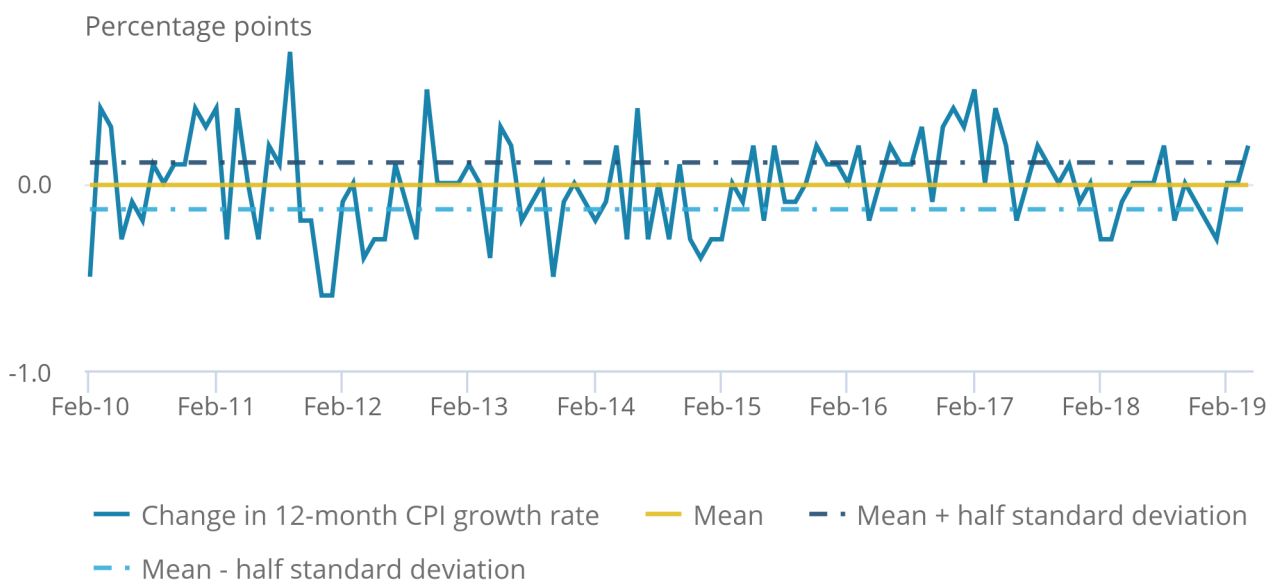
Across the entire period of 111 months, 47 months have been classified as “non-volatile”, while the remaining 64 months have been classified as “volatile”.

**Figure 2: Areas within the standard deviation threshold show periods of “non-volatile” inflation, while those outside the threshold represent periods of “volatile” inflation**

Monthly change in the 12-month Consumer Prices Index (CPI) growth rate, UK, February 2010 to April 2019

Figure 2: Areas within the standard deviation threshold show periods of “non-volatile” inflation, while those outside the threshold represent periods of “volatile” inflation

Monthly change in the 12-month Consumer Prices Index (CPI) growth rate, UK, February 2010 to April 2019



Source: Office for National Statistics – Consumer Prices Index

To investigate the role of volatile components, we have identified the top 10% most volatile of the 85 class components in the CPI basket – which equates to eight classes of the CPI basket - based on the standard deviation in their 12-month growth rate. This does not account for variability in month on month changes. Economic commentary of CPI usually focuses on class-level components that have driven changes in the 12-month CPI rate, therefore, our analysis was carried out at this level. However, it should be noted that volatility at the item level may offset by opposing movements of other items when aggregated to class level.

Table 1 shows the most volatile 10%, alongside their respective 2019 CPI basket of goods and services weight. These volatile components of CPI comprise a relatively small proportion of CPI, with a combined contribution of just 6.4% of the total CPI basket in 2019. Other components, falling just outside of this top 10%, include oils and fats, equipment for the reception and reproduction of sound and pictures (for example, televisions, portable speakers, DAB radios, and so on), and second-hand cars.

Table 1: Top eight volatile Consumer Prices Index (CPI) components in order of volatility  
UK, 2019

<b>Volatile items</b>	<b>2019 weight</b>
Liquid fuels e.g. kerosene	0.1%
Photographic, cinematographic and optical equipment e.g. cameras – digital, action, etc.	0.2%
Fuels and lubricants – mainly petrol and diesel	3.0%
Insurance connected with transport – car and travel insurance	0.3%
Data processing equipment – personal and laptop computers along with their associated software and peripherals	0.8%
Passenger transport by air	0.5%
Gas	1.2%
Passenger transport by sea and inland waterway	0.3%
Combined total	6.4%

Source: Office for National Statistics – Consumer Prices Index

## 4 . Results and analysis

This section analyses the contribution of the top 10% most volatile Consumer Prices Index (CPI) components to the change in the 12-month rate of CPI inflation from 2010 onwards. In addition, we explore whether the contribution of these volatile components differs during “non-volatile” and “volatile” periods.

### Top 10% most volatile CPI components

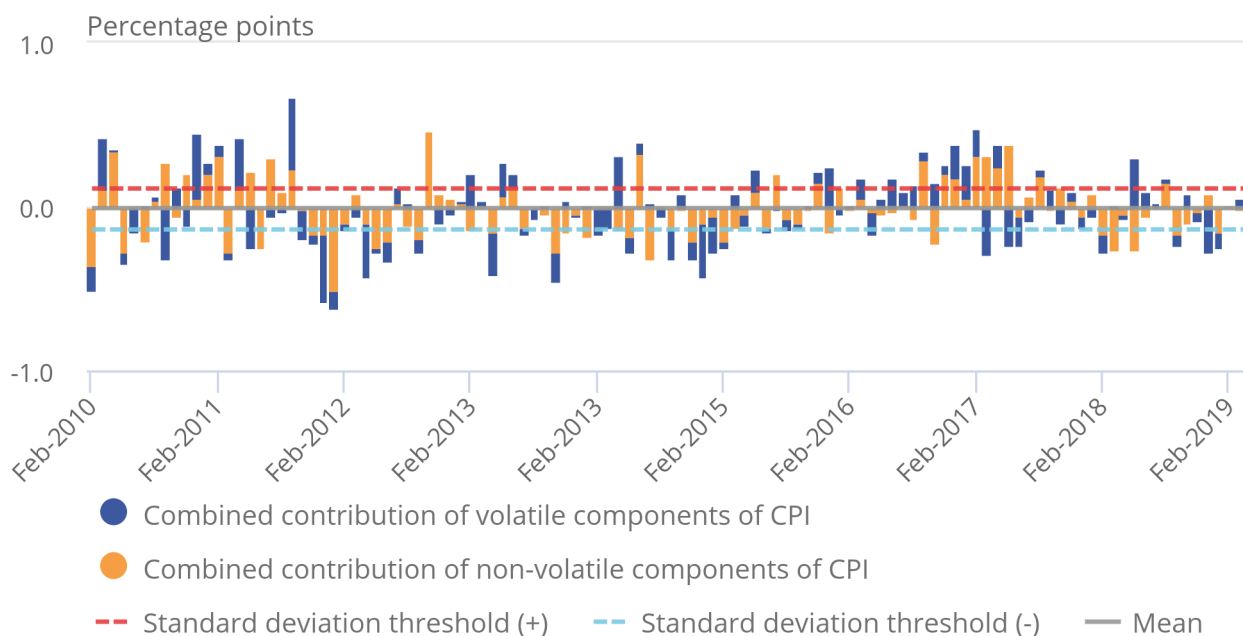
The top 10% most volatile CPI components – despite only representing 6.4% of the CPI basket – on average account for 10% of the change in the headline 12-month CPI rate (Figure 6, Annex A) . As outlined in the conclusion, further work is planned to look at the composition of these volatile components to see the extent of these contributions vary over time.

### Figure 3: The combined contribution of volatile and non-volatile components of CPI

Contributions to change in the 12-month growth rate, February 2010 to April 2019

## Figure 3: The combined contribution of volatile and non-volatile components of CPI

Contributions to change in the 12-month growth rate, February 2010 to April 2019



Source: Office for National Statistics – Consumer Prices Index

Some of the top 10% of volatile CPI components that have been identified are volatile in their nature but also sometimes in their pricing strategy. For example, products such as air and sea fares – which accounted for a combined 0.8% of the CPI basket in 2019 – are priced using dynamic pricing strategies. Retailers of tickets for air and sea travel often attempt to segment the market and aim to price discriminate by grouping consumers according to their willingness to pay, dependent on various factors including demographics, peak-time travel and time of purchase.

Dynamic pricing is often used to maximise revenue as well as to gain a competitive edge. This flexible approach to pricing may account for some of the volatility of products such as air and sea fares, which have had such a pronounced effect on the change in the 12-month growth rate of CPI at specific and consistent periods of each year throughout the sampled period.

For holiday and travel items, we observe large price rises during peak holiday periods (August and December). Factors such as the timing of Easter - as seen in 2011 in Figure 4 when Easter was later in the year - have caused notable upwards movements in the contributions of air fares to the change in 12-month CPI growth, as retailers have increased their prices during peak travel times.

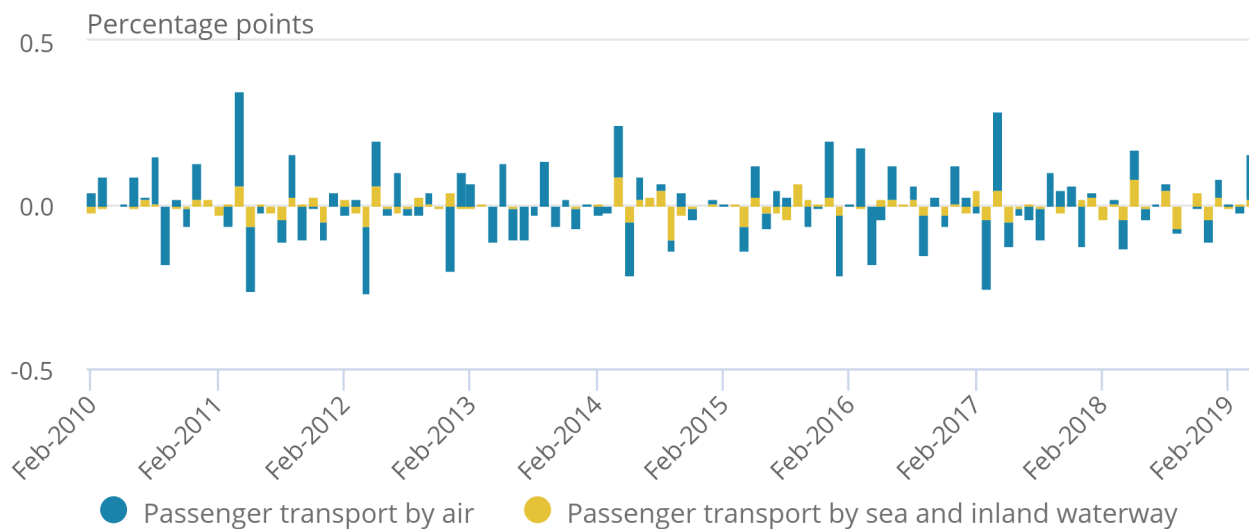
Similar patterns are also evident in the contributions of sea fares, albeit to a lesser extent than air fares, with retailers in both sectors appearing to use similar pricing strategies.

## Figure 4: The combined contribution of sea and air fares to the change in 12-month CPI growth

February 2010 to April 2019, based on 0.5 standard deviation threshold

### Figure 4: The combined contribution of sea and air fares to the change in 12-month CPI growth

February 2010 to April 2019, based on 0.5 standard deviation threshold



Source: Office for National Statistics – Consumer Prices Index

In addition to sea and air fares, the pricing mechanisms of some of the other volatile CPI components may also offer some explanation as to why they are among the most prominent causes of the change in the 12-month growth rate of CPI.

The pricing of products such as transport insurance for cars and motorbikes are heavily dependent on factors including age, location, experience and the previous history of each individual driver. Insurance premiums are often dependent on factors including age, location, experience and the previous history of each individual driver. However, some of the short-term volatility in this series caused by these factors is mitigated by our methodology used in compiling these statistics, as price quotes are compared for the same person in successive months.

The price movements of components such as gas, liquid fuels, and fuels and lubricants – which account for a combined 4.3% of the CPI basket respectively – are heavily reliant on a number of factors, including both supply and demand side factors.

On the supply side, the price of products such as gas are dependent on factors such as natural gas production, net imports (which are heavily dependent on variations in exchange rates) and storage inventory levels. Increases in supply tend to pull prices down, while decreases in supply tend to push prices up. Increases in prices tend to encourage natural gas production and imports, and sales from natural gas storage inventories. On the demand side, factors include weather (temperatures), economic conditions and petroleum prices.

In addition to the top 10% most volatile components, which have been identified using this methodology, certain other items of the CPI basket have been highlighted in more recent months as having a prominent impact on the change in the 12-month CPI growth. For example, computer games from the top 20 chart and theatre admissions items have featured regularly in recent months as driving the change in the 12-month growth rate of CPI, despite only representing 0.26% and 0.21% of the CPI basket respectively in 2019. This may also be down to the unconventional pricing strategies from the firms that sell them.

The retail price of computer games has broadly risen over time, partially because of the increased quality of the product. However, this is not always the case as each individual game is priced using a unique pricing strategy. For example, some computer games are priced using a high one-off payment, while an ever-increasing amount of games are priced at a lower level (or in some cases completely free for games available to purchase online), dependent on multiple in-play payments for additional content required once purchased for downloadable content. It should be noted that the index does not include free games nor in-play payments in games.

This unique pricing strategy, combined with the fairly high turnover and wide-ranging price of games in the computer games component, offers some explanation as to why they have been having a particularly notable impact on the change in the 12-month CPI growth rate.

## **Relationship between volatile and non-volatile components**

The relationship between the contributions of volatile and non-volatile CPI components differs over time, as the headline 12-month CPI growth rate experiences periods of relative stability and instability. Figure 5 shows the combined contributions that the top 10% most volatile and remaining 90% of components make in non-volatile and volatile periods. The net contribution to the change in the 12-month growth of the volatile components of CPI during periods of non-volatile CPI growth is substantially smaller in absolute size than the contributions of the volatile components during volatile periods of CPI growth, across the period of February 2010 onwards.

The volatile components of CPI form 39% of the absolute contributions to change in the 12-month growth rate of CPI (total lengths of bars in Figure 5) during volatile months, while they comprise only 29% during non-volatile months of growth, across the period from February 2010 onwards. The value for non-volatile months is not a percentage of the total change in the 12-month growth rate of CPI, as this measure does not account for direction of the contributions.

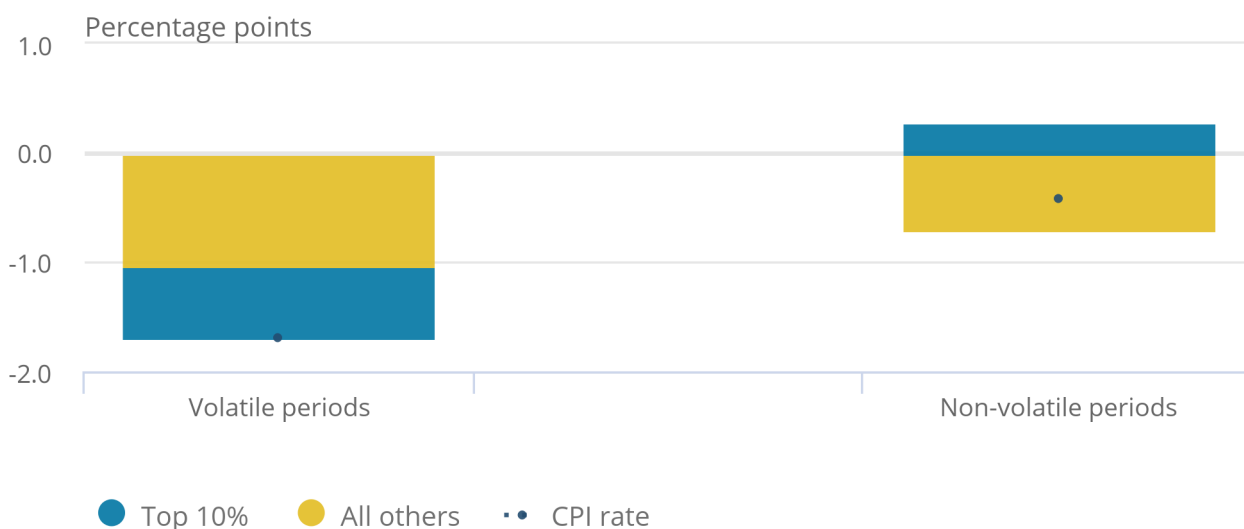


**Figure 5: Volatile components have a smaller contribution to the change in the 12-month rate of CPI in periods of “non-volatile” inflation**

Contribution to change in the 12-month Consumer Prices Index (CPI) rate of volatile items during “non-volatile” and “volatile” periods of CPI, UK, February 2010 to April 2019

Figure 5: Volatile components have a smaller contribution to the change in the 12-month rate of CPI in periods of “non-volatile” inflation

Contribution to change in the 12-month Consumer Prices Index (CPI) rate of volatile items during “non-volatile” and “volatile” periods of CPI, UK, February 2010 to April 2019



Source: Office for National Statistics

Notes:

1. Based on 0.5 of a standard deviation threshold.

To investigate this further, the net annual contributions in volatile periods and in non-volatile periods have also been calculated using the same standard deviation threshold (0.5). CPI has endured several periods of volatility since 2010, where these volatile periods have been identified using the approach outlined in the [Methodology section](#).

The number of years in which the top 10% of volatile classes have made a larger contribution to the overall change in the CPI rate compared with the remaining 90% of the basket is relatively even. However, the relative size of the contributions of the non-volatile components of CPI considerably outweighs the contributions of volatile components.

## 5 . Conclusions

Our analysis finds that the top 10% volatile Consumer Prices Index (CPI) components – which have a combined CPI basket weight of only 6.4% in 2019 – do have a disproportionately large impact on the change in the 12-month growth rate of CPI.

These volatile classes include transport insurance, sea and air fares, and also gas and fuels. These classes exhibit price volatility for different reasons such as their pricing mechanisms and exposure to the wider economy. Despite these volatile components having a disproportionate effect on the change in the 12-month rate, these components do not have a larger impact on the change in the CPI rate in non-volatile periods of growth.

The analysis in this article should provide stakeholders with a more in-depth understanding of the role of some of the lower-weighted, more volatile components of the CPI basket, and the part they play in the change in CPI from one month to the next. This in turn should also allow data users in general to better understand some of the short-term fluctuations within the CPI basket from the drivers of the longer-term underlying inflationary picture, allowing for more informed decisions to be made.

Further work will be carried out to look at the composition of these volatile components to see the extent of these contributions vary over time, while also looking at the properties of these movements to understand how persistent this volatility is and how it changes from one month to the next.

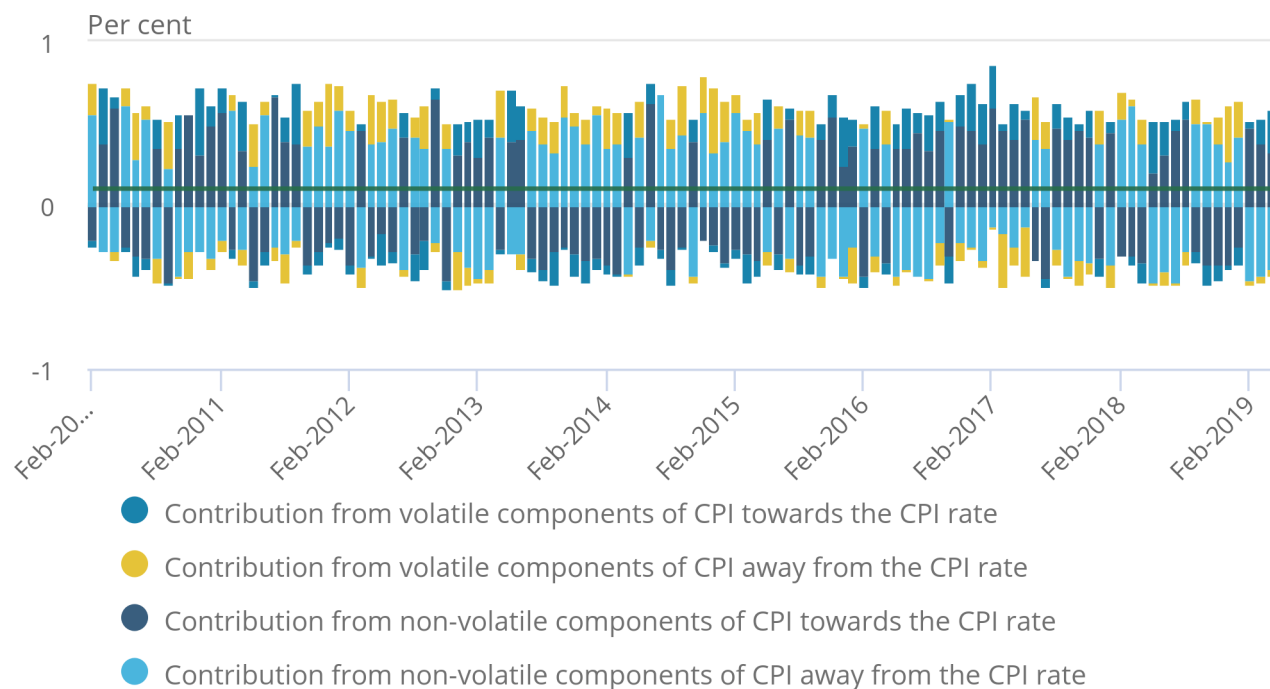
## 6 . Annex

**Figure 6: Volatile components of the CPI basket on average form 10% of the contributions towards the change in the 12-month CPI rate**

Contributions to change in the 12-month Consumer Prices Index (CPI) growth rate, UK, February 2010 to April 2019

Figure 6: Volatile components of the CPI basket on average form 10% of the contributions towards the change in the 12-month CPI rate

Contributions to change in the 12-month Consumer Prices Index (CPI) growth rate, UK, February 2010 to April 2019



Source: Office for National Statistics

Percentage of contributions towards and away from the 12-month Consumer Price Index (CPI) growth rate from volatile and non-volatile components of the CPI basket. Percentages are calculated as the fraction of total absolute contributions of all classes to the CPI rate from either volatile or non-volatile classes. The sign of the percentage represents whether the contribution is towards (positive) or away from (negative) the total change in 12-month CPI rate.