

Article

The dispersion of price changes in the Consumer Prices Index: 2022

Measuring the dispersion of inflation rates across the individual goods and services that make up the Consumer Prices Index including owner occupiers' housing costs (CPIH).

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1 . Main points

- The headline rate of consumer prices inflation is a weighted average of the price changes for the goods and services making up the price index; the dispersion of price changes relates to how spread out the inflation rates of specific classes of goods and services are relative to the average.
- The dispersion of price changes may be useful for analysing the breadth and depth of inflationary pressures in the UK through measures of underlying or core inflation, and the variation in inflation experiences of different household groups relative to the headline inflation rate.
- This article presents several measures of dispersion in price changes making up the Consumer Prices Index including owner occupiers' housing costs (CPIH); these show that inflation variability has increased significantly over the last two years coinciding with the acceleration in the headline rate of inflation.

2 . Introduction

The Consumer Prices Index including owner occupiers' housing costs (CPIH) is our most comprehensive measure of consumer prices at the Office for National Statistics (ONS). Each month we collect prices for over 700 goods and services that are representative of UK households' expenditure. Each specific item is given a weight that reflects its share of total expenditure, as shown in our [Consumer price inflation basket of goods and services: 2023 article](#).

The weighted mean average is a measure of central tendency for all the price changes of the goods and services that make up the CPIH. The headline measure of inflation is reported as the 12-month change in this average. This rate of inflation has accelerated over the last two years, and although slightly slowing in recent months, consumer prices were 8.8% higher in January 2023 than one year earlier (Figure 1).

Figure 1: Mean and median estimates of consumer prices inflation have significantly increased over the last two years

Weighted mean and weighted median CPIH inflation rates, percentage increase over the previous 12 months

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Weighted mean and weighted median CPIH inflation rates, percentage increase over the previous 12 months



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

An alternative measure of central tendency is the weighted median, reflecting the price change of the specific item in the middle of the distribution, when all price changes in the CPIH have been ordered from the lowest to the highest. This measure is not widely published by national statistics institutes around the world, but the [median consumer prices inflation rate published by the Federal Reserve Bank of Cleveland](#) is a long-standing and closely followed statistic in the United States.

The weighted median CPIH inflation rate in the UK was 4.3% in the 12 months to January 2023 (Figure 1). It is lower than the headline measure as it excludes the very large positive price changes to energy-related items. However, this measure has also increased significantly over the last two years implying that the pickup in UK inflation is broader based, and not just driven by the very large price increases observed for energy-related products.

Diffusion indexes, [as described by the Federal Reserve Bank of Richmond](#), are simple indicators that reflect the relative proportion of observations that contribute positively to an index. They are often presented as a net balance between the positive and negative contributions. For a price index, this would be the weighted balance between the proportion of prices that are increasing relative to the proportion that are decreasing. A diffusion index of the components of consumer price inflation is currently published by the [Bank of Japan as a measure of underlying inflation](#). It captures how widespread price increases are at any point in time.

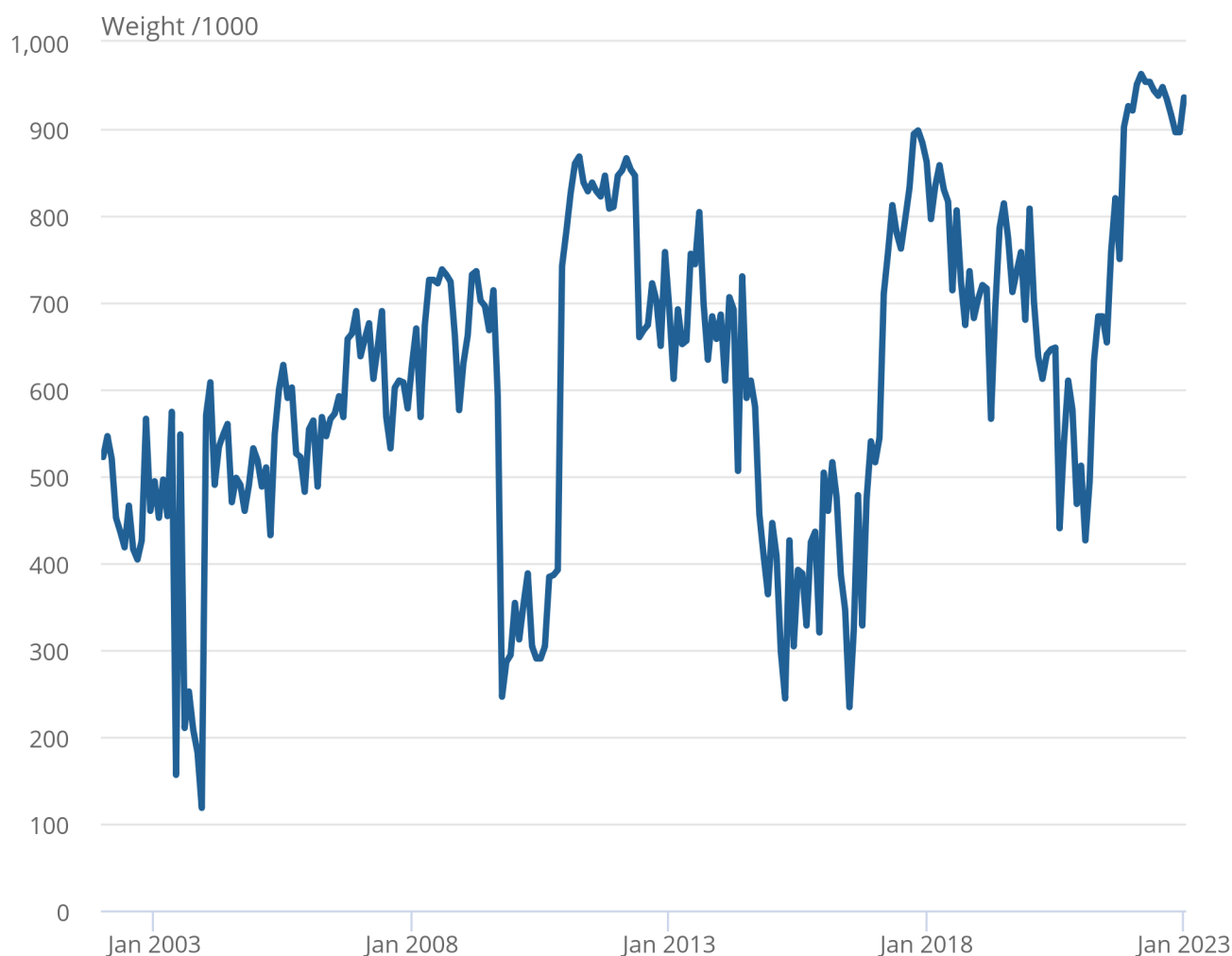
Figure 2 shows the net balance between the weighted proportions of the CPIH index where inflation was positive and negative over the preceding 12-month period. This shows a sharp rise in the net balance over the last two years. In January 2023, 96.8% of the weighted items in the CPIH basket recorded an increase in prices compared with 3.2% recording a fall in prices. This means that the net balance between the two, equalling 93.6%, remains close to the highest balance recorded over the available data period.

Figure 2: Almost all the items in the CPIH basket recorded an increase in price over the last year

The net balance of weighted proportions of the Consumer Prices Index including owner occupiers' housing costs (CPIH) where prices were up or down on 12 months previously

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The net balance of weighted proportions of the Consumer Prices Index including owner occupiers' housing costs (CPIH) where prices were up or down on 12 months previously



Source: Consumer price inflation, UK and authors' calculations from the Office for National Statistics

Notes:

1. The data in this chart have been constructed using 87 classes of goods and services and their respective weights forming the CPIH.
2. The sum of weights in the CPIH basket equals 1000, so this net balance statistic will be bounded between positive 1000 (all items are increasing in price) and negative 1000 (all items are decreasing in price).

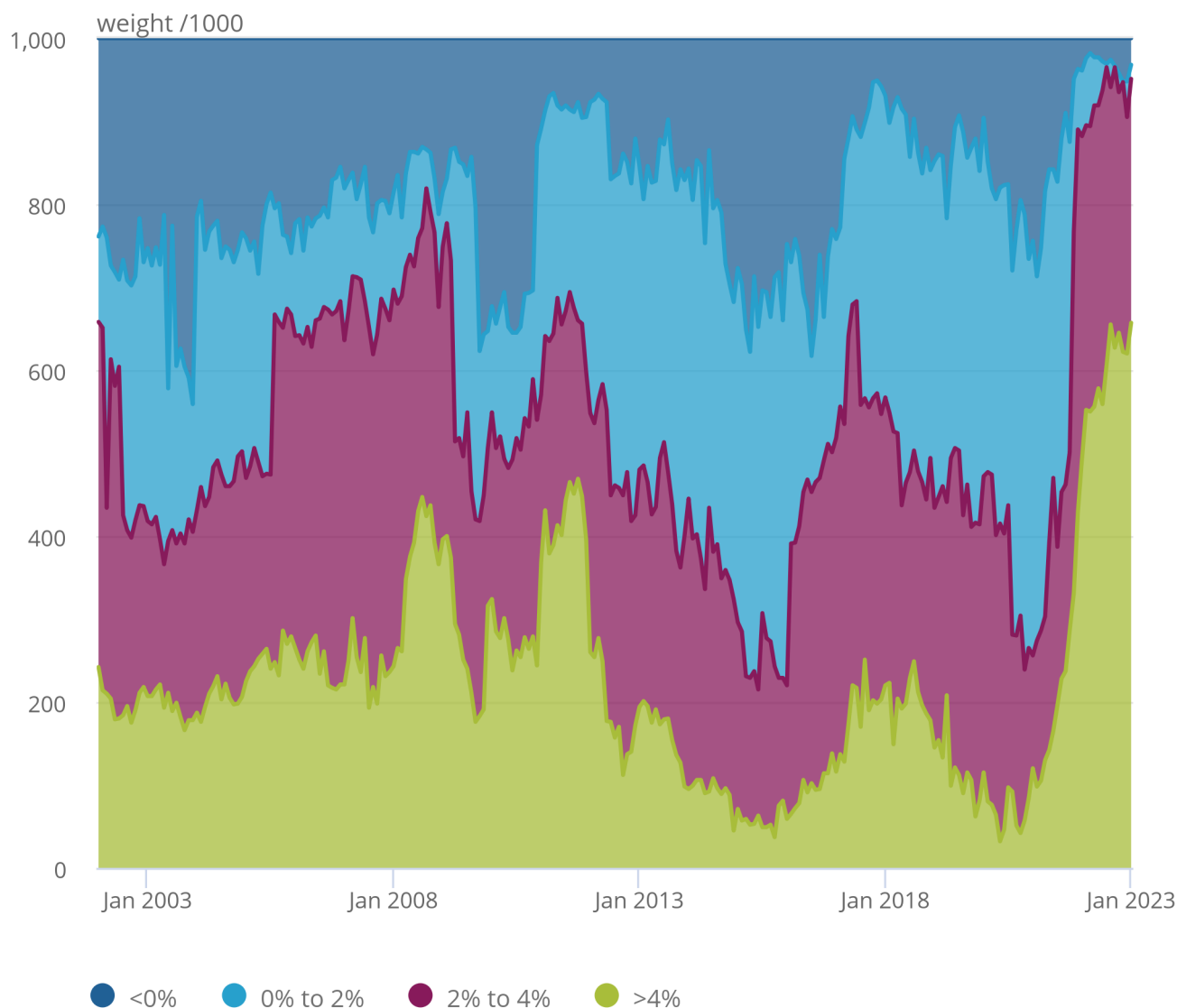
Another form of diffusion measure presents the respective proportions of the weighted price index that fall in different ranges of inflation, rather than simply "up" and "down." As Figure 3 shows, over the last two years an increasing proportion of the CPIH index has been in the category marking larger positive increases in inflation. In January 2023, 65.7% of the CPIH basket by weight recorded 12-month price increases above 4%. This continues the recent trend for most of the consumer prices basket by weight to be in this highest inflation band.

Figure 3: Nearly two-thirds of the CPIH basket recorded a 12-month inflation rate greater than 4%

The relative proportions of the Consumer Prices Index including owner occupiers' housing costs (CPIH) by weight in each range of 12-month inflation rates, total weight = 1000

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The relative proportions of the Consumer Prices Index including owner occupiers' housing costs (CPIH) by weight in each range of 12-month inflation rates, total weight = 1000



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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The mean and median averages and diffusion indices are commonly used as "summary measures" of a distribution, applied in these examples by statisticians to provide an indicator of the general change in prices across all the components making up a price index.

However, we may also be interested in the dispersion of the inflation data; that is, how spread out or how concentrated price changes are relative to the average or another indicator of central tendency. This might provide insight into how headline inflation rates compare with underlying or core inflation rates, and the extent to which inflation experiences might vary across different household groups. This article considers a variety of metrics for analysing the dispersion of price changes in the CPIH and how these measures have changed over time.

3 . Why might the dispersion of inflation rates in the CPIH matter?

Core inflation

Core inflation is a constructed measure of the underlying inflationary pressures in the economy; that is, the part of inflation that is likely to persist into the medium to longer term. Measures of core inflation recognise headline inflation rates may be driven by temporary supply shocks, or other effects that have a significant but not a lasting impact.

The Office for National Statistics (ONS) typically reports core inflation as the CPIH all items index, excluding energy, food, alcoholic beverages, and tobacco. These items are considered relatively volatile items in the inflation basket. We have recently published our [New estimates of core inflation, UK: 2022, article](#) based on trimmed-mean estimates of inflation, where each month the top and bottom 15% of the distribution of price changes by weight is removed from the inflation calculation.

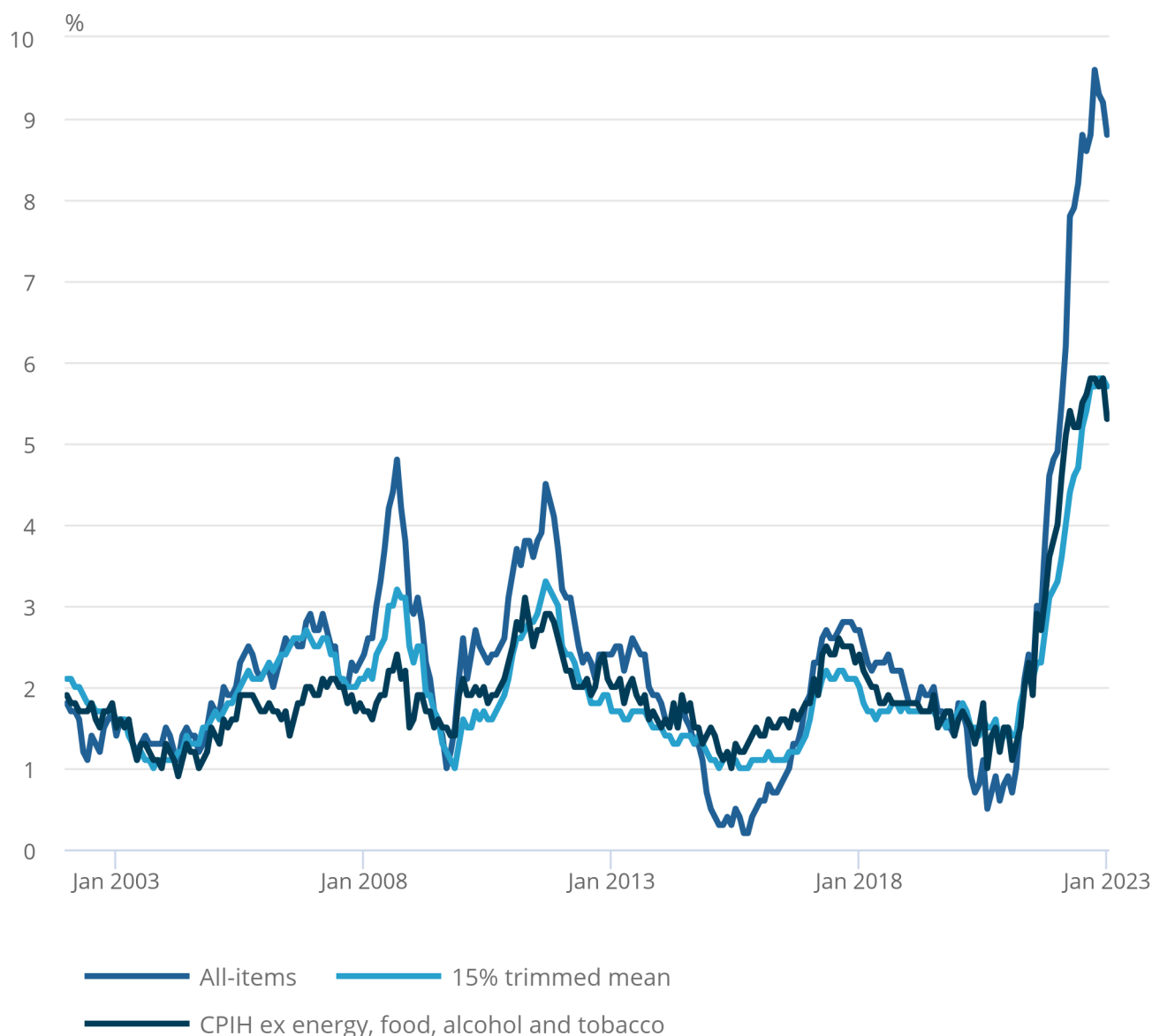
Figure 4 shows how both the exclusion-based and trimmed-mean estimates of core inflation have compared with the headline CPIH inflation rate. Whereas the 12-month increase in the CPIH to January 2023 was 8.8%, the exclusion-based and trimmed-mean estimates were lower, at 5.3% and 5.8%, respectively. Both estimates reflect the removal of very high rates of inflation in energy items. However, given core measures are also very high relative to historical rates, it suggests that the pickup in inflation has been broader across a range of goods and services.

Figure 4: Core CPIH inflation rates have not accelerated as fast as the headline rate

Headline (all-items) and core Consumer Prices Index including owner occupiers' housing costs (CPIH) inflation rates, percentage increase over the previous 12 months.

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Headline (all-items) and core Consumer Prices Index including owner occupiers' housing costs (CPIH) inflation rates, percentage increase over the previous 12 months.



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

Notes:

1. The data in this chart have been constructed using 87 classes of goods and services and their respective weights forming the CPIH.

Greater disparity in inflation rates across the items in the price index may imply that underlying or core inflation measures are different from headline measures. This is because there have been particularly large positive or negative price changes for certain items that are deemed as transitory and removed from core estimates.

The measurement of inflation for different household groups

The headline inflation rate may become less representative for different households with different expenditure patterns when price changes of individual items are less uniform. We have recently started publishing [CPIH and CPI inflation rate estimates for UK household groups](#) to measure how the experiences of changing prices vary by different types of UK households.

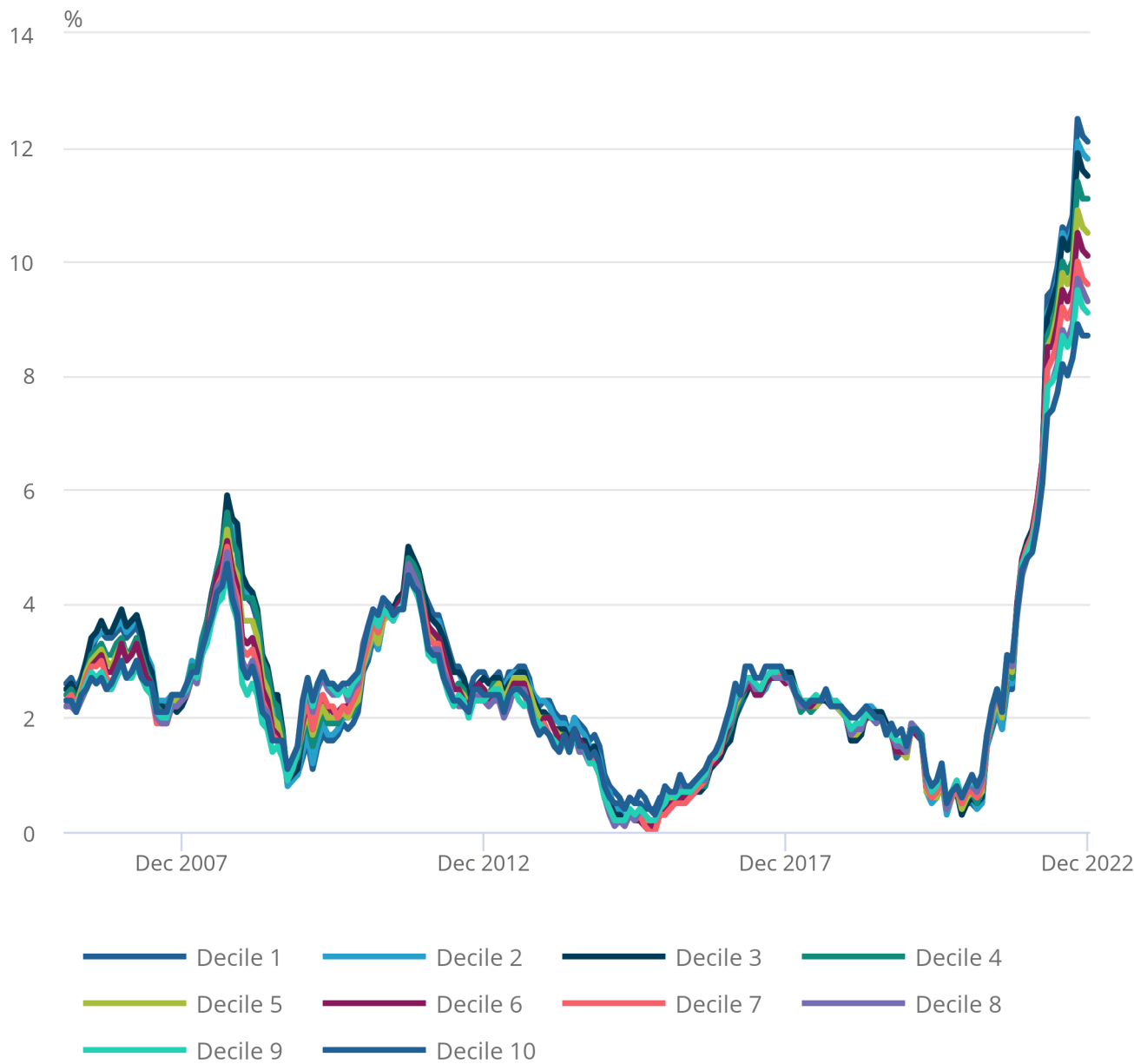
Figure 5 shows CPIH consistent inflation rates for each household income decile. Over the last year, as the headline inflation rate has accelerated, the variation in inflation rates across these household groups has widened. The latest published data shows the headline CPIH inflation rate in December 2022 was 9.2%. However, this ranged from a high of 12.1% for the bottom household income decile group, to a low of 8.7% for the top household income decile group.

Figure 5: Rates of CPIH inflation experienced by different household income groups have widened in the last year

Inflation rates consistent with the Consumer Prices Index including owner occupiers' housing costs (CPIH) by household income decile, percentage increase over the previous 12 months.

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Inflation rates consistent with the Consumer Prices Index including owner occupiers' housing costs (CPIH) by household income decile, percentage increase over the previous 12 months.



Source: CPIH and CPI inflation rate estimates for UK household groups from the Office for National Statistics

Notes:

1. The data in this chart shows the annual percentage growth by equivalised disposable income decile using democratic weights.

This reflects differences in expenditure patterns across households' income deciles. For instance, the housing, water, electricity, gas and other fuels category of expenditure accounts for 45.9% of the expenditure of the bottom decile, but only 33.6% for the top decile. Therefore, a sharp rise in energy prices is expected to have a larger impact on the inflation rate experienced by the bottom income decile group than the top income decile group.

4 . Variance-based measures of inflation dispersion

The mean average is the first moment of a distribution. The second moment is the variance, which measures the average squared dispersion around the mean. The standard deviation is simply the square root of the variance and offers the advantage of being expressed in the same units as the mean average itself.

Figure 6 shows the standard deviation in the Consumer Prices Index including owner occupiers' housing costs (CPIH) distribution over time. This shows a sharp increase in the standard deviation over the last two years, coinciding with the acceleration in headline inflation rate. However, the variance of a distribution tends to increase as the average increases, so this result is to be partly expected.

Figure 6: The variability of inflation rates across individual items in the CPIH has increased sharply over the last two years

The standard deviation of 12-month price changes in the Consumer Prices Index including owner occupiers' housing costs (CPIH)

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The standard deviation of 12-month price changes in the Consumer Prices Index including owner occupiers' housing costs (CPIH)



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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1. The data in this chart have been constructed using 87 classes of goods and services and their respective weights forming the CPIH.

5 . Point and range estimates of CPIH inflation

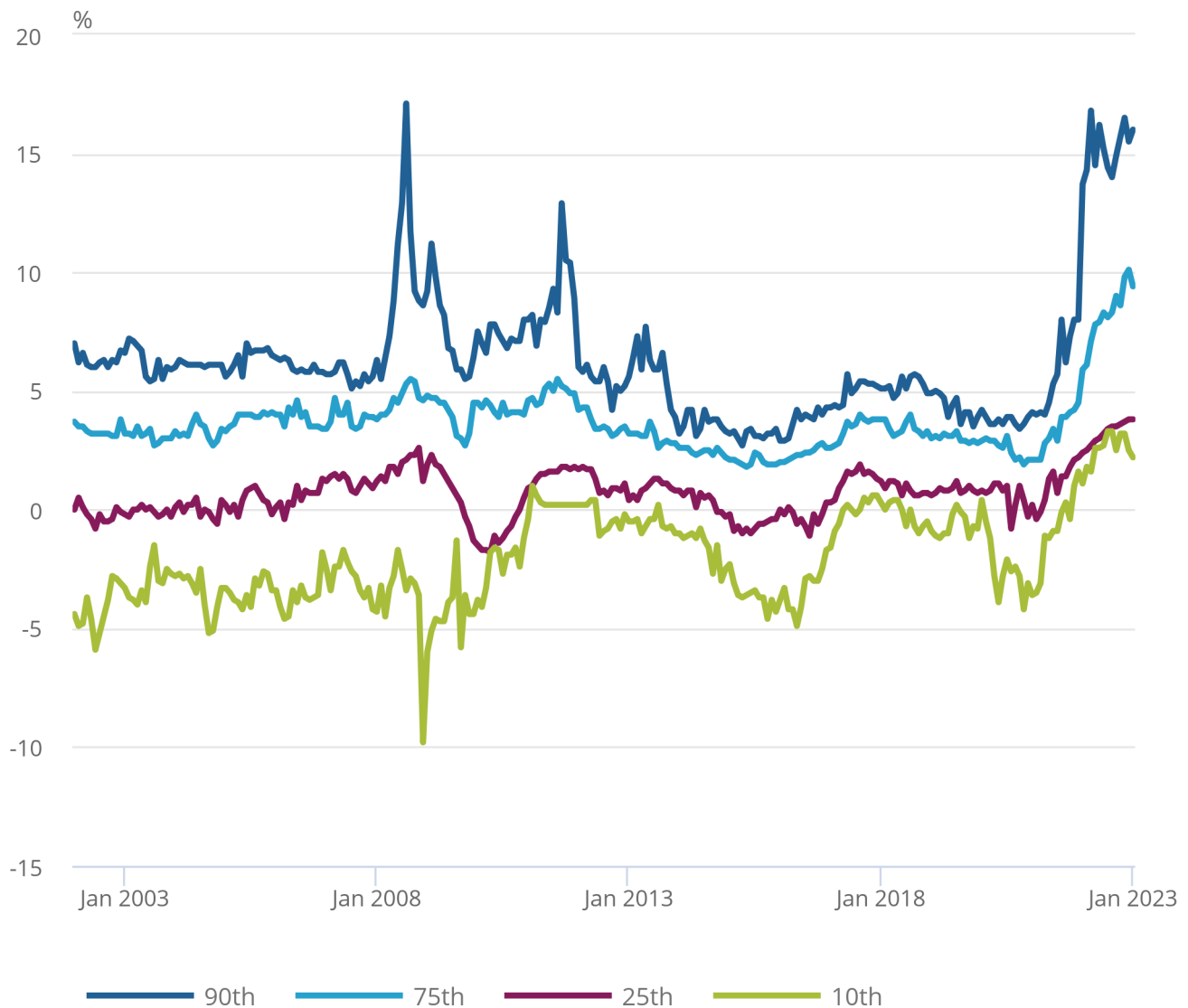
The dispersion of price changes for the goods and services making up the CPIH can be measured by comparing inflation rates at specific points or over given ranges of the distribution. Figure 7 shows the paths of CPIH inflation for 4 different percentiles of the distribution - 90th, 75th (upper quartile), 25th (lower quartile) and the 10th - where the inflation rates for each item in the distribution have been ordered from the lowest to the highest. These respective 12-month inflation rates in January 2023 were 16.0%, 9.4%, 3.8% and 2.2%.

Figure 7: CPIH inflation has increased over the entire distribution but with the greatest acceleration at the top end

Inflation rates at different percentile points in the Consumer Prices Index including owner occupiers' housing costs (CPIH) distribution, 12-month percentage change

Figure 7: CPIH inflation has increased over the entire distribution but with the greatest acceleration at the top end

Inflation rates at different percentile points in the Consumer Prices Index including owner occupiers' housing costs (CPIH) distribution, 12-month percentage change



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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A comparison of inflation rates at these different percentiles is an indicator of how the distribution of price changes has changed over time. The 90-10 comparison shows how price changes at the top of the distribution have changed relative to those towards the bottom. Figure 8 demonstrates that this range increased sharply over the last year, reflecting large price increases at the top end of the distribution for energy items in particular. However, the gap was smaller than in 2008, largely because inflation at the bottom end of the distribution has also increased sharply in the recent period.

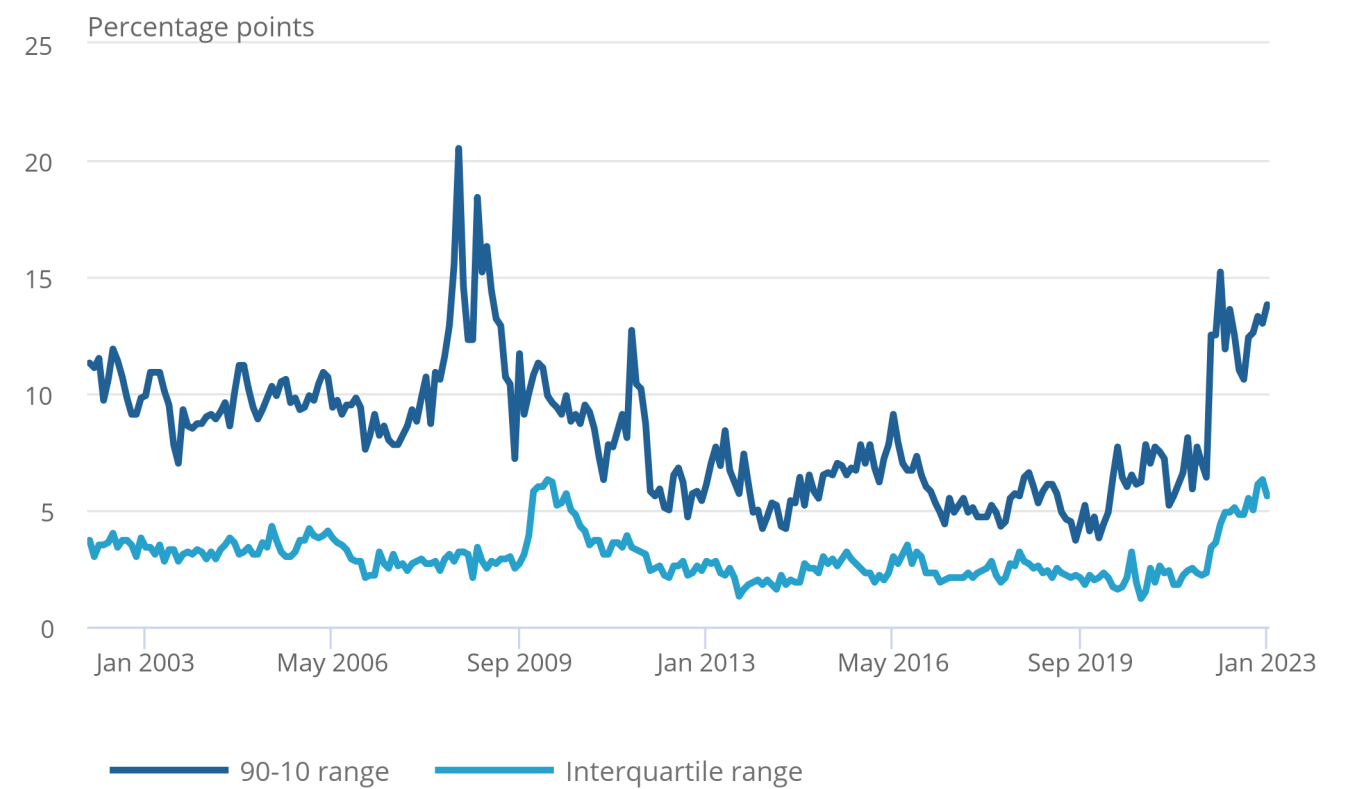
The interquartile range - the difference between the upper and lower quartiles - gives an indication of how prices are changing towards the middle of the distribution. Figure 8 shows that this has also widened over the last year. This implies that the increasing dispersion of price changes is not just at the top and bottom of the distribution but is seen more broadly across all items.

Figure 8: The greater dispersion in price changes is broad based, not just at the top end

Differences in inflation rates between specific percentiles of the Consumer Prices Index including owner occupiers' housing costs (CPIH), percentage points

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Differences in inflation rates between specific percentiles of the Consumer Prices Index including owner occupiers' housing costs (CPIH), percentage points



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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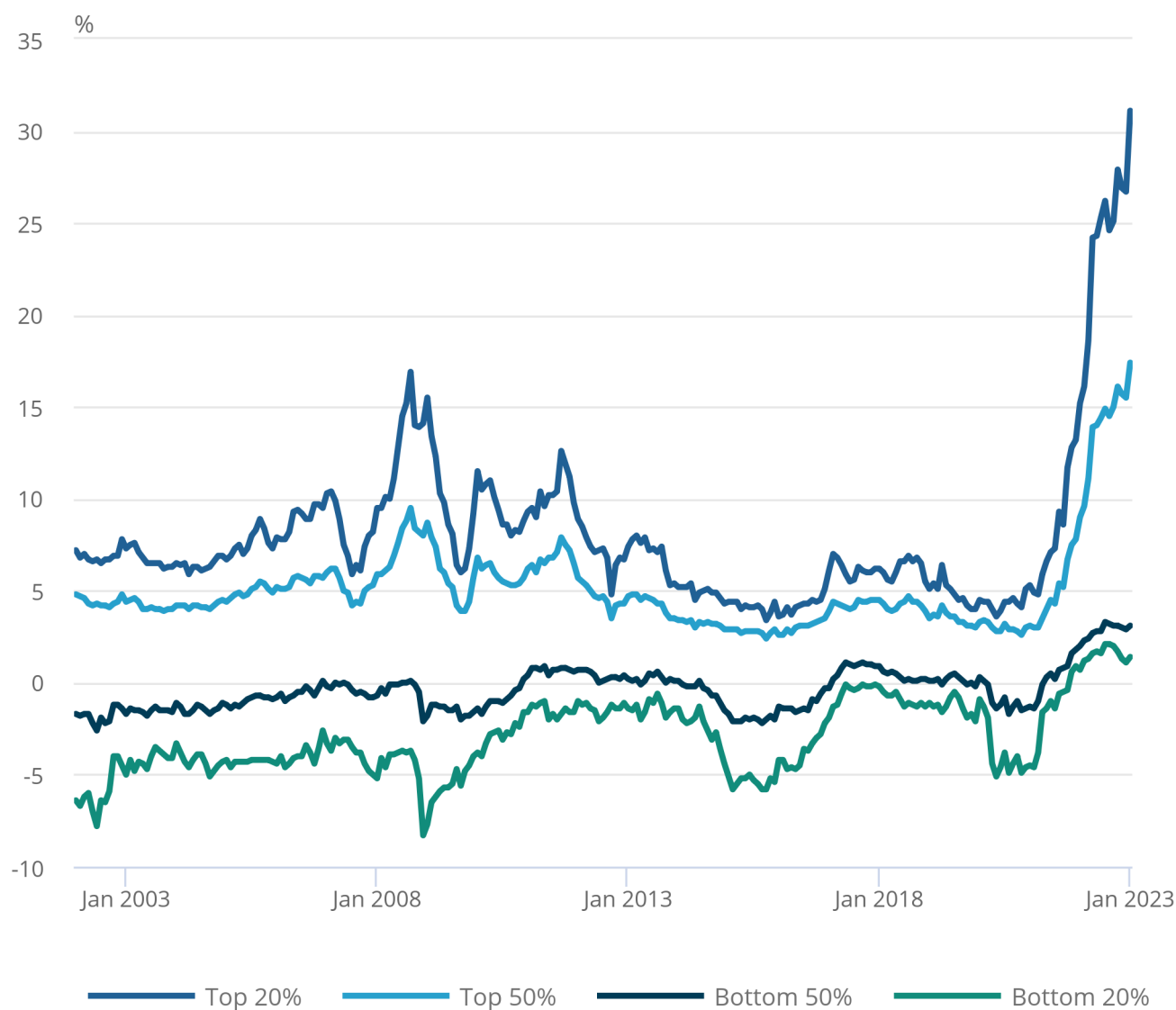
Instead of comparing inflation rates at specific points of the distribution, it is also possible to compare average inflation rates over different ranges of the distribution. Figure 9 shows the average CPIH inflation rates for the individual classes of goods and services in the top 20%, top 50%, bottom 50% and bottom 20% of all price changes. Over the 12 months to January 2023, these rates were 31.1%, 17.4%, 3.1% and 1.4%, respectively.

Figure 9: The average inflation rate for the top 20% classes of goods and services was 31.1% in January 2023

Average inflation rates over different ranges of the Consumer Prices Index including owner occupiers' housing costs (CPIH) distribution, 12-month percentage change

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Average inflation rates over different ranges of the Consumer Prices Index including owner occupiers' housing costs (CPIH) distribution, 12-month percentage change



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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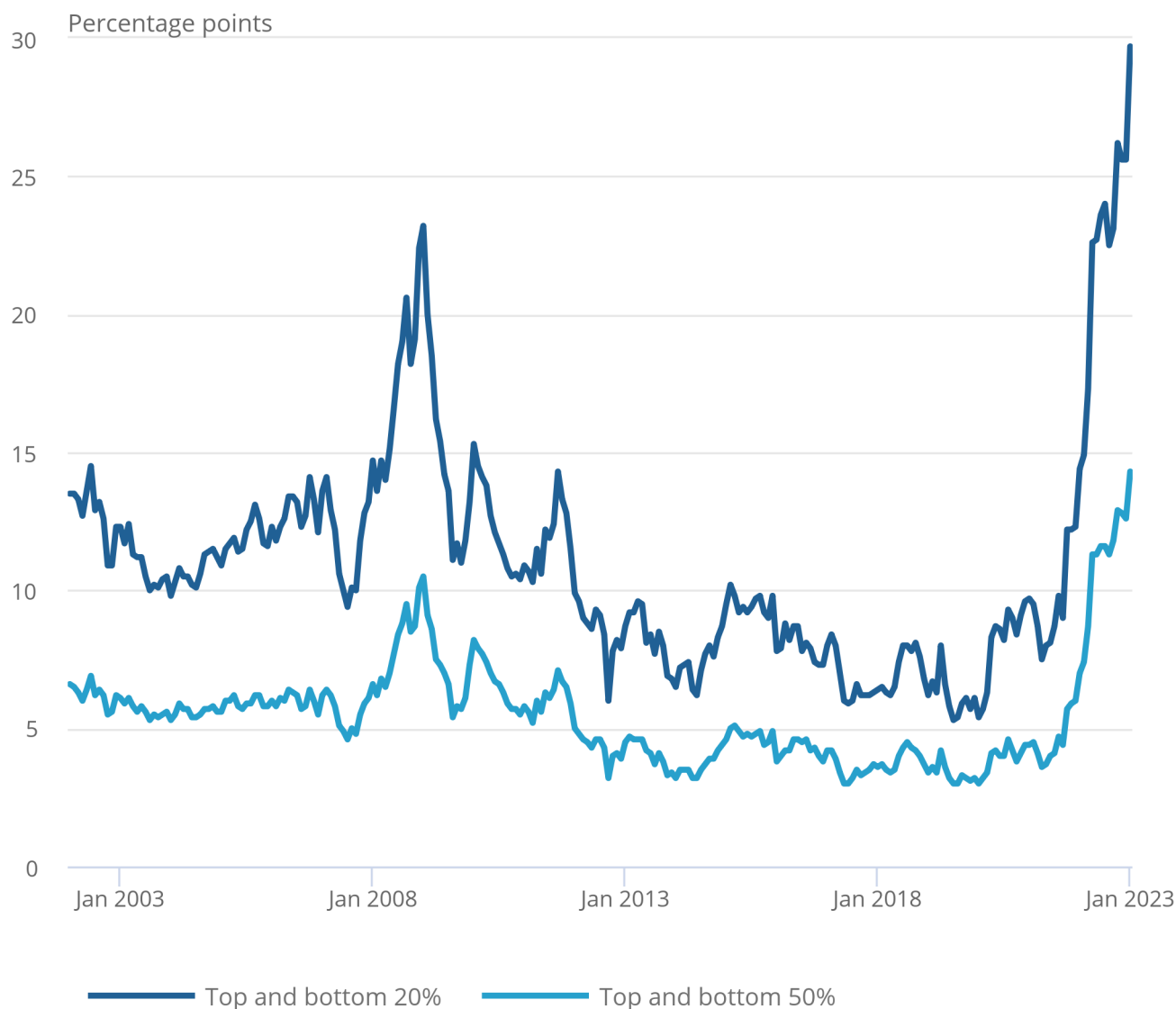
Figure 10 also shows a widening of inflation rates across the CPIH. This is seen at the extremities (top 20% compared with the bottom 20%) and over a broader array (top 50% compared with the bottom 50%) of the distribution.

Figure 10: Inflation rates at the top of the CPIH distribution have surged relative to those at the bottom

Differences in average inflation rates between ranges of the Consumer Prices Index including owner occupiers' housing costs (CPIH), percentage points

Figure 10: Inflation rates at the top of the CPIH distribution have surged relative to those at the bottom

Differences in average inflation rates between ranges of the Consumer Prices Index including owner occupiers' housing costs (CPIH), percentage points



Source: Consumer price inflation, UK, and authors' calculations from the Office for National Statistics

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6 . The dispersion of price changes in the CPIH data

[Consumer price inflation tables](#)

Dataset | Released 15 February 2023

Measures of monthly UK inflation data including CPIH, CPI and RPI. These tables complement the consumer price inflation time series dataset.

7 . Cite this article

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