Office for National Statistics

Article

Persistence in consumer prices inflation, UK: 2002 to 2023

Estimates of the underlying trend rate of inflation in the UK economy.

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1 . Main points

- The persistent component of consumer prices inflation is identified as that part of inflation which is common to all goods and services in the index; this can be considered as the general underlying trend or core inflation rate across the whole economy.
- The persistent or common inflation component of the Consumer Prices Index including owner occupiers' housing costs (CPIH) was 6.8% over the 12 months to July 2023; although the all-items CPIH inflation rate reached its peak in October last year and had fallen to 6.4% in July 2023, the persistent component of the inflation rate has been slower to reach a turning point and so the subsequent fall in the inflation rate has been smaller.
- The inflation rate in the restaurants and cafes class is found to be a good measure of the underlying trend in consumer prices inflation in the UK economy.
- Across the 87 classes of goods and services making up the CPIH, there is a clear inverse relationship between items that display relative inflation persistence and those that display relative inflation volatility.

2 . Overview of persistence in consumer prices inflation

Our approach to measuring persistence in the rate of consumer prices inflation is closely related to the concept of core inflation. Core inflation is an underlying rate of inflation in the economy that is more likely to be representative of the medium-term inflation rate than the headline rate. It excludes volatile and transitory components of the price index, such as the movements in food and energy prices experienced over the last two years, which can be significant drivers of short-term inflation patterns.

There are a number of different methods for estimating core inflation. A typical and straightforward approach is to identify those classes of goods and services where prices are volatile and either remove them or give them lower weights in the inflation calculation. For example, the Office for National Statistics (ONS) definition of core inflation excludes food, energy, alcoholic beverages, and tobacco.

Core inflation can also be estimated by directly observing the more persistent components of the price index and giving them exclusive or higher weights in the inflation calculation. The most common way of doing this is a time series econometrics approach using the strength of autoregressive (AR) coefficients, that is, the extent to which the current rate of inflation of a particular good or service reflects its rate of inflation in the past. For more information about this approach, see Bank of England's Core Inflation in the UK papers and European Central Bank's Persistence-weighted Measure of Core Inflation in the Euro Area paper.

We follow a different approach in this article. We describe inflation persistence as the underlying trend inflation rate in the economy that is common across all the goods and services making up the consumer prices index (including housing costs). That is, the general path of inflation that broadly represents most of the goods and services purchased by households. Direct estimation of this underlying common trend will then serve as a measure of the persistent part of inflation.

Our methodology closely follows:

- Federal Reserve Bank of Chicago's An Alternative Measure of Inflation paper
- Federal Reserve System's common measure of inflation
- Federal Reserve Bank of New York's underlying inflation gauge
- Bank of England's How broad-based is the increase in UK inflation publication

3 . Estimating the persistent component of UK inflation

Methodology

The Office for National Statistics (ONS) publishes time series for 87 classes of goods and services making up the Consumer Prices Index including owner occupiers' housing costs (CPIH), our preferred measure of consumer prices inflation. For each of these (i = 1, 2, and so on, to 87), it is assumed that the rate of price change over 12 months ($CPIH_{i.t}$) can be split into two parts:

- A common component (S_t) that represents the trend or underlying inflation rate in the price index as a whole
- an individual component ($_{i.t}$), which for each good or service is the difference between the observed and common trend inflation rates.

Therefore, we have the following 87 equations where the inflation rate for each item is the sum of the common and individual components:

$$CPIH_{1,t} = S_t + \epsilon_{1,t} \;\; \epsilon_1 \sim (0, \sigma_1)$$

$$CPIH_{87,t} = S_t + \epsilon_{87,t} \;\; \epsilon_{87} \sim (0, \sigma_{87})$$

Each of the individual components is estimated to have a zero mean, so that over the sample period the common inflation component is an unbiased estimate of the observed inflation rate for each item. However, each of these individual components will have its own variance (var(i)). As this variance increases, a greater proportion of the inflation rate for that item is allocated to the individual component relative to the common component.

For estimation purposes it is necessary to provide some structure for the dynamic properties of the common inflation rate, which is described as the structural parameter S_t. For this, a simple AR(1) process will suffice. That is, the 12-month inflation rate is a function of the 12-month inflation rate in the previous month.

$$S_t = \rho S_{t-1} + V_t \quad V \sim (0, 1)$$

The coefficient determines the effect of the inflation rate in the previous month on the current inflation rate.

The complete model consisting of 88 equations can easily be set up in state-space form and estimated using the Kalman filter. Note that the variance of the error term governing the common inflation component () has been set equal to one. This means that we can interpret the signal-to-noise ratio for each item as 1/var(i), which reflects how much of the 12-month inflation rate ($CPIH_t$) is signal (S) compared with noise ($_i$). The greater the signal-to-noise ratio, the greater the association between that item's inflation rate and the common inflation component.

In other words, we interpret the signal-to-noise ratio for a CPIH item as a measure of its inflation persistence. Items with a relatively high signal-to-noise ratio are more strongly correlated with the common inflation component and representative of the underlying trend rate of inflation in the economy. For those items with a low signal-to-noise ratio, the individual component is a relatively more important determinant of the inflation rate.

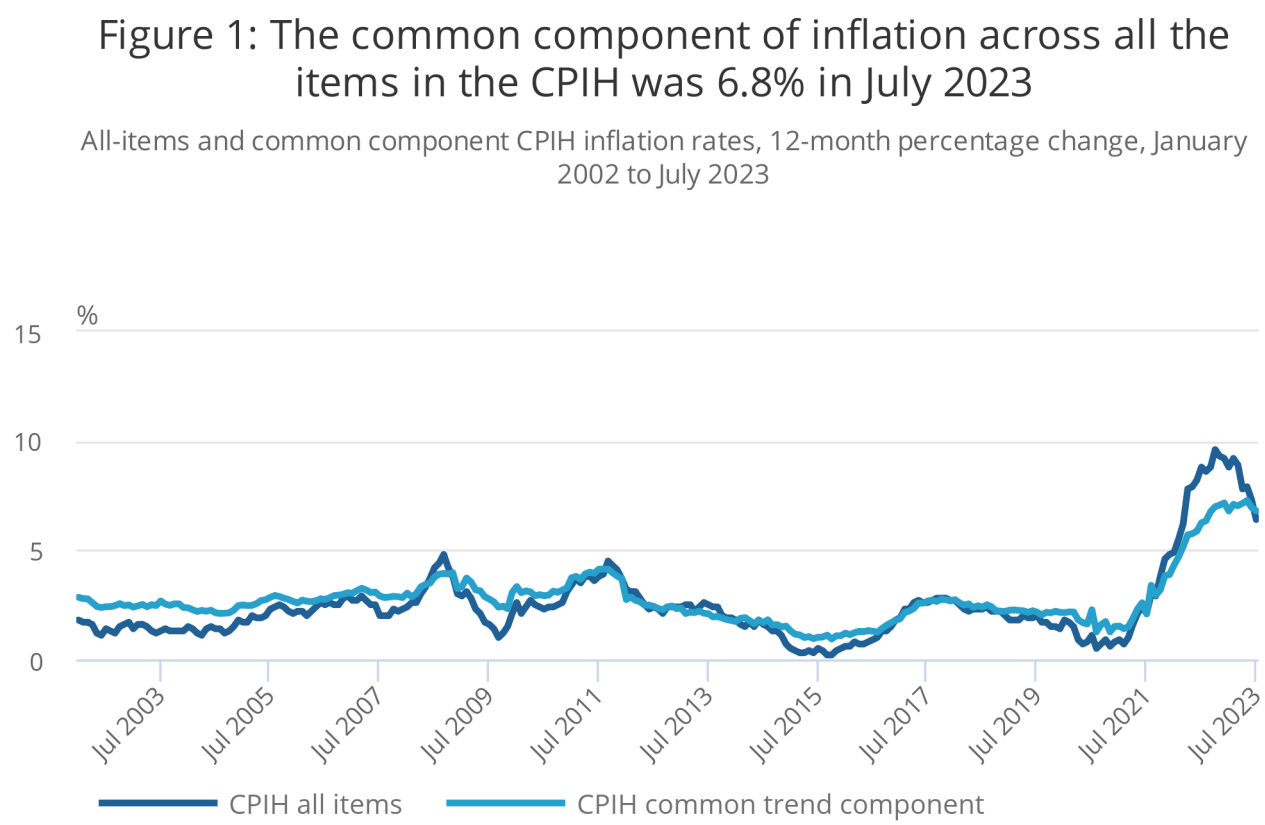
Results

Figure 1 shows our estimate of the common component of inflation in the CPIH index alongside the aggregate CPIH (all-items) inflation rate. Over the last two years there has been a steep rise in the common component inflation rate which peaked at 7.3% in May 2023 before falling to 6.8% in July 2023. The all-items rate peaked at 9.6% in October 2022 and has since fallen to 6.4% in July 2023. This is the first month since September 2021 that the common component rate has exceeded the all-items rate.

Falling energy prices have provided the largest downward contributions to the change in CPIH inflation in recent months. The relative volatility of energy prices means these items are likely to have a smaller impact on the common component inflation rate, and so largely accounts for the smaller rise in inflation compared with the all-items rate up to October 2022, and then the smaller fall in the inflation rate since then. Our estimate of the underlying inflation rate in the UK economy has been slower to reach a turning point and subsequently fall than the headline all-items inflation rate.

Figure 1: The common component of inflation across all the items in the CPIH was 6.8% in July 2023

All-items and common component CPIH inflation rates, 12-month percentage change, January 2002 to July 2023



Source: Consumer Prices Inflation and author's calculations from the Office for National Statistics

The calculation of signal-to-noise ratios for each of the 87 items gives an indication of which components of the inflation basket are more closely driven by the persistent or common component of inflation, and those which more likely reflect individual specific components.

Table 1 lists the bottom 10 CPIH items in terms of signal-to-noise ratio. These are the items that we identify as having the least inflation persistence, that is, they have a relatively weak association with the common underlying trend rate of inflation.

We note that this list is heavily occupied by energy-related items, which are broadly recognised as the most volatile components in the index and frequently excluded in core measures. For further details, see our Energy intensity of the Consumer Prices Index: 2022 article. Audio-visual and data processing type products are also identified as having low signal-to-noise, partly reflecting the strong price deflation of these items, especially after quality adjustments have been implemented, meaning price movements have behaved differently to the rest of the goods and services in the index.

Table 1: The top-10 least persistent components in CPIH inflation

CPIH item	Signal-to-noise ratio
04.5.3 Liquid fuels	9
04.5.2 Gas	14
09.1.2 Photographic, cinematographic and optical equipment	33
09.1.3 Data processing equipment	40
04.5.1 Electricity	49
07.2.2 Fuels and lubricants	79
12.5.4 Transport insurance	80
09.1.1 Reception and reproduction of sound and pictures	83
07.3.3 Passenger transport by air	91
04.5.4 Solid fuels	153

Source: Consumer Prices Inflation and author’s calculations from the Office for National Statistics

In contrast, Table 2 sets out the most persistent components in the CPIH index, that is, those that have the highest signal-to-noise ratios and a strong correlation with the common underlying trend in inflation. This list is dominated by housing services and personal and recreational services. This finding is consistent with research carried out by the Federal Reserve Bank of New York, which reports that services inflation tends to be a more important driver of core inflation than goods inflation, because it more closely follows longer-term inflation expectations and conditions in the labour market. For more information, see the Federal Reserve Bank of New York's Improving Forecasts of Core Inflation press release.

Table 2: The top-10 most persistent components in CPIH inflation

CPIH item	Signal-to-noise ratio
11.1.1 Restaurants & cafes	10793
04.1 Actual rentals for housing	5992
03.1.4 Cleaning, repair and hire of clothing	5859
07.2.1 Spare parts and accessories	4577
12.1.1 Hairdressing and personal grooming establishments	3846
11.1.2 Canteens	3724
09.4.1 Recreational and sporting services	3720
07.1.1A New cars	3613
06.2.2 Dental services	3556
09.2.1/2 Major durables for in/outdoor recreation	3554

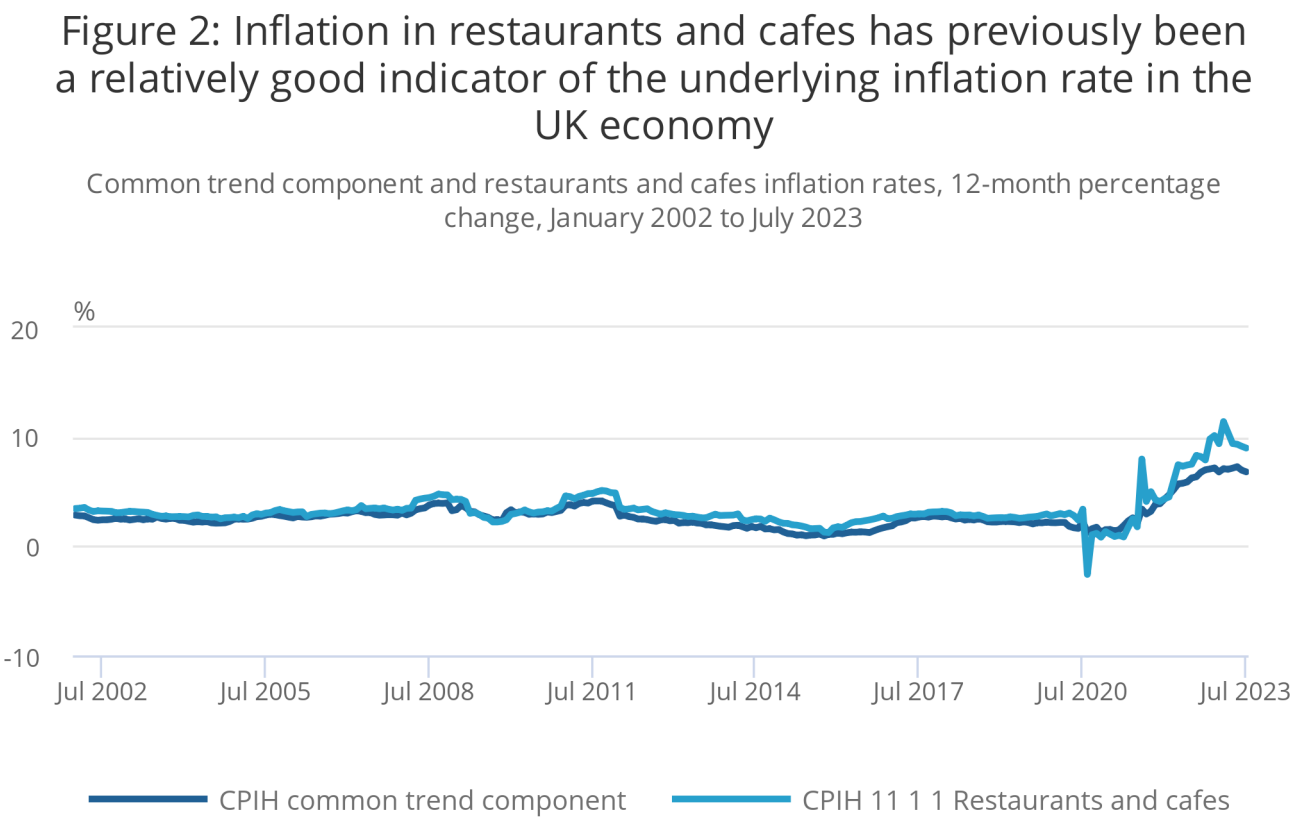
Source: Consumer Prices Inflation and author's calculations from the Office for National Statistics

One noteworthy item is the restaurants and cafes class (CPIH 11.1.1), which has a very high signal-to-noise ratio. This component of the CPIH price basket is a strong driver of the common component of inflation for the entire index (as shown in Figure 2). That is, the inflation rate in the restaurants and cafes class has historically been a good measure of the underlying trend in consumer prices inflation in the UK economy.

This might be an indicator of the relative importance of labour costs in this industry, and how these in turn are driven by labour market conditions and longer-term inflation expectations. Another factor is that inputs to the restaurants and cafes sector consist of a relatively high proportion of food and energy costs, so price movements often reflect the same broad shocks that impact the majority of items in the index. For further details, see our Energy intensity of the Consumer Prices Index: 2022 article.

Figure 2: Inflation in restaurants and cafes has previously been a relatively good indicator of the underlying inflation rate in the UK economy

Common trend component and restaurants and cafes inflation rates, 12-month percentage change, January 2002 to July 2023



Source: Consumer Prices Inflation and author's calculations from the Office for National Statistics

Notes:

1. The sharp fall in the 12-month inflation rate in August 2020 reflects the Eat Out to Help Out scheme introduced by the British Government to support the hospitality industry during the coronavirus (COVID-19) pandemic. This led to a corresponding sharp increase in the inflation rate in August 2021 because of the base effect.

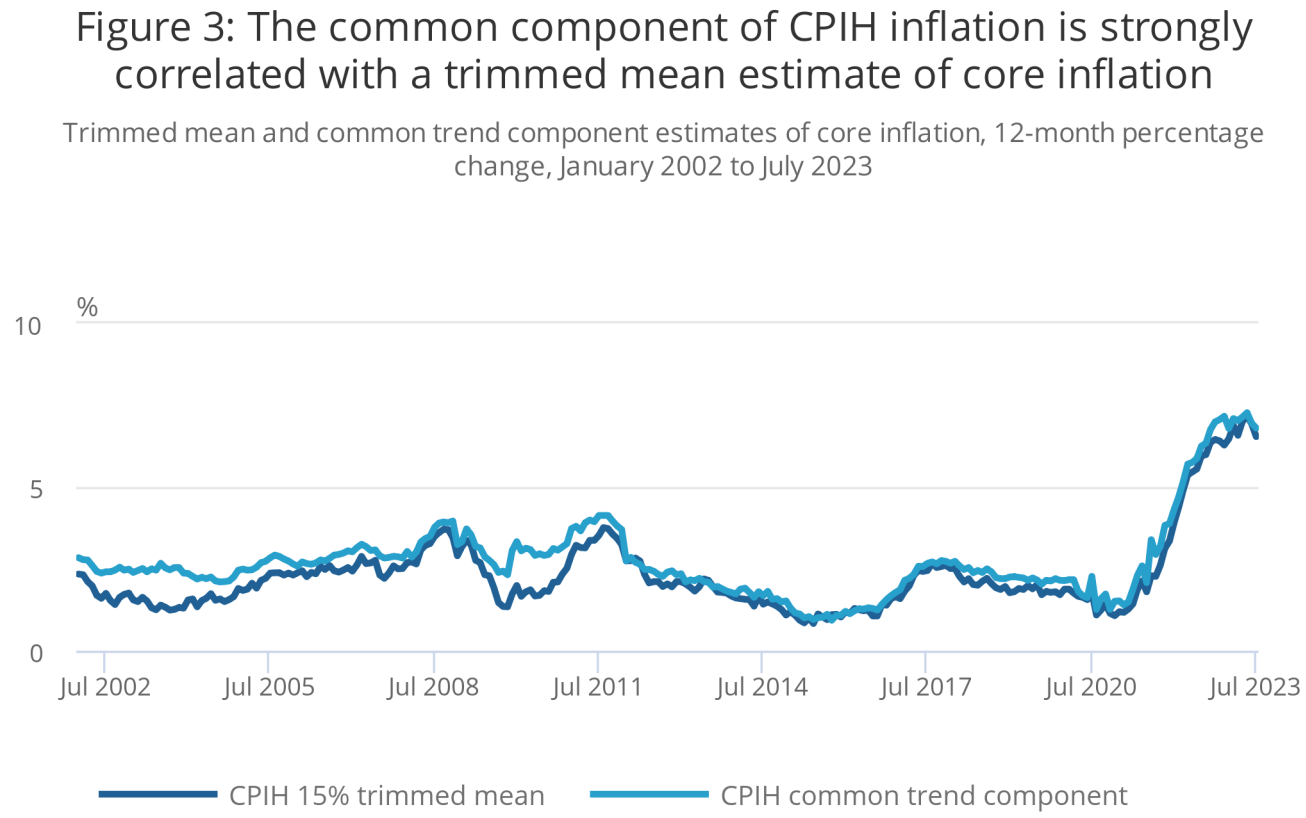
4 . Comparing persistence and volatility in the CPIH

Last year the Office for National Statistics (ONS) published estimates of core inflation based on trimmed mean calculations, where the top 15% and bottom 15% of the index by weight in terms of the size of price movements are removed. This is designed to strip out the more volatile components of the price index, leaving behind an estimate of core inflation which reflects broader and less transitory price movements. Unlike exclusion-based measures, which most National Statistics Institutes around the world use as core inflation measures, this specifically removes the more volatile price movements at the item-level in every month. For further details, see our New estimates of core inflation, UK: 2022 article.

Figure 3 plots the trimmed mean and the common component estimates of inflation. These show a high degree of coherence, a reflection that both approaches are attempting to keep persistent components and remove volatile components of the Consumer Prices Index including owner occupiers' housing costs (CPIH) (although they do so in opposite ways). Our latest estimate of the trimmed mean inflation was 6.5% in July 2023, down from a peak rate of 7.2% in May 2023. Therefore, like the estimate of the common trend rate of inflation, the turning point was later and the fall in the inflation rate was smaller than for the all-items CPIH.

Figure 3: The common component of CPIH inflation is strongly correlated with a trimmed mean estimate of core inflation

Trimmed mean and common trend component estimates of core inflation, 12-month percentage change, January 2002 to July 2023



Source: Consumer Prices Inflation and author's calculations from the Office for National Statistics

To provide further insight on how the two approaches compare, Figure 4 shows a scatter chart where each of the 87 items in the CPIH have been ranked in terms of:

- the signal-to-noise ratio, from lowest to highest (1 to 87)
- and the percentage of months for which they are trimmed, that is, when the item appears in the top or bottom 15% of all price changes, also ranked from lowest to highest (1 to 87)

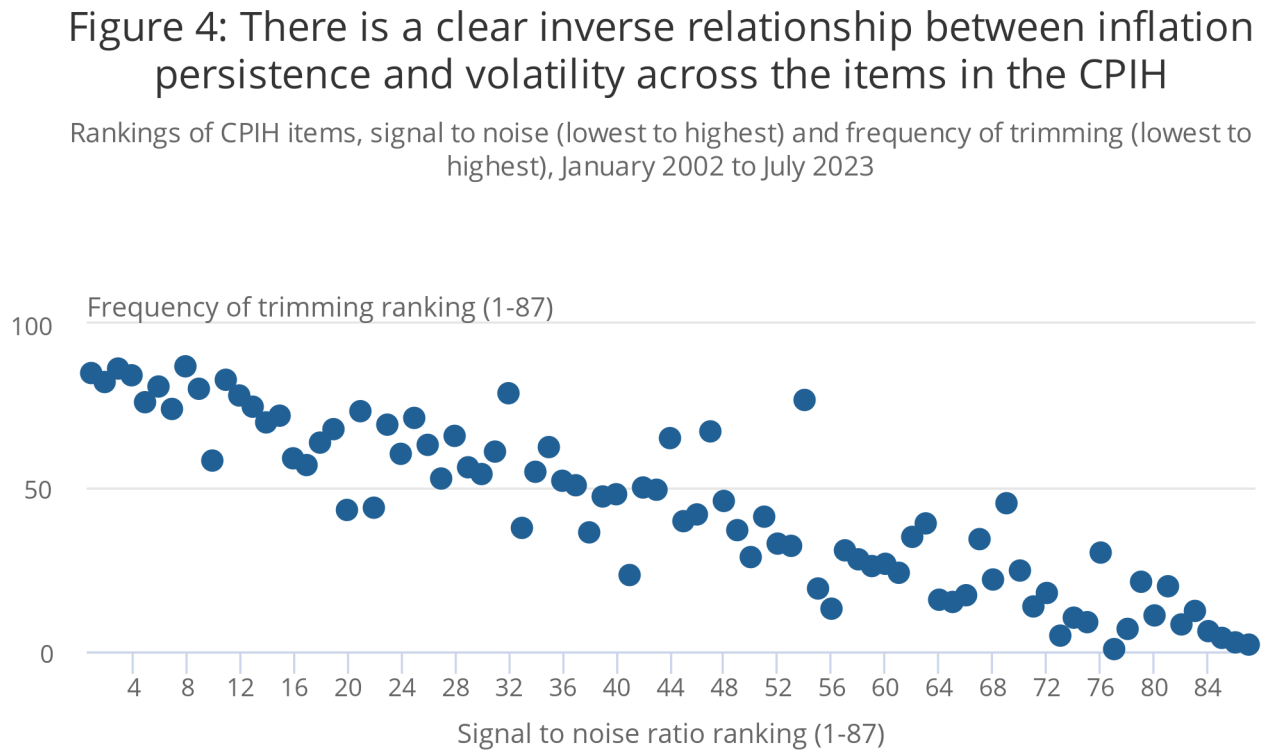
We would expect to see a negative correlation between the two. That is, the items with the smallest signal-to-noise ratio are identified to be relatively less persistent and more volatile components of the CPIH, and so are also trimmed more often. The scatter chart tends to confirm this expectation.

In Figure 4 we can also identify that energy-related and audio-visual items (Table 1) are concentrated in the top left-hand quadrant, meaning they exhibit relatively low signal-to-noise in the common component estimate of inflation and are excluded more often in the trimmed mean estimate of core inflation.

At the other end of the scale, the items found in the bottom right-hand quadrant, which are ranked relatively highly for signal-to-noise ratio and lowly for frequency at which they are trimmed, tend to reflect housing services and recreational or personal services (Table 2). This confirms the general inverse relationship between the persistence and volatility of price changes across the items in the CPIH.

Figure 4: There is a clear inverse relationship between inflation persistence and volatility across the items in the CPIH

Rankings of CPIH items, signal to noise (lowest to highest) and frequency of trimming (lowest to highest), January 2002 to July 2023



Source: Consumer Prices Inflation and author's calculations from the Office for National Statistics

We will continue to monitor the persistent component of consumer prices inflation in understanding the underlying trend or core inflation rate in the economy.

5 . Persistence in consumer prices inflation data

Consumer price inflation tables
Dataset | Released 16 August 2023
Measures of monthly UK inflation data including CPIH, CPI and RPI. These tables complement the consumer price inflation time series dataset.

6 . Glossary

Consumer price inflation

Consumer price inflation is the rate at which the prices of goods and services bought by households rise or fall. It is estimated by using price indices.

Consumer Prices Index (CPI)

The CPI is a measure of consumer price inflation produced to international standards and in line with European regulations. The CPI is the inflation measure used in the UK government's target for inflation.

Consumer Prices Index including owner occupiers' housing costs (CPIH)

CPIH is the most comprehensive measure of inflation in the UK. It extends the Consumer Prices Index (CPI) to include a measure of the costs associated with owning, maintaining and living in one's own home, known as owner occupiers' housing costs (OOH), along with Council Tax. Both are important expenses for many households and are not included in the CPI.

7 . Data sources and quality

More information about our UK Consumer Prices Indices methodology is available in our article, Consumer price indices, a brief guide, and in our Consumer Price Inflation Quality and Methodology Information report.

8 . Related links

Food and energy price inflation, UK: 2023\
Article | Released 23 May 2023
Food, energy, and core price inflation in the UK, and insights as to why UK inflation might be higher than in other advanced economies.

The energy intensity of the consumer prices index: 2022
Article | Released 17 April 2023
Estimates of the direct and indirect energy intensity of the Consumer Prices Index.

The dispersion of price changes in the consumer prices index: 2022
Article | Released 16 March 2023
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).

Demand and supply factors in CPI inflation, UK: 2021 to 2022
Article | Released 9 March 2023
Insights into the effects of the re-opening of economies and supply bottlenecks on Consumer Prices Index (CPI) inflation in 2021 and 2022.

New estimates of core inflation, UK: 2022
Article | Released 10 October 2022
Measures of consumer prices inflation excluding the items that record the more volatile price changes each month.

9 . Cite this article

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