Consumer price inflation, historical estimates, UK, 1950 to 1988 – methodology

A historical series of our lead measure of inflation, the Consumer Prices Index including owner occupier's housing costs (CPIH), which extends the series back to 1950. Definitive historical division-level indices for both Consumer Prices Index (CPI) and CPIH from 1950 to 1988 are available. Data in this release are not a National Statistic and are provided for indicative purposes only.

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To be announced

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1 . Main changes

- Remodelling the Consumer Prices Index (CPI) historical series between 1950 and 1988 has generally resulted in a lowering in the CPI 12-month inflation rate of 0.2 percentage points on average.
- Restaurants and hotels is most affected by the remodelling exercise.
- On average, the Consumer Prices Index including owner occupier's housing costs (CPIH) annual inflation is 0.6 percentage points lower than CPI over the period between 1950 and 1988; the difference is driven by the housing and household services division, which is the only division that differs for the two measures.
- On average, the CPIH 12-month inflation rate for housing and household services is 4.9 percentage points lower than the equivalent CPI division over the period from 1950 to 1988.

2 . Overview of historical estimates of consumer price inflation

Consumer price inflation is the rate at which the prices of goods and services bought by households for the purpose of consumption rise or fall. The Consumer Prices Index including owner occupiers' housing costs (CPIH) is the ONS's lead measure of consumer price inflation. This replaced the Consumer Prices Index (CPI) as the headline figure in March 2017, which has the same coverage but with the addition of Council Tax and owner occupiers' housing costs in CPIH.

Owner occupiers' housing costs (OOH) are the costs associated with owning, maintaining and living in one's own home. They are distinct from the purchase cost of a house, which is the purchase of an asset. CPIH uses the "rental equivalence" approach to measuring these costs. This attempts to determine the value of the rent for an equivalent property in the private sector. The equivalent rent value serves as a proxy for the flow of services that the owner occupier receives from their house. You can find out more about how the rental equivalence measure of OOH is constructed in our CPIH Compendium.

Until now, there has only been limited time-series data available for CPIH. In 2018, we published a series of estimates for CPIH from 1988 to its introduction in 2005. In this new release, we have made use of new data sources and modelling to extend this series back in time.

The limited data pertaining to the rental equivalence and Council Tax components over the period comes primarily from components of the Retail Prices Index (RPI).

Estimates for missing periods make use of additional sources such as:

- the RPI Rent and Rates index (which is the nearest equivalent to actual rents in the classification structure used in CPIH)
- an implied price deflator for imputed rental values from Household Final Consumption Expenditure survey data
- modelling of missing periods

This release is complementary to the previous release. In addition to extending the series back between 1950 to 1988, this release includes a new re-working of our previous modelled CPI series over the same period. It accounts for revisions to the historically modelled part of the series between 1989 and 1996 in the 2018 publication. The Restaurants and accommodation services division is most affected by the remodelling exercise.

The calculation of CPIH for this period uses the same model as the new CPI series. However, the Housing and household services division is modelled independently of the new CPI series, given the differences in coverage.

The CPIH model is derived by expanding the CPI model. We therefore first present the development of a remodelled CPI series before discussing the creation of a CPIH historical series for the same period based upon it. Our article entitled Consumer price inflation, historical estimates, UK: 1950 to 1988, published 18 May 2022, provides a contextual analysis of the historical price movements in this extended time series.

3 . A remodelled Consumer Prices Index series, 1950 to 1988

Revisions made in 2018 to the original Consumer Prices Index (CPI) historical modelled estimates between 1989 and 1996, suggest that the modelled series for earlier periods (1950 to 1988) would also benefit from a remodelling exercise to improve the quality. A new model specification has been designed for the CPI historical series, including these revised estimates, to create a single consistent series across the whole time period. For more information on the revision to the CPI series, please refer to our Consumer Prices Index including owner occupiers' housing costs (CPIH) historical series 1988 to 2004 article.

The new model specification is designed following the same approach as previous publications. Broadly, that approach is to:

1. adjust the Retail Prices Index (RPI) 12-month inflation series to reflect differences in scope and coverage from CPI, and to map RPI growths to the Classification of Individual Consumption according to purpose (COICOP) , which is an international harmonised classification structure used in the CPIH and CPI

2. specify an autoregressive integrated moving average (ARIMA) model of the impact of the change in formula used in the CPI and RPI; the model inputs are the adjusted RPI described in the first point and the equivalent CPIH divisions from 1989 onwards

3. derive index values from the modelled 12-month CPI inflation rates for each division, and COICOP weights from RPI weights using the same adjustments as in the first point, then calculate the all-items index for CPI and derive 12-month inflation rates from it

The main difference in the calculation of the remodelled series is in the design specification of each model for the divisions of the CPI structure. Each division was reconsidered, receiving an alteration to improve the fit of the model to the revised data. These data now also include more recent publications for use in modelling, up to 2019. The model specifications are detailed in Table 1. Full details of the original modelling approach can be found in our article, Modelling a back-series for the Consumer Prices Index, 1950 - 2011.

Table 1: Model specifications for consumer price inflation divisions
Divisions, selected ARIMA order and seasonal component

	Model specification	
Division	**Selected ARIMA Order (p,d,q)**	**Seasonal Component (P,D,Q)**
Food and non-alcoholic beverages	(1,1,1)	(0,0,1)
Alcohol and Tobacco	(0,1,1)	(1,0,0)
Clothing and footwear	(0,1,0)	(1,0,0)
Housing and household services	CPIH (1,1,0)	(0,0,1)
	CPI (0,2,1)	
Furniture and household goods	(0,1,1)	(0,0,1)
Health	(1,1,0)	(1,0,0)
Transport	(0,1,2)	(1,0,0)
Communications	(0,1,1)	(0,0,1)
Recreation and Culture	(3,1,1)	(1,0,1)
Education	N/A	N/A
Restaurants and hotels	(0,1,0)	(0,0,1)
Miscellaneous Goods and Services	(0,2,1)	(1,0,1)

Source: Office for National Statistics

Notes

1. An ARIMA model specification is given in terms of three components, typically denoted (p, d, q). The p component is used to denote the number of time lags of the autoregressive model; that is, the number of previous periods for which the previous values of the variable are used as predictors of the current value. The d component is the minimum number of times that we need to take the previous value of the series from the current value in order to make the series stationary (independent of time). This is so we can apply the autoregressive and moving average components of the model. The q component is the number of previous periods used within the moving average calculation.

2. We separate the non-seasonal from the seasonal components of the model. The latter consider each component with respect to the seasonality of the data, and they are specified separately. For example, how many times the series must be differenced with respect to the same time in the previous season.

Because of historical data limitations, there are areas where there are no usable data in the historical RPI series between 1947 to 1987. Education was not included in CPI calculations prior to 2000, four years after CPI was first introduced. This means that in the education division there are no equal and no alternative data sources available. Therefore, no ARIMA specification and no estimates of education costs are calculated.

The coverage of modelled estimates over the earlier years of the series has also been expanded from previous work. Every division within the COICOP structure, other than education, now has modelled estimates from 1950 onwards.

To map RPI 12-month inflation rates onto the COICOP classifications, a similar approach has been taken to that used in our CPIH historical series: 1988 to 2004. Those sections which did not map directly into a single COICOP division have their weights shared across the relevant divisions. For example, alcohol sales has a proportion of its weight from the RPI placed into the measuring of alcohol in hotels, restaurants and cafes. This is so it represents the sales of alcoholic drinks in these places, as per the COICOP specification. Consequently, there may be some differences in the adjusted RPI data over the estimated period. As these changes are applied throughout the series, users can expect changes when compared with the original estimates. A description of the mappings from RPI divisions to CPI divisions is given in Table 2.

Table 2: Details of adjustments to the RPI series

CPI Division	RPI Index contributing (%)	1949-51	1952-55	1956-61	1962-73	1974-86
Food & non-alcoholic beverages	Food	100	100	100	100	100
Alcohol & Tobacco	Alcohol	47	100	47	45	64
	Tobacco	53	0	53	55	36
Clothing & Footwear	Clothing & footwear	100	100	100	100	100
Housing & Household Services	Fuel & light	52	52	38	38	42
	Rent & Imputed rent	48	48	61	34	20
	Rates and water charges	0	0	0	18	18
	Water charges	0	0	0	0	4
	DIY materials	0	0	0	10	11
	Repair and maintenance charges	0	0	0	0	5
Furniture & Household Goods	Furniture	18	13	23	22	18
	Furnishings	13	13	0	0	17
	Electrical appliances	20	13	14	19	20
	Other household equipment	14	13	8	6	13
	Household consumables	19	10	17	11	18
	Domestic services	7	19	19	21	6
	Personal services	9	19	19	21	8
Health	Chemist goods	100	100	100	100	100
Transport	Fares	100	100	56	4	15
	Purchase of motor vehicles	0	0	44	24	34
	Maintenance of motor vehicles	0	0	0	24	11
	Petrol & oil	0	0	0	24	29
	Vehicle insurance & tax	0	0	0	24	11
Communications	Postage	100	100	100	50	20
	Telephone charges etc.	0	0	0	50	80
Recreation & Culture	Pet care	18	32	27	29	7
	Audio-visual equipment	47	21	20	0	12
	Records, toys, photos & sports	23	15	16	26	29
	Leisure services	12	32	22	26	30
	Books & newspapers	0	0	15	19	18
	Gardening products	0	0	0	0	4

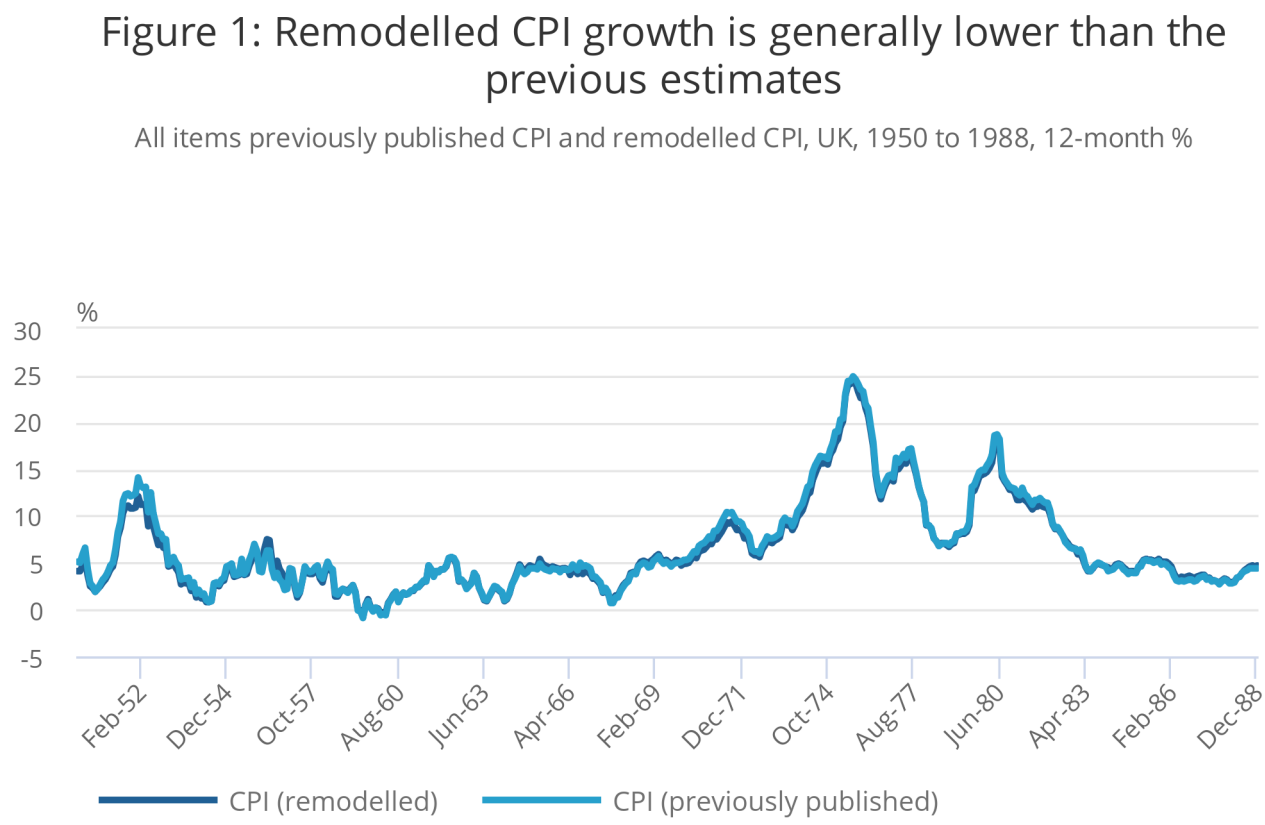
Education	**None**	-	-	-	-	-
Restaurants & Accommodation services	**Alcoholic drink**	100	100	100	60	60
	Catering	0	0	0	40	40
	Fees and subscriptions	30	40	34	0	27
Miscellanous Goods & Services	**Domestic services**	30	40	34	67	23
	Chemist goods	40	20	32	33	50

Source: Office for National Statistics

To generate an overall “all items” headline rate for CPI, divisional estimates are aggregated using RPI weightings, similarly mapped to CPI divisions and rescaled so that they sum to one. This differs from the previous modelling exercise, where any residual weight was placed on an index with a constant annual growth rate of zero. The newly modelled series also incorporates the revised CPI data over the period 1989 to 1996. This has a varying effect across the divisions, owing to the changes in the data being used.

Figure 1: Remodelled CPI growth is generally lower than the previous estimates

All items previously published CPI and remodelled CPI, UK, 1950 to 1988, 12-month %



Source: Office for National Statistics

Our new series typically exhibits lower growth rates than the previously published series. On average, the series is 0.2 percentage points lower over the period between 1989 to 1996. However, the differences can be larger or smaller over different periods of time. The changes described in Figure 1 result in improved data quality and modelling, whilst still showing approximately the same trend as the previous series. The differences in the old and new series are most pronounced in the series for Restaurants and hotels (Figure 2).

Figure 2: Restaurants and hotels show the largest differences after remodelling

Inflation estimates by division, previously published CPI and remodelled CPI, UK, 1950 to 1988, 12-month %

Download the data

.xlsx

In the case of restaurants and hotels, this is because of treatment of alcohol prices. Previously, the restaurants and hotels division was represented by catering in RPI. Alcohol and tobacco in CPI was represented by the RPI categories for alcoholic drink, and tobacco. However, alcoholic drink includes both on and off sales of alcohol. Therefore, for this model, the weight for alcoholic drink has been split across both restaurants and hotels, and alcohol and tobacco in CPI. This can be observed by comparing the movements in Figure 2 for these divisions, which demonstrate similar movements after the remodelling exercise.

Previously published and remodelled estimates for the majority of the remaining divisions are very similar in both series. However, where estimates differ, this is likely to be because of the differences in the mapping of RPI to CPI, as well as the differing ARIMA specifications used.

4 . A Consumer Prices Index including owner occupiers' Housing costs (CPIH) series, 1950 to 1988

With the recreation of the Consumer Prices Index (CPI) historical series, it is possible to incorporate the cost of owner occupiers' housing and to reuse this methodology to create a historical CPIH series. The same approach is used with the incorporation of rental estimates and rates in an adjusted series to simulate the owner occupiers' housing costs (OOH) component. An autoregressive integrated moving average (ARIMA) model is then used to estimate the differences between the adjusted Retail Prices Index (RPI) and CPIH Housing and household services series. It is therefore a model of the formula differences between the two measures.

This approach is complicated because of a lack of readily available data for rental estimation for owner occupiers, though rates are easier to obtain. This is because they are incorporated within the RPI calculation. Rents' data for owner occupiers are included in the RPI over the period 1956 to 1974. Therefore, data for other periods covered in the time series must be sourced elsewhere. The data used to incorporate the imputed rental index and rates or Council Tax into the adjusted RPI inflation rate over different time spans, is described in the following subheadings.

Imputed rents in the RPI in:

- 1950 to 1955 were not available, so the rent and rates index was used
- 1956 to 1962 were included in the overall housing index using the housing index as the price indicator
- 1962 to 1974 were included in the rents index using the rents index as the price indicator
- 1975 to 1987 were not available, so the imputed rents deflator from the National Accounts was used

Rates or council tax in:

- 1950 to 1951 were included in rents and rates
- 1952 to 1962 were included in RPI housing
- 1962 to 1974 were rates and water charges

The weights for imputed rents in:

- 1950 to 1955 were 1.5%
- 1956 to 1974 were the RPI weight
- 1975 to 1985 were interpolated using the growth from the Family Expenditure Survey data
- 1985 to 1987 were National Accounts household expenditure data

Imputed rents were included in the RPI from January 1956 to January 1975, when the method for calculating OOH was reviewed by the RPI Advisory Committee and changed. The reasons for this were because of criticisms that: "House buyers have been very conscious of rising prices and mortgage interest rates" and that: "Rented housing and owner-occupied housing were now distinct housing markets" (RPI Advisory Committee, 1975). However, the housing market in 1975 was very different to that of today, and the data sources available to the price statisticians at the time were more limited.

For the period January 1975 to January 1988, the imputed rents deflator from the 2014 National Accounts dataset was used. Straight line interpolation between the quarterly data points were used to get a monthly series.

The weight of imputed rents during the period 1975 to 1985 is not available from National Accounts. Household budget survey data were instead used to estimate the weights, pre-1985. Imputed rents were calculated by multiplying the average rents by number of rooms by the corresponding number of similar sized owner-occupier households. Knowing the average weekly spend by households, it is then possible to calculate the weight for imputed rents.

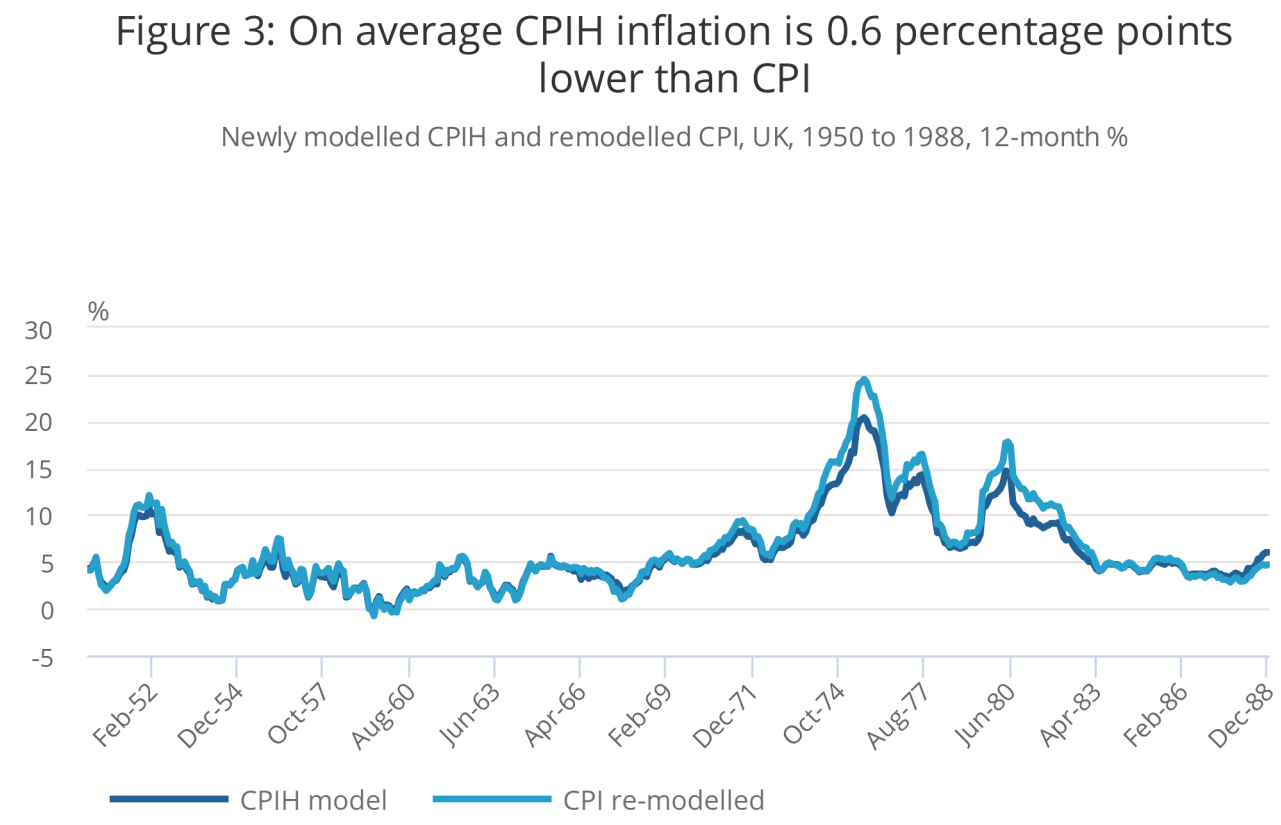
For the periods prior to 1956, imputed rents were represented by the RPI index for rent and rates. This was given a weight of 1.5%, which roughly corresponds to its share of the RPI index in 1956.

A new ARIMA model specification is created for the CPIH housing and household services division. It differs to the one created for the CPI series to account for the differences in the two measures (Table 1). As with the CPI modelling exercise, there is no usable data for the education division, therefore this series has not been modelled. The adjusted RPI weights are then used to derive an all-items index and 12-month inflation rates, incorporating the additional elements of OOH in CPIH.

The modelled CPIH is compared with the remodelled CPI in Figure 3. On average, CPIH 12-month growth is 0.6 percentage points lower than CPI 12-month growth. From 1975 onwards, these differences are more pronounced in the periods of higher inflation. Here, the CPIH 12-month rate is generally 1.1 percentage points lower than CPI, whereas prior to 1975 it is generally 0.3 percentage points lower. Further analysis of the historical price movements in this extended time series is provided in our Consumer price inflation, historical estimates, UK: 1950 to 1988 article.

Figure 3: On average CPIH inflation is 0.6 percentage points lower than CPI

Newly modelled CPIH and remodelled CPI, UK, 1950 to 1988, 12-month %

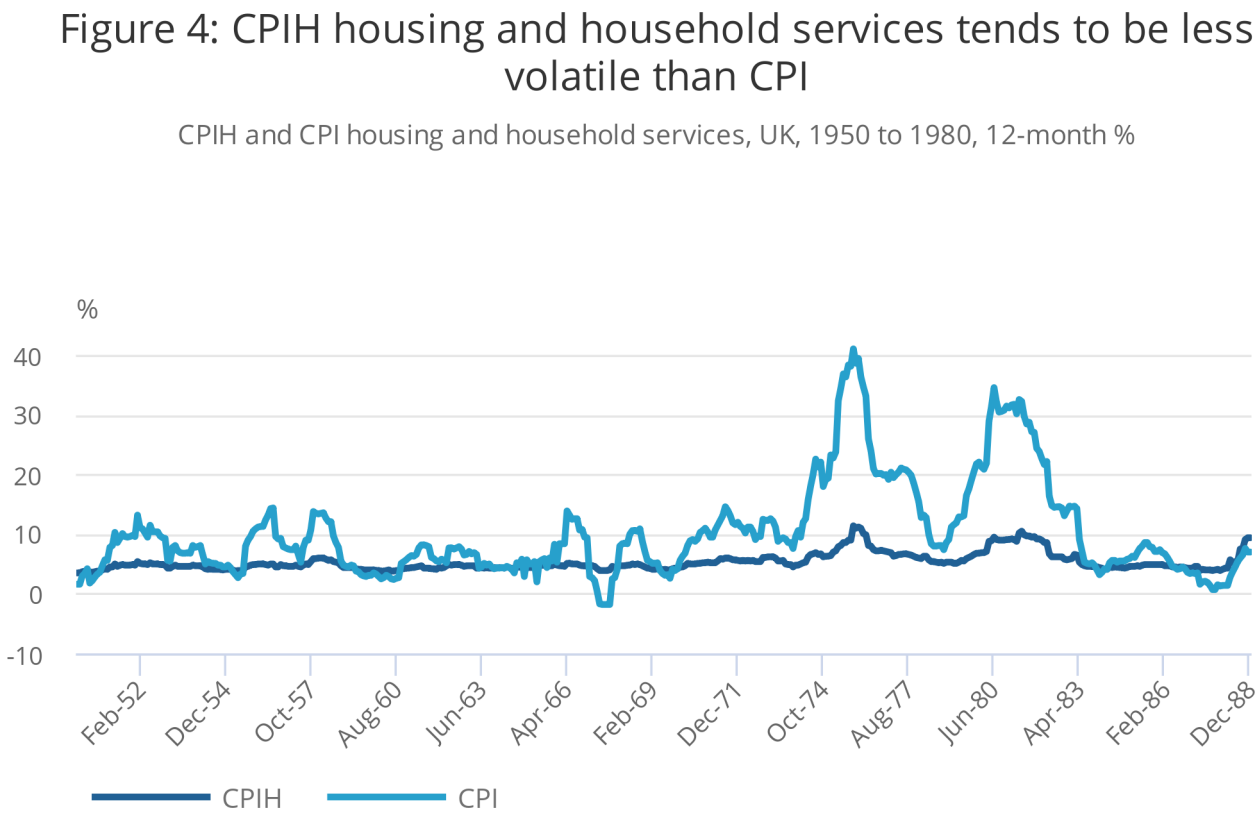


Source: Office for National Statistics

The only difference between CPIH and CPI is in the housing and household services division, as this includes both imputed rents and Council Tax. Therefore, it is this division that is driving the differences between the two series. Figure 4 shows housing and household services for both the CPIH and CPI models. Like the all-items aggregate, the differences between CPIH 12-month inflation and CPI are generally more pronounced after 1975. Across the period from 1950 to 1988, CPIH is 4.9 percentage points lower than CPI. Prior to 1975, CPIH is 2.9 percentage points lower than CPI; however, from 1975 onwards, this increases to 8.6 percentage points lower on average. Overall, the CPIH housing and household services division tends to show less volatile growth than the equivalent CPI division.

Figure 4: CPIH housing and household services tends to be less volatile than CPI

CPIH and CPI housing and household services, UK, 1950 to 1980, 12-month %



Source: Office for National Statistics

5 . Future developments

In addition to the development of a historical series for our consumer price inflation statistics presented in this article, we are undertaking a programme of transformation. This will include identifying new data sources, improving methods, and developing systems to improve both the Consumer Prices Index including owner occupiers' housing costs (CPIH) and the Consumer Prices Index (CPI).

The Office for National Statistics (ONS) currently collect most local price data from physical stores and shops. In the future, our consumer price statistics will be a mix of traditionally collected data, existing administrative data, and a variety of new data sources. This is outlined in our Transformation of consumer price statistics April 2022 article.

These developments are part of a continuous programme of improvement. In 2023, we are prioritising the inclusion of new data and methods in rail fares and second-hand cars, because of new data availability. In 2024, our focus will be on groceries and private rents, building up the scale of transformation over time. Our ambition is to bring in new data sources for further areas of the inflation basket, and continue to improve these statistics over the coming years. These new data sources will not affect historical estimates of CPIH and CPI, which are rarely revised.

In addition, we are also continuing to develop our Household Costs Indices (HCIs). These are slightly different to traditional inflation measures and look directly at the changes in spending by different household types, such as retired or low-income households. As well as those items included in headline consumer inflation, it includes additional items such as, direct changes in mortgage interest payments, and insurance costs paid by households. HCIs also use a different method of weighting together price changes, which give all households an equal weight. Our most recent Household Costs Indices, UK: fourth preliminary estimates, 2005 to 2021 were published on 4 May 2022.

We are also producing further analysis to help users understand the impact of rising consumer price inflation on UK households. More information on this is available in our article The cost of living, current and upcoming work: March 2022.

6 . Related links

Consumer price inflation, UK
Bulletin | Released 18 May 2022
Price indices, percentage changes, and weights for the different measures of consumer price inflation.

Consumer price inflation, historical estimates, UK 1950 to 1988
Article |18 May 2022
A historical series of the Consumer Prices Index including owner occupier's housing costs (CPIH) and Consumer Prices Index (CPI) which extends the series back to 1950. Definitive historical division-level indices for both CPI and CPIH from 1950 to 1988 are available. Data in this release are not a National Statistic and are provided for indicative purposes only.

Consumer Prices Index including owner occupiers' Housing costs (CPIH) historical series: 1988 to 2004
Article | Released 14 December 2018
A historical series of our lead measure of inflation, CPIH, which extends the series back to 1988. Historical class-level indices for both CPI and CPIH are available for the first time. Data in this release are not a National Statistic.

Modelling a back series for the Consumer Prices Index, 1950 – 2011
Article | Released 31 July 2014
This paper describes a method used to produce a modelled back series for CPI growth rates covering the period 1950 to 1988. The difference between the RPI and the CPI is modelled back through time using an autoregressive integrated moving average (ARIMA) model and other available data. Series included in the approach include the 12 two-digit CPI categories and the all-items series.

The Harmonised Index of Consumer Prices: historical estimates
Article | Released December 1998
The UK Harmonised Index of Consumer Prices (HICP) was first published in February 1997. The index started in January 1996 and the first 12-month inflation figures were for January 1997. The Office for National Statistics (ONS) constructed estimates of the UK HICP back to 1988. This article presents these estimates and explains how they were derived.