

Article

# Measures of owner occupiers' housing costs, UK: April to June 2017

Understanding the different approaches of measuring owner occupiers' housing costs (OOH) associated with owning, maintaining and living in one's own home.

Contact:  
cpi@ons.gov.uk  
cpi@ons.gov.uk  
+44 (0)1633 455171

Release date:  
12 September 2017

Next release:  
12 December 2017

## Table of contents

1. [Main points](#)
2. [Introduction](#)
3. [A brief description of owner occupiers' housing costs](#)
4. [Payments](#)
5. [Net acquisitions](#)
6. [Rental equivalence](#)
7. [Comparing the different approaches of measuring owner occupiers' housing costs](#)
8. [Annex 1: List of published articles on the different approaches of measuring OOH](#)
9. [Annex 2: Methodology](#)
10. [Annex 3: Weights analysis](#)

# 1 . Main points

- Owner occupiers' housing costs (OOH) in the UK under the rental equivalence approach have grown by 2.0% in Quarter 2 (Jan to Mar) 2017 compared with the corresponding quarter of the previous year.
- OOH according to the net acquisition approach have grown by 2.5% in Quarter 2 2017.
- OOH compiled using the payments approach experienced growth of 0.5% in Quarter 2 2017.

## 2 . Introduction

This series of articles aims to provide more information about the different approaches to measuring owner occupiers' housing costs (OOH) to aid your understanding of the differences in concept and underlying methodology. It will be updated on a quarterly basis to evaluate the performance of the different measures over time, in prevailing economic conditions. We invite you to submit feedback on this release to [cpi@ons.gov.uk](mailto:cpi@ons.gov.uk).

We have published a number of articles that summarise the different approaches of measuring OOH. Table 1 in Annex 1 provides a link to each paper and a summary of its contents. For more general information on the Consumer Price Index including owner occupiers' housing costs (CPIH), please see the [CPIH compendium](#).

You should note that the payments approach and net acquisitions are both experimental indices and therefore we would caution against any use other than for research purposes. More information on the methodology for each approach can also be found in Annex 2.

## 3 . A brief description of owner occupiers' housing costs

The Consumer Prices Index including owner occupiers' housing costs (CPIH) extends the Consumer Prices Index (CPI) to include a measure of owner occupiers' housing costs (OOH), along with Council Tax. OOH are the costs of housing services associated with owning, maintaining and living in one's own home. This is distinct from the cost of purchasing a house, which is partly for the accumulation of wealth and partly for housing services.

There is not a single defined measure of OOH because they can be calculated differently depending on what the target is. In particular, should OOH be measured at the point of acquisition of the housing service, the point of use, or the point at which it is paid for? Each of these three approaches has its own specific methodological strengths and weaknesses, and is measured using different methods.

## 4 . Payments

### What is the payments approach?

The payments approach aims to measure the payments related to the ownership of owner occupier housing. This means that all payments that households make as owner occupiers when consuming housing should be included, such as mortgage interest payments, transaction costs and running costs. The payments approach is not our favoured method to measuring owner occupiers' housing costs (OOH) in the Consumer Prices Index including owner occupiers' housing costs (CPIH). This is because a consumer price index aims to measure consumption, and interest payments represent the cost of borrowing money rather than the cost of consumption.

OOH (Payments) is an experimental series and we therefore advise using it with some caution. We are continuing to work on identifying possible improvements to the current methodology and data sources. Any changes to the index will be highlighted in future releases and we will update the methodology section and historical series accordingly. For more information on the current methodology and data sources used to construct the OOH (Payments) approach, please see Annex 2A.

## Payments approach

The payments approach is calculated using the following model:

Payments approach = Mortgage interest payments

- + Council Tax (Great Britain)
- + Northern Ireland rates
- + Dwelling Insurance
- + Ground rent
- + Stamp duty
- + Estate agent fees
- + Home-buyers survey
- + Major repairs and maintenance
- + House conveyancing

## Latest figure and long-term trend

Owner occupiers' housing costs (OOH) compiled using the payments approach – OOH (Payments) – rose by 0.5% as compared with Quarter 2 (Apr to June) 2016 (Figure 1). This is an increase from the previous quarter and is still broadly in line with historical trends, which have seen growth in OOH (Payments) fluctuating around 0% since the beginning of 2014.

Figure 2 presents the contributions to the quarterly growth rate of OOH (Payments) from the sub-indices used in its construction. Mortgage interest payments remain the largest negative contributor, unchanged from the previous quarter. This could still be due to the drop in the Bank of England base rate to 0.25% in August 2016. Council Tax remains the highest positive contributor.

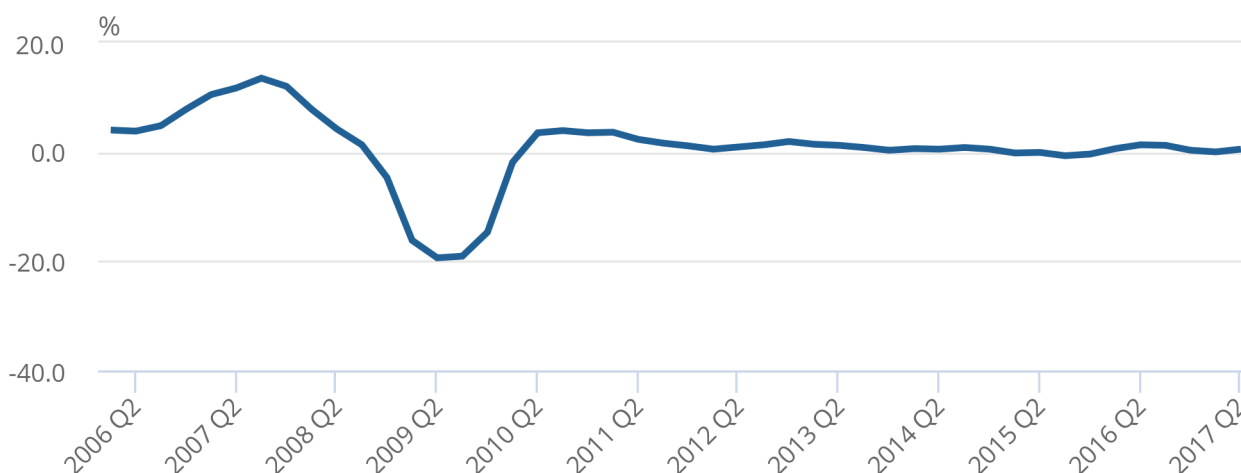
For a longer time series of contributions, please see the [dataset](#) presented alongside this release.

### Figure 1: OOH (Payments) growth rate, quarter on corresponding quarter of previous year

UK, Quarter 1 (Jan to Mar) 2006 to Quarter 2 (Apr to June) 2017

#### Figure 1: OOH (Payments) growth rate, quarter on corresponding quarter of previous year

UK, Quarter 1 (Jan to Mar) 2006 to Quarter 2 (Apr to June) 2017



Source: Office for National Statistics

#### Notes:

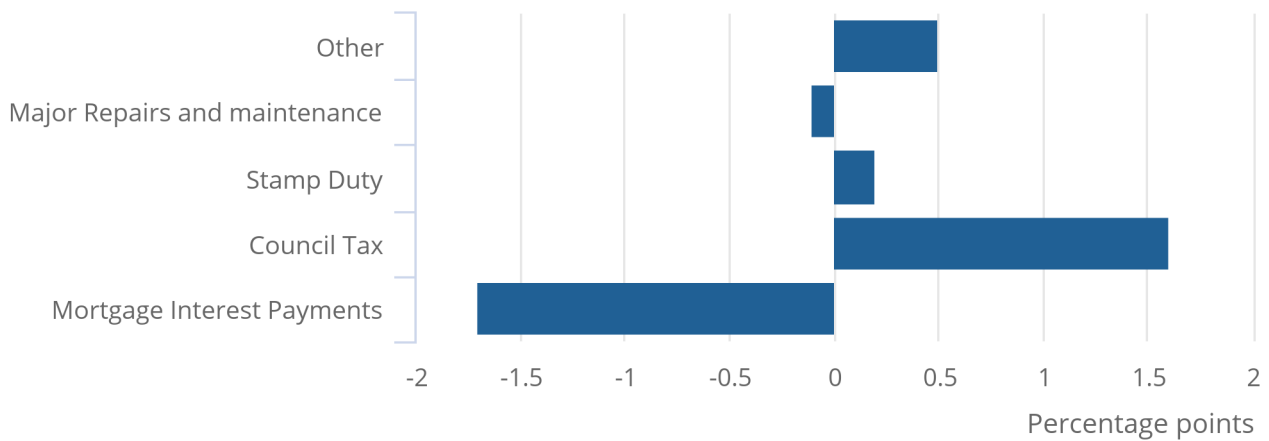
1. Q1 refers to Quarter 1 (January to March); Q2 refers to Quarter 2 (April to June); Q3 refers to Quarter 3 (July to September); and Q4 refers to Quarter 4 (October to December).

**Figure 2: Contributions to percentage change in OOH (Payments) from component sub-indices, latest quarter on corresponding quarter of previous year**

UK, Quarter 2 (Apr to June) 2017

Figure 2: Contributions to percentage change in OOH (Payments) from component sub-indices, latest quarter on corresponding quarter of previous year

UK, Quarter 2 (Apr to June) 2017



Source: Office for National Statistics

Notes:

1. Contributions may not sum due to rounding. Council Tax includes Council Tax in Great Britain and Northern Ireland rates. Other includes dwelling insurance, ground rent, estate agent fees, home-buyers survey and house conveyancing.
2. Q1 refers to Quarter 1 (Jan to Mar); Q2 refers to Quarter 2 (Apr to June); Q3 refers to Quarter 3 (July to Sept); and Q4 refers to Quarter 4 (Oct to Dec).

## 5 . Net acquisitions

## What is the net acquisitions approach?

The net acquisitions approach to measuring owner occupiers' housing costs (OOH (NA)) theoretically treats a home as the purchase of a good that is part asset (the land) and part consumable (the house) and excludes the land component from the index. OOH (NA) also includes costs associated with buying and maintaining a house; for example, self-builds and renovations, repairs and maintenance, transfer costs and dwelling insurance. The "net" principle in net acquisitions relates to the fact that only transactions that occur between the OOH sector and other sectors (for example, construction firms and private landlords) should be included.

In practice, while the measure presented here is the best measure of the net acquisitions approach that we can currently produce, the lack of available source data means that some components are not recorded fully. For instance, because of the lack of available data, the methodology used does not separate between the land and house price, and therefore there will be some measure of asset price included in the example. We therefore advise that OOH (NA) should be used and referred to with caution and it is consequently not our favoured approach of measuring OOH in Consumer Prices Index including owner occupiers' housing costs (CPIH).

As with the OOH (Payments) approach, it is an experimental index and we will continue to work on improving the methodology and data sources used in the index. For more information on the methodology used to construct OOH (NA), please see Annex 2B.

## Net acquisitions approach

The net acquisitions approach is calculated using the following model:

Net acquisitions approach = Acquisition of new dwellings

- + Self builds and renovations
- + Existing dwellings new to the OOH sector
- + Services related to acquisition
- + Major repairs and maintenance
- + Insurance connected with the dwelling
- + Other services related to ownership of dwellings

## Latest figure and long-term trend

The net acquisitions approach – OOH (NA) – grew by 2.5% in Quarter 2 (Apr to June) 2017 compared with Quarter 2 2016. This is higher than the 2.1% growth rate for Quarter 1 (Jan to Mar) 2017 and indicates an upwards shift in the series (Figure 3).

Figure 4 shows the contributions to quarter on corresponding quarter of previous year growth rate for OOH (NA). The new dwellings component remains the largest contributor to OOH (NA) growth, contributing 2.2 percentage points to the overall growth rate. This has increased from the previous quarter's contribution of 1.5 percentage points and could be attributed to the rise in house prices seen in Quarter 2 2017.

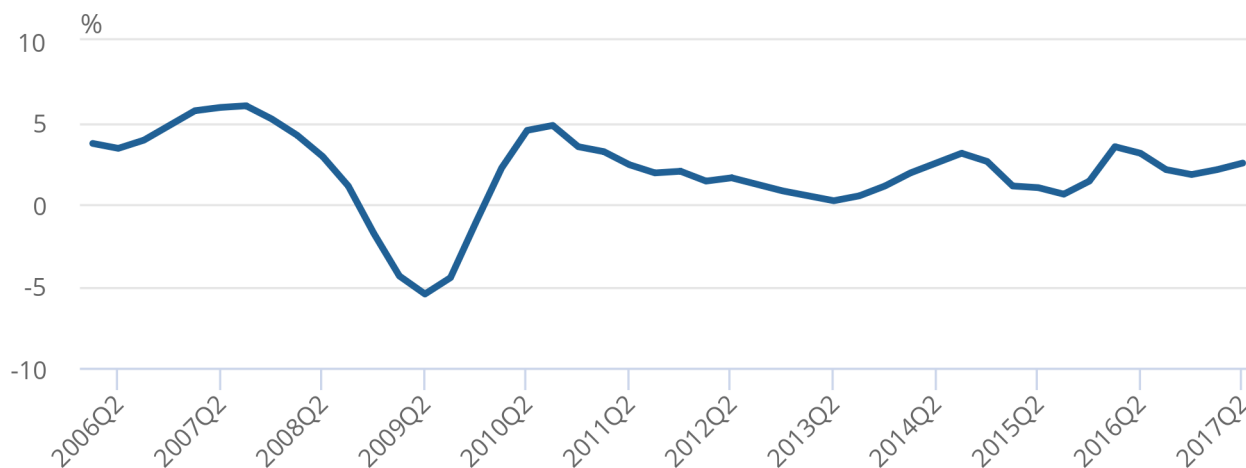
For a longer time series of contributions, please see the [dataset](#) presented alongside this release.

### Figure 3: OOH (NA) growth rate, quarter on corresponding quarter of previous year

UK, Quarter 2 (April to June) 2006 to Quarter 2 (April to June) 2017

## Figure 3: OOH (NA) growth rate, quarter on corresponding quarter of previous year

UK, Quarter 2 (April to June) 2006 to Quarter 2 (April to June) 2017



Source: Office for National Statistics

#### Notes:

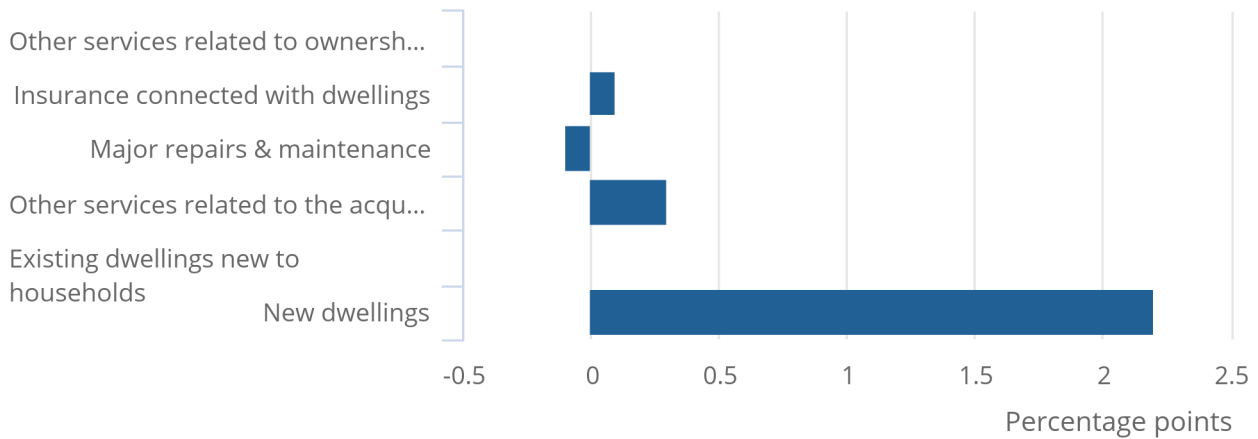
1. Q1 refers to Quarter 1 (Jan to Mar); Q2 refers to Quarter 2 (Apr to June); Q3 refers to Quarter 3 (July to Sept); and Q4 refers to Quarter 4 (Oct to Dec)

**Figure 4: Contributions to percentage change in OOH (NA) from component sub-indices, latest quarter on corresponding quarter of previous year**

UK, Quarter 2 (Apr to June) 2017UK, Quarter 2 (Apr to June) 2017

Figure 4: Contributions to percentage change in OOH (NA) from component sub-indices, latest quarter on corresponding quarter of previous year

UK, Quarter 2 (Apr to June) 2017UK, Quarter 2 (Apr to June) 2017



Source: Office for National Statistics

Notes:

- Contributions may not sum due to rounding. New dwellings includes acquisition of new dwellings and self builds and renovations.
- Q1 refers to Quarter 1 (Jan to Mar); Q2 refers to Quarter 2 (Apr to June); Q3 refers to Quarter 3 (July to Sept); and Q4 refers to Quarter 4 (Oct to Dec).

## 6 . Rental equivalence

## What is the rental equivalence approach?

This section presents the rental equivalence approach to measuring owner occupiers' housing costs (OOH (RE)), which targets the measurement of ongoing consumption of OOH services, rather than when OOH is acquired or when it is paid for. As a consumer price index, the Consumer Prices Index including owner occupiers' housing costs (CPIH) is a measure of the cost of consumption. Therefore the choice of method for measuring OOH should be based on the most statistically accurate method for measuring the cost of consumption in the UK. This means that asset prices should not be included, as an asset is not consumed in the way that goods and services are.

The rental equivalence approach is our preferred method for measuring OOH costs in the CPIH because the other approaches include either a measure of interest rates, or some measure of the capital element of housing, which make them unsuitable for a price index that measures the changing cost of consumption. The approach is also based on a higher quality data source than the other approaches presented in this article, allowing for a more reliable estimate of the measure.

For more information about why the rental equivalence is used in CPIH, please see the [CPIH compendium](#).

## Latest figure and long-term trend

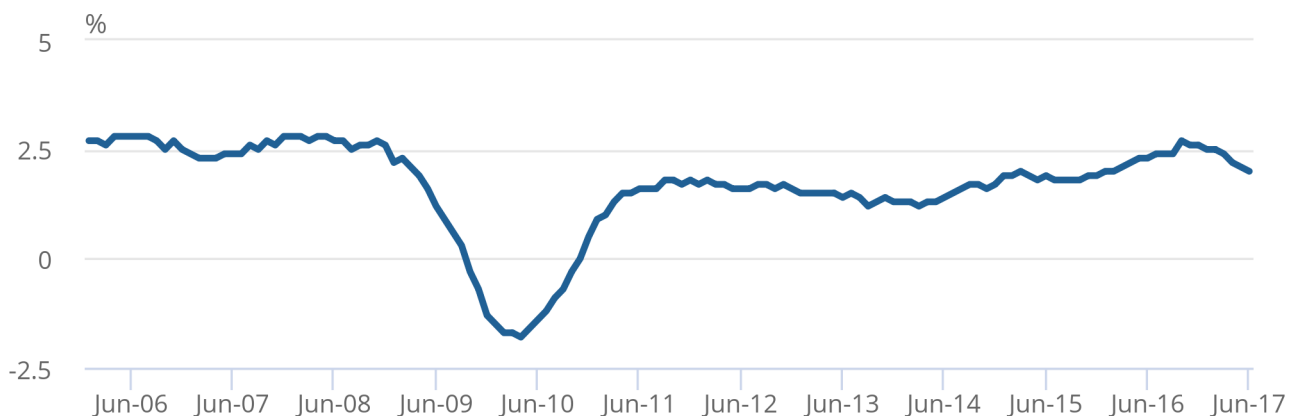
OOH (RE) grew by 2.0% in June 2017 compared with June 2016 (Figure 5). The recent months of OOH (RE) growth corresponding to Quarter 2 (Apr to June) 2017 have shown a slowdown in the growth of OOH (RE). On a quarterly basis, OOH (RE) grew by 2.0% in Quarter 2 2017 compared with the corresponding quarter of the previous year, down from 2.5% in Quarter 1 (Jan to Mar) 2017. This highlights a recent trend in decreasing OOH (RE) growth, which may be due to a slowdown in [private rental prices](#) seen since the end of 2016.

### Figure 5: 12-month growth rate of OOH (RE)

UK, Jan 2006 to June 2017

Figure 5: 12-month growth rate of OOH (RE)

UK, Jan 2006 to June 2017



Source: Office for National Statistics



## 7 . Comparing the different approaches of measuring owner occupiers' housing costs

Although there is not a single defined measure of owner occupiers' housing costs (OOH) and each of the methods discussed measure different aspects of OOH, it is still useful to look at the three measures together to see how they differ over time.

The cumulative measure of all three approaches is presented in Figure 6. It suggests that since 2005, OOH net acquisitions (NA) has shown the strongest growth over the period. OOH payments approach (Payments) saw strong growth prior to the economic downturn due to the large positive contributions from the growth in mortgage interest payments (Figure 6). Of the three measures, it has also seen the largest fall since the economic downturn, again driven by the falling price of mortgage interest payments and has still not recovered its pre-downturn peak. Figure 7 illustrates the changes in OOH growth as 12-month growth rates.

OOH rental equivalence (RE) appears at a lag compared with the OOH (NA) and OOH (Payments) approaches for the peak and trough before and after the economic downturn. This lag is because OOH (RE) is a "stock" measure of rents. This means that it captures price information for the entire stock of rental properties, which includes existing contracted properties and properties that are new to the market. Therefore, the flow of new rents based on recent developments in house prices will only gradually influence its development because the stock of existing dwellings is so much larger. This also means that the relative peaks and troughs of OOH (RE) will be subdued relative to OOH (NA), because the large stock of contracted rental properties is likely to mute the impact of volatile house prices.

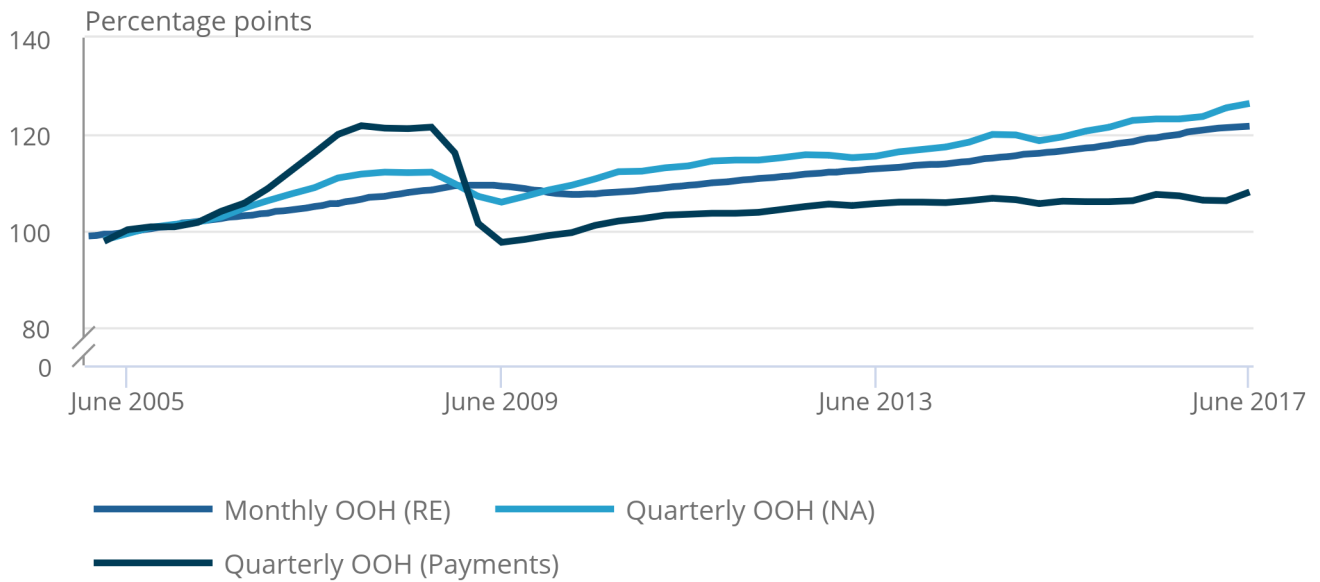
This is the first period since Quarter 2 (Apr to June) 2016 where the growth of OOH (NA) has surpassed the growth of OOH (RE) (Figure 7). This could be attributed to the rise in house prices compared to the slowdown in the growth of rental prices, highlighting the impact that asset prices have on the OOH (NA) series.

**Figure 6: OOH (RE), OOH (NA) and OOH (Payments) indices, Index 2005 = 100**

UK, Quarter 1 (Jan to Mar) 2005 to Quarter 2 (Apr to June) 2017

Figure 6: OOH (RE), OOH (NA) and OOH (Payments) indices, Index 2005 = 100

UK, Quarter 1 (Jan to Mar) 2005 to Quarter 2 (Apr to June) 2017



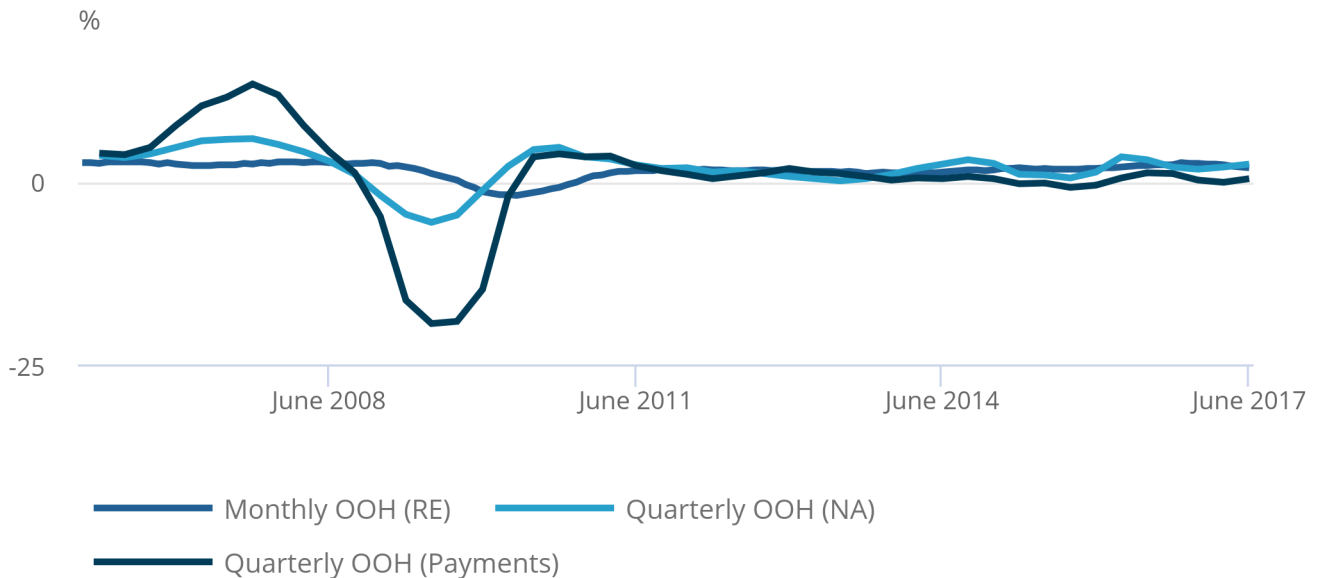
Source: Office for National Statistics

**Figure 7: 12-month growth rate OOH (RE); OOH (NA) and OOH (Payments) growth rate, quarter on corresponding quarter of previous year**

UK, Quarter 1 (Jan to Mar) 2006 to Quarter 2 (Apr to June) 2017

Figure 7: 12-month growth rate OOH (RE); OOH (NA) and OOH (Payments) growth rate, quarter on corresponding quarter of previous year

UK, Quarter 1 (Jan to Mar) 2006 to Quarter 2 (Apr to June) 2017



Source: Office for National Statistics

The lag for OOH (RE) is not a disadvantage to using the rental equivalence approach in the calculation of the OOH component in the Consumer Prices Index including owner occupiers' housing costs (CPIH). This is because the rental equivalence approach aims to measure the housing services that are consumed each period (consistent with the principles that underlie the construction of CPIH) and therefore does not need to follow the trend of house prices. If consideration is required of house prices, the House Price Index should be used instead.

## 8 . Annex 1: List of published articles on the different approaches of measuring OOH

Table 1: List of published articles on the different approaches of measuring OOH

<b>Publication</b>	<b>Description</b>
<a href="#"><u>Understanding the different approaches of measuring owner occupiers' housing costs (OOH): Quarter 2 (Apr to June) 2016</u></a>	This is the first article in the series and therefore it provides a more detailed description of each of the methods in the first section of the article ( <a href="#"><u>Different approaches of measuring owner occupiers' housing costs</u></a> ). It also provides a more detailed commentary and analysis of the historical time series and the main drivers behind these long-term trends. <a href="#"><u>Spotlight: the relationship between private rents and house prices</u></a>
<a href="#"><u>Understanding the different approaches of measuring owner occupiers' housing costs (OOH): UK, Quarter 3 (July to Sept) 2016</u></a>	This article provides more of a template for future quarterly releases, with more focus on the latest quarterly movements in the different measures rather than the longer-term trends and methodology. <a href="#"><u>Spotlight: owner occupiers' housing costs in the RPI</u></a>
<a href="#"><u>Understanding the different approaches of measuring owner occupiers' housing costs (OOH): Weights analysis</u></a>	This article was published as a stand-alone piece of analysis, which aggregated the approaches with the Consumer Prices Index (CPI) to create a hybrid aggregate inflation measure that includes OOH as measured by each approach. The analysis will be updated on a quarterly basis in a dataset published alongside each quarterly article, and is summarised in Annex 2 of the quarterly article.
<a href="#"><u>Understanding the different approaches of measuring owner occupiers' housing costs (OOH): UK, Quarter 4 (Oct to Dec) 2016</u></a>	This article follows the template of the previous quarterly releases. <a href="#"><u>Spotlight: Analysis of revisions to OOH(RE) expenditure weights</u></a>
<a href="#"><u>Understanding the different approaches of measuring owner occupiers' housing costs (OOH): UK, Quarter 1 (Jan to Mar) 2017</u></a>	This article follows the template of the previous quarterly releases. <a href="#"><u>Spotlight: changes to methodology</u></a>

## 9 . Annex 2: Methodology

## Annex 2A: Payments methodology

The payments approach is an experimental method for measuring owner occupiers' housing costs (OOH (Payments)) that attempts to capture what households pay out as owner occupiers when consuming housing (excluding capital repayments). This includes mortgage interest payments, transaction costs such as estate agency fees and legal fees, and running costs such as repairs and maintenance, ground rent and dwelling insurance.

Table 2 presents a full list of the OOH (Payments) component indices, as well as the source data for the prices and weights information used to construct the index. Most of the indices are drawn from the Retail Prices Index (RPI), which can be said to follow a payments approach to measuring OOH.

One of the problems for the payments approach is to account for major repairs and maintenance, which are difficult to obtain prices for on a consistent basis. One method of dealing with this problem is the approach taken in the RPI, which includes a component for the depreciation of the property. The approach was characterised as estimating the amount of money households should put aside for necessary major repairs and updating to maintain the value of the property. The method used here, which is more in line with a true payments approach, is to include a major repairs and maintenance component, proxied by the regular repairs and maintenance series in the Consumer Prices Index (CPI) due to lack of alternative data source.

The other sub-index that does not come from the RPI is the Stamp Duty index. This has been constructed for the OOH net acquisitions (NA) approach (see Annex 2B) and uses national accounts gross fixed capital formation (GFCF) and household final consumption expenditure (HHFCE) as the source data for the expenditure weights.

**Table 2 : Source data for OOH (Payments) sub-indices**

<b>OOH (Payments) indices</b>	<b>Source of price data</b>	<b>Source of weights data</b>
Mortgage interest payments	RPI	RPI
Council Tax (Great Britain)	RPI	RPI
Northern Ireland rates	RPI	RPI
Dwelling insurance	RPI	RPI
Ground rent	RPI	RPI
Stamp duty	Stamp Duty index	HHFCE and GFCF
Estate agent fees	RPI	RPI
Home-buyers survey	RPI	RPI
Major repairs and maintenance	CPI	HHFCE
House conveyancing	RPI	RPI

Source: Office for National Statistics

Note:

1. This table incorrectly originally listed this category as National Insurance rates. This was updated to read Northern Ireland rates on 15th November 2017 at 1pm.

## Annex 2B: Net acquisitions methodology

The net acquisitions approach is an experimental method for measuring owner occupiers' housing costs (OOH (NA)) that are associated with the purchase and ongoing ownership of dwellings for own use. As the Harmonised Index of Consumer Prices (HICP) does not cover investment spending, the net acquisitions approach treats a home as the purchase of a good that is part asset (the land) and part consumable (the house) and excludes the land component from the index.

OOH (NA) also includes costs associated with buying and maintaining a house; for example, self-builds and renovations, repairs and maintenance, transfer costs and dwelling insurance. The method we use to calculate OOH (NA) was proposed by Eurostat. It groups sub-indices measuring different aspects of OOH costs into two classes; those related to the acquisition of dwellings and those related to the ownership of dwellings.

The ideal method for excluding the land component in OOH (NA) is the net-net approach, whereby prices and weights both exclude the land component from the house purchase. However, as many member states (including the UK) are unable to implement the net-net approach due to a lack of available data, Eurostat requires all member states to use the net-gross (net weight, gross price) approach. This includes the use of the UK House Price Index (HPI), which does not separate between the land and house price, within the "acquisition of new dwellings" and "existing dwellings new to the OOH sector" components. This means that the net acquisitions approach presented here will include some measure of asset price in the index.

In addition to the HPI, Table 3 presents the other sources of component price indices. With the exception of the Stamp Duty index, all are drawn from some of our existing publications, including the Consumer Prices Index (CPI), Producer Price Index (PPI) and Retail Prices Index (RPI). More information about each of the sub-indices is available.

Table 3 also shows that the component expenditure weights used to compile OOH (NA) are derived from the national accounts gross fixed capital formation (GFCF) and household final consumption expenditure (HHFCE). The "net" principle in net acquisitions relates to the fact that only transactions that occur between the OOH sector and other sectors (for example, construction firms and private landlords) should be included. However, we cannot currently distinguish between sectors and therefore the weight for "acquisition of new dwellings" includes expenditure on all newly constructed dwellings and not those specifically destined for the OOH sector as per the methodology outlined by Eurostat.

In addition, a weight for "existing dwellings new to the OOH sector" does not exist; therefore, a zero weight is currently applied. The "other services related to ownership of dwellings" is based on the national accounts series 04.4.4 "other services relating to the dwelling" and has zero expenditure recorded in Blue Book 2016. It therefore has a weight of zero in the net acquisitions approach and is excluded from the calculation.

**Table 3: Source data for OOH (NA) sub-indices**

<b>OOH (NA) Indices</b>	<b>Source of price data</b>	<b>Source of weights data</b>
Acquisitions of new dwellings (excluding land)	HPI	GFCF
Self-builds and renovations	PPI and CPI	GFCF
Existing dwellings new to the OOH sector	HPI	No weight currently exists
Services related to acquisition	RPI and a Stamp Duty index	HHFCE and GFCF
Major repairs and maintenance	CPI	HHFCE
Insurance connected with the dwelling	RPI	HHFCE
Other services related to ownership of dwellings	No price index	HHFCE

Source: Office for National Statistics

## Annex 2C: Rental equivalence methodology

The rental equivalence approach is a method for measuring owner occupiers' housing costs (OOH (RE)) at the point at which the services provided by OOH are consumed.

Rental equivalence uses the rent paid for an equivalent house as a proxy for the costs faced by an owner occupier. The rent charged by landlords covers not just the property but many of the other costs borne by owner occupiers, such as repairs and maintenance, and transaction costs. Therefore, under the rental equivalence approach, these are not estimated separately, as to do so would introduce double-counting. The rental equivalence approach also does not capture changes in asset value; rather it measures the change in price of housing services provided.

The rental equivalence approach uses private rental data from the Valuation Office Agency (VOA), supplemented with data from the devolved administrations. The data are stratified regionally as well as by property type (detached, semi-detached, terraced, or flat or maisonette) and whether the property is furnished or unfurnished. For each stratum, elementary aggregates are calculated which are then weighted together to create an aggregate index.

The private rental data are used in both the calculation of the OOH component in the Consumer Prices Index including owner occupiers' housing costs (CPIH) – the rental equivalence approach – and the Index of Private Housing Rental Prices (IPHRP). The difference between the indices stems from the different weights used to combine the elementary aggregates. Strata weights for OOH (RE) are designed to represent the owner occupied market and strata weights for IPHRP are designed to represent the private rental market. For example, looking at the range of housing available on the market, there would be a larger proportion of typical rental properties (for example, one-bedroom flats) and the weights calculated would reflect this mix. By comparison, the owner occupied housing weights will reflect the larger proportion of more typically purchased properties (for example, three-bedroom detached houses). Expenditure weights are calculated by multiplying dwelling stock counts for the owner occupied sector or private rental sector by average rental prices.

For a more detailed overview of the rental equivalence approach methodology, please see the [CPIH compendium](#).

## 10 . Annex 3: Weights analysis

In January 2017, we published a stand-alone piece of analysis that aggregated the different approaches to measuring owner occupiers' housing costs (OOH) with the Consumer Prices Index (CPI) to create a hybrid aggregate inflation measure, which includes OOH as measured by each approach: [Understanding the different approaches of measuring owner occupiers' housing costs \(OOH\): Weights analysis](#).

From March 2017, the Consumer Prices Index including owner occupiers' housing costs (CPIH) was extended to include Council Tax. To ensure that CPIH is of the best possible quality, the full back series of CPIH has been revised to incorporate Council Tax and revised weights for OOH using the rental equivalence approach. This means that the CPIH series published in the [dataset](#) alongside this release will be different to that published in the January article.

There are also changes to the CPI-H (Payments) and CPI-H (NA) series. To ensure coherence with the new CPIH series, CPI-H (NA) has been revised to include Council Tax. OOH (NA) remains the same. OOH (Payments) includes Council Tax and therefore it is already coherent with CPIH. The January article identified two methods of calculating the payments approach. We have since identified a correction in the OOH (Payments1) approach, which has more closely aligned the two methods. From now on we will therefore only include the OOH (Payments1) method in the quarterly spreadsheet and rename these series OOH (Payments) and CPI-H (Payments).

For reference, the formula used to calculate the aggregate indices for CPI-H (Payments) and CPI-H (NA) is as follows:

$$CPI - H(Payments)_r^t = \frac{\sum_{i=1}^n p_i^t q_i^r + p_{ooH(Payments)}^t q_{ooH(Payments)}^r}{\sum_{i=1}^n p_i^r q_i^r + p_{ooH(Payments)}^r q_{ooH(Payments)}^r}$$

$$CPI - H(NA)_r^t = \frac{\sum_{i=1}^n p_i^t q_i^r + p_{CT}^r q_{CT}^r + p_{ooH(NA)}^t q_{ooH(NA)}^r}{\sum_{i=1}^n p_i^r q_i^r + p_{CT}^r q_{CT}^r + p_{ooH(NA)}^r q_{ooH(NA)}^r}$$

Equation notes:

1. p is the price level.
2. q is the volume purchased.
3. r is the reference period.
4. t is the time period.
5. i is the items in the Consumer Prices Index basket.
6. CT is Council Tax.

CPIH is as published.