

Article

Regional house price level estimates, England and Wales: 1995 to 2021

Applying a new methodology for estimating quarterly, regional House Price Levels in England and Wales, proposed by the Organisation for Economic Co-operation and Development.

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1 . Main points

- We have applied the Organisation for Economic Co-operation and Development's (OECD's) proposed methodology for estimating regional House Price Levels (HPLs) to housing transactions data for England and Wales.
- The estimated HPLs are comparable between regions and over time, are representative of the underlying dwelling stock, and are based on house price data from all available time periods rather than a single reference year.
- There are regional disparities in HPLs across England and Wales, and the magnitude of these disparities has changed over time.
- The regional disparity in house prices decreased following the 2008 global financial crisis, but there were disparities in the rates of recovery, with London being the fastest region to recover and the North East being the slowest.
- Disparities over time are also seen in the affordability of housing between regions when comparing regional HPLs to median regional disposable household income; London was consistently the least affordable region.
- Although the proposed methodology has strengths, it is not the intention to change the existing UK House Price Index methodology.

2 . Overview of the OECD's proposed methodology

This article explores a new methodology proposed by the Organisation for Economic Co-operation and Development (OECD) in their 2021 working paper on [Estimating regional house price levels: Methodology and results of a pilot project with Spain](#). The OECD working paper puts forward a method to calculate regional House Price Levels (HPLs) that are consistent with the evolution of regional House Price Indices (HPIs). HPLs are therefore representative of the underlying stock of dwellings and are based on house price data from all available time periods rather than a single reference year.

The proposed methodology has been applied to understand the similarities and differences between HPL estimates produced by the UK HPI and the proposed OECD methodology.

We present experimental regional HPL estimates obtained from this proposed method when applied to [HM Land Registry Price Paid property transactions data](#) for England and Wales. HPL estimates are compared with income statistics to analyse housing affordability estimates across English regions and Wales. We also assess the level of regional disparity in HPLs over time.

As the analysis presented in this article is experimental, care should be taken in drawing any firm conclusions from the results presented.

At this time, we do not intend to change the existing methodology used in the UK HPI for the following reasons.

First, HPLs calculated using UK HPI outputs are sensitive to the reference year selection (currently 2015). Therefore, when the reference year changes, there is potential for HPLs to experience a large revision, but between reference year changes HPLs will show consistency in each monthly publication. In contrast, this proposed methodology would lead to revisions to HPLs in every publication, although the magnitude of those frequent revisions would likely be smaller. There are advantages and disadvantages to both approaches.

Second, there is also a difference in what aspect of the housing market these statistics aim to measure. The UK HPI and accompanying average house prices are transaction-weighted, therefore representative of the current housing market. In contrast, the proposed methodology aims to estimate HPLs that are representative of the underlying stock of dwellings.

Third, data volumes are limited by the number of property transactions that take place within a given time period. The UK HPI uses hedonic regression to model house prices every month. A strength of hedonic regression is that you do not need every possible combination of property attributes present in each month's transaction data to successfully fit a hedonic regression model. This enables UK HPI to produce monthly house price estimates down to local authority level, and to produce additional breakdowns, such as average house price by property type for each local authority. However, the OECD methodology uses stratification, which means that sufficiently high volumes of data are required for all strata in every time period. To ensure sufficient data volumes in every stratum, the OECD method has been applied at quarterly frequency with no additional breakdowns (such as a property type split). In theory, the OECD proposed methodology could be applied at greater frequency and granularity than applied here. However, in practice, transaction data volumes are not high enough to implement the OECD methodology in the UK HPI to produce monthly estimates while retaining the high granularity and additional breakdowns currently published.

In this article, unless otherwise stated, the term "regions" is used to describe the nine regions of England, in addition to Wales.

3 . House Price Indices and House Price Levels

House Price Indices

Many statistical agencies, including the Office for National Statistics (ONS), produce House Price Indices (HPIs) at both the national and sub-national levels.

Price indices are designed to measure pure price changes over time. They are therefore adjusted to account for changes in the mix or quality of properties sold in a given period. As a result, these HPIs are often referred to as quality-adjusted or mix-adjusted. Further information about the current HPI methodology can be found in [HM Land Registry's \(HMLR's\) Quality and methodology guidance](#).

Sub-national HPIs allow for the comparison of house price evolutions across regions within a country, for example, to assess regional disparity in the recovery of house prices in the wake of the 2008 global financial crisis.

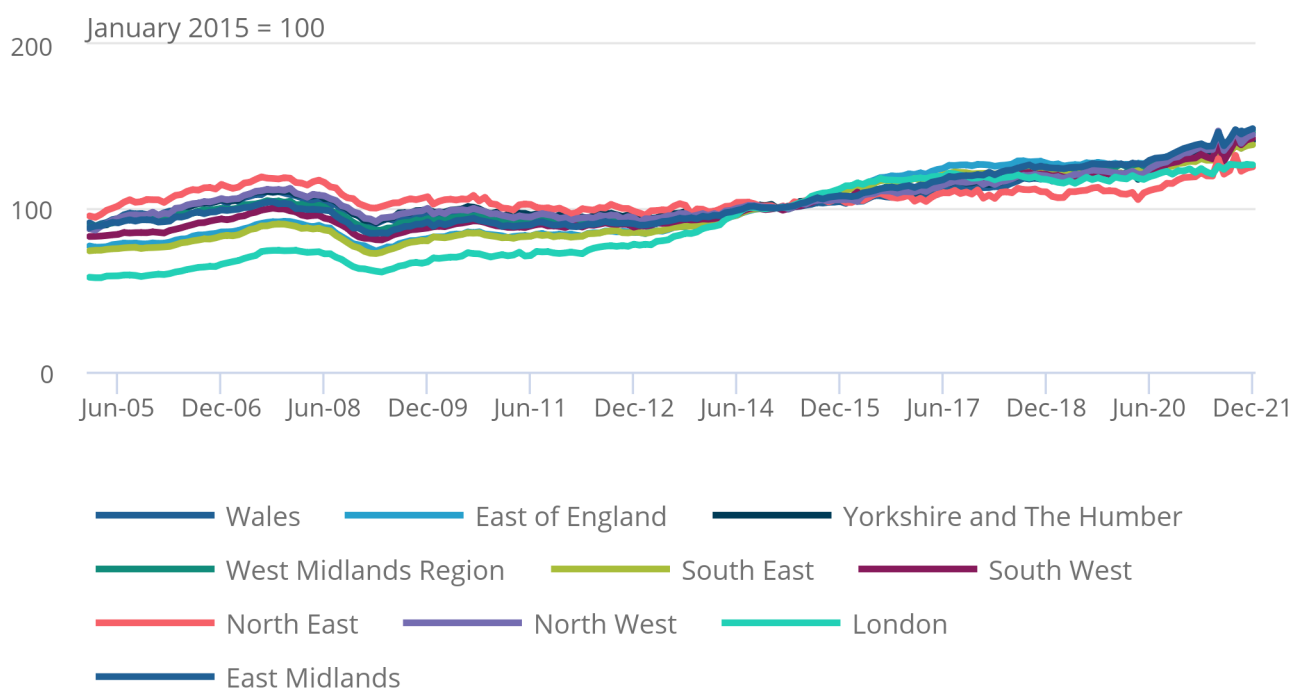
Figure 1 shows there have been large differences in house price evolutions across the regions of England and Wales since 2005. Data are presented up to December 2021, which is not subject to any further revisions under the [UK HPI revision policy](#).

Figure 1: Regional House Price Indices (HPIs) differ across England and Wales

UK HPI at regional level, England and Wales, January 2005 to December 2021

Figure 1: Regional House Price Indices (HPIs) differ across England and Wales

UK HPI at regional level, England and Wales, January 2005 to December 2021



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

House Price Levels

Although HPIs can be used to track and compare house price evolutions over time and between regions, they do not contain any information on the actual House Price Levels (HPLs). For example, Figure 1 shows that since 2020 house prices in Wales have increased at a greater rate than in London. However, it does not show that average house price levels are considerably higher in London than in Wales.

Another advantage of regional HPLs is that they can be combined with other statistics, such as average income, to compare housing affordability across regions. It is therefore important to consider both HPIs and HPLs when analysing house price statistics to capture a full picture of the housing market.

Alongside national and regional HPIs, the ONS also publishes the following other measures of average HPLs:

- [UK house price data: quarterly tables](#) - simple averages of house prices based on a sub-sample of Regulated Mortgage Survey (RMS) data
- [House price statistics for small areas \(HPSSAs\)](#) - means and medians of house prices, and number of transactions for property sales in England and Wales
- [UK HPI statistics](#) - average house price levels and indices for the UK, produced using price paid data from HMLR, Registers of Scotland (ROS) and Northern Ireland Housing Executive (NIHE); average HPLs are extrapolated from a base price that is reflective of the 2015 housing market, using the mix-adjusted UK HPI to uprate the 2015 price

These statistics are all representative of the property transactions that occurred in a given period, rather than the underlying housing stock. Since the quarterly tables and HPSSAs are not mix-adjusted, the evolutions in these HPLs are not reflective of pure price changes. They should therefore not be compared directly over time. By contrast, the average HPLs derived from the UK HPI are comparable over time because the UK HPI is mix-adjusted. However, under the current methodology these price levels are sensitive to the choice of reference year.

The methodology proposed in the Organisation for Economic Co-operation and Development's (OECD's) [Estimating regional house price levels](#) combines regional HPIs with information on HPLs at all available periods, rather than a single reference year. The proposed methodology also aims to estimate HPLs that are representative of the underlying stock of dwellings. This contrasts with the HPLs published as part of UK HPI, which are transaction-weighted, and therefore representative of transacted properties.

In this article, the OECD proposed methodology has been applied to UK HPI data to estimate HPLs that are representative of dwelling stock.

4 . UK HPI and OECD proposed methodology

UK HPI average price levels methodology

A time series of regional House Price Levels (HPLs) should show price evolutions consistent with the existing mix-adjusted House Price Indices (HPIs), to avoid giving conflicting information about house price inflation rates. For example, users are advised against using the average prices from the house price statistics for small areas (HPSSAs) to calculate a HPI or to infer trends over time.

The regional HPLs published alongside HPIs in the UK HPI publication are calculated using an extrapolation method. This ensures the HPLs are comparable over time and show evolutions consistent with the HPIs. To produce comparable house prices over time, a base set of average prices is uprated with the price index.

This method was chosen based on the feedback from users during the [Consultation on the Development of a Definitive House Price Index in 2014](#). There was a preference for a set of prices that were comparable over time, with the base price updated regularly to ensure the reference set of transactions remains representative of the current market.

This re-referencing process will rescale the entire price series by a factor that reflects the change in the mix of properties sold in the new reference period compared with the original reference period.

Revising the entire back-series in this way does not affect estimates of inflation between two points in time. However, it does change estimates of price levels at each time point, which may cause confusion to users who are unfamiliar with this methodology.

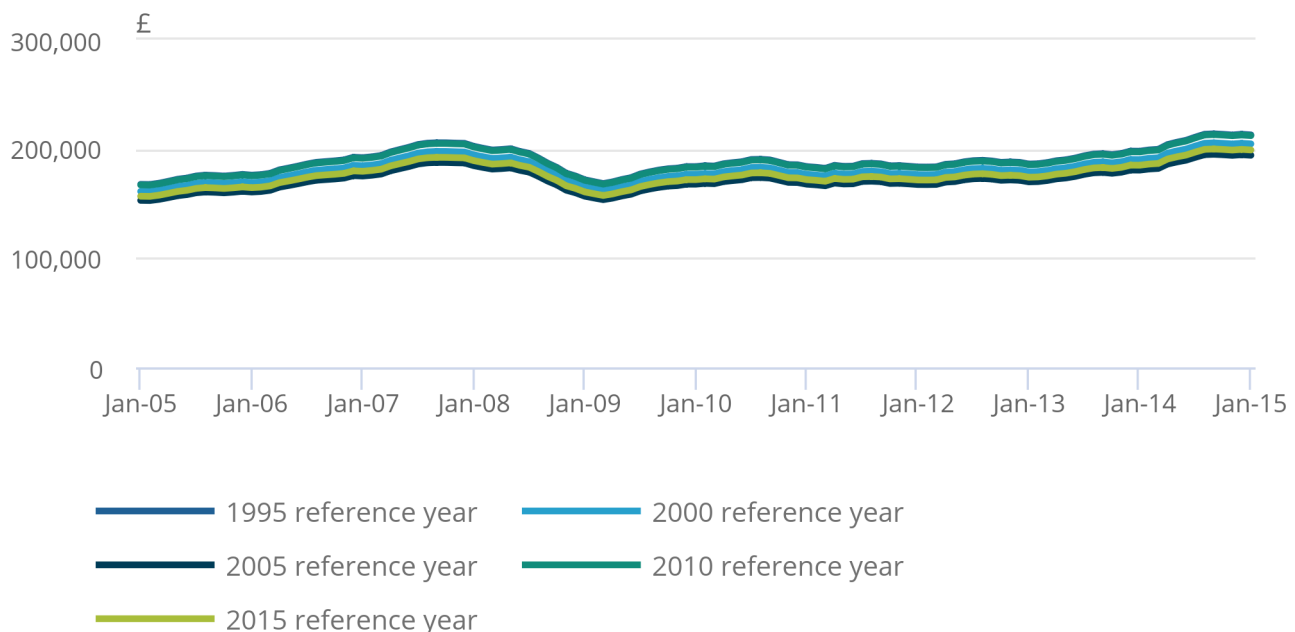
Figure 2 shows the potential impact that re-referencing every five years may have on UK HPI price levels. This example uses the UK HPI series for England and Wales (area code K04000001) using five different reference years. At the time of writing, the reference year currently used in the UK HPI is 2015.

Figure 2: House Price Levels are sensitive to the choice of reference year

Extrapolated average House Price Levels derived from different reference years, for England and Wales, 2005 to 2015

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Extrapolated average House Price Levels derived from different reference years, for England and Wales, 2005 to 2015



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

In addition, the size of the re-referencing effect may be different across regions, which will lead to changes in estimates of relative price levels across regions after re-referencing. This limitation of the existing methodology affects comparisons of house prices between regions, which is a primary use of HPLs that HPIs alone cannot fulfil.

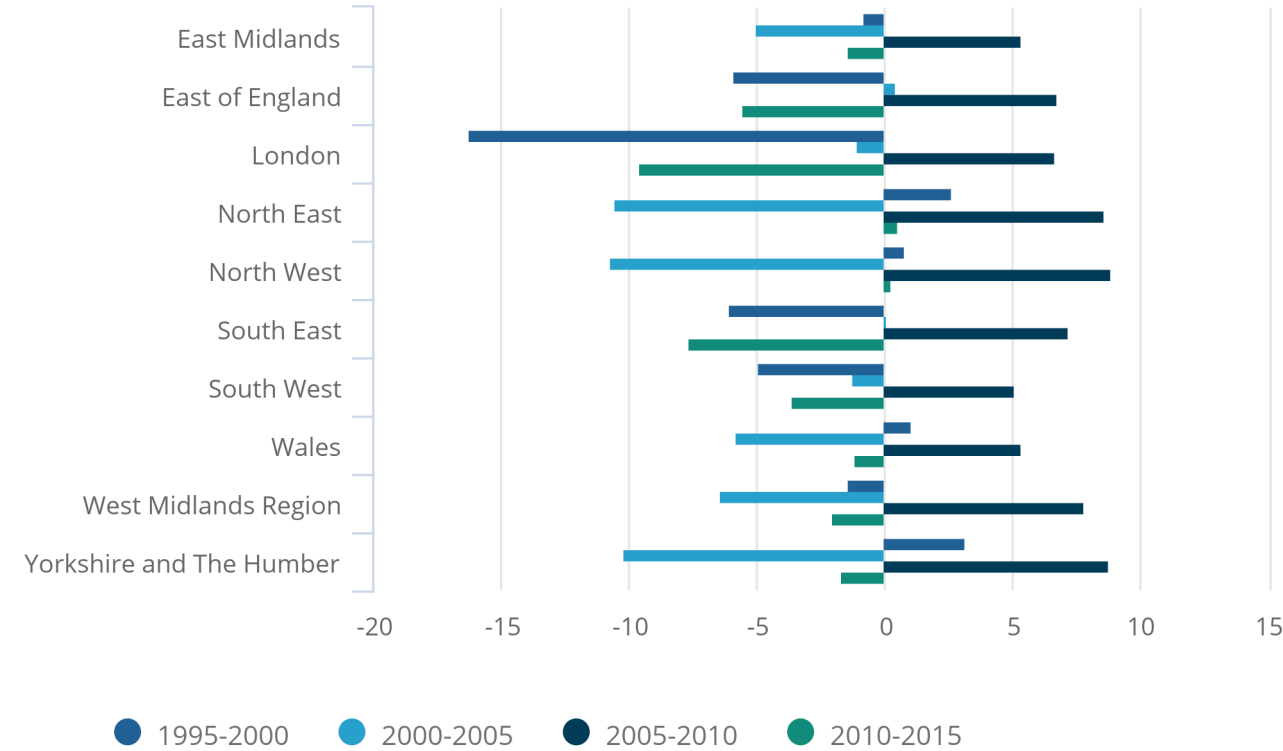
Figure 3 shows the variation in the re-referencing factor across regions for each change of reference year. For example, the 1995 to 2000 re-referencing period shows the effect of switching from 1995 base prices to 2000 base prices for each region. Not only is the size of the revision different across regions, but the direction of the revision (upwards or downwards) can also differ.

Figure 3: The effect of re-referencing House Price Levels varies across regions

Scaling factor applied upon re-referencing average house price to different time periods, 1995 to 2015, by region, England and Wales

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Scaling factor applied upon re-referencing average house price to different time periods, 1995 to 2015, by region, England and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Proposed Organisation for Economic Co-operation and Development (OECD) methodology

This section provides a brief overview of the proposed OECD methodology. For an in-depth description of the methodology, see the OECD's [Estimating regional house price levels paper](#). The proposed methodology removes the reliance on the choice of reference year by using house price information from all available periods.

The OECD methodology works in two stages. In the first stage, regional HPLs are estimated based on a geographical stratification (dividing the sample into subgroups of local authorities) of house transaction prices. In practice, average transaction prices per square metre are calculated within strata and aggregated to the regional level using the total surface of dwellings in the underlying stock as weight. This is a simple way to improve the geographical representativity of housing transactions, but it does not ensure that the quality of transacted dwellings in each stratum is constant over time. Therefore, the evolution of stratified HPLs does not only capture pure price changes but may also include quality effects.

In the second stage, state space models are used to improve the reliability of the stratified HPLs. These models build on the idea that the mix of properties in the dwelling stock of a reasonably large geographical area is stable from one year to the next. Therefore, the evolution of HPLs that are representative of the stock of dwellings should correspond to pure price changes, and quality-adjusted HPLs provide additional information to increase the reliability of stratified HPLs. State space models are the adequate statistical framework to combine information from stratified HPLs and HPIs, and they have two distinct benefits. First, they guarantee that the resulting HPLs have the same evolutions as the corresponding HPIs published by official statistical agencies. Moreover, they use the available information on HPLs at all dates without having to choose a reference period arbitrarily.

Mathematically, this model consists of a measurement equation and two state equations.

Measurement equation:

$$\ln P_t^A = \ln \alpha_t^A + \epsilon_t^A$$

The measurement equation captures the first core idea of the model: that the stratified (first-stage) HPL P_t^A in region A at period t is a noisy estimate (an estimate that may be susceptible to random fluctuations within the data) of the true house price level α_t^A , with some estimation error ϵ_t^A .

The measured price level is estimated by stratification, and the error term captures quality effects that are not controlled for in the stratification method.

State equation one:

$$\ln \alpha_t^A = \ln \alpha_{t-1}^A + \ln(HPI_t^A) - \ln(HPI_{t-1}^A)$$

State equation two:

$$\epsilon_t^A = \sum_{i=1}^p \phi_i^A \epsilon_{t-i}^A + \eta_t^A$$

The first state equation imposes that the true price level for a given region evolves over time in the same way as the HPI for that region.

The second state equation models the estimation error as an autocorrelated AR(p) process. This model assumes that the unobserved quality effects are likely to be persistent over time, therefore estimation errors are correlated over time. The parameters are autocorrelation coefficients, and η_t^A is a Gaussian process with standard deviation .

In this model, the estimation errors from the previous p periods are correlated with the estimation error of the current period, where p is described as the lag length. We ran the model using different lag lengths and selected the best performing value of p for each region separately.

Using the conclusions of the OECD working paper and assessment of UK HPI data sources, the following specifications were applied to construct first estimates for regional HPLs using a stratification method:

- transaction prices were used instead of asking prices
- HM Land Registry (HMLR) Price Paid transaction data were linked to Valuation Office Agency (VOA) Council Tax property attributes data
- local authorities were used as strata and aggregated to regional level to calculate the first stage estimates, since more granular geographical stratification provides HPL first estimates in better agreement with existing HPIs
- quarterly estimates were produced to increase data volumes used to calculate HPL estimates and so increase reliability of estimates
- property transaction data for existing dwellings were used since existing dwellings are more representative of the dwelling stock than newly built dwellings
- estimates of house price divided by surface area (pound sterling per square metre) were used to control for differences in property size
- stock weights were used to aggregate strata, and these were calculated using the total surface area of the dwellings in the stock
- VOA Council Tax property attributes was the most appropriate source for estimating dwelling stock

The second stage uses the first estimates alongside the corresponding regional HPI, which should ideally be stock-weighted. In the absence of a stock-weighted HPI in the second stage (state space model), we used the transaction-weighted UK HPI for existing dwellings only.

Although the UK HPI is transaction-weighted, it was judged to be a suitable choice in this instance for two reasons. Firstly, HPIs tend to be far less sensitive to the choice of weighting scheme than HPLs. Secondly, by using the transaction-weighted HPI for existing dwellings only, it gives a good approximation for a stock-weighted HPI, since existing dwellings make up the vast majority of the dwelling stock.

New builds make up a higher share of property transactions compared with their prevalence in the dwelling stock, so using the aggregated UK HPI for all dwelling types would give too large a weight to newly built dwellings.

Using these specifications, the geometric mean of price per square metre was calculated for existing dwellings in each local authority at quarterly frequency. These strata averages were aggregated to regional level using stock weights. The stock weight for a local authority labelled W_i is calculated as follows:

$$W_i = \frac{A_i}{\sum_j A_j}$$

Where A_i is the total surface area for dwellings in the local authority labelled i . The sum in the denominator runs over all local authorities that make the region to which local authority i belongs. Since the composition of the dwelling stock is fairly stable over time, the same stock weights were used for all time periods.

Model selection

The state space model is run for each region independently, with four different model specifications tested. The four specifications tested correspond to the lag lengths $p = 1, 2, 3$ and 4 . The second state equation is written as follows for each of the four specifications:

- AR1:

$$\epsilon_t = \phi_1 \epsilon_{t-1} + \eta_t$$
- AR2:

$$\epsilon_t = \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + \eta_t$$
- AR3:

$$\epsilon_t = \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + \phi_3 \epsilon_{t-3} + \eta_t$$
- AR4:

$$\epsilon_t = \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + \phi_3 \epsilon_{t-3} + \phi_4 \epsilon_{t-4} + \eta_t$$

For each region the parameters ϕ_j and σ^2 are estimated by maximum likelihood. The best model is selected using various methods of assessing how well the model fits the data.

Diagnostic tests were used to assess the distribution of the standardised residuals, which should be normally distributed under the assumptions of the state space model. Standardised residuals are a measure of the difference between the actual data and the model prediction. The diagnostic tests consisted of a mix of visual checks and hypothesis tests to check the model assumptions are valid given the measured data.

Information criteria were used to measure the fit of the models while penalising the inclusion of additional variables to the model.

Likelihood ratio tests were used to assess whether the estimated autocorrelation parameters ϕ_j were significantly different from zero, by comparing the likelihood between pairs of models.

5 . Analysis of regional House Price Level estimates

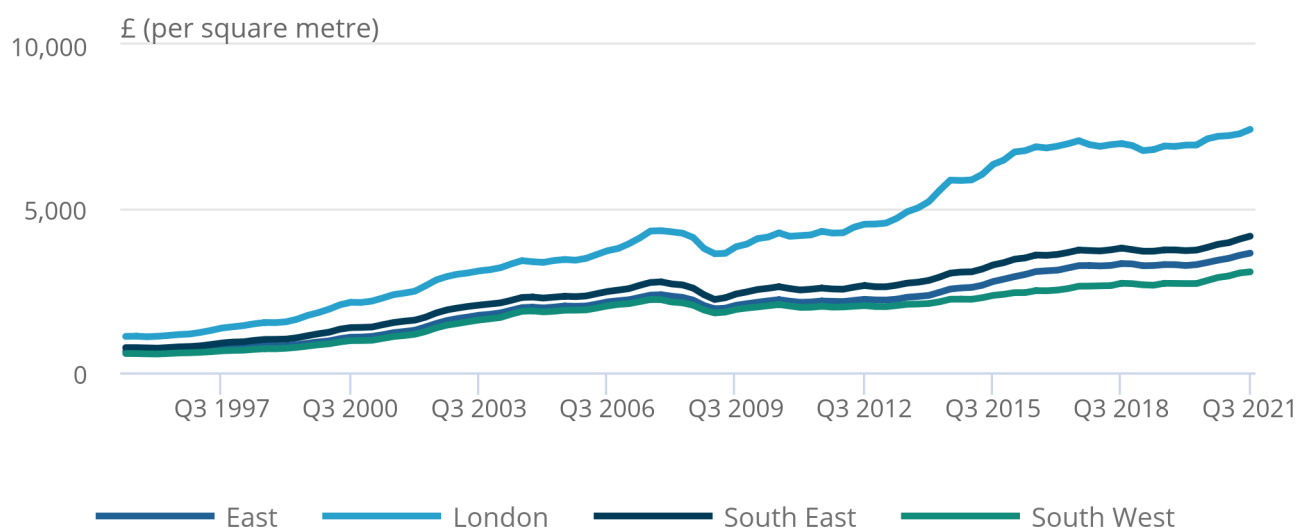
Figure 4 shows the regional House Price Level (HPL) estimates output by the state space model, using the lag length that gave the best model fit.

Figure 4: House price per square metre has been highest in London since 1995

Average house price per square metre for London and Southern English regions, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021

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Average house price per square metre for London and Southern English regions, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021



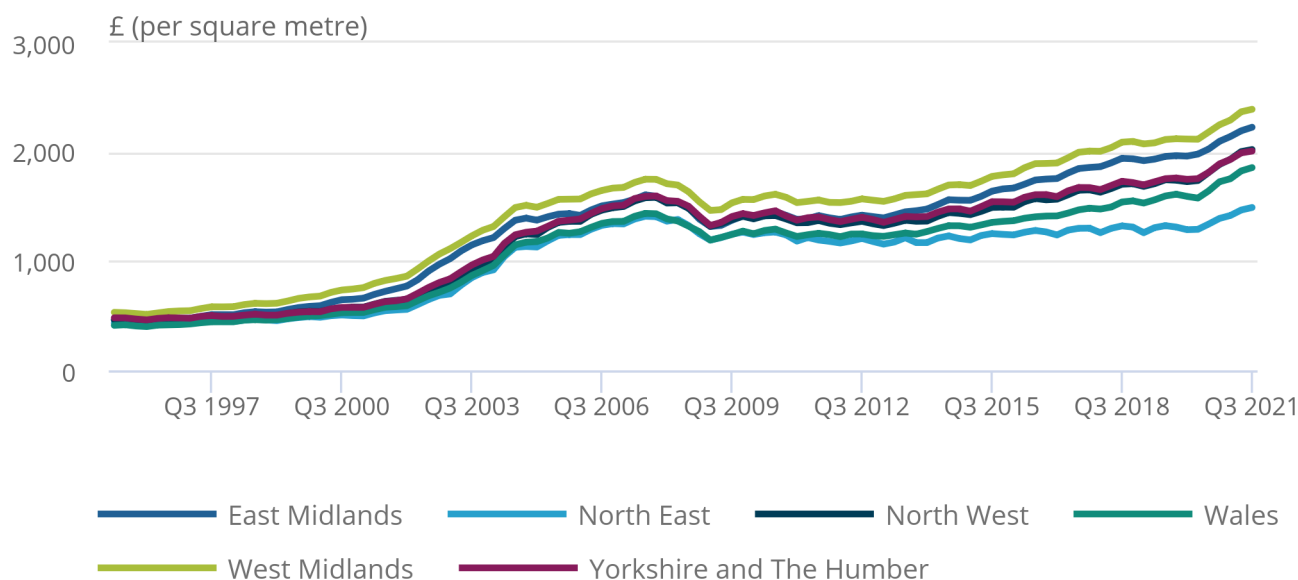
Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Figure 5: House price per square metre has been lowest in the North East since 2009

Average house price per square metre for Wales and the non-Southern English regions, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021

Figure 5: House price per square metre has been lowest in the North East since 2009

Average house price per square metre for Wales and the non-Southern English regions, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

In Quarter 2 (Apr to June) 1995, at the beginning of the series, London was the region with the highest house prices in England and Wales at £1,100 per square metre, followed by the South East at £750. Compared with London, the remaining regions had house prices that were relatively close to each other.

Between Quarter 2 1995 and Quarter 4 (Oct to Dec) 2005, HPLs in London more than doubled. HPLs generally increased at a faster rate across London and regions in the South of England. By 2001, there was a wide margin between regions in the South of England outside of London and regions in the North of England and Wales.

HPLs generally increased at a faster rate across London and regions in the South of England.

Between Quarter 2 2001 and Quarter 4 2005, five regions' HPLs more than doubled, these were the North East, North West, Wales, Yorkshire and The Humber and the East Midlands. HPLs increased by a much faster rate in these regions compared with those in the South of England.

The North West and Yorkshire and The Humber alternated as the regions with the third and fourth lowest HPLs per square metre between 1999 and 2002. HPLs in the North West first overtook those in the Yorkshire and The Humber in Quarter 3 (July to Sept) 1999 and then HPLs per square metre in these two regions continued to overtake each other until Quarter 1 (Jan to Mar) 2002. HPLs per square metre in Yorkshire and The Humber remained higher than those in the North West until Quarter 1 2021 when HPLs in the North West overtook Yorkshire and The Humber. In Quarter 3 2021, HPLs in the North West were £2,020 per square metre compared with £2,010 per square metre in Yorkshire and The Humber.

Following changes to Stamp Duty Land Taxes since the global coronavirus (COVID-19) pandemic started in Quarter 1 (Jan to Mar) 2020, HPLs have generally increased more rapidly in the last two years of data compared with the previous three-year annual average.

HPLs in London have consistently been the highest out of every region in England and Wales

HPLs in London have consistently been the highest, increasing consistently between Quarter 2 1995 until Quarter 4 2007, from £1,100 per square metre to £4,320 per square metre. The financial crisis led to a large decline in HPLs between Quarter 4 2007 and Quarter 1 2009, from £4,320 to £3,620.

HPLs in London were the quickest to recover from the financial crisis, with HPLs reaching their pre-financial crisis peak by Quarter 2 2012. HPLs in London increased rapidly from £3,630 in Quarter 2 2009 to £6,770 per square metre in Quarter 2 2016.

More recently, HPLs in London between Quarter 1 2020 and Quarter 3 2021 rose at a slower rate of 6.9% compared with other English regions and Wales. This slower annual price inflation may have been because of increases in remote working during the coronavirus pandemic, which meant workers no longer needed to live close to offices. HPLs increased from £6,940 in Quarter 1 2020 to £7,410 in Quarter 3 2021.

HPLs in the South East have consistently been the second highest out of any region in England and Wales

The region with the second highest HPLs has consistently been the South East. Between Quarter 2 1995 and Quarter 4 2007 there was a consistent increase in HPLs from £750 per square metre to £2,760 per square metre. The financial crisis led to a decrease in HPLs between Quarter 4 2007 and Quarter 1 2009, from £2,760 per square metre into £2,220 per square metre.

HPLs in the South East were the second quickest to recover after the global financial crisis, reaching their pre-financial crisis peak in Quarter 1 2014. HPLs also increased by the second highest percentage on average between Quarter 2 2009 and Quarter 1 2016. However, more recently, average annual inflation slowed between Quarter 1 2016 and Quarter 3 2021.

HPLs in Wales overtook HPLs in the North East in Quarter 1 1999

Wales was originally the region with the lowest HPLs until it overtook the North East in Quarter 1 1999. Between Quarter 2 1995 and Quarter 2 2001, Welsh HPLs increased by 35% from an average of £410 per square metre in Quarter 2 1995 to £560 per square metre in Quarter 2 2001.

HPLs increased sharply by 126% between Quarter 2 2001 and Quarter 4 2005, from £560 to £1,260 per square metre in this period. Like all other regions, the global financial crisis had a negative impact on Welsh HPLs. Between Quarter 3 2007 and Quarter 1 2009, HPLs fell from £1,440 per square metre to £1,190 per square metre.

HPLs in Wales were the second slowest to recover from the global financial crisis, only reaching their pre-financial crisis peak in Quarter 2 2017. The average HPL in Wales in Quarter 3 2021 was £1,860 per square metre.

HPLs in the North East became the lowest of any region in England and Wales in Quarter 1 1999

In Quarter 2 1995, average HPLs in the North East were the second lowest out of any region until Quarter 1 1999 when HPLs became the lowest out of any region in England and Wales.

HPLs increased steadily in the North East up until the global financial crisis, where, like other regions, HPLs decline sharply. The North East and Wales alternated as the regions with the lowest HPLs between Quarter 2 2008 and Quarter 4 2009, when HPLs in Wales overtook those in the North East for the last time, the North East has remained the region with the lowest HPLs since Quarter 4 2009.

After the global financial crisis, HPLs in the North East were the slowest of all regions to recover. HPLs did not reach their pre-financial crisis peak until Quarter 1 2021. Between Quarter 2 2009 and Quarter 1 2016, HPLs increased by the lowest amount in the North East compared with any other region. In Quarter 3 2021, average HPLs were £1,490 per square metre.

6 . Analysis of house price levels by coefficient of variation

The coefficient of variation of House Price Levels (HPLs) provides a more quantitative method of analysing differences in HPLs across regions. For a given quarter, the coefficient of variation is calculated as the ratio between the standard deviation of HPLs across all regions and the mean HPL across all regions. For example, a higher coefficient of variation reflects larger disparities in HPLs across regions.

Along with the chart showing the coefficient of variation, scatter plots have also been produced, which help explain the fluctuations in coefficient of variation. For each time period that has been analysed, the scatter plots compare the initial price level at the beginning of the period, set to a log scale, with the subsequent price inflation for the remainder of the period.

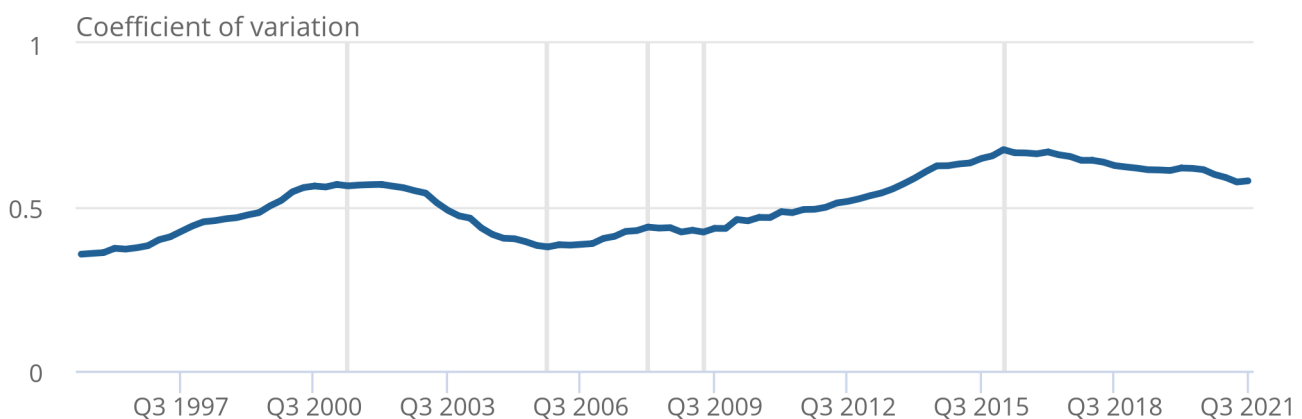
Figure 6 shows the coefficient of variation between 1995 and 2021. The trends of the coefficient of variation can be split into six distinct time periods as shown by the dashed vertical lines. These periods are analysed within the next section of the article.

Figure 6: Regional disparities in house price levels have changed over time

Coefficient of variation between regions, England and Wales, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021

Figure 6: Regional disparities in house price levels have changed over time

Coefficient of variation between regions, England and Wales, Quarter 2 (Apr to June) 1995 to Quarter 3 (July to Sept) 2021



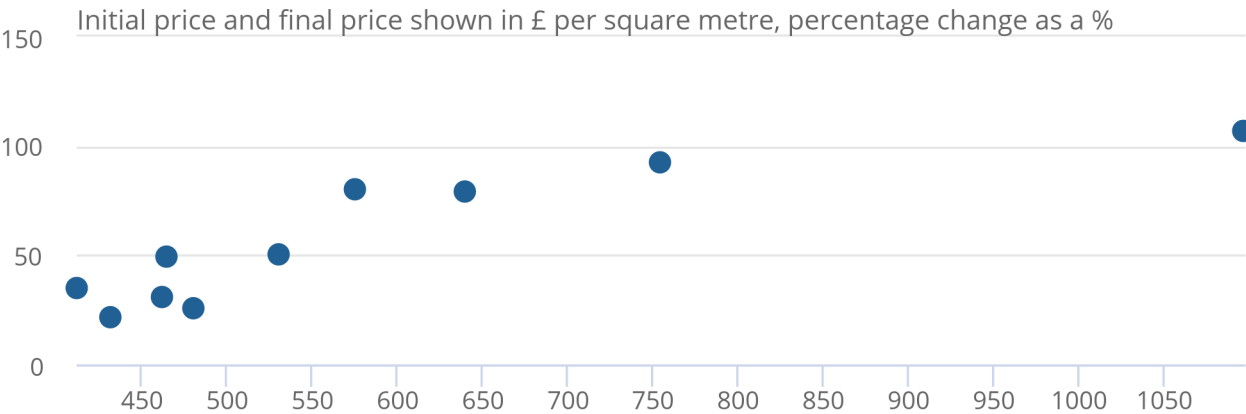
Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Figure 7: Higher Quarter 2 1995 house prices correlated with higher subsequent inflation until Quarter 2 2001

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 1995 to Quarter 2 2001, for English regions and Wales

Figure 7: Higher Quarter 2 1995 house prices correlated with higher subsequent inflation until Quarter 2 2001

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 1995 to Quarter 2 2001, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Between Quarter 2 (Apr to June) 1995 and Quarter 2 2001, there was a large divergence between regions' HPLs as the coefficient of variation increased from 0.36 to 0.56. This can be explained by a clear positive relationship between initial HPLs in Quarter 2 1995 and subsequent average inflation until Quarter 2 2001.

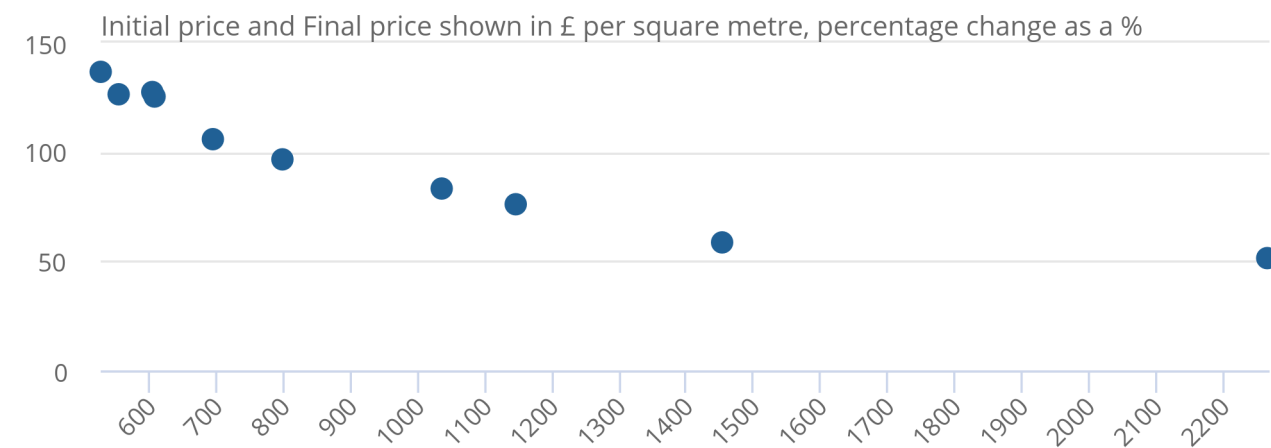
Regions with the highest HPLs, such as London and the other regions in the South of England, had the largest increase in HPLs. Regions in the North of England and Wales with initially lower HPLs experienced lower increases in house prices than the rest of England and Wales.

Figure 8: Higher Quarter 2 2001 house prices correlated with lower inflation until Quarter 4 2005

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 2001 to Quarter 4 2005, for English regions and Wales

Figure 8: Higher Quarter 2 2001 house prices correlated with lower inflation until Quarter 4 2005

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 2001 to Quarter 4 2005, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

There was a convergence in HPLs in English regions and Wales as shown by the quite rapid decline in coefficient of variation from Quarter 2 2001 until Quarter 4 (Oct to Dec) 2005. This can be explained by the negative relationship between the initial price and subsequent inflation in this period.

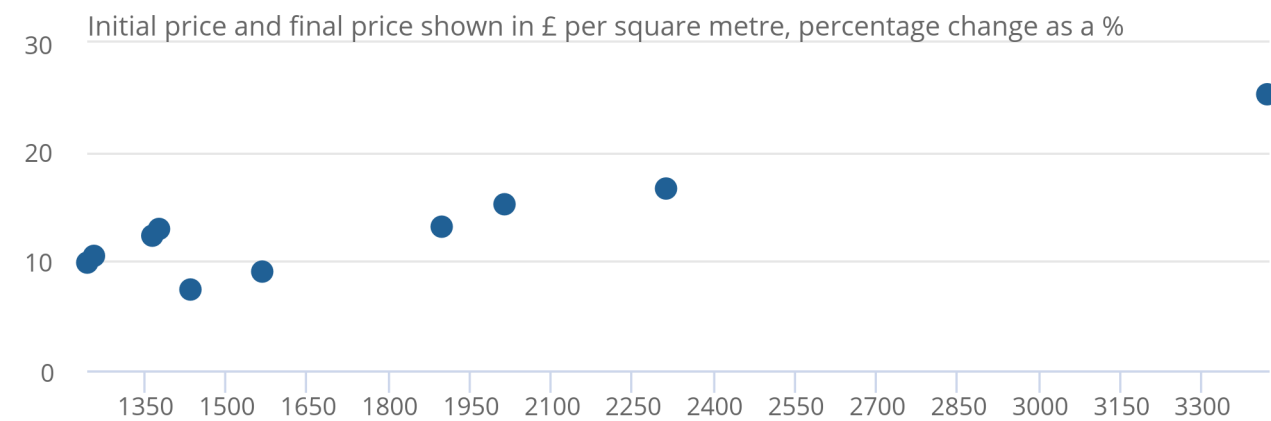
The regions that experienced the fastest increases were the North East and Wales, the regions with the two lowest HPLs, while regions in the South of England experienced much lower increases in this period. By Quarter 4 2005 the coefficient of variation had declined to 0.38, marginally higher than the coefficient of variation in Quarter 2 1995.

Figure 9: Higher Quarter 4 2005 house prices correlated with higher inflation until Quarter 1 2008

A scatterplot comparing the house price level and subsequent inflation, Quarter 4 2005 to Quarter 1 2008, for English regions and Wales

Figure 9: Higher Quarter 4 2005 house prices correlated with higher inflation until Quarter 1 2008

A scatterplot comparing the house price level and subsequent inflation, Quarter 4 2005 to Quarter 1 2008, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

In the lead up to the 2008 global financial crisis, there was a divergence in regions' HPLs as the coefficient of variation increased from 0.38 in Quarter 4 2005 to 0.44 in Quarter 1 (Jan to Mar) 2008. This is because there was a positive relationship between the initial HPL and the subsequent average inflation across the rest of the period.

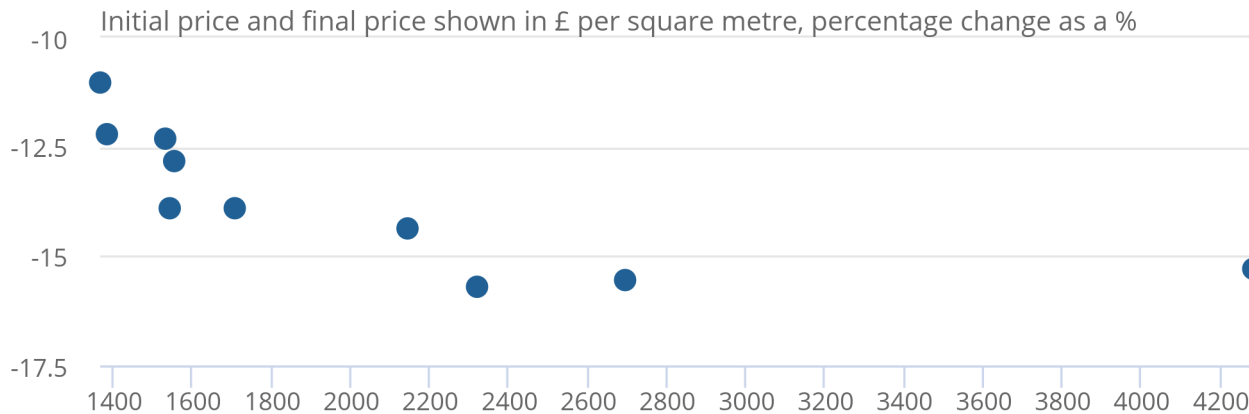
The highest inflation in this period was in London, followed by the South East. Regions with the lower initial HPLs, such as the East Midlands, West Midlands, and the North East, experienced the lowest inflation in this period.

Figure 10: Higher Quarter 1 2008 house prices correlated with lower inflation until Quarter 2 2009

A scatterplot comparing the house price level and subsequent inflation, Quarter 1 2008 to Quarter 2 2009, for English regions and Wales

Figure 10: Higher Quarter 1 2008 house prices correlated with lower inflation until Quarter 2 2009

A scatterplot comparing the house price level and subsequent inflation, Quarter 1 2008 to Quarter 2 2009, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

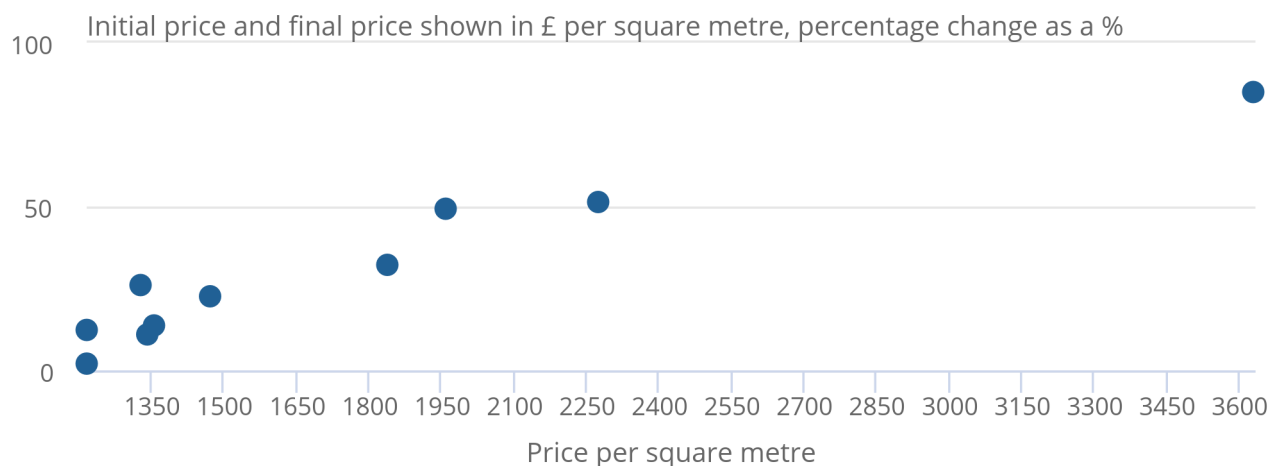
There was a slight decrease in the coefficient of variation between Quarter 1 2008 and Quarter 2 2009 showing that the 2008 global financial crisis had the effect of reducing disparities in house prices between regions in the short term. There was a slight negative relationship between initial HPL and subsequent house price inflation. The South East, East of England and London were the regions with the highest rate of decline in HPLs, whereas regions with initially low HPLs (such as the North East and Wales) did not decline by as much. The coefficient of variation decreased from 0.44 in Quarter 1 2008 to 0.42 in Quarter 2 2009.

Figure 11: Higher Quarter 2 2009 house prices correlated with higher inflation until Quarter 1 2016

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 2009 to Quarter 1 2016, for English regions and Wales

Figure 11: Higher Quarter 2 2009 house prices correlated with higher inflation until Quarter 1 2016

A scatterplot comparing the house price level and subsequent inflation, Quarter 2 2009 to Quarter 1 2016, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

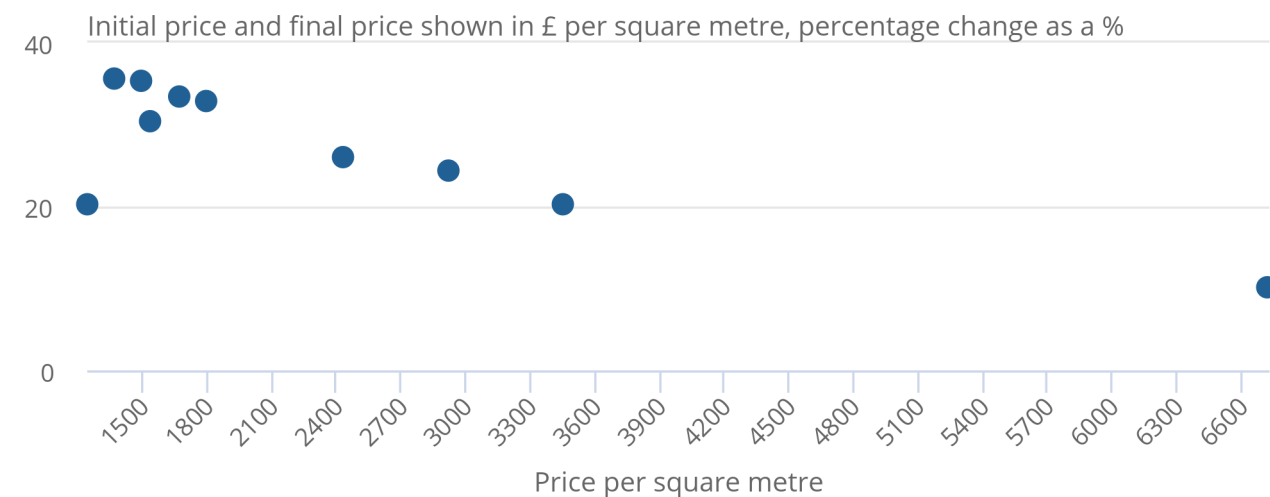
The coefficient of variation increased sharply from 0.42 in Quarter 2 2009 to 0.68 in Quarter 1 2016. This is the quarter in which the coefficient of variation is at its highest. This is because regions' HPLs recovered from the financial crisis very differently. London, which was the region that already had the highest HPLs, was by far the region with the highest rate of increase in HPLs in this period. Other regions with relatively higher HPLs, such as the South East and East of England, increased by a faster rate than regions in the North of England.

Figure 12: Higher Quarter 1 2016 house prices correlated with lower inflation until Quarter 3 2021

A scatterplot comparing the house price level and subsequent inflation, Quarter 1 2016 to Quarter 3 2021, for English regions and Wales

Figure 12: Higher Quarter 1 2016 house prices correlated with lower inflation until Quarter 3 2021

A scatterplot comparing the house price level and subsequent inflation, Quarter 1 2016 to Quarter 3 2021, for English regions and Wales



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Between Quarter 1 2016 and Quarter 3 (July to Sept) 2021 there was a convergence in regions HPLs as the coefficient of variation decreased from 0.68 to 0.58. This can be explained by the fact that there was a slight negative correlation between initial HPL in Quarter 1 2016 and subsequent average annual house price inflation from Quarter 1 2016 to Quarter 3 2021. HPLs in London increased at just over half the rate of the second slowest region, contributing heavily to this decline in the coefficient of variation. The North East was an outlier to this trend as it was the region with the lowest initial price level but had the second lowest subsequent annual inflation in this period. This contributed to a slightly gentler decrease in the coefficient of variation.

7 . Ratio of house price levels to disposable income, by region

A benefit of estimating regional House Price Levels (HPLs) is that they can be combined with regional disposable income to analyse house price affordability across regions. The data used are from the Household Finances Survey and are measured as nominal disposable income -- gross income after the effects of benefits and direct taxes equivalised using the Organisation for Economic Co-operation and Development (OECD) equivalisation methods, see [Adjusting household incomes: equivalence scales \(PDF, 388KB\)](#). Using nominal disposable income ensures that both sides of the affordability equation are balanced on a nominal basis.

We calculate the ratio of disposable household income equivalent to the average house price in each region. This is used as an indicator of regional housing affordability.

A mean house size (floor area) has been calculated for each region, this was multiplied by the price per square metre to generate the price of an average sized property and then divided by the average regional disposable income to generate a ratio of HPLs to disposable income. The data have been taken as the 50th percent point (median) household income. As the analysis presented in this article is experimental, care should be taken in drawing any firm conclusions from the results presented.

This uses a similar approach to the official estimates of housing affordability, such as our [Housing purchase affordability in Great Britain: 2021](#). Both approaches combine income data with house price estimates to generate a ratio of disposable income to house prices in England and Wales, but the official affordability series is derived from the values of homes that sold in that time period.

Figures 13 and 14 show the ratio of HPLs to disposable income for each English region and Wales, for the financial year ending (FYE) 1999 to the FYE 2021.

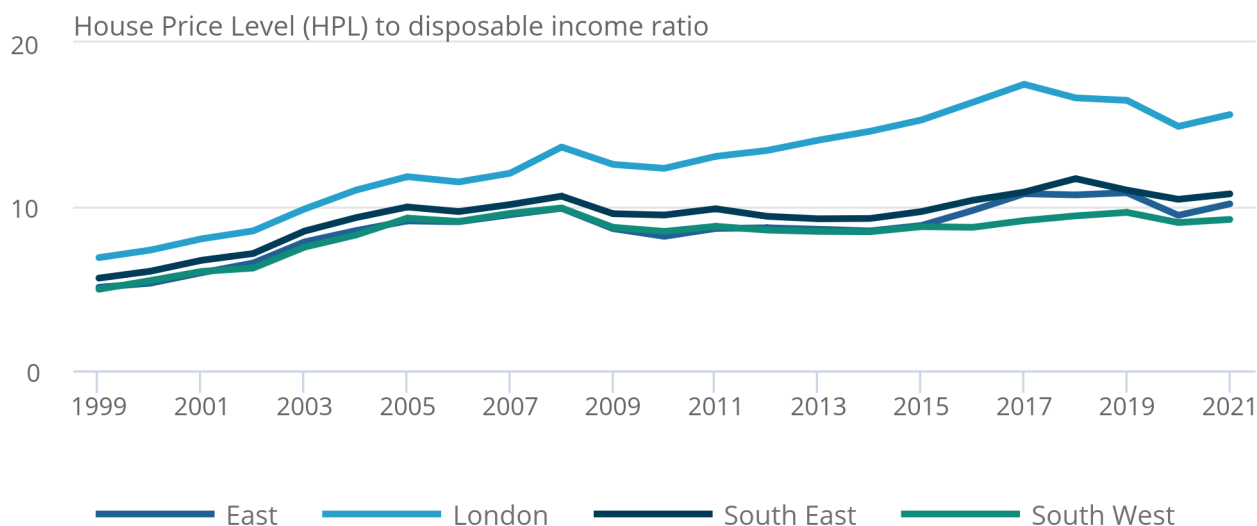
A decrease in the ratio of HPL of disposable household income does not always necessarily correspond to an increase in affordability, since there will be many other economic factors affecting people's ability to purchase a house.

Figure 13: London consistently had the highest House Price Level to income ratio in England and Wales

The ratio of House Price Levels (HPLs) for an average-sized property and disposable income, London and Southern English regions, financial year ending 1999 to financial year ending 2021

Figure 13: London consistently had the highest House Price Level to income ratio in England and Wales

The ratio of House Price Levels (HPLs) for an average-sized property and disposable income, London and Southern English regions, financial year ending 1999 to financial year ending 2021



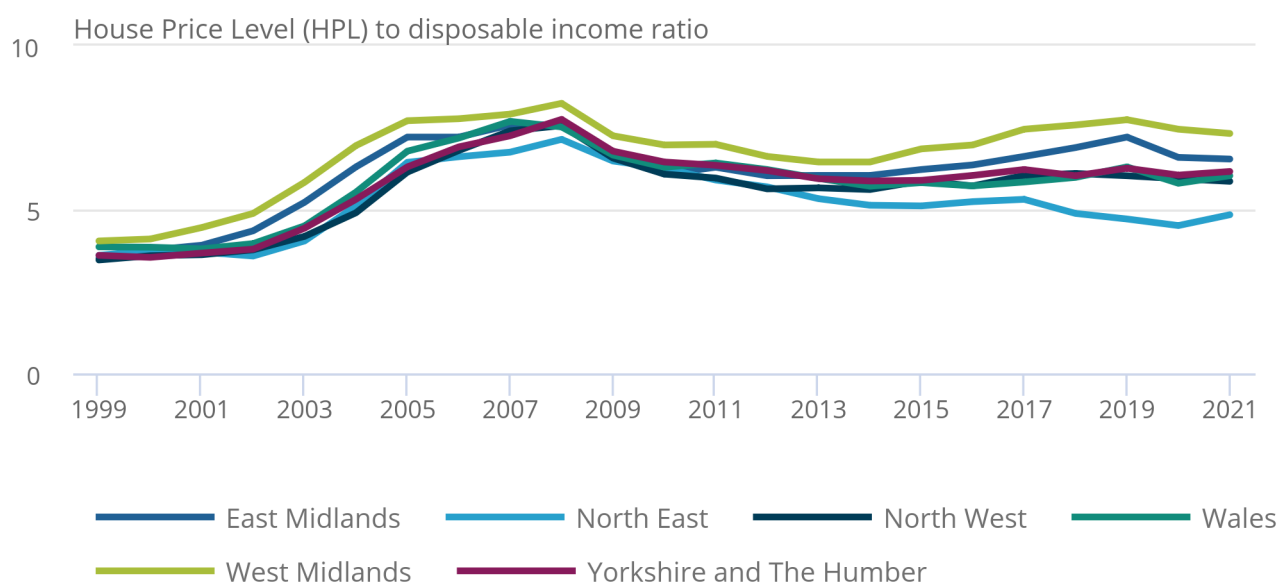
Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Figure 14: Several regions had lower House Price Level to income ratios in 2021 than pre-global financial crisis

The ratio of House Price Levels (HPLs) for an average-sized property and disposable income, Wales and the non-Southern English regions, financial year ending 1999 to financial year ending 2021

Figure 14: Several regions had lower House Price Level to income ratios in 2021 than pre-global financial crisis

The ratio of House Price Levels (HPLs) for an average-sized property and disposable income, Wales and the non-Southern English regions, financial year ending 1999 to financial year ending 2021



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

The regions of England and Wales can be split into three groups in terms of trends in HPL to disposable income ratios between the FYE 1999 and 2021. London has consistently been the region with the highest ratio of HPL to disposable income, while regions in the Midlands and North of England and Wales have had the lowest ratio of HPLs to disposable income, and many of these regions have traded places between 1999 and 2021. The ratio of HPLs to disposable income in the Southern English regions has generally been somewhere in between London and the other regions in England and Wales.

The ratio of HPLs to disposable income steadily increased between the FYE 1999 and 2005, before the ratio of HPLs to disposable income decreased following the global financial crisis period. In the longer term the changes in the ratio of HPLs to disposable income were much more varied. The ratio of HPLs to disposable income was highest in London than any other region. Whereas the ratio of HPLs to disposable income remains below the pre-financial crisis peak in every region other than London, the South East and the East of England.

The ratio of HPLs to disposable income steadily increased between 1999 and 2005

In the FYE 1999, at the beginning of the series, London had the highest ratio of HPLs to disposable income. The price of an average sized property was 6.9 times the disposable income in London. The South East had the second highest ratio of HPLs to disposable income where the price of an average sized property was 5.6 times the disposable income in that region. The lowest ratio of HPLs to disposable income was in the North West and East Midlands, where the price of an average sized property was 3.5 times the disposable income in that region.

In the FYE 2005, the North West had the lowest HPL to disposable income ratio in as much as the ratio had increased to 6.1. The second lowest ratio of HPLs to disposable income was in Yorkshire and The Humber, where the price of an average sized property was 6.3 times the disposable income. The East Midlands was no longer the region with the lowest HPL to disposable income ratio, and the ratio was higher than four other regions in England and Wales. London remained the region with the highest ratio of HPLs to disposable income, where the price of an average sized property was 11.8 times the disposable income. The South East also remained the region with the second highest ratio of HPLs to disposable income. The price of an average sized property was 10.0 times the disposable income.

The ratio of HPLs to disposable income reached a relative peak in most regions in 2008

The ratio of HPLs to disposable income reached a relative peak in the FYE 2005 in some regions, but in other regions the ratio continued to rise until the FYE 2007. The ratio of HPLs to disposable income in the North East fell below Yorkshire and The Humber and the North West, making it the region with the lowest ratio of HPLs to disposable income in England and Wales in the FYE 2006. The ratio of HPLs to disposable income increased in all regions except Wales between the FYE 2007 and 2008. In the North East, the region with the lowest HPL to disposable income ratio, the price of an average sized property was 7.1 times the disposable income. In London, the region with the highest HPL to disposable income ratio, the price of an average sized property was 13.6 times that of disposable income.

The ratio of HPLs to disposable income decreased in all regions between 2008 and 2010

During the global financial crisis period, the ratio of HPLs to disposable income decreased across all regions because HPLs decreased steeply while disposable income continued to increase, albeit marginally.

This does not necessarily mean that housing was more affordable in this period since this indicator does not consider the full economic climate at the time.

In London, the ratio of HPLs to disposable income decreased by 1.3 between the FYE 2008 and FYE 2010 to a ratio of 12.3 from a ratio of 13.6. Although, this ratio was still much larger than other regions. The largest difference came in the East of England, which saw the ratio of the price of an average sized property to disposable income declined by 1.7 from 9.9 to 8.2. The smallest difference came in the North East, as the ratio of HPLs to disposable income decreased by 0.9, which meant that the price of an average sized property was now 6.3 times of disposable income in that region.

The change in the ratio of HPLs to disposable income varied widely across regions between 2010 to 2017

The varied recovery rates across regions following the global financial crisis led to differing changes in the HPL to disposable income ratios across the English regions and Wales. London experienced a fast rebound in HPLs and consequently the ratio of HPLs to disposable income in London had reached its pre-financial crisis peak by the FYE 2014 and quickly accelerated. By FYE 2017, the price of an average sized property was 17.5 times that of disposable income. This ratio is 6.6 higher than the second least affordable region, the South East, where the price of an average sized property was 10.9 times the disposable income in that region.

Conversely, the ratio of HPLs to disposable income decreased in four regions. The North East and North West traded places as the region with the lowest HPL to disposable income ratio in this period until the FYE 2013, the North East has remained the region with the lowest HPL to disposable income ratio. In the FYE 2017, the price of an average sized property was 5.3 times higher than the disposable income in that region. The ratio of HPLs to disposable income in many regions, such as the North East, North West and Wales, has remained lower after the global financial crisis. This is because of HPLs growing at a slower rate relative to income levels after the global financial crisis compared with before the financial crisis.

The ratio of HPLs to disposable income in the South East and East of England reached its lowest in the FYE 2018 and 2019, respectively

The South East of England and the East of England were the only two regions other than London where the ratio of HPLs to disposable income reached its highest after the global financial crisis. This ratio was at its highest in the FYE 2018 and 2019, respectively. In the South East the peak was 11.7, compared with 10.6 in the pre-financial crisis peak. In the East of England the peak was 10.8, compared with 9.9 in the pre-financial crisis peak.

In the FYE 2020, the ratio of HPLs to disposable income decreased in all regions. This can be explained by a larger increase in disposable income across regions compared with the increase in HPLs in the financial year ending 2020.

8 . Comparison of UK HPI and proposed OECD method results

As previously stated in Section 2, there are several differences between the proposed Organisation for Economic Co-Operation and Development (OECD) House Price Levels (HPLs) methodology and the current UK House Price Index (HPI) average price levels methodology. These differences make a straightforward comparison between the two methods difficult.

One limitation that makes a direct comparison difficult is that the UK HPI statistics reflect residential properties that have been sold in given time periods, whereas the estimates produced by this analysis reflect the residential dwelling stock. Results from this experimental analysis were therefore compared against the UK HPI average prices for existing dwellings, since this series reflects the dwelling stock (on which the OECD estimates are based) more closely than the new build dwelling series. The UK HPI outputs average price levels for sold properties, while this analysis outputs average price per square metre for the residential dwelling stock. The average floor area of the dwelling stock (OECD proposed methodology) may be different to the average floor area of sold properties (UK HPI). We have tried to account for that difference in a couple of ways, as discussed in the following.

Comparing average house price outputs

One approach, to increase the comparability between the HPLs produced by each method, was to multiply this experimental analysis' price per square metre output by a constant average floor area for each region to produce an average price per property series for each region. The average floor area for each region was estimated using area information for the residential dwelling stock.

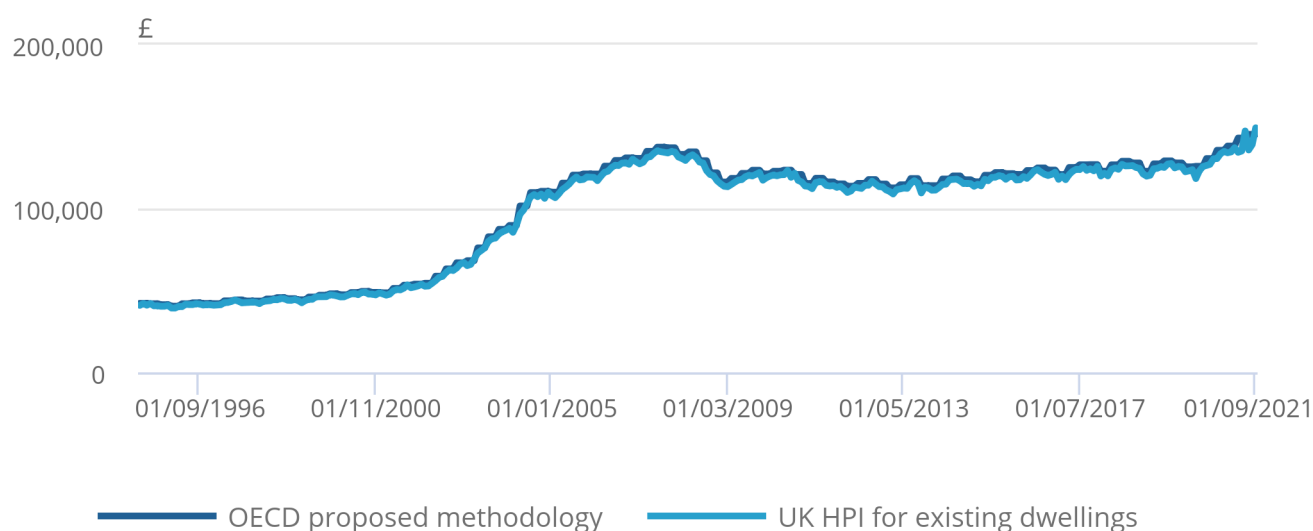
A limitation of this approach is that the average floor area of the dwelling stock has been assumed to not change over time and does not account for changes in the mix of dwelling stock properties over time.

Figure 15: House Price Levels from the OECD methodology and UK HPI are similar in the North East

Average House Price Levels (HPLs), OECD proposed methodology and UK HPI methodology for existing dwellings, 1995 to 2021

Figure 15: House Price Levels from the OECD methodology and UK HPI are similar in the North East

Average House Price Levels (HPLs), OECD proposed methodology and UK HPI methodology for existing dwellings, 1995 to 2021



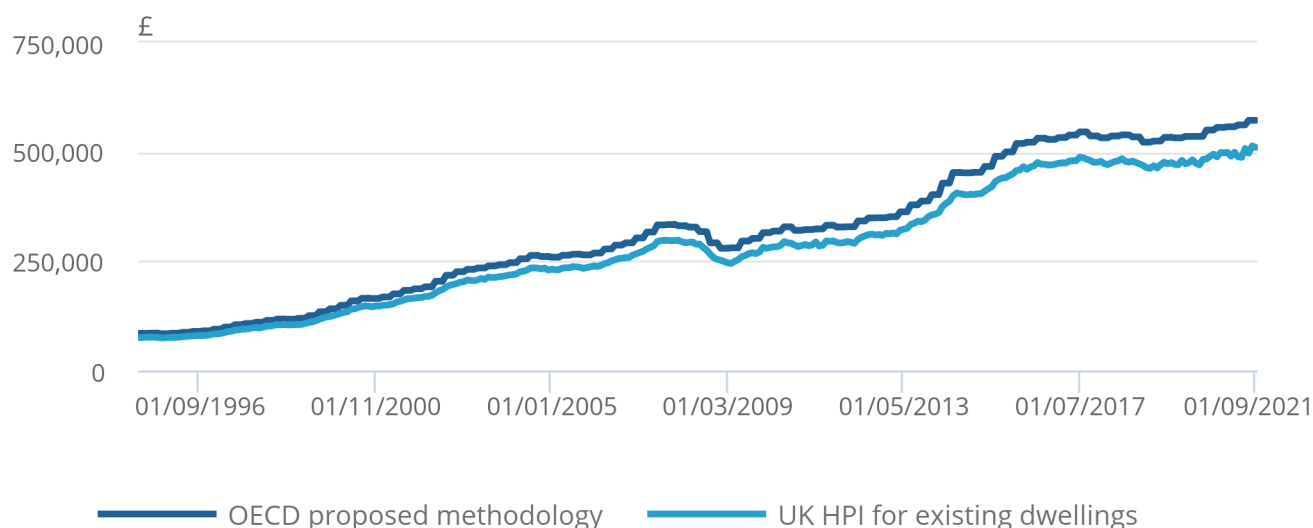
Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Figure 16: House Price Levels from the OECD methodology are higher than UK HPI estimates in London

Average House Price Levels (HPLs), OECD proposed methodology compared with UK HPI methodology for existing dwellings, London: 1995 to 2021

Figure 16: House Price Levels from the OECD methodology are higher than UK HPI estimates in London

Average House Price Levels (HPLs), OECD proposed methodology compared with UK HPI methodology for existing dwellings, London: 1995 to 2021



Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Additionally, this approach multiplies the experimental estimate of regional average price per square metre by the regional average property floor area to estimate average price per property. Different results would be obtained from multiplying the price per square metre of each property by its floor area, then calculating a regional average price.

This comparison showed that the two methods estimated similar trends in average house price. In North England regions, Wales and the Midlands, average price level estimates from the proposed methodology closely follow the UK HPI average prices for existing dwellings (the closest HPI estimate to the dwelling stock on which the OECD estimates are based). For regions in the South of England, the average price level estimates from the proposed methodology were higher than the UK HPI estimates but followed a similar trend.

Comparing average house price per square metre outputs

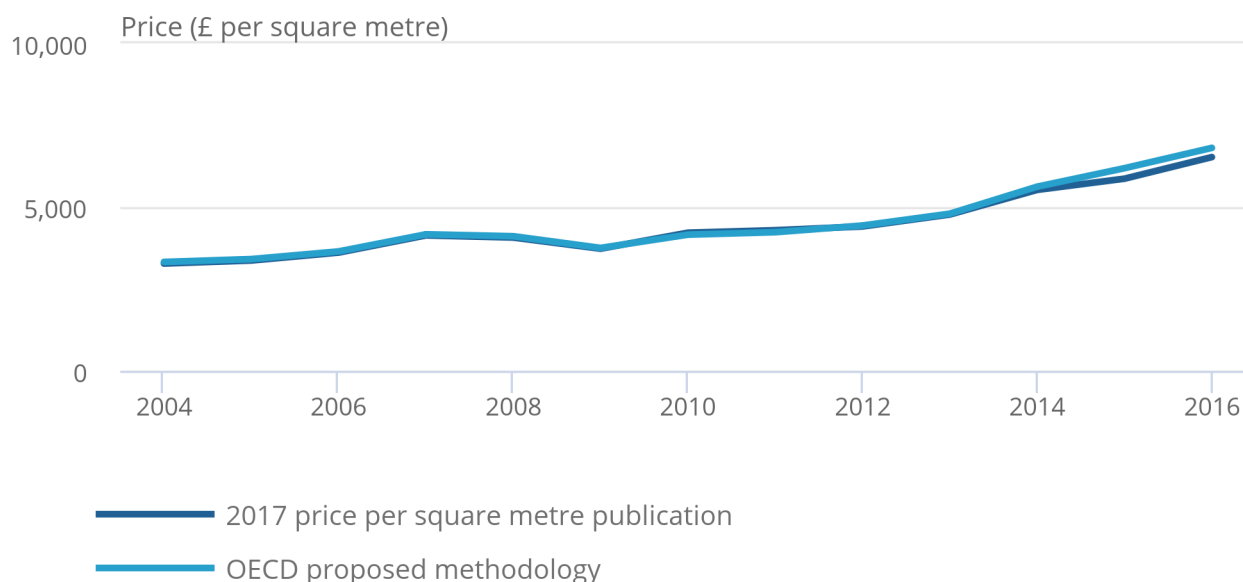
Another approach, to increase the comparability between the HPLs produced by each method, was to compare OECD price per square metre estimates with our [House price per square metre and house price per room, England and Wales estimates published in 2017](#). These UK HPI house price per square metre estimates were obtained by dividing the transaction price for each property by its floor area. These transactions were then averaged (using a geometric mean) and aggregated to higher geographies for each year.

Figure 17: House price per square metre outputs show similar trends for London between 2004 and 2016

Average price per square metre, OECD proposed methodology compared with UK HPI price per square metre outputs, London, 2004 to 2016

Figure 17: House price per square metre outputs show similar trends for London between 2004 and 2016

Average price per square metre, OECD proposed methodology compared with UK HPI price per square metre outputs, London, 2004 to 2016



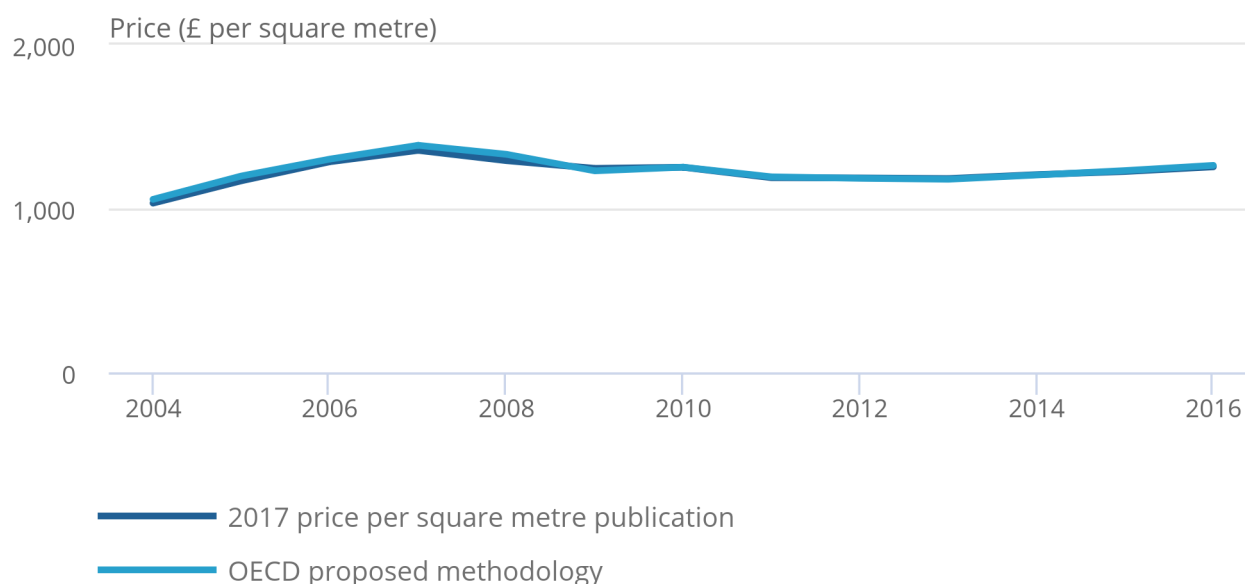
Source: UK House Price Index from HM Land Registry, Registers of Scotland, Land and Property Services Northern Ireland, and the Office for National Statistics

Figure 18: House price per square metre outputs are similar in the North East between 2004 and 2016

Average price per square metre, OECD proposed methodology compared with UK HPI price per square metre outputs, North East, 2004 to 2016

Figure 18: House price per square metre outputs are similar in the North East between 2004 and 2016

Average price per square metre, OECD proposed methodology compared with UK HPI price per square metre outputs, North East, 2004 to 2016



Source: UK House Price Index from HM Land Registry and the Valuation Office Agency

Similar trends were observed in all regions when using this second approach to compare the two methods.

Closer agreement between outputs is observed in this comparison than in the first comparison. This could be attributed to using more aligned methods to account for floor area. In the first comparison, the average price per square metre OECD proposed methodology outputs were multiplied by a constant average floor area. In the second comparison, the UK HPI price per square metre outputs were calculated by dividing individual properties' prices by that same property's floor area, aligning more closely to the method used to produce the OECD proposed methodology outputs, explaining the closer agreement between outputs.

Some of the remaining difference may be because of differences in the price reference period used in each method.

Because of the many differences between the OECD proposed methodology and the UK HPI methodology, users are strongly advised to use caution when interpreting estimates from this experimental analysis. While the results of the two methods show similar trends, differences are apparent, which could be attributed to differences between the methodologies, differences between average prices of properties sold and the underlying dwelling stock, and assumptions implemented in the calculations.

We hope users find this one-off analysis useful. However, there are currently no plans to repeat this analysis in future.

9 . Regional house price level data

[Regional house price level estimates](#)

Dataset | Released 5 May 2023

Tables of quarterly house price per square metre estimates for the English regions and Wales produced by applying the proposed OECD methodology. State space model specification selection for the English regions and Wales

[UK House Price Index: reports 2023](#)

Reports and Datasets | Released 19 April 2023

Monthly house price movements, including average price by property type, sales and cash mortgage sales, as well as information on first-time buyers, new builds and former owner occupiers. Data are collected by HM Land Registry and published on GOV.UK.

10 . Glossary

House Price Index (HPI)

A house price index (HPI) measures the price changes of residential housing as a percentage change from a specific time period (12 months before, or a base period where the HPI in 2015 equals 100).

House Price Level (HPL)

A House Price Level (HPL) is a measure of the average price of residential housing in a particular time period.

Mix adjustment

Mix adjustment is a method used to ensure that the HPI reflects a pure change in the price of houses over time and not just the change in the composition of houses sold in that period.

Disposable household income

Also known as net income, this is the combined earnings (employed and self-employed), state support (benefits and pensions) and other income (such as investment income) of a household, less the effect of direct taxes such as income tax, national insurance contributions, and council tax. Disposable income is arguably the most widely-used household income measure. More information on different types of income statistics can be found in our [Income and earnings statistics guide](#).

Equivalised income

Equivalised income is used in this release, which is income that has been adjusted to take account of household mix. Income data have been equivalised using the modified Organisation for Economic Co-operation and Development (OECD) scale, [Adjusting household incomes: equivalence scales \(oecd.org\) \(PDF, 388KB\)](#), with the reference point of a household consisting of two adults and no children.

Financial year

A financial year is a period of 12 months, used by government, business and other organisations to calculate the budgets profits or losses. For purposes of this paper, the financial year is the period between 1 April and 31 March.

11 . Data sources and quality

HM Land Registry (HMLR) price paid data

Data on residential property transactions for England and Wales, collected as part of the official registration process are provided by HM Land Registry for properties that are sold for value. This data source is also used in the production of the UK House Price Index (UK HPI). Further information on this data source can be found in the [quality assurance of administrative data \(QAAD\) of HMLR](#) used in the UK HPI.

Valuation Office Agency (VOA) Council Tax data

The main source of property attributes data that is used to supplement house price data for England and Wales is administrative data taken from the Council Tax Valuation list maintained by the Valuation Office Agency. The VOA has been responsible for banding properties for Council Tax since the tax was first introduced in 1993; before then, the VOA was responsible for the earlier system of domestic rates. The Council Tax Valuation list is a robust source of property attributes (such as the size of the property) data that cover, in principle, all residential properties in England and Wales. To access the quality assurance of administrative data used in the production of UK HPI, see the [Valuation Office Agency Council Tax Valuation Lists](#).

Household Finances Survey (HFS)

The source of income data that is used from financial year ending 2018 is the HFS, which is a combination of the longitudinal Survey on Living Conditions (SLC) and the cross-sectional Living costs and Food Survey (LCF). Both the SLC and LCF are conducted throughout the year and across the whole of the UK. Together, the SLC and LCF provide common variables on income, employment, benefits and pensions. These harmonised variables create the "core" of the HFS output. The LCF contains some additional expenditure questions while the SLC contains a policy relevant module that is regularly reviewed.

Prior to 2018, income data are from the LCF only, because of sample-size restrictions, three-year rolling averages are used, so 2017 results include responses from 2016, 2017 and 2018. Using the HFS data from 2018 onwards has led to an increase in sample-size from 5000 to 17000, and so single year estimates from the HFS are used from 2018 onwards.

More information on the income statistics used can be found in our [Improving the measurement of household income methodology](#).

12 . Related links

[Estimating regional house price levels: Methodology and results of a pilot project with Spain](#)

Working paper | Released 8 December 2021

Organisation for Economic Co-operation and Development (OECD) methodology paper presenting a new methodology for estimating regional house price levels.

[UK House Price Index: February 2023](#)

Bulletin | Released 19 February 2023

Monthly house price inflation in the UK, calculated using data from HM Land Registry, Registers of Scotland, and Land and Property Services Northern Ireland.

[Housing Purchase Affordability, Great Britain: 2021](#)

Bulletin | Released 28 July 2022

House price decile to equivalised household disposable income decile ratios. Part of our additional measures of housing affordability series.

[House price per square metre and house price per room, England and Wales: 2004 to 2016](#)

Bulletin | Released 11 October 2017

Annual data on house price by size of property calculated using data from HM Land Registry and Valuation Office Agency.

13 . Cite this article

Office for National Statistics (ONS), released 5 May 2023, ONS website, article, [Regional house price level estimates for England and Wales: 1995 to 2021](#)