S&P Dow Jones Indices

A Division of S&P Global

Halifax House Price Index (HHPI) 2019

Index Manual for HHPI model introduced in 2019

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1) Significant Index Administration Events

The following Index Administration events apply to each index of the **Halifax House Price Index (HHPI) 2019 family**.

Table 1: Index Administration Events

Date	Index Administration Event
January 2021	Governance and Regulatory Compliance sections are consolidated under Section 4) — Governance and Regulatory Compliance
April 2019	**IHS Markit Benchmark Administration Limited (IMBA UK)** officially commences Index Administration
January 2018	Annual attestation of IOSCO compliance
January 1983	**Index Commencement Date**
January 1992	**Index Base Date** (base level = 100)

2) HHPI (2019) Overview

When first introduced in 1984, the Halifax House Price Index (HHPI) represented a major advance in the measurement of house price changes in the United Kingdom.

Unlike earlier series, and house price statistics produced by other institutions, the new figures issued by the then Halifax Building Society were standardised rather than based on simple price averages. By allowing for the influence of the different characteristics of houses on their prices, using a database especially established by the Halifax, and maintained by Lloyds Banking Group (LBG), for this purpose, the new series placed the measures on a truly comparable footing, thereby providing a more accurate indication of like-for-like house price movements than was previously possible.

Broadly speaking, the HHPI methodology was left unchanged since its inception in 1983. Whilst the hedonic regression on which the original model is based remains a pre-eminent method of house price index generation in 2019, during the years that have passed since 1983 there have been several developments that encourage methodological upgrading. For instance, changes in the mix of UK housing stock – both geographical and physical housing attributes – plus the reduced influence of certain property characteristics in price determination led, especially in recent years, to an undesirable effect of increasing HHPI index volatility.

Borne out of both a deep knowledge of the original HHPI model, which we define in this document as HHPI (1983) and a careful assessment of the current literature on house price determination provided by

statistics agencies based in the UK and the euro area, IHS Markit has subsequently undertaken a number of methodological enhancements to tackle the aforementioned issues with HHPI (1983). These include:

- refreshing the data exclusion criteria, with particular focus on the inclusion of shared ownership transactions
- replacing existing model characteristics with a more parsimonious set. This selection includes improving the granularity of location characteristics
- creating an enhanced weighting system based on the chain-linking methods used by statistical agencies around the world
- remapping the HHPI sample to current Government Office Region (GOR) specifications to create UK regions consistent with UK official statistics

These enhancements have been combined to create a new set of HHPI indices for users, which we refer to as HHPI (2019), covering the following indices at both the UK national and regional level:

Table 2: List of Halifax House Price Index (HHPI) 2019 family

Index Series	Frequency	Total Number of indices
UK AHAB, SA + NSA UK New Homes, NSA UK Existing Homes, NSA UK First Time Buyers, NSA UK Former Owner Occupiers, NSA	Monthly	6
UK+12 Regions AHAB, SA + NSA UK New Homes, NSA UK+12 Regions Existing Homes, NSA UK+12 Regions First Time Buyers, NSA UK+12 Regions Former Owner Occupiers, NSA	Quarterly	66
UK+12 UK Regions AHAB, NSA UK New Homes, NSA UK+12 Regions Existing Homes, NSA UK+12 Regions First Time Buyers, NSA UK+12 Regions Former Owner Occupiers, NSA	Annual	53

3) Index Methodology

The following sections present an overview of the HHPI (2019) methodology.

The sole source of data for HHPI (2019) remains Lloyds Banking Group (LBG). Using mortgage approval data provided by LBG, it is possible to determine not only the price information related to property transactions, but also several attributes related to the type (detached, semi-detached, terraced etc.), size (bedrooms, floor space in square metres), age (new/old), and location. The dataset is then combined with hedonic regression techniques to generate house price indices.

With the core aim of HHPI (2019) to provide a robust measure of changes in residential property prices, as in the case of HHPI (1983), several types of transaction are excluded from index generation. These include:

- Re-mortgages
- Business use, capital raising, or building mortgages
- Discounted mortgages relative to market value (as determined by observed data that shows the property valuation < 75% of purchase price e.g. the “Right-to-Buy” scheme).

An exception to the discounted mortgage rule is shared ownership mortgages which are, for the first time, included in the new version of the HHPI. We also now include buy-to-let properties and those bought directly from less-conventional vendors e.g. builders.

The effects of including shared ownership mortgages enable the HHPI (2019) to:

- better reflect the current structure of the UK housing market, especially in relation to the trend towards increasing levels of shared ownership among first-time buyers
- enjoy a higher sample size and help to reduce the period-to-period volatility of HHPI both at national and regional levels.

3.1) Index Calculation

The HHPI is calculated by estimating the price of a fixed ‘basket’ of attributes of houses sold in different time periods (an analogy is with the standard basket of goods in the retail price index). By taking a ratio of two valuations we subsequently estimate the change in property prices across a time period.

To reflect the idea that the mix of properties is not necessarily constant and can change between periods, the HHPI (2019) basket of attributes is fixed to a 12-month period and subsequently updated once a year using three years of LBG transactional data (although an exception is the regional weights for the UK level indices, which are calculated using external data from the Land Registry, HMRC and Council of Mortgage Lenders. This is to help guard against any regional bias that may be present in the LBG transactional dataset).

Given that successive years of data are not directly comparable, each basket runs for a 13-month period from January to January (or in the case of a quarterly index, Q1 to Q1). Individual ‘in-year’ price indices for each basket of goods are created with the first January (or Q1) index value set to 100. The ‘in-year’ indices are subsequently ‘chained’ together to provide a continuous time series by taking the month 13 January figure (or quarter 5 figure) as the first reading of the next year’s basket.

This should be viewed as a considerable improvement on the original methodology, which used a standardised house determined in 1983. Throughout recent years there have been a number of changes in property development (such as a rise in the number of bathrooms, the increased use of central heating etc.) that has made the standardised house in 2019 look different to that of 1983. Chain-linking methods subsequently help to address these changes in the housing market and, going forward, provide a natural protection against future changes.

A further update to the methodology is to use a parsimonious and more targeted set of property characteristics. HHPI (1983) utilised a vast array of attributes. Whilst these were relevant in 1983, a number have unfortunately become obsolete or hard to measure e.g. central heating statistics, garage spaces etc. In line with empirical evidence and indices produced around the globe, our new set of characteristics has been chosen to focus primarily on size, type, and location.

Valuing the standardised property with the use of these price-determining characteristics is achieved using the same semi-logarithmic hedonic regression specification employed by the original 1983 HHPI model. In the case of housing, prices reflect the valuation placed by purchasers on a particular set of locational and physical attributes (or characteristics) possessed by each house. The subsequent need

for ‘standardisation’ arises out of the observation that two houses are not alike: they can differ according to a variety of quantitative and qualitative characteristics relating to the physical attributes of the houses themselves or to their locations.

The difficulty is the implicit value placed by a purchaser on each characteristic cannot be observed because transactions take place in terms of a single total price. Therefore, in order to remove that part of price variation due to changes in the mix of house characteristics over time, and so to measure the variation caused by inflationary factors, it is necessary to disaggregate prices into their constituents statistically. This is achieved by using a multivariate regression equation of the form:

$$ln(P_i) = \beta_0 + \beta_1 X_1^i + \beta_2 X_2^i \ + ... + \beta_j X_k^i \ + e_i$$

Here P_i reflects the price of an individual property i which is determined by a set of $k = \{1, 2, ..., n\}$ characteristics X_k^i. If the property has a particular characteristic then it takes the value of 1 or 0, with the exceptions of the number of bedrooms (between 1 and 8) and floor area (m^2 bounded between 30 and 500).

The set of $\beta_1, \beta_2, ..., \beta_j$ regression coefficients correspond to the qualitative and quantitative characteristics, whilst the group of unmeasured factors (assumed to be randomly distributed) which are specific to each house but for which data are not available is captured by the statistical error e_i.

The regression is subsequently calculated using the widely-used technique of Ordinary Least Squares (OLS).

3.2) Property Characteristics

The index uses a variety of characteristics to determine a standardised house in the UK which, when taken together, help to explain the majority of the variation in house prices. Compared to HHPI (1983), the new version of the model takes a more targeted approach to the standardised house price, focusing on value-added characteristics such as type, size, age and location.

Taking each of these in isolation:

a. Property Type

LBG attributes a property type to each mortgage offer, these being:

Detached, Semi-Detached, Terraced, Flat, Bungalow

As would be expected, detached properties tend to command higher selling prices than semi-detached, which in turn tend to be higher than terraced properties etc.

b. Size

The LBG mortgage data includes information on the size of each property in square metres. Not surprisingly we find that this is a key, statistically significant, determinant of the price of a property i.e. Ceteris Paribas the larger the property the greater the value.

The price of the property is also partly explained by the number of bedrooms that it possesses. The higher the number of bedrooms the higher the price tends to be. LBG mortgage offers contain information on bedroom numbers and, as such, this variable is included in the regression specification.

c. Age

New houses tend to attract a price premium relative to older properties with similar attributes. Including a categorical characteristic that encapsulates this (i.e. new or not new) is found to be statistically significant in our hedonic regression specification and is subsequently included as an explanatory variable.

d. Location

In line with HHPI (1983), a set of dummy variables that encapsulates a particular UK region that the property resides within continues to be used. A slight variation on the original methodology is the use of Government Office Region classifications (GOR) for England, rather than the original Economic Planning Region (EPR) classification. This provides us with nine English regions: Eastern England, East Midlands, Greater London, North East, North West, South East, South West, West Midlands and Yorkshire & Humberside. These are combined with Northern Ireland, Scotland and Wales to provide 12 UK regions.

A notable difference between the 1983 and 2019 HHPI indices has been greater focus on the treatment of locational property characteristics. The existing methodology used the EPR as the only price-determining locational factor. However, within any given region there will variance in terms of desirability between postcode areas and this will be reflected in respective house prices. Greater granularity within the location variables can be expected to notably improve the ability to accurately estimate house prices.

Whilst a commercially available location variable (ACORN) is used by the Nationwide and the Office for National Statistics (ONS) in the generation of their own, similar, house price indices, IHS Markit has created its own propriety classification system to help determine an area's house-price level in the context of its GOR region and housing-mix.

Note UK and regional HHPI (2019) models may contain differences in explanatory variables employed in respective hedonic regression specifications. These difference are seen in Table 3: HPI Regression Specifications.

Table 3: HPI Regression Specifications

HHPI Regression Specifications					
Explanatory Variables (Dependent Variable: ln Purchase Price)	✓ denotes variables included			✗ denotes variable excluded	
	All Houses	Existing Houses / New Houses	First-Time Buyers / Former Owner Occupiers	GOR Regions	
				All, FTB, FOO	EXI / NEW
Property Type					
Detached	*Omitted Dummy Variable*				
Semi-Detached	✓	✓	✓	✓	✓
Terraced	✓	✓	✓	✓	✓
Bungalow	✓	✓	✓	✓	✓
Flat	✓	✓	✓	✓	✓
Size					
Square Metres	✓	✓	✓	✓	✓
Number of Bedrooms	✓	✓	✓	✓	✓
Age					
New House	✓	✗	✓	✓	✗
Property Location - Region					
Eastern England	✓	✓	✓	✗	✗
East Midlands	✓	✓	✓	✗	✗
North East	✓	✓	✓	✗	✗
North East	✓	✓	✓	✗	✗
North West	✓	✓	✓	✗	✗
Northern Ireland	✓	✓	✓	✗	✗
Scotland	✓	✓	✓	✗	✗
South East			*Omitted Dummy Variable*		
South West	✓	✓	✓	✗	✗
Wales	✓	✓	✓	✗	✗
West Midlands	✓	✓	✓	✗	✗
Yorkshire & Humberside	✓	✓	✓	✗	✗
Property Location - Regional Postcode					
PROP1	✓	✓	✓	✓	✓
PROP2	✓	✓	✓	✓	✓
PROP3	✓	✓	✓	✓	✓
PROP4	✓	✓	✓	✓	✓
PROP5			*Omitted Dummy Variable*		
PROP6	✓	✓	✓	✓	✓
PROP7	✓	✓	✓	✓	✓
PROP8	✓	✓	✓	✓	✓
PROP9	✓	✓	✓	✓	✓

3.3) Index Performance

The model changes have resulted in a number of improvements to HHPI performance, which we define from the perspective of three key metrics:

- statistical output from the regression calculations e.g. explanatory power (RSQ statistics), parameter significance as measured by t-statistics
- sample size
- index volatility

Table 4: HHPI (2019) Key Metrics (July 2007 to June 2018) provides some summary statistics related to these metrics at the UK level, not only for the All House All Buyers (AHAB) indices, but also the sub-indices of First-Time Buyers (FTB), Former Owner Occupiers (FOO) and Existing (EXI).

Table 4: HHPI (2019) Key Metrics (July 2007 to June 2018)

Index Series (United Kingdom)	Sample Gain	RSQ	Volatility Improvement (y/y inflation rates)	Standardised Price (at Jun-18)	Price Difference to HHPI1 (% 5-Year Average)
AHAB	**35%**	**82.4%**	**43.1%**	**£231,903**	**2.2%**
First-Time Buyers	36%	82.3%	49.0%	£183,536	5.2%
Former Owner Occupiers	33%	83.7%	48.3%	£278,868	4.2%
Existing Houses	20%	84.2%	63.5%	£220,398	-4.7%
New Houses	n/a	84.1%	n/a	£244,815	n/a

Notes: Gain columns reflect the difference between equivalent HHPI1 (1983) and HHPI (2019) data. In this instance, a positive number equates to a higher reading for HHPI (2019) models. Note all comparisons cover the period July 2007 to June 2018 and, reflective of their market sensitivity, we do not include raw sample size numbers. We measure volatility by taking the square root of the average squared monthly movement in annual rates of change for both the HHPI (1983) and HHPI (2019) indices. Using a ratio of these two numbers provides an estimate of the relative difference between the monthly movements of the two data series. A positive number in the tables reflect favourable performance for HHPI (2019) models.

Table 4: HHPI (2019) Key Metrics (July 2007 to June 2018) highlights the positive impacts that the model refinements have made on all of our key performance metrics.

Firstly, amendments of the data cleansing rules to include shared-ownership, buy-to-let and non-typical vendors such as builders has led to a noticeable gain in sample size over the test period. At the UK level the increase is 35%. There is a slightly stronger increase in the number of first-time buyers (FTB) and we also have a greater representation of new properties in our sample (as implied by the number of existing houses rising by 20% on average). Note this is broadly expected given the inclusion of shared ownership and direct purchases from builders. With this in mind, we have taken the opportunity to supply a New Houses Index which had been previously discontinued.

Secondly, the addition of our new property location characteristics, allied with a parsimonious regression specification focusing on size, age, location and property type leads to noticeable and considerable gains in the explanatory power of the indices compared to HHPI (1983).

The AHAB UK model, with a RSQ average of 82.4%, is a considerable improvement on HHPI (1983) – an increase of 14.2 ppts. The three other currently available models – FTB, FOO and EXI – also enjoy noticeable gains in explanatory power, whilst the RSQ reading for new houses is over 80%.

Thirdly, the implied volatility of all indices is reduced, reflective of the new parsimonious regression specification which has removed variables that have proven difficult in recent years to identify coefficient values for i.e. central heating, garage spaces etc. At 43.1%, the improvement in volatility seen at the UK level is considerable, with even larger improvements seen for FTB (49.0%), FOO (48.3%) and EXI (63.5%).

4) Governance and Regulatory Compliance

IHS Markit Benchmark Administration Limited (IMBA UK) is the Administrator of HHPI 2019 Index family. Information on IMBA UK's governance and compliance approach can be found here. This document covers:

- Governance arrangements, including external committees
- Input data integrity
- Conflicts of interest management
- Market disruption and Force Majeure
- Methodology changes and cessations
- Complaints
- Errors and restatements
- Reporting of infringements and misconduct
- Methodology reviews
- Business continuity

More details about IMBA UK can be found on the Administrator's website.

5) Construction of this Index Manual

The Index Manual is published by the Index Administrator. In the event of any inconsistency between the English language version of this Index Manual and that translated into any other language, this English version shall prevail.

6) Disclaimer, Licensing and Trademark

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For any general index enquiries, please contact the IHS Markit Index Administration support group at support@ihsmarkit.com.

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8) ESG Disclosures

EXPLANATION OF HOW ENVIRONMENTAL, SOCIAL & GOVERNANCE (ESG) FACTORS ARE REFLECTED IN THE KEY ELEMENTS OF THE BENCHMARK METHODOLOGY [1]		
1	**Name of the benchmark administrator.**	IHS Markit Benchmark Administration Limited (IMBA)
2	**Underlying asset class of the ESG benchmark. [2]**	N/A
3	**Name of the S&P Dow Jones Indices benchmark or family of benchmarks.**	Halifax HPI 2019 Benchmark Statement
4	**Do any of the indices maintained by this methodology take into account ESG factors?**	No
Appendix latest update:		March 2023
Appendix first publication		March 2023

[1] The information contained in this Appendix is intended to meet the requirements of the European Union Commission Delegated Regulation (EU) 2020/1817 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the minimum content of the explanation of how environmental, social and governance factors are reflected in the benchmark methodology and the retained EU law in the UK (The Benchmarks (amendment and Transitional Provision) (EU Exit) Regulations 2019.

[2] The ‘underlying assets’ are defined in European Union Commission Delegated Regulation (EU) 2020/1816 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the explanation in the benchmark statement of how environmental, social and governance factors are reflected in each benchmark provided and published.

A) Glossary

Term	Definition
HHPI	means Halifax House Price Index (HHPI) 2019 family.
IHS Markit Benchmark Administration Limited (IMBA UK)	means the Administrator of the HHPI 2019 index family
IHS Markit Website	means the following website: http://www.markit.com/Product/Halifax-House-Price-Index .
Index Base Date	is the date of the initial level of the index. See Table 1: Index Administration Events.
Index Commencement Date	is the date the i**ndex level** was first published. See Table 1: Index Administration Events.
Index Manual	means this document, as amended, replaced or substituted, from time to time.
Index Owner	means IHS Markit.

Disclaimer

Performance Disclosure/Back-Tested Data

Where applicable, S&P Dow Jones Indices and its index-related affiliates (“S&P DJI”) defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the index is set to a fixed value for calculation purposes. The Launch Date designates the date when the values of an index are first considered live: index values provided for any date or time period prior to the index’s Launch Date are considered back-tested. S&P DJI defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company’s public website or its data feed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed “Date of introduction”) is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index’s public release date.

Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Information presented prior to an index’s launch date is hypothetical back-tested performance, not actual performance, and is based on the index methodology in effect on the launch date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. In addition, forks have not been factored into the back-test data with respect to the S&P Cryptocurrency Indices. For the S&P Cryptocurrency Top 5 & 10 Equal Weight Indices, the custody element of the methodology was not considered; the back-test history is based on the index constituents that meet the custody element as of the Launch Date. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results

and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results.

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate certain ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used. Index returns shown do not represent the results of actual trading of investable assets/securities. S&P DJI maintains the index and calculates the index levels and performance shown or discussed but does not manage any assets.

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Intellectual Property Notices/Disclaimer

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