Methods explained

A quarterly series of short articles explaining statistical issues and methodologies relevant to ONS and other data in a simple, non-technical way. As well as defining the topic areas, the notes explain when, why and how these methodologies are used. Where relevant, we also point the reader to further sources of information.

House price indices of the UK

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SUMMARY

There are a number of house price indices that measure the rate of inflation in the UK housing market. This article provides an overview of the three main UK house price indices published by the Department for Communities and Local Government, Nationwide and Halifax. It details how they are constructed and explains why differences can occur between these three measures. The article also covers the newly published Land Registry house price index and comments on its methodology.

The UK housing market is of interest to the public as changes in the price of houses significantly affect both homeowners and potential buyers. During the early 1990s, there was a prolonged recession in the housing market, followed by a recovery that led to high growth in the late 1990s; both of which received widespread media attention. More recently, rising house prices have focused attention on the difficulties faced by first-time buyers trying to enter the housing market. When setting UK interest rates, the Bank of England's Monetary Policy Committee takes into account the inflationary pressures on the economy as a result of the housing market.

This article focuses on the methodologies of these three house price indices (Department for Communities and Local Government (DCLG), Nationwide and Halifax), specifically how the indices are constructed and what they are actually measuring. It summarises the methodological differences that exist and expands on some of the key concepts central to understanding house price indices. It explains why house price indices are not always consistent despite apparently measuring the same thing.

Methodologies

There are several approaches that can be taken to calculate the average rate of change in house prices. It is possible to create a simple house price index by calculating the average purchase price and converting it into an index. The three house price indices examined in this article all use more sophisticated approaches. These are illustrated in **Table 1**.

Table 1 presents a comprehensive analysis of the methodological differences that exist between these house price indices. The content serves as the structure for the rest of this article in explaining the differences that are observed in the measures of inflation, as illustrated in **Figure 1**.

Figure 1
Annual house price inflation[1]
Percentages
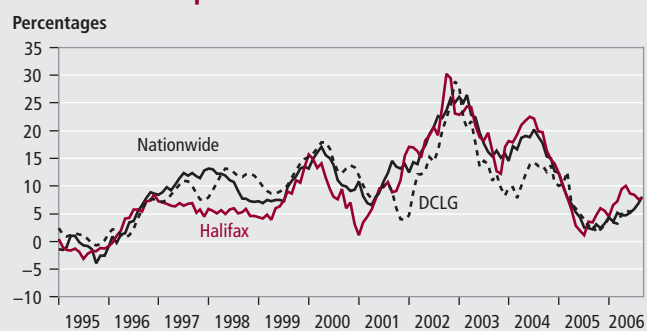
1 The DCLG house price index is only available as a monthly index dating back to February 2002. Figure 1 has been constructed by making use of the quarterly DCLG series that is available and applying a cubic spline function to interpolate a monthly series (and the resultant annual rate of inflation).

As can be seen in Figure 1, the rates of inflation that are inferred from the Nationwide and Halifax house price indices are broadly in line with one another (particularly since 1999), as the statistical techniques used are similar. However, there are marked differences with the DCLG index, particularly in the period from late 2003 to 2005.

The differences that are observed in Figure 1 could be caused by a variety of different factors affecting the construction of the index. These include:

- the composition of the sample used to obtain the price data
- the definition of price used in the respective house price indices
- variables used in the statistical model to estimate average prices
- the weights used for 'mix adjustment' and how they are applied
- whether the index is seasonally adjusted or not

The sample

The sample primarily refers to how the price data are collected that allow house price indices to be constructed. The samples used by Nationwide and Halifax are based on in-house mortgage data, which are essentially the number of new mortgage loans each building society makes. The DCLG index is based on data that are available from different mortgage lenders, collected by the Financial Services Authority (FSA). It is compulsory for all mortgage lenders to submit their data to the FSA.

Table 1
Summary of the UK house price indices

	DCLG	Nationwide	Halifax
Data	Data are available from 50 mortgage lenders (about a third of all purchase completions)	In-house mortgage origination data based on number of new loans written	In-house data based on mortgage approvals
Price definition	Purchase completion	Mortgage approval	Mortgage approval
Extent of cover	UK	UK	UK
Variables used to estimate property price	■ Type of dwelling ■ Is the dwelling old or new? ■ Is the purchaser a first time buyer? ■ Number of habitable rooms/number of bedrooms ■ County/London borough ■ Type of neighbourhood ■ Type of local authority	■ Type of dwelling ■ Number of bedrooms ■ Floor size ■ Double garage ■ Parking space or no garage ■ More than one bathroom ■ New ■ Region ■ Type of neighbourhood ■ Parliamentary constituency	■ Type of dwelling ■ Number of habitable rooms ■ Number of garages ■ Number of acres ■ Garden ■ Number of bathrooms ■ Number of toilets ■ Property age ■ Region
Mix adjustment	Yes	Yes	Yes
Weighting method	Expenditure weights	Volume weights	Volume weights
Measures	Value of set of transacted dwellings	Price of Nationwide representative dwelling	Price of Halifax representative dwelling
Seasonal adjustment	No	Yes	Yes

These mortgage lenders submit all their completions data (see below), which cover around a third of all completions on mortgaged purchases. Since the Nationwide and Halifax indices are based on in-house data, and also on prices at the mortgage approval stage rather than completion prices, their data are available at an earlier stage compared with the DCLG index. This means that their indices provide a timelier indicator of house price trends.

The definition of price

The Nationwide and Halifax price indices are based solely on the mortgage approvals they provide to their respective customers. The house price measured by these indices is the price at the asking stage of the buying process when the mortgage is first approved. The DCLG index is based on the actual purchase price at the completion stage. The price at the mortgage approval stage can differ from the price at which the dwelling is bought at the purchase completion stage. In practice, there is a negotiation process between these two stages in which it is possible for the price of the dwelling to change, which may cause differences in the measured rate of house price inflation (note that all three indices exclude cash purchases).

There is usually a time lag between the mortgage approval and purchase completion stages in which there can be a difference in the absolute value of the house price as well as the rate of inflation that is measured. One advantage of approvals data is that they give an earlier indication of current trends in prices, as these data are available at an earlier stage.

The DCLG price index was specifically designed to be based on purchase completions and not mortgage approvals despite the less timely nature of this data. There are three primary reasons why this index, based on the purchase completion stage, gives a better reflection of the housing market:

■ not all mortgage approvals go through to the purchase completion stage
■ the purchase price at the mortgage application stage can change by the time the completion goes through, and
■ an ideal house price index should reflect actual transaction prices

Mix adjustments

All three indices make mix adjustments, which are used to ensure house price indices reflect a pure price effect as far as possible. Adjustments ideally need to be made to house price indices so that any change in the rate of inflation is not simply picking up changes in the composition of properties that are being bought and sold (the 'mix' of properties). A mix-adjusted house price index attempts to remove (as far as possible) the dependence between the average price and the mix of properties that are transacted in that particular time period. It does this by weighting each property type or characteristic by a relative weight that is fixed from one index base period to the next.

If no mix adjustment is made, the resultant house price index would reflect the types of properties that are sold in a given time period. This may not give an accurate picture of what is actually happening in the housing market. A mix adjustment example is presented in **Box 1**.

Variables used in the statistical model

All three indices use prices based on a statistical model. This is because there are so many characteristics which affect the price of a dwelling that it is impossible to produce a definitive list of property types for which average prices can be obtained. In the example of Box 1, a four-bedroom house may be detached, semi-detached or terraced, with or without a garage, old or new, and so on. In fact, all dwellings are unique and it is necessary to identify the most important, available characteristics to classify them into a manageable number of dwelling types.

Box 1

A mix adjustment example

The two tables illustrate an example of how mix adjustments are carried out. They show how the composition of properties sold changes from year t to year t+1. This is shown by the relative change in the types of properties sold. There is also information on the average prices of these properties. It has been assumed that there has been a 10 per cent increase in the prices of all these properties from year t to year t+1.

When mix adjustments are made, fixed relative weights are used. In this example, these represent the relative volume of transactions in a particular period (year t). Fixing these weights when constructing a mix-adjusted house price index means that, unlike a simple average approach, the measure of house price inflation will not be affected if there is a change in composition of property types sold.

If over time there is a change in the property mix that is being sold so that more four-bedroom houses are being sold at the expense of one- and two-bedroom flats, a simple average approach would pick up a faster rate of house price inflation than there actually is (assuming that four-bedroom houses are dearer).

Given a price rise of 10 per cent for all property types between year t and year t+1, intuition would suggest that the overall rate of house price inflation should be 10 per cent. Using the simple average approach (Table A), where the weights are not fixed, the house price index states an annual inflation rate of 17.7 per cent for the average property. Some of this inflation measure is the price effect but some is also the fact that there has been a relative increase in the number of higher priced properties sold.

Table A
Simple average

Property type	Number of sales (q_t)	Average price (p_t)	Number of sales (q_{t+1})	Average price (p_{t+1})
1 bedroom flat	150	£100,000	100	£110,000
2 bedroom flat	150	£110,000	100	£121,000
2 bedroom house	200	£160,000	200	£176,000
3 bedroom house	350	£200,000	400	£220,000
4 bedroom house	150	£250,000	200	£275,000
Average property price		**£171,000**		**£201,300**
Average rate of inflation				**17.7 per cent**

In Table B, a mix adjustment approach is used, fixing the relative sales of properties from year t. As it was assumed that the rate of inflation for all property types was 10 per cent, one would expect this to be the average rate of inflation. When a mix adjustment is made, this is what is observed.

Table B
Mix adjustment

Property type	Number of sales (q_t)	Average price (p_t)	Number of sales (q_t)	Average price (p_{t+1})
1 bedroom flat	150	£100,000	150	£110,000
2 bedroom flat	150	£110,000	150	£121,000
2 bedroom house	200	£160,000	200	£176,000
3 bedroom house	350	£200,000	350	£220,000
4 bedroom house	150	£250,000	150	£275,000
Average property price		**£171,000**		**£188,100**
Average rate of inflation				**10.0 per cent**

Table 2 shows the broad property classification variables that are used by Nationwide, Halifax and the DCLG. A house price index is structured according to these variables, which have been grouped to make the analysis clearer. In practice, there are subtle differences in the definition of the variables used in the respective statistical models. Table 1 shows this in more detail. Note that DCLG uses fewer classification variables because they are reliant on data from the FSA and, unlike Nationwide and Halifax, do not have ready access to full property details.

Applying these statistical models minimises the impact of changes in the mix of individual property within each defined dwelling type. The models also allow estimation of an average price when there are no sales in the sample for any particular dwelling type.

The monthly price estimates for each dwelling type, calculated from these statistical models, are then applied to a set of fixed weights to construct a mix-adjusted house price index.

Weights

One of the main reasons for the differences observed in Figure 1 is the variation in the weighting methods applied between the DCLG index and the Nationwide and Halifax indices, so that the respective indices reflect the UK housing market.

Table 2
Property classification variables

Property classification	Nationwide	Halifax	DCLG
Type of dwelling	✓	✓	✓
Number of habitable rooms	✓	✓	✓
Floor size (square feet)	✓	-	-
Number of garages	✓	✓	-
Number of acres	-	✓	-
Garden	-	✓	-
Number of bathrooms	✓	✓	-
Property age	✓	✓	✓
Region	✓	✓	✓
First time purchase	-	-	✓

The Nationwide and Halifax use volume-based weights to construct their house price indices. This means that price movements according to these indices are weighted by the number of transactions.

The DCLG index applies expenditure weights to the estimated purchase price for each dwelling type. This is equivalent to applying volume weights to prices rather than price movements (see **Box 2**). Use of expenditure weights makes the DCLG index more sensitive than the Nationwide and Halifax indices to price movements for the more expensive properties, as a higher weight is given to the more expensive properties. This difference is illustrated in Box 2.

Box 2

The difference between volume- and expenditure- based weights

The example shows three different property types; A, B and C which have different rates of house price inflation (5 per cent, 10 per cent and 20 per cent respectively). The fixed volume weights are 100, 200 and 200, respectively.

Volume-weighted price change:

$$\frac{(100 \times 5) + (200 \times 10) + (200 \times 20)}{500}$$

= 13.0 per cent

Expenditure-weighted price change:

$$\frac{[(100 \times 105,000) + (200 \times 165,000) + (200 \times 240,000)] - 80,000,000}{80,000,000}$$

= 14.4 per cent

	Volume (q_t)	Expenditure	Average price (p_t)	Average price (p_{t+1})	Price change (per cent)
A	100	£10m	£100,000	£105,000	5
B	200	£30m	£150,000	£165,000	10
C	200	£40m	£200,000	£240,000	20
Overall	500	£80m	£160,000	£183,000	14.4
Volume-weighted price changes					**13.0**
Expenditure-weighted price change					**14.4**

When volume-based weights are used, the house price index shows a 13.0 per cent increase. This is less than the 14.4 per cent increase from the expenditure-weighted index because it is the expensive properties (Type C) which have the greatest price increase.

If the cheaper properties had larger price increases than the expensive properties, the volume-weighted index would show a higher increase than the expenditure-weighted index.

The increase in the expenditure-weighted index is identical to the increase in mix-adjusted average prices. This is because the expenditures are derived from year t prices.

Seasonal adjustment

House prices show a seasonal component as price changes tend to be stronger in the summer months and weaker in the winter months. This is because the market is more buoyant in the summer as there are more potential buyers, which means that there is less pressure for a seller to discount prices in order to push through a sale. Nationwide figures show that June raw prices, that is, non-seasonally adjusted prices, are 1.3 per cent above their seasonally adjusted level, whereas January raw prices are 1.9 per cent below their seasonally adjusted level. Incidentally, there is also an Easter effect.

When analysing annual rates of house price inflation, the implications of whether seasonal adjustments are applied are insignificant. The seasonal factors that affect house prices mean that even though these factors are likely to cause house prices to be higher, for example, in June in one year, the same factors are likely to have a similar effect in the previous June. Hence, annual inflation rates are not likely to be significantly affected by seasonal adjustment.

However, if shorter-term house price inflation analyses are made, such as on a quarterly basis, this can cause there to be divergences in house price indices if one is seasonally adjusted and the other is not. If the index is not seasonally adjusted, it would be picking up the absolute change in prices but would not be the best reflection of the inflationary pressures in the housing market. By publishing a seasonally adjusted house price index, it allows for the comparison of data between two quarters for which the seasonal pattern is different. The importance of whether an index is seasonally adjusted depends on whether short- or long-term analyses of the housing market are being made.

Both the Nationwide and Halifax indices are seasonally adjusted, whereas presently the DCLG index is not and hence should not be used for quarterly or monthly comparisons. This is because there is not enough data yet for the DCLG index to be seasonally adjusted (a monthly series is only available back to February 2002), although there are plans to make seasonal adjustments to the DCLG index when enough data are available.

Land Registry house price index

A new monthly house price index, produced by the Land Registry, was launched in October 2006. Like the Nationwide and Halifax indices, this new index is seasonally adjusted. The main difference between this index and those discussed above is that it uses a repeat sales method. This means that the index is based on observed price changes for repeat sales of the same property since April 2000. This ensures like-for-like price comparisons as it enables price changes on the same property to be tracked over time. It also avoids the need for the relatively arbitrary categorisation of individual dwellings into dwelling types. Statistical modelling is only required to link the price changes for individual properties, which are bought and sold in different months, into a single, monthly series.

The repeat sales methodology enables 'property specific' elements that cause the price of the property to deviate from the overall trend of house price inflation also to be captured.

The measure is based on the Land Registry's complete record of repeat sales residential property transactions in England and Wales. This means that unlike the other indices discussed, the Land Registry house price index also includes cash purchases as well as mortgages.

Cash purchases account for a significant amount of dwelling purchases (approximately 25 per cent). Due to the differences in the characteristics of the cash-bought dwellings and mortgage-purchased dwellings, this can cause differences to be observed in the measured rate of inflation.

Despite the methodological advantage of the repeat sales approach, there are some drawbacks to the Land Registry house price index:

- the index only measures price changes for properties sold in England and Wales, not the whole of the UK
- because of the repeat sales methodology, the only properties that are included in the sample are those that have been sold twice or more since 2000. Unlike the other three indices, it therefore does not include properties with only one sale since 2000 and it cannot include the effect of any new properties that are sold
- the index is subject to long-term revisions. Revisions covering a short time span are normal as new or revised data become available but, under the repeat sales method, new sales for properties previously sold many years ago can affect the index all the way back to the time of these earlier sales

Conclusion

This article has examined some of the ways house price indices can be constructed. Some of the methodological features of interest have been explained. The article provides a basis to help understand the differences that are observed in the DCLG, Nationwide and Halifax measures of house price inflation. Figure 1 shows that the latter two measures of house price inflation are very similar to one another. As Table 1 summarises, this is because many of the statistical techniques used to construct both series are similar. The differences that are seen between these two measures are likely to arise from the fact that the representative properties tracked by both Nationwide and Halifax are likely to differ from each other, reflecting the differences in clientele.

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