# DEVELOPMENTS IN THE UNITED KINGDOM'S HOUSE PRICE INDEX

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Christopher Jenkins and Jim O'Donoghue
Office for National Statistics, United Kingdom
Christopher.jenkins@ons.gsi.gov.uk

## 1. Abstract

The UK Office for National Statistics (ONS) has recently taken over the responsibility for the processing and publication of an official UK House Price Index (HPI).  This paper summarises the methodology used in the production of the United Kingdom (UK) HPI and discusses the differences when compared with other house price measures available in the UK.  The paper also considers the development work required to produce a definitive house price measure for the UK, as recommended in a recent review of UK house price statistics[1] by the UK National Statistician

## 2. Introduction

There is no single definitive official house price index for the UK.  A number of UK government agencies produce and publish information on UK house prices as official statistics.  In addition there are other statistics on house prices which are produced by a range of private sector bodies using differing sources and measures (Matheson, 2010).  Up until March 2012, the UK Department for Communities and Local Government (DCLG) produced and published monthly figures for average house prices and price indices for the UK and its component countries and regions.  In December 2011 it was announced that the responsibility for the DCLG HPI would transfer to the ONS, with the transfer to be completed by the end of March 2012.  From this point onwards, responsibility for the compilation and publication of the UK HPI rests with the ONS.

Prior to this, the National Statistician carried out a review of UK house price statistics in 2010.  The review report summarised that there is a great deal of interest in changes in the value of UK houses and there is confusion for users from having a number of different house price indices.  The review report concluded that none of the current official house price measures meet all key user requirements and further work is needed to establish whether and how a single official index (which better meets user requirements) could be produced (Matheson, 2010).  The report also requested that more effort is necessary to better explain the current methods used

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[1] http://www.statisticsauthority.gov.uk/national-statistician/ns-reports--reviews-and-guidance/national-statistician-s-reports/national-statistician-s-review-of-house-price-statistics.pdf

to produce UK house price statistics and provide fuller commentary on the comparisons between official measures and other non-official sources.[2]

3. Office for National Statistics' HPI

From April 2012, ONS has taken the responsibility for the production and publication of the house price index from DCLG. The ONS HPI is a price index based on completed mortgage transactions, so it specifically measures the price actually paid for a property in the UK (at the end of the sale/purchase phase). The source of data for the ONS HPI is from the Regulated Mortgage Survey (RMS) as collected by the Council of Mortgage Lenders (CML). The RMS is a monthly survey, to which mortgage lenders participate on a voluntary basis. House price information is collected from mortgage lenders for property sales (that were financed by a mortgage) that reached completion during the reference month (and for which they provided the mortgage). Other variables are also collected via RMS, which include
- locality (postcode)
- type of dwelling (detached, terraced etc.)
- whether or not the property is new or old
- whether the buyer was a first time buyer or not
- number of habitable rooms
- number of bedrooms

The RMS dataset, and therefore the ONS HPI, is limited to mortgage purchases only; it does not cover residential property purchases that have taken place as a cash sale. This is a recognised limitation with the ONS HPI and will be discussed further in section five.

Coverage of ONS HPI

Historically, DCLG and its predecessors calculated a quarterly house price index from 1968 until 2002 based on a 5 per cent sample of completions from a wide cross-section of the UK's mortgage lenders (as collected in the RMS). During this period, the HPI sample size ranged from approximately 26k to 36k mortgage transactions per year. This was due to the fact that mortgage lenders were only required to provide a 5 per cent sample of mortgage completions via the RMS. However, since 2002, due to technological advances in the recording of mortgage applications most lenders were able to provide 100 per cent of completions for the RMS. This increase in sample records meant that it was now possible to calculate a reliable monthly HPI and therefore since 2002 the ONS HPI has been published on a monthly basis. The number of cases now included in the HPI calculations averages approximately 25k cases per month (based on 2011). It is estimated that the data collected via the RMS accounts for 65 to 70 per cent of all UK mortgages for house purchase.

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[2] Official measures are produced by the ONS and UK Land Registry. The main non-official measures are produced by the Halifax and Nationwide, along with Rightmove.co.uk and the Royal Institute of Chartered Surveyors.

Methodology

The ONS HPI is a mix-adjusted chained Lasperyes-type price index. The house prices are mix-adjusted to compensate for the variation in the characteristics of houses sold in any one period and then averaged to provide an indication of the overall change in house prices. The chain linking of the index is carried out annually, with each year's index being based on January of the current year. Prices are estimated using a multivariate fixed effects regression model (hedonic regression) based on the data provided each month by CML (via the RMS).

Algebraically, the index in month $m$ of year $y$ is calculated as:

$$ I_m^y = \frac{\sum_c w_c^0 * p_c^m}{\sum_c w_c^0 * p_c^{Jan}} $$

where $w$ and $p$ are the weight and average price respectively for cell $c$, and the weight in the base period $0$ is calculated as:

$$ w_c^0 = \frac{q_c^0}{\sum_c q_c^0} $$

where $q$ is the number of transactions.

Transaction weights are calculated using two data sources. For England and Wales, data as recorded by HM Land Registry (HMLR) are used. All house sales in England and Wales are recorded with the HMLR and therefore this represents a complete data set for these periods. However, the same level of data is unavailable for Scotland and Northern Ireland. Therefore the numbers of transactions in the RMS dataset are used for these countries.

The transaction weights are based on the preceding three years' transactions data and are held fixed for one year at a time (for instance, the 2012 weights are based on transactions completed between 1 October 2009 and 30 September 2011). Weights are calculated for each combination of the analysis variables (see below) found in the data. If a record has a missing value, a non-missing value is imputed from the base data using the set of records with the same values for the non-missing variables. For instance, if a record has missing values for the number of rooms and the old/new dwelling indicator:

1. the number of records (N) with the same values for the other analysis variables (region, acorn group, cluster group, dwelling type, first time buyer marker, old/new property) plus price band is counted
2. A random number (n) in the range 0 to N is generated
3. The missing values are imputed by setting them to be the same as those of the nth record with the same values for the other analysis variables
4. If no matching records can be found, the least influential variable is dropped and the matching process repeated. This process is repeated until only region and price band are left to be matched against. If a match still cannot be found, the value for the variable of interest is left as missing

The number of records for each combination of the analysis variables (referred to as a cell) is counted, and adjusted to reflect the number of mortgage transactions actually recorded by the Land Registry in the corresponding periods. This gives the cell weights. In 2011, there were approximately 100,000 cells.

The average price for each cell is calculated each month by fitting a regression model[3] to the set of data covering the mortgage transactions reported during the most recent month. The dependent variable is the natural log of the price, and the independent variables are:
- County
- ONS's Cluster group – a socio-economic and demographic area indicator
- Acorn class – a commercial geo-demographic and lifestyle classification
- First-time buyer or former owner occupier
- Dwelling type – e.g. detached house, flat etc
- Old /new property
- Number of rooms in the property

There are also a number of 2-way interaction terms:
- Acorn group by dwelling type
- Acorn group by first-time buyer/former owner occupier
- Dwelling type by old/new property

Imputation of missing values is not done for the data used in the regression model. Instead they are given a dummy value and each observation is given a weight reflecting the significance of the variable(s) with the missing value(s). The greater the explanatory power of the missing variable the lower the weight attached to the observation in the model. Variables with no missing values are given a weight of 1.00. The regression model is used to generate a modelled price for each 'cell' found in the base period's data. These are then weighted together to give average prices for various aggregations of the data – e.g. region by old/new dwelling.

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[3] http://www.communities.gov.uk/documents/housing/pdf/141410.pdf

The modelled average prices for the latest period are compared against the modelled price for the corresponding base period (January) to give the indices. Chained indices are then obtained by linking together successive years January based indices. One consequence of updating the weights each year is that the mix-adjusted house prices cannot be compared between years, as the weights are different. However, by annually chain linking the indices, the HPI index and year-on-year comparisons based on the index can be made.

The UK housing market follows a seasonal pattern with more purchases taking place in the spring compared to the winter months. To compensate for this, the ONS HPI seasonally adjusts the main UK indices and publishes the seasonally adjusted estimates alongside the non-seasonally adjusted estimates each month. The seasonal adjustment model used in the ONS HPI is reviewed and updated annually following publication of the June HPI.

<u>Limitations with the ONS HPI</u>

As already detailed above, conceptually ONS's HPI only covers those properties purchased using a mortgage. Cash sales are explicitly excluded from the price index. Additionally, the ONS HPI is the least timely UK house price measure, being published usually on the second Tuesday in the second month after the reference period. A comparison with the timeliness of the other main UK HPIs can be found in the next section. The timeliness of ONS's HPI is slow as it relies on third party data being provided via the RMS. The RMS collects data from a sample of up to fifty different mortgage lenders each period. The collection and quality assurance of these data each month takes time and therefore the ONS HPI is not able to be as timely as those HPIs that use in-house data. However, the timing of the ONS HPI means that very little revision is necessary. The ONS HPI, at present, doesn't publish any estimates lower than regional level. Sub-regional estimates have not been produced to date mainly due to the concerns over sample sizes below regional level, particularly if this analysis was required on a monthly basis. These limitations are considered further in the next few sections.

4. UK House Price Statistics

The housing market and statistics on house prices are of key importance in the UK (Matheson, 2010). The users of these statistics range from central and local government, who use the data to support decision making in the UK, through to surveyors valuing properties and private individuals investigating house prices in their local area. These differing requirements have led to a number of different measures being developed in the UK over time. The ONS HPI is just one of these measures. This section considers the other main house price measures currently available in the UK and evaluates the conceptual differences with the ONS HPI. A summary table is provided in annex A of this paper.

## HM Land Registry (HMLR) index[4]

The monthly HMLR HPI is an alternative official statistic alongside the ONS HPI. Like the ONS HPI, the concept being measured is the transaction price (so the actual price paid on completion at the end of the buying process). All residential property sales in England and Wales are registered with HMLR so it uses its own dataset (effectively a census) to produce its HPI. However, there is often a time lag between property completion and registration of the sale with HMLR. As a result, the HPI is subject to revision as more complete data are received.

The HMLR HPI is calculated using a repeat sales regression technique which compares the price of a property sold in one time period with the price of the same property when sold in an earlier period (back to 1995). A quality adjustment factor is then applied when deriving the index to adjust for improvements or deterioration that are made to dwellings over time. This means that the HPI does not cover any new build properties as by definition these have only been transacted once.

The HMLR HPI only covers England and Wales (separate indices are produced by counterpart departments in Scotland and Northern Ireland) but publishes data below regional level (down to local authority and London borough geographies). The variables collected for the HMLR HPI are limited. The data are disaggregated by the type of property (detached, semi-detached, terraced or flat) but there is no information on the size of the property (such as number of rooms) or characteristics of the buyer. The HMLR HPI is published on both a seasonally and non-seasonally adjusted basis.

The HMLR HPI is timelier than the ONS HPI, publishing monthly estimates within 20 working days of the reference period. There is however a lag in HMLR receiving complete records for a period, which means that revisions are made in subsequent periods.

## Halifax house price index[5]

Halifax is a UK banking chain, a subsidiary of Lloyds Banking Group. The Halifax HPI is a monthly price index based on all house price transactions financed by Halifax in the period. The data refer to mortgage transactions at the time of approval (so at an earlier stage in the buying phase when a mortgage is approved) rather than on actual completed transactions as with the ONS and HMLR HPIs. This means the Halifax HPI may include some cases which never proceed to completion. Additionally, like the ONS HPI, the Halifax index does not include any cash purchases.

The Halifax HPI has data back to 1983, making it the longest running HPI available covering the whole UK. The HPI publishes data at a UK level and down to a regional level based on Halifax mortgages only.

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[4] http://www.landregistry.gov.uk/public/house-prices-and-sales
[5] ttp://www.lloydsbankinggroup.com/media1/economic_insight/halifax_house_price_index_page.asp

The Halifax HPI is calculated using a mix-adjustment method (hedonic regression) similar to that of the ONS HPI. In terms of the variables collected and analysis published, the Halifax HPI disaggregates data by type of buyer (first time buyer and former owner occupiers). The HPI is also published on both a seasonally and non-seasonally adjusted basis.

In terms of timeliness, the Halifax HPI is considerably more timely that the ONS HPI and publishes its monthly estimates three weeks after the second Tuesday in the reference month. This quick turnaround is to be expected as the price index is calculated using only in-house data, to which Halifax has immediate access.

Nationwide house price index[6]

Nationwide is a British building society. The monthly Nationwide HPI follows a very similar methodology to the Halifax HPI detailed above. The index is calculated using only Nationwide financed mortgages in the reference period. The data refer to mortgage transactions at the time of approval as opposed to completed transactions like the ONS HPI.

On a monthly basis, the Nationwide HPI runs back to 1991, however a quarterly series at sub-regional level is available back to 1973. The Nationwide HPI publishes data at a UK level on a monthly basis and down to a regional level on a quarterly basis. The quarterly regional indices are also available by type of dwelling, whether the buyer was a first time buyer or former owner occupier and whether the property was new or old.

The Nationwide HPI is calculated using a mix-adjustment method (hedonic regression) similar to the ONS HPI and Halifax HPI. The Nationwide HPI is published on a seasonally and non-seasonally adjusted basis.

The Nationwide is one of the timeliest UK measures, publishing estimates at 1 to 1.5 weeks after the cut-off date (21st of the reference month). This quick turnaround is to be expected as the price index is calculated using only in-house data, to which Nationwide have immediate access.

Rightmove house price index[7]

Rightmove is a property website in the UK. The monthly Rightmove HPI is a price index calculated using the advertised asking price of residential properties for sale. This represents the beginning of the house buying phase and is based on an asking price, as opposed to the completed transaction price published by ONS. Not all houses advertised on Rightmove.co.uk will move to completion.

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[6] http://www.nationwide.co.uk/hpi/Default.asp?calculate=true
[7] http://www.rightmove.co.uk/house-prices.html

The Rightmove HPI has been published monthly since 2003 and publishes data at a UK, regional and London Borough level.  No further price index disaggregation by type of dwelling, buyer etc. is available, although average house prices by type of dwelling are provided.

The index is calculated by taking an average of the advertised asking prices for all properties on the Rightmove.co.uk website.  Approximately ten thousand UK estate agents list on the Rightmove.co.uk website and this represents approximately 200k cases per period.  The Rightmove HPI is not published on a seasonally adjusted basis.

Due to the instant access to data, the Rightmove HPI is the timeliest of the main UK HPIs and publishes on the third Monday of the reference month.

Royal Institute of Chartered Surveyors (RICS) HPI[8]

The RICS HPI is a monthly price index based on a survey of chartered surveyors.  Each month, approximately 300 chartered surveyors are asked their opinion on whether house prices have fallen, increased or stayed the same during the previous three months.  Therefore the price being measured is an opinion and not a completed transaction price like the ONS HPI.

The RICS HPI is published monthly, with the time series beginning in 1978.  The data are published at England and Wales level only and no further disaggregation of data is available.

The index is calculated by taking an adjusted balance figure of the percentage of chartered surveyors who think there has been a rise or fall in the period (calculated by subtracting those reporting a fall from those reporting a rise). Figures are also available in a seasonally adjusted format.

The RICS HPI is published on the second Tuesday in the month after the reference period.

As detailed above, each of the main UK house price measures differs slightly in both the price being measured and the methodology which is being used to calculate the index.  This means that coherence and comparability between each of the measures can be difficult for users, as in some periods the differing measures may be showing conflicting movements.  This can be evident when comparing the ONS HPI with those based on mortgage approvals (such as Halifax and Nationwide).  There is a time-lag between a mortgage approval and completion (which can range from a couple of weeks to a couple of months).  Therefore, data published for April based on mortgage approvals are more likely to directly compare with completions data for May (or even in some cases June).  Therefore some of the short term movements in

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[8] http://www.rics.org/housingmarketsurvey

the various price indices can differ, however, the long term trends are broadly the same.

The chart below highlights the 12 month percentage change for each of the ONS, Land Registry, Halifax and Nationwide measures:

**Year on Year comparison - UK house price indices (January 2009 onwards, not seasonally adjusted)**

Note - Land Registry covers England and Wales only

Legend: ONS, Halifax, Nationwide, Land registry
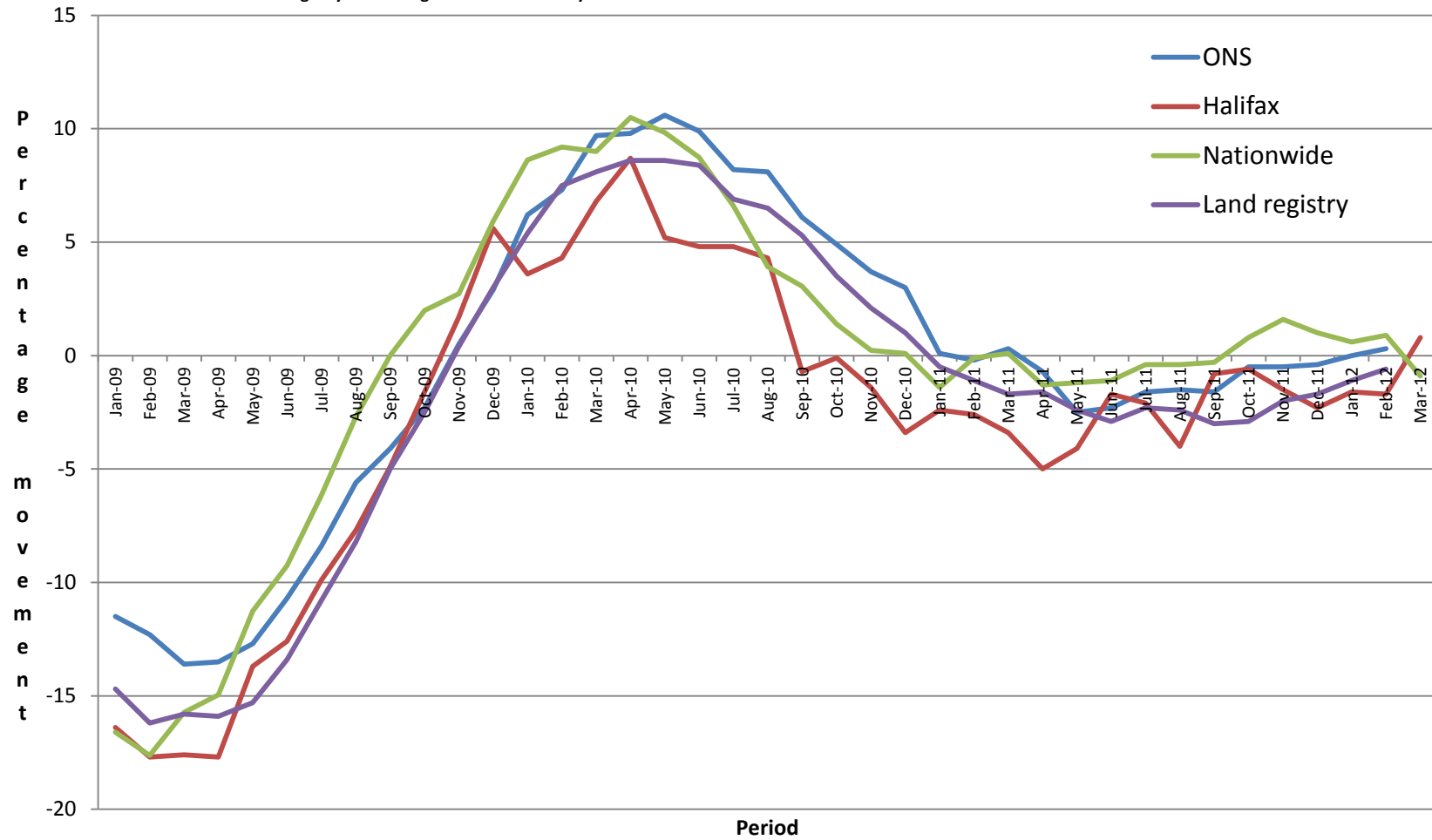
5. National Statistician's review of UK house price statistics

The previous section provided an indication of the different house price measures available in the UK. From a user perspective it is easy to see that there is likely to be some confusion regarding which measure best meets their requirements. With this in mind, the UK National Statistician conducted a review of UK House Price Statistics [9] and put forward a number of recommendations to 'improve the explanation of current methods and comparisons between official measures and other non-official sources' and to investigate how a single definitive house price index could be produced by the official statistics producer community.

The review and accompanying recommendations were based on an analysis of current practice and feedback from the user community.  Specifically, recommendation one of the review defined the key criteria for the production of a single definitive HPI.  The index should:
   i.    represent the prevailing market price of residential property at completion of sale
   ii.   measure both house prices and house price inflation based on the price paid for transacted properties
   iii.  have UK coverage
   iv.   generate estimates (at least) monthly
   v.    be timely with minimal revisions
   vi.   be available as a seasonally adjusted and an unadjusted series
   vii.  provide a consistent index series to enable trend analysis
   viii. provide robust sub-regional estimates and estimates for user defined areas
   ix.   provide comparable estimates for sub-sets of transactions or properties

Full details on the rationale behind each of the criteria can be found in section 7 of the National Statistician's report.

6. Developing a definitive UK house price index

With the above in mind, ONS has begun to think about what development is required to produce the definitive measure outlined in the review.  One of the difficulties here is what does definitive mean?  Each user of a price index has a specific requirement that needs to be met, and the UK housing market can be thought of as being made up of a number of different sub-markets (for example the housing market in London is likely to be considerably different from the housing market for the North East of England).

For the purpose of development, the definitive house price index could be thought of as the price index that best meets the majority of identified user needs.  Therefore one of the potential options for the development is to improve the ONS HPI.
The ONS HPI in its current format meets most of the criteria detailed above.  The limitations that need further consideration relate to improving the timeliness of the

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[9] http://www.statisticsauthority.gov.uk/national-statistician/ns-reports--reviews-and-guidance/national-statistician-s-reports/national-statistician-s-review-of-house-price-statistics.pdf

index, providing robust sub-regional estimates and improving the coverage of prices so that cash sales are incorporated.

Improving the timeliness of the index is difficult given the source of data that is currently used. Putting pressure on the internal production process could improve timeliness by a matter of days. The only option for drastic improvements in timeliness is to consider alternative data sources which may then affect the quality of the index. An alternative course of action would be to better inform the users of the reasons why the ONS HPI is less timely than other measures.

The production of robust sub-regional estimates should be possible based on the current ONS HPI dataset. The main reservations regarding the production of such a dataset is the sample size at this low level and therefore the quality of estimates produced. However, analysis carried out previously suggests that whilst this could be an issue for monthly data, the production of a less frequent sub-regional index could be possible. This would need to be investigated further with the users before an assessment is made.

The main development issue is the inclusion of cash sales in the ONS HPI. This has been considered previously and there are a number of issues that need to be resolved:

A source of cash sales data is available from the respective Land Registry departments (England and Wales, Northern Ireland and Scotland). However, the range of information collected by each Land Registry department is limited compared to what is required for the ONS HPI and specifically, for inclusion in the ONS HPI hedonic regression model.

Crucially, Land Registry data do not include attributes data such as type of buyer and number of rooms in the property. Both of these attributes are analysis variables in the ONS HPI regression model (and both are of particular importance to the model). Therefore a method of imputing for the missing attributes would be required so the hedonic regression model can be extended to include cash sales. A further practical issue would be to investigate the availability of cash sales data. As mentioned in section 4, Land Registry data represent a census of property purchases in a period, there is often a lag between the completion of purchase and the registration of the transaction with the Land Registry. This would likely lead to revisions each period as complete data are received following publication. An investigation of the likely extent of revisions would need to be considered before any work could be progressed.

The above comments represent an initial consideration of what could be done to improve the ONS HPI to better meet user needs. No actual work has taken place to begin the implementation yet, but it is hoped that this will be taken forward during the second half of 2012.

## 7. Conclusions

There are numerous house price measures available in the UK, with the conceptual coverage of each measure being slightly different. This has lead to some confusion for users in terms of comparability and the identification of the most suitable measure to meet requirements.

The UK National Statistician's review of UK house price statistics highlighted the above issue and put forward recommendations for both the improvement in the way UK house prices statistics are published alongside each other and to develop a definitive official house price index.

Alongside this review, it was announced that the UK HPI published by DCLG would transfer to ONS. This transfer has now been completed and ONS will begin taking forward the development work required to improve the HPI and implement the review recommendations. This work will likely focus on a number of key areas:

- improving the coverage of the ONS HPI, specifically the inclusion of cash sales
- improving the commentary that sits alongside the ONS HPI to better inform users of the methodology and comparability with other house price measures

It is hoped that the work will progress during the rest of 2012.

Annex A:  Table of Characteristics of main UK House Price Indices[10]

| Index | Time in house sale cycle | Geographic coverage | Coverage | Timeliness | Index methodology | Time series | Seasonal adjustment | Smallest geography published |
|---|---|---|---|---|---|---|---|---|
| ONS HPI | Completion | UK | Sample of mortgages. Excludes cash sales | Second Tuesday in second month after reference period | Hedonic regression | Monthly since 2002, linked to previous quarterly index back to 1968 | Yes | Region |
| HM Land Registry | Registration of sale with Land Registry | England and Wales | Excludes properties that have not sold twice since 1995 and new builds | 20 working days after reference period | Repeat sales regression | 1995 | Yes | London Borough, Unitary Authority and County |
| Halifax | Mortgage offer | UK | Mortgage offers by Halifax only (excludes cash sales) | Three weeks after second Tuesday in reference month | Hedonic regression | 1983 | Yes | Region |
| Nationwide | Mortgage offer | UK | Mortgage offers by Nationwide only (excludes cash sales) | 1 to 1.5 weeks after the cut-off date (21$^{st}$ of the reference month) | Hedonic regression | Monthly since 1991, quarterly back to 1973 | Yes | Sub-region on a quarterly basis |
| Rightmove | Houses on the market (asking price) | UK | All houses advertised on Rightmove.co.uk | Third Monday of the reference month | Averaging of prices | 2003 | No | London Borough |
| Royal Institute of Chartered Surveyors | Opinion | England and Wales | Opinion - house prices rising, falling or staying the same | Second Tuesday in reference month | Net balance of responses | 1978 | Yes | Region |

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[10] This table is taken from the National Statistician's review of House Price Statistics (annex C)

References

Matheson, J (2010). National Statistician's Review of House Price Statistics. Newport: United Kingdom Statistics Authority. Available from http://www.statisticsauthority.gov.uk/national-statistician/ns-reports--reviews-and-guidance/national-statistician-s-reports/index.html