Article

Research Output: Alternative estimates of subnational dwelling stock by tenure: 2018

Exploring an alternative method that uses a range of data sources to produce subnational dwelling stock by tenure estimates in England and Wales. This Research Output is not an official statistic.

Table of contents

1 . Introduction

This article explores alternative methods and data sources to produce annual subnational estimates of the dwelling stock by tenure. It presents a model-based method that brings together data from multiple sources for local authorities in England and Wales. The aim is to improve the precision of estimates, by building on the strengths of multiple sources of information.

This is the second article released as part of a Research Output. The first article, Subnational dwelling stock by tenure estimates, England: 2012 to 2018, is an update to our previous research output, which uses an existing survey-based approach to produce estimates of the dwelling stock by tenure. As there is a degree of uncertainty around these estimates, it can be difficult to achieve robust estimates at small geographic levels, and therefore ways to overcome this are explored in this article.

Annual estimates of the tenure of dwellings for subnational geographies provide evidence to help planning authorities set housing policy and allows them to monitor the distribution of tenure over time within an area and between areas. They provide information that helps the sampling and adjustment of data collected about the private rented sector. More information about the use and the range of dwelling stock by tenure statistics is available in the accompanying article.

In this article, there are two main criteria that help us assess whether this alternative method is more accurate:

- are the estimates comparable to existing data sources?

- do the estimates have lower coefficients of variation (CVs) around the estimates, so they are considered more precise because of less dispersion in the data?

Our previous research output on subnational dwelling stock by tenure in England provided estimates of the full tenure breakdown at the local authority level. However, these are still being developed so are not official statistics. For local authorities in Wales, the Welsh Government produce National Statistics that provide a full tenure breakdown for local authorities on an annual basis. These should be referred to for official statistics for Wales.

We are exploring this method as a potential replacement of our existing method for England, but data have been processed for both England and Wales to provide a wider range of test data to assess the strength of the estimates. The aim is to improve the precision of the estimates for England, by building on the strengths of multiple sources of information. The purpose of this article is to make recommendations for improving the precision of the estimates for England. The article includes information about the methods used to process the underlying data and produce estimates for local authorities.

This article also looks at the broader research conclusions that can be drawn, which include reflections on the accuracy of the methods and which method is likely to be the most appropriate for measuring tenure at a local level for England. We would like your feedback on the data and methods used to produce these estimates. Please email any feedback to better.info@ons.gov.uk.

2 . Summary of research conclusions

We consider this new alternative method to produce subnational estimates of the dwelling stock by tenure in England that are more precise, when compared with the existing survey-based approach.

Comparison with existing estimates for English local authorities

When comparing estimates for English local authorities between the existing and alternative method for producing subnational dwelling stock by tenure estimates, less than 2% of local authorities have significantly different estimates. This shows that the new model provides results in line with the existing method. However, this new alternative method produced a smaller coefficient of variation (CV) for more local authorities in England for all tenures, so the estimates from the alternative model are considered more precise than the existing estimates.

Comparison with existing social housing data

This new alternative method generates estimates of the size of the social housing stock that we can compare with National Statistics on the [number of dwellings in social housing by local authority](). The difference between the official estimates and the estimates presented here was smaller than one percentage point in the majority of local authorities in England. This suggests the estimates are accurate and gives us confidence that the estimates of privately rented and owner-occupied dwellings from this model are also accurate.

Comparison with Welsh Government data

When comparing estimates for Welsh local authorities between this alternative method and equivalent statistics published by the Welsh Government, the largest difference across all tenures and local authorities in 2018 was 3.4 percentage points. This was the difference in the percentage of owner-occupied dwellings in Gwynedd. However, generally, the trends in the official estimates of tenure by local authority in Wales follows the trend in these alternative estimates. This gives us confidence that in addition to providing useful estimates across tenures, this method provides useful estimates across areas.

There was no consistent direction in the difference between the estimates using this alternative method, in comparison with the existing data sources, for both England and Wales. This highlights that there is no obvious systematic error caused by the method.

Comparison of models

The most accurate estimates are obtained when inputting data for England and Wales in separate models. We recommend that the England data-only model is taken forward for England as:

- data are closely matched to published estimates from our existing method, with less than 2% having significantly different estimates

- social housing data are comparable with National Statistics available for the social housing dwelling stock by local authority, with a difference of smaller than one percentage point for a majority of local authorities in England

- the CVs were generally smaller when using the alternative method, in comparison with our existing method

We do not recommend using Welsh data in the England model as there are differences in tenure overall between England and Wales. By including Wales in the same model as England, this has little impact on estimates for English local authorities, as England makes up a larger proportion of the sample. There is a larger impact on data for Wales. This highlights the importance of keeping the countries in separate models.

3 . Disclaimer

We have published these Research Outputs to provide an indication of the tenure breakdown of dwellings at the subnational level. Research Outputs are produced to provide information about new methods and data sources being investigated.

Official statistics on private dwellings by tenure are currently only available at the country level in England. Statistics on dwelling stock by tenure are available for local authorities in England but do not provide a breakdown of owner-occupied and privately rented dwellings. This method is being explored as a potential replacement to our existing method for England. National Statistics that provide a full tenure breakdown for local authorities in Wales are available; these should be referred to for Wales.

The statistics presented in this release are subject to a margin of error as the estimates are partly based on survey data and there is a level of variability across input data sources. Therefore, users of these statistics should refer to the coefficient of variation (CV) and confidence intervals – which provide a measure of the uncertainty around the estimates – when making interpretations.

4 . Methodology summary

These alternative estimates use the Generalised Structure Preserving Estimator (PDF, 2.26MB) (GSPREE) method to produce estimates of the number and percentage of owner-occupied and privately rented dwellings out of the total dwelling stock, for local authorities in England and Wales. The GSPREE method uses small area estimation techniques to combine and draw strength from several data sources. It takes census data from 2011 and supplements it with social survey data from the Annual Population Survey (APS) to generate more reliable and complete estimates than it would be possible to generate from each source individually. For more information on the GSPREE process, see Explaining the Generalised Structure Preserving Estimator.

Table 1 demonstrates the main differences between the existing and alternative method for producing subnational dwelling stock by tenure estimates.

Table 1: Differences between the existing and alternative method of producing subnational dwelling stock by tenure estimates

	Existing Survey Method	Alternative Model Method
Coverage	England	England and Wales
Data sources	- Weighted tenure data – Annual Population Survey (APS) - Vacancy rates by tenure, region and year - English Housing Survey - Private sector stock by local authority – Ministry of Housing, Communities and Local Government (MHCLG)	- Unweighted tenure data - APS - Tenure by local authority - 2011 Census data - Tenure breakdown by country – MHCLG and Welsh Government - Total dwelling stock by local authority - MHCLG and Welsh Government
Tenures included	Private sector only	Full tenure breakdown
Vacancy rate adjustment	Vacancy rate adjustments made by tenure, region and year	No adjustment made
Constraining to official statistics on dwelling stock	Estimates are constrained to the Private sector stock by local authority	Estimates are constrained two ways – to the total stock by local authority, and to the overall tenure breakdown by country.

Source: Office for National Statistics – Alternative estimates of subnational dwelling stock by tenure

Notes

1. See Subnational dwelling stock by tenure estimates, England: 2012 to 2018 for estimates of dwelling stock by tenure from 2012 to 2018, using the existing survey-based approach. Back to table

National Statistics are available for the total dwelling stock for each local authority and for the total number of dwellings in each tenure at the country level. The estimates presented in this release have therefore been adjusted in line with these robust and recent dwelling stock estimates (referred to as margins). The margins data are taken from the live tables on dwelling stock produced by the Ministry of Housing, Communities and Local Government (MHCLG) for England and dwelling stock estimates for Wales produced by the Welsh Government.

In addition to estimates of the number of dwellings that are owner-occupied and privately rented, this article presents estimates of social housing dwelling stock by local authority. However, National Statistics for this tenure are already available at the subnational level. These are produced by the MHCLG, so the social housing estimates presented in this release are for comparison and quality assurance purposes.

The total dwelling stock for each local authority, calculated by aggregating the estimates for the three tenures, equals the total stock by local authority published by MHCLG in Table 100 (XLS, 735kb) for England and by Welsh Government for Wales. An exception to this is when the local authority boundaries have changed, because the estimates presented in this release refer to the April 2019 local authorities.

Estimates in this article relate to the number of dwellings, but this requires the assumption that households are equivalent to dwellings, despite definitional differences. The APS and census data relate to households and therefore only refer to dwellings that are occupied, because it would not be possible to obtain a response from a vacant dwelling. The breakdown of tenures from the household level data are benchmarked to data on the number of dwellings. There are no adjustments made to the household level data to account for the differences in vacant dwellings by tenure or geographical location.

There are three models produced using GSPREE, which are shown in Table 2.

Table 2: Models produced using the Generalised Structure Preserving Estimator method

Model	Countries Included	Dataset used	Model outcome
1	England and Wales	- Uses data for local authorities in England and Wales - Uses both dwelling stock data from the Ministry of Housing Communities and Local Government (MHCLG) for England, and from the Welsh Government for Wales	- Provides the most precise estimates for England, with generally smaller coefficient of variations (CVs). - Provides less precise estimates for Wales, with larger CVs and estimates less comparable to existing data sources.
2	England	- Uses data for local authorities in England only - Uses dwelling stock data from the MHCLG for England only	- Estimates for England produced by this model has generally larger CVs than in Model 1, however the difference in precision between the two models is not large enough to affect the quality of the estimates. - Model 3 produces the most precise estimates for Wales, and so using Model 2 for England creates consistency in approach used, without being detrimental to quality.
3	Wales	- Uses data for local authorities in Wales only - Uses dwelling stock data from the Welsh Government for Wales only	- Provides the most precise estimates for Wales, with smaller CVs and data being more comparable to existing data sources.

Source: Office for National Statistics – Alternative estimates of subnational dwelling stock by tenure

Notes

1. Figures produced for England will differ in Models 1 and 2; for Wales, they will differ in Models 1 and 3. This is because we are benchmarking to different column margin totals, as they are based on the overall number in each tenure for the whole target population. Back to table

2. It is possible to compare data across models. The Annual Population Survey data and census data are the same data source for each country, and the total dwelling stock by local authority are calculated using a comparable method for each country. Back to table

Significant differences throughout this Research Output refer to 95% confidence intervals around the estimates not overlapping.
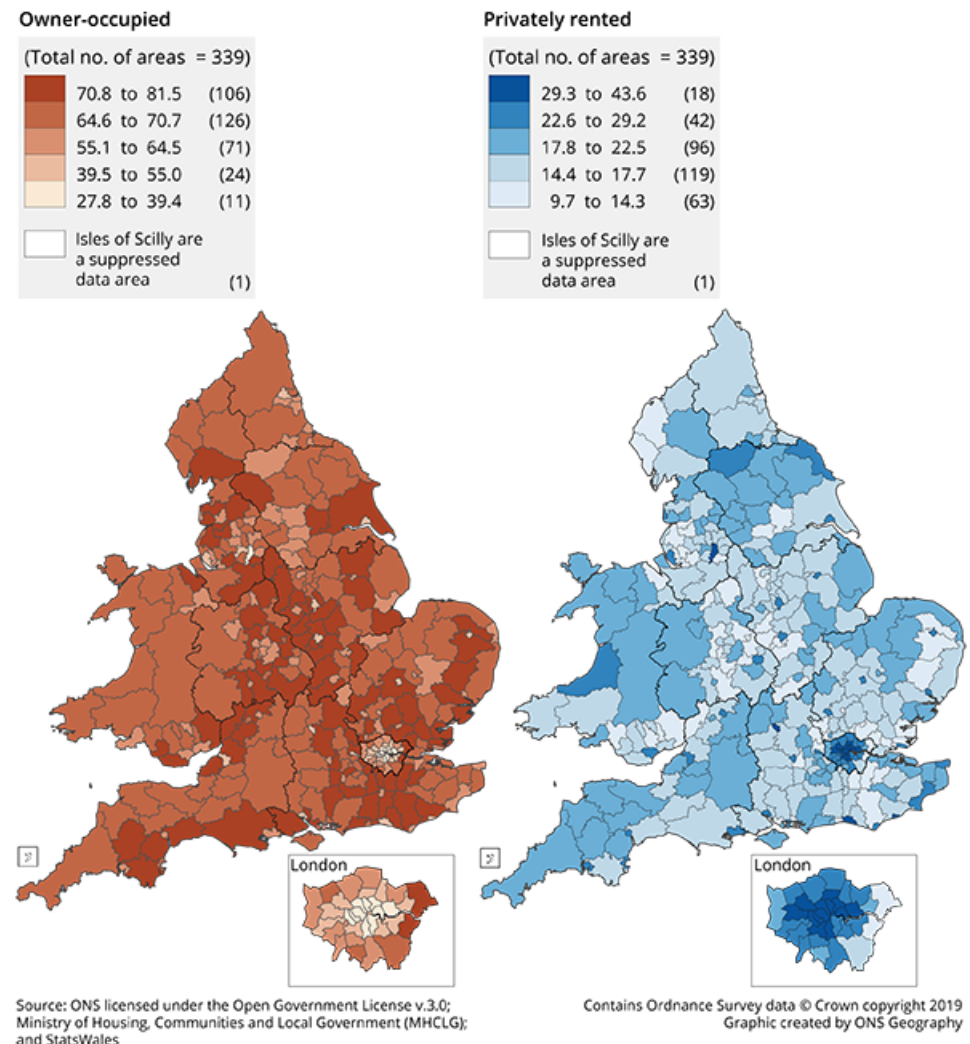
5 . Research findings

This section starts by providing analysis of the data that is produced by the models. Then, comparisons are made that help determine whether this alternative method can be considered as more accurate against our criteria:

- are the estimates comparable to existing data sources?

- do the estimates have lower coefficients of variation (CVs) around the estimates, so they are considered more precise because of less dispersion in the data?

Percentages of owner-occupied and privately rented dwellings for local authorities in England and Wales

In 2018, the percentage of owner-occupied dwellings, out of the total dwelling stock, ranged from 27.8% in Hackney to 81.5% in Rochford. The percentage of privately rented dwellings ranged from 9.7% in North East Derbyshire to 43.6% in Westminster. Figure 1 compares the geographical distribution of the percentage of the dwelling stock that was owner-occupied and privately rented in 2018.

Figure 1: The percentage of dwellings, out of the total dwelling stock, by local authority district in England and Wales, 2018

Owner-occupied

(Total no. of areas = 339)

70.8 to 81.5	(106)
64.6 to 70.7	(126)
55.1 to 64.5	(71)
39.5 to 55.0	(24)
27.8 to 39.4	(11)
Isles of Scilly are a suppressed data area	(1)

Privately rented

(Total no. of areas = 339)

29.3 to 43.6	(18)
22.6 to 29.2	(42)
17.8 to 22.5	(96)
14.4 to 17.7	(119)
9.7 to 14.3	(63)
Isles of Scilly are a suppressed data area	(1)

London

London

Source: ONS licensed under the Open Government License v.3.0; Ministry of Housing, Communities and Local Government (MHCLG); and StatsWales

Contains Ordnance Survey data © Crown copyright 2019
Graphic created by ONS Geography

Source: Office for National Statistics licensed under the Open Government License v3.0; Ministry of Housing, Communities and Local Government; and Welsh Government

Figure 1 shows that higher percentages of privately rented dwellings in 2018 were generally found in London and surrounding regions. The 10 local authorities with the highest percentage of privately rented dwellings were all in London, and conversely the 10 with the lowest percentages of owner-occupied dwellings were also in London. The geographical distribution of owner-occupied dwellings was a bit more spread, with the 10 local authorities in England and Wales with the highest percentages in 2018 being spread across East of England, South East, East Midlands and West Midlands.

Changes over time in owner-occupied dwellings

In the alternative model, there were four local authorities in England and Wales that had a significant decrease in the percentage of owner-occupied dwellings between 2012 and 2018 (Pendle, West Lindsey, Rushcliffe and Southend-On-Sea). There were no local authorities with a significant increase in the percentage of owner-occupied dwellings.

Changes over time in privately rented dwellings

There were more local authorities (13) with a significant increase in the percentage of privately rented dwellings over the six-year period. It is interesting to note that none of these were located in the North East, North West, Yorkshire and The Humber, or London. There were no local authorities with a significant decrease in the percentage of privately rented dwellings.

Figure 2 shows six local authorities that had the largest gap between upper confidence limit in 2012 and lower confidence limit in 2018 for privately rented dwellings. This provides an indication of the areas that had the most significant change.

Figure 2: Local authorities in which there was a significant change in privately rented dwellings all had an increase

The 95% confidence interval range, for local authorities in which there was a significant change in privately rented dwellings, England and Wales, 2012 to 2018
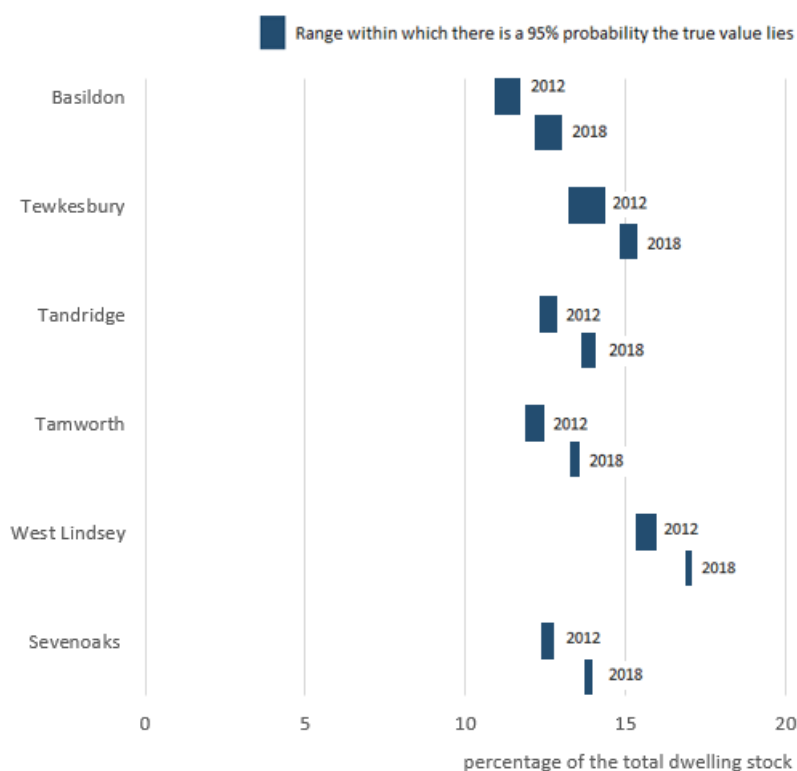
Source: Office for National Statistics – Annual Population Survey, Census, and Subnational dwelling stock by tenure estimates; Ministry of Housing, Communities and Local Government – live tables on dwelling stock; and Welsh Government – dwelling stock estimates by local authority and tenure

Notes:

1. The six local authorities are those with the largest percentage point difference between the upper confidence interval for 2012 and lower confidence interval for 2018 out of the 13 local authorities with a significant change.

In summary, this analysis suggests that at the local authority level, there are not large changes in the distribution of tenure over time.

Comparing model results to National Statistics on social housing, by local authority in England

Making comparisons between the percentage of dwellings that are socially rented, produced using this alternative method and the National Statistics already available, is a good indicator in the validity of the estimates produced using this alternative method. In terms of what is already available, National Statistics that provide the number of dwellings that are socially rented in local authorities in England are published by the Ministry of Housing, Communities and Local Government (MHCLG) in Table 100 (XLS, 735kb). The MHCLG's data on social rents come from the Local Authority Housing Statistics return and the Homes and Communities Agency's Statistical Data return for Private Registered Providers.

Figure 3 summarises the percentage points difference in socially rented dwellings between the MHCLG's statistics and the alternative method.

Figure 3: Small percentage point differences for social housing dwelling stock between MHCLG statistics and the alternative method

Distribution of the percentage points difference in the percentage of socially rented dwellings, local authorities in England, 2018
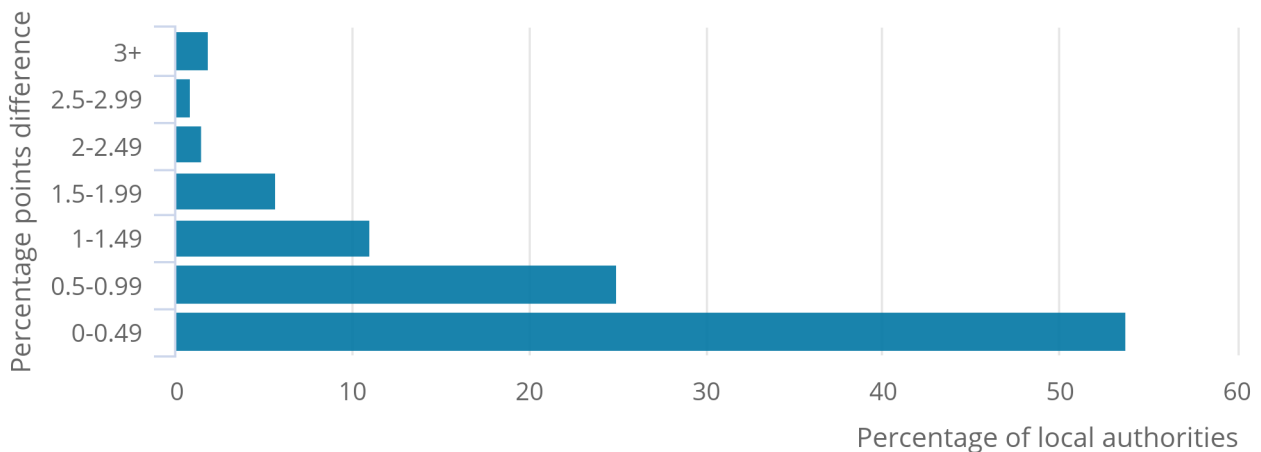
Source: Office for National Statistics – Annual Population Survey, Census, Subnational dwelling stock by tenure estimates; and Ministry of Housing, Communities and Local Government – live tables on dwelling stock

Notes:

1. The percentage is based on the number of local authorities that have data available in both sources, so this excludes the Isles of Scilly.

When comparing the percentage of all dwellings that were socially rented between the two data sources for 2018, the largest percentage points difference in any local authority was 6.14 in Richmondshire. However, Figure 3 shows that the most common band for percentage points difference between the two statistics was between 0 and 0.49 percentage points. There were 249 local authorities (78.8%) that had a percentage points difference of less than 1, and of these 170 had a difference of less than 0.5. This highlights that the estimates produced using the Generalised Structure Preserving Estimator (GSPREE) in the alternative method have a relatively high level of validity.

Comparison with existing ONS research output data for England

We have previously published Research Outputs on the number and percentage of dwellings that are owner-occupied and privately rented. These estimates use tenure information from the Annual Population Survey (APS) and include vacancy rate adjustments using data from the English Housing Survey (EHS). The estimates are also constrained to National Statistics on dwelling stock by local authority produced by the MHCLG. This provides estimates (existing method) that can be compared with the alternative estimates presented in this release to provide a measure of validity. The estimates that are used to provide the comparisons are available for England only, and so the England-only model (Model 2) is used here.

Figure 4 and Figure 5 show the correlation between the percentage of dwellings that were owner-occupied or privately rented out of the total dwelling stock, between the existing and alternative method of producing dwelling stock by tenure estimates.

Figure 4: Estimates of owner-occupied stock using the alternative method were lower in more local authorities than when using the existing method
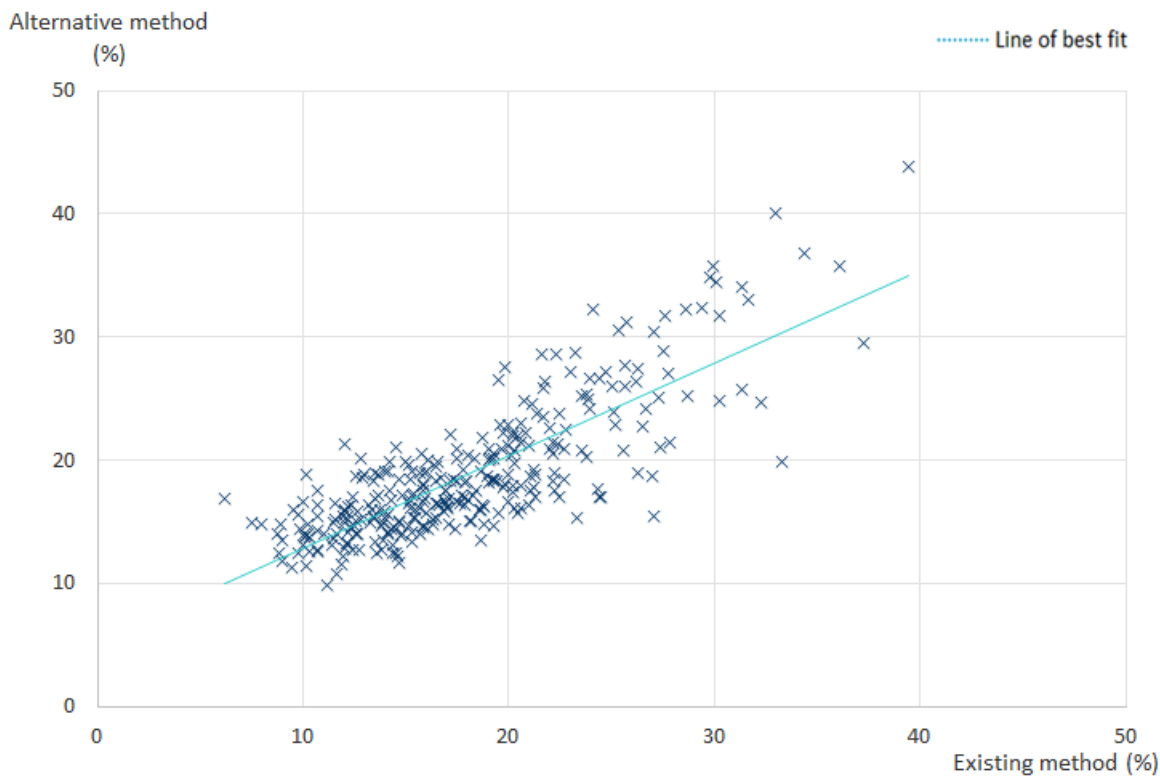
Percentage of owner-occupied dwellings out of the total dwelling stock, local authorities in England, 2018
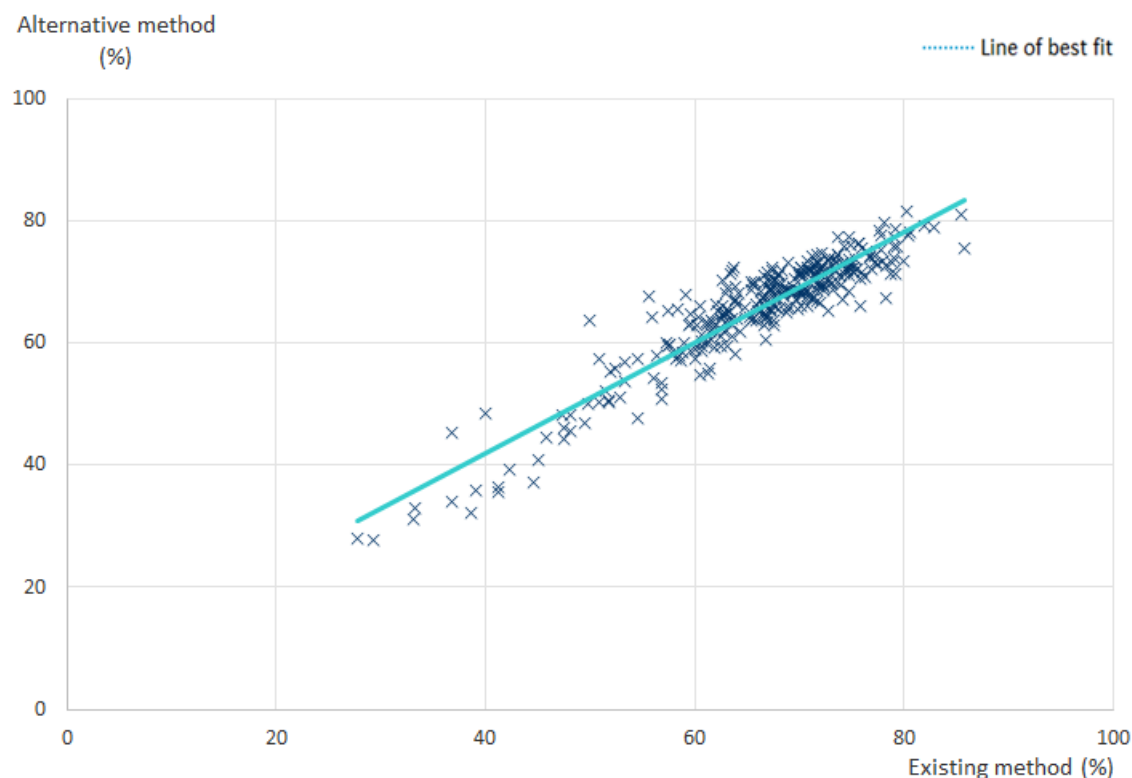
Source: Office for National Statistics – Annual Population Survey, Census, Subnational dwelling stock by tenure estimates; and Ministry of Housing, Communities and Local Government – English Housing Survey, live tables on dwelling stock

Figure 5: Estimates of privately rented stock using the alternative method were higher in more local authorities than when using the existing method

Percentage of privately rented dwellings out of the total dwelling stock, local authorities in England, 2018

Source: Office for National Statistics – Annual Population Survey, Census, Subnational dwelling stock by tenure estimates; and Ministry of Housing, Communities and Local Government – English Housing Survey, live tables on dwelling stock

For owner-occupied dwellings in 2018, 57.2% of local authorities had a higher percentage using the existing method, while 42.8% had a higher percentage using the alternative method. For privately rented dwellings in 2018, 38.3% had a higher percentage using the existing method, while 61.7% had a higher percentage using the alternative method. There was not a consistent direction in the difference between estimates using the existing method, compared to the alternative method using the GSPREE. This suggests an absence of systematic bias in the alternative estimates.

One way to compare the existing and alternative methods would be to look at the rank order of the percentage of privately rented dwellings in each method. However, the local authority rankings alone do not take account of confidence intervals and the CVs around the estimates.

For example, Hertsmere in the East of England had the 224th highest privately rented percentage using the alternative method, but it was ranked 25th when using the existing method. However, this local authority has a relatively large CV for both methods, at 21.3% for the alternative method and 18.4% for the existing method, and the 95% confidence intervals overlap, which means that there is not a significant difference between the two.

Another way to compare the existing and alternative methods is to look at whether the 95% confidence intervals overlap. For owner-occupied estimates in 2018, of the 311 local authorities that had data available using both methods, only two local authorities did not overlap. These local authorities were Kensington and Chelsea in London and Medway in the South East. For privately rented dwellings, there were four local authorities in 2018 where the 95% confidence intervals around the estimates did not overlap. These were Blackpool in the North West, Rutland in the East Midlands, Southend-on-Sea in the East of England and Reading in the South East.

Having presented analysis looking at the comparability of the estimates with existing sources, it is also important to consider which method produces the most precise estimates. The CV can be used as an indicator of the quality of estimates. It is the ratio of the standard error of an estimate to the estimate, expressed as a percentage, so it is relative to the size of the actual estimate. A CV of less than 20% has been considered as an acceptable quality standard for Office for National Statistics (ONS) published outputs; a smaller CV therefore indicates a higher-quality estimate.

There were 116 local authorities that had a CV higher than 20% for the estimate of privately rented dwellings using the existing method, whereas there were only 29 when using the alternative method. These estimates are considered as unreliable for practical purposes, and so having fewer local authorities in the high CV band is an improvement provided by the alternative method. It is more common for lower estimates to have higher CVs, so privately rented and socially rented estimates tend to have larger CVs.

It is useful to assess the accuracy of the two methods by comparing the CVs for every local authority, because estimates with lower CVs are considered more precise. Figure 6 provides a comparison of the CVs produced for the owner-occupied estimates for each local authority and year, comparing the existing method with the alternative method.

Figure 6: The alternative method generally produced estimates of owner-occupied dwelling stock that had lower coefficients of variation than the existing method

Percentage of local authorities with higher coefficients of variation, England, 2012 to 2018

Figure 6: The alternative method generally produced estimates of owner-occupied dwelling stock that had lower coefficients of variation than the existing method

Percentage of local authorities with higher coefficients of variation, England, 2012 to 2018
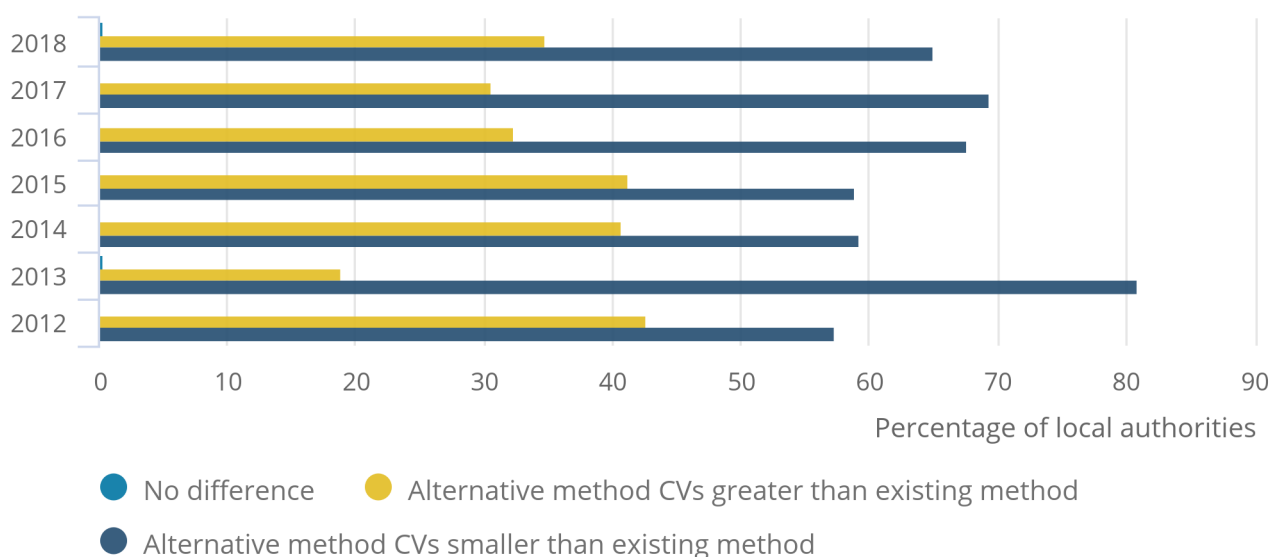
Source: Office for National Statistics – Annual Population Survey, Census, Subnational dwelling stock by tenure estimates, Ministry of Housing, Communities and Local Government – English Housing Survey, live tables on dwelling stock

Notes:

1. The percentage is based on the total number of local authorities with data available in both methods.

For every year, there were more local authorities that had a smaller CV around their owner-occupied estimate in the alternative method than in the existing method, ranging from 57.4% in 2012 to 80.9% in 2013.

Summary of method comparison for England

When comparing the alternative method with existing data sources for England, over 98% of local authorities have 95% confidence intervals that overlap. This shows that the method produces estimates that are not statistically different to the existing method. The main advantage of the alternative method is that we consider it to produce more precise estimates of dwelling stock by tenure when compared with the existing survey-based approach. The alternative method has a higher percentage of local authorities with a lower CV and is therefore considered higher quality. Overall, there were fewer local authorities for which the estimates from the alternative method had CVs greater than 20% than in the existing method.

Comparison with Welsh Government data for Wales

There are National Statistics available on the number of dwellings by tenure for local authorities in Wales, published by the Welsh Government. Data on local authority and registered social landlord housing stock are taken directly from social landlords, so social landlord data is collected in a similar way to the MHCLG's data for England. Private sector dwellings are calculated by subtracting the number of social landlord dwellings from the total number of dwellings for each local authority. The private sector stock is then broken down by applying the proportion of private sector dwellings that were privately rented using household APS datasets.

These National Statistics provide data on all three tenures, to which we can compare our alternative estimates produced using the GSPREE. The estimates we are comparing with are available for Wales only, and so the comparisons are made using the Wales-only model (Model 3).

The largest difference between the Welsh Government and the alternative estimates across all tenures and local authorities in 2018 was found in Gwynedd, with a 3.4 percentage points difference in owner-occupied dwellings. Swansea had the largest difference for privately Comparison with existing ONS research output data for England sectionrented dwellings (2.9 percentage points) and Pembrokeshire for social landlord dwellings (2.2 percentage points).

There was no systematic trend of differences between the alternative method and the official statistics for Wales. For owner-occupied and privately rented dwellings in 2018, there were 11 local authorities in Wales for which the estimates were higher in the alternative method and 11 for which the estimates were higher in the official statistics for Wales. For social landlord dwellings in 2018, 12 local authorities had a larger estimate in the alternative method, while 10 had a larger estimate in the official statistics for Wales.

Figure 7 shows the difference in ranks between the percentage of owner-occupied dwellings using the alternative method and official estimates for Wales.

Figure 7: The ranking of local authorities' owner-occupied dwellings stock in Wales was similar for both the alternative method and the official statistics for Wales

Rank of owner-occupied dwelling percentages, for the five local authorities with the highest percentage using the alternative method, Wales, 2018
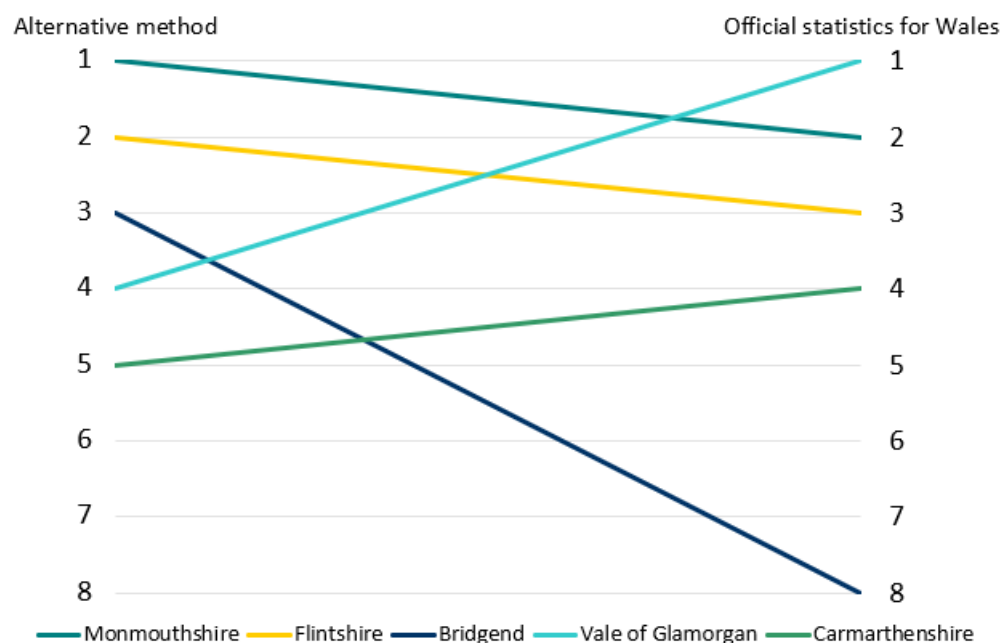
Source: Office for National Statistics – Annual Population Survey, Census; and Welsh Government – Dwelling stock estimates by local authority and tenure

Figure 7 shows that the local authorities in Wales that had the highest percentage of owner-occupied dwellings using the alternative method also had higher percentages in the official statistics for Wales. More than two-thirds of all local authorities in Wales had a difference in rank between the two statistics of three or less in 2018, for all three tenures. For social landlord dwellings, 68% of local authorities had a difference in rank of no more than one, and the five local authorities with the highest percentages were the same.

There were 16 out of 22 local authorities (72.3%) that had a percentage of dwellings in the official statistics that fell within the upper and lower 95% confidence intervals for both owner-occupied and social landlord dwellings. There were 14 (63.6%) that fell within the confidence intervals for privately rented dwellings. An ideal outcome would be for all percentages in the official estimates to fall within the relevant 95% confidence intervals of the alternative method. Differences between the two sets of estimates exist because of the use of multiple data sources, particularly census data, which does not have an influence on the breakdown of dwellings by tenure in the official estimates.

Deciding the most appropriate model to use

The use of the GSPREE method meets our criteria for producing higher quality estimates of the dwelling stock by tenure. In addition, by analysing the size of the CV, we can determine which model produces estimates that are considered more statistically precise. Comparisons are made between Model 1, which inputs all local authorities in England and Wales together, and Models 2 and 3, which only include the local authorities of the separate countries (See Table 2).

The CV is influenced by two main factors: sample size and the variability across input data. By combining England and Wales in the same model, this generates a larger sample sizes; CVs can therefore be lower. However, in this modelling, it is important to note that for Wales, the tenure breakdown is different to many areas in England, especially compared with London.

By including data for Wales in the combined country model, the data are largely influenced by England, which makes up the largest proportion of the data. An example of this is overall tenure breakdown to which the data is benchmarked against. The percentage of owner-occupied dwellings in Wales is 69.7%, while in England and Wales the percentage is 63.6%, which is much more in line with the 63.2% in England. Therefore, keeping the countries data separate would be ideal because of the tenure breakdown differences overall.

Overall, the best method to generate country-specific dwelling stock estimates is to use country-specific models. Therefore, Model 2 could be the best way of generating subnational dwelling stock by tenure estimates for England.

6 . Research conclusions

The findings in this Research Output have helped expand our understanding of methods to produce subnational estimates of dwelling stock by tenure at the local authority level. The steps taken to combine useful information from multiple data sources have shown that estimates that can be considered more precise than estimates produced using the existing method could be created. This was concluded on the basis that the coefficients of variation (CVs) were generally smaller when using the alternative method, in comparison with our existing method. There were also much fewer local authorities that had a CV higher than 20% when using the alternative method. This means that these estimates are considered more precise with the alternative method, while the estimates are also comparable to existing data sources.

To provide more accurate and precise estimates of dwelling stock by tenure in England, we recommend producing future estimates for England using the new alternative method Model 2, which uses England-only data.

7 . Explaining the Generalised Structure Preserving Estimator (GSPREE)

The Generalised Structure Preserving Estimator (GSPREE) method can be used to estimate a cross tabulation of the population between two or more categorical variables, for example, the local authority dwellings by tenure. Estimates are produced by combining information from different sources including administrative, survey and census data and drawing on the strengths of each. The method provides a framework for estimating population characteristics for specific geographies in non-census years, where such comprehensive data are not available.

As a minimum for GSPREE, there must be two sources of input data: one from a survey and the other from a proxy source. The GSPREE methodology treats the tenure category definitions in the survey data as the target definitions, even if the proxy data are defined slightly differently. A proxy data source contains detailed information for the same cross-tabulated set of areas and categories of the target table, but it does not exactly measure it. This could be because of a number of factors such as differing time periods, differences in the target population and/or inconsistent variable category definitions.

The GSPREE method obtains the best possible estimates by combining the survey and proxy data through a statistical model. Having obtained estimates of the cross tabulation, the method then benchmarks the estimates to row and column margins, using iterative proportional fitting. It is vital that these row and column margins are of high quality and have undergone a rigorous quality assurance process, such as National Statistics that have been certified as compliant with the Code of Practice for Statistics. Benchmarking estimates ensures that they are correctly scaled to represent the population and are consistent across different geographic levels.

There are several sources of information relating to tenure, but no one source alone provides the exact information required. Data available on tenure meet the needs of input data for the GSPREE method. Table 2 shows the data sources used in our GSPREE method and how these are input into the statistical model.

Table 3: Input data for the Generalised Structure Preserving Estimator model

Type	Source	Data used	Strengths	Limitations
Survey	Annual Population Survey (ONS[1])	Full tenure breakdown[2] for local authorities England and Wales Variables- Postcode, Tenure, Landlord of Accomodation, Relation to household reference person	- Annual data - Designed to collect information on tenure - Same survey for England and Wales	- Not economically viable to obtain a sample large enough to provide precise estimates for small geographies - Degree of uncertainty around estimates
Proxy	2011 Census (ONS)	Full tenure breakdown for local authorities England and Wales	- Comprehensive data on tenure as it covers the whole of England and Wales - Does not suffer from missing geographical areas or zero counts	- Only available every 10 years, so can be out-of-date between censuses
Row margins	England: Live tables on dwelling stock - Table 100 (MHCLG[3]) Wales: Dwelling stock estimates (Welsh Government)	Total stock for local authorities	- National Statistics, so are considered robust - Annual data	
Column margins	England: Live tables on dwelling stock -- Table 104 (MHCLG) Wales: Dwelling stock estimates (Welsh Government)	Full tenure breakdown for the country as a whole	- National Statistics, so are considered robust - Annual data	

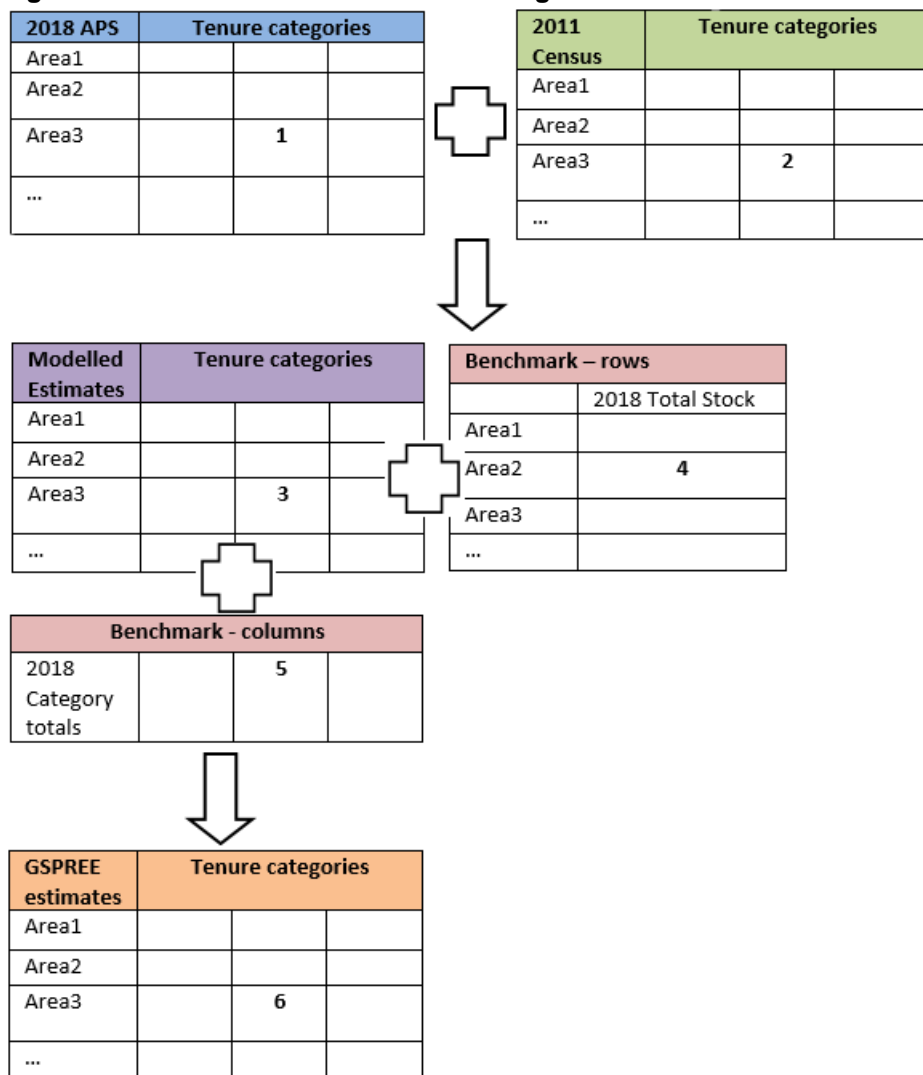Source: Office for National Statistics – Alternative estimates of subnational dwelling stock by tenure

Notes

1. ONS = Office for National Statistics. Back to table

2. Full tenure breakdown = Owner-occupied, Privately rented and Socially rented categories separately. Back to table

3. MHCLG = Ministry of Housing, Communities and Local Government. Back to table

It is only possible to use tenure information from data sources that cover all tenure categories of interest. This means that it is not possible to use data sources such as the Tenancy Deposit Protection schemes data on secured deposits, which would provide useful information about the private rental sector but no information about owner-occupiers.

Figure 8 illustrates an overview of the process used by the GSPREE models to produce the modelled estimates of tenure by local authority.

Figure 8: Generalised Structure Preserving Estimator data structure for tenure, 2018

2018 APS	Tenure categories		
Area1			
Area2			
Area3		1	
...			

2011 Census	Tenure categories		
Area1			
Area2			
Area3		2	
...			

Modelled Estimates	Tenure categories		
Area1			
Area2			
Area3		3	
...			

Benchmark – rows	2018 Total Stock
Area1	
Area2	4
Area3	
...	

Benchmark - columns			
2018 Category totals		5	

GSPREE estimates	Tenure categories		
Area1			
Area2			
Area3		6	
...			

Source: Office for National Statistics – Alternative estimates of subnational dwelling stock by tenure

We would like your feedback on the data and methods used to produce these estimates. Please email any feedback to better.info@ons.gov.uk.

8 . Feedback

We would like to receive feedback on this Research Output and the methodology used to produce these estimates, including how they might be improved and potential uses of the data. Please email your feedback to better.info@ons.gov.uk.

9 . Further development of dwelling stock estimates

This new method makes use of data from multiple sources to produce subnational dwelling stock by tenure estimates. This method has been successful and has improved the precision of the estimates, so we are looking to adopt this new methodology. We will work with the devolved administrations of the UK to help determine the best method for the estimates in each country.

In addition, we will explore whether there are any other data sources that could be incorporated into our new method, to draw on strengths from other sources and try to further improve the precision of the estimates.

10 . Dwelling stock by tenure statistics across the UK

Annual subnational statistics on the dwelling stock are available for each of the four UK countries. See the Subnational dwelling stock by tenure estimates, England: 2012 to 2018 article for more information.