

Article

Tenure estimates for households and dwellings, England: GSPREE compared with Census 2021 data

An assessment of the subnational dwellings and household by tenure datasets using the Generalised Structure Preserving Estimator (GSPREE) model compared with Census 2021 data.

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1 . Main points

- Though the census provides an unparalleled view of how many households and dwellings there are in each tenure at the national and subnational level every ten years, between censuses, annual estimates for local authorities are produced using a Generalised Structure Preserving Estimator (GSPREE) model.
- The GSPREE model was found to have a strong correlation with Census 2021 data so continues to be recommended for estimating subnational tenures for households and dwellings on an annual basis.
- The number of households that owned their accommodation outright or owned with a mortgage or loan were generally overestimated, while households in the rented tenures were generally underestimated, by the GSPREE model when compared with Census 2021 data.
- The differences between the GSPREE model and Census 2021, such as the sample used, tenure definitions and data time periods, mean that we do not expect results to be the same, but we make assessments based on 95% confidence intervals produced in our annual estimates for households.
- The GSPREE method makes use of historic census data along with existing administrative and survey data sources, though we continue to explore other data to improve overall accuracy.

2 . Background

This article assesses how accurate the subnational tenure estimates of households and dwellings produced using the Generalised Structure Preserving Estimator (GSPREE) method are in relation to Census 2021 data. This allows us to assess our current approach to produce subnational tenure data between censuses. Our [Subnational estimates of dwellings and households by tenure](#), England 2021 article provides data on the tenure distribution within [dwellings](#) and [households](#) for local authorities in England.

Annual estimates of dwellings and households by tenure are required to 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. Estimates of dwellings by tenure are used to inform the sampling and adjustment of data collected about the private rental sector.

Estimating subnational tenure estimates on an annual basis

There were no published annual statistics on the number of households by tenure, or the dwelling stock by tenure breakdown within the private sector, for subnational geographies in England between decennial censuses. We explored the use of a small area estimation method (Generalised Structured Preserving Estimator (GSPREE)) to fill the gap in available statistics. For more information on the GSPREE method, please see [Assessing the Generalised Structure Preserving Estimator \(GSPREE\) for Local Authority Population Estimates by Ethnic Group in England report \(PDF, 2.3 MB\)](#). The estimates for dwellings also include administrative data on dwelling stock estimates. This provides a framework for estimating population characteristics in non-census years when such comprehensive data are not available.

We produce estimates on the tenure breakdown of households and dwellings at the local authority level. There are three main types of tenure for which households and dwellings can be categorised: owner-occupied, privately rented and socially rented. We then split the owner-occupied category into owned outright and owned with a mortgage or loan.

To produce estimates for households, unweighted tenure counts at the local authority level are taken from the Annual Population Survey (APS) and combined with historic census tenure data (2011). These data are input into the GSPREE model. They are constrained to weighted counts of the total number of households by local authority, and counts of tenure at the country level, from APS data. We can produce 95% confidence intervals around these estimates to provide information about the degree of uncertainty.

To produce dwelling estimates, APS and historic census data are also used. However, as these are household level datasets, a vacancy rate adjustment needs to be applied to provide an indication of the number of dwellings. This uses data from the English Housing Survey (EHS). Vacancy rates by tenure are only available at the regional level, so all local authorities within the same region and tenure get the same vacancy rate adjustment. Estimates are constrained to the published number of dwellings in a local authority, and number of dwellings by tenure for England overall. These figures are [published by the Department for Levelling Up, Housing and Communities \(DLUHC\)](#). For dwellings, we only produce estimates on the private sector, as the DLUHC produce data on the number of socially rented dwellings for local authority districts in England. As we do not cover the entire dwelling stock, we cannot produce confidence intervals around the dwelling estimates.

Household data from the APS used to produce both estimates cover January to December 2021, so does not exactly match the time period of Census Day (21 March 2021). We would ideally use data for the year ending September 2021, with Census Day at the midpoint, but this is not available. Although Census 2021 data are available to replace the 2011 Census data in the GSPREE model, we use 2011 Census data for this comparison to assess how well the data has been predicted forward in the model.

Census 2021 data on tenure

Census 2021 data have been released at the national and subnational level for households and dwellings, which will be used in the model for future releases. Tenure information is only available for occupied dwellings from Census 2021, as it requires a household to complete the census questionnaire. To provide a tenure breakdown for all dwellings from the census, we take the number of unoccupied dwellings in each local authority from Census 2021 data and apply EHS vacancy rates by tenure.

Coronavirus (COVID-19) impact

The data being compared in this article are for 2021, and have been affected by the coronavirus pandemic. Data collection from the APS used in the GSPREE model shifted entirely to telephone interviewing from March 2020, which affected who responded to the survey. There were notable decreases in the proportions of respondents living in privately rented dwellings, and increases in those living in owned-outright properties. The EHS could not reach vacant dwellings in 2020, so vacancy rates by tenure from 2019 are used as the latest data point.

As Census 2021 was carried out during the pandemic, some people (such as overseas students or those privately renting) may have moved back in with family members, leaving more unoccupied dwellings.

Further information

We have used the percentage breakdown of each tenure within local authorities rather than counting the tenures. This is preferable, as households and dwellings can vastly differ in size among local authorities. To match with the tenure categories produced using the GSPREE model, shared ownership is included in the "owned with a mortgage or loan" category.

We look at the percentage point difference between Census 2021 results and GSPREE-modelled data. A positive difference means that the GSPREE-modelled data is overestimating tenures when compared with Census 2021 data. A negative difference means that the GSPREE method is underestimating tenures when compared with Census 2021 data.

3 . Comparing data on households

Correlation between Generalised Structure Preserving Estimator (GSPREE) and Census 2021 data

Correlation shows the relationship (or lack thereof) between two sets of data. A correlation of 1 means that both sets of data have an exact positive relationship, while 0 means that the two data sets are unrelated. When comparing the correlation for each tenure within households, there is a strong positive relationship between the two sets of data, indicating that the GSPREE model is a good comparison with the Census percentages. The results show that:

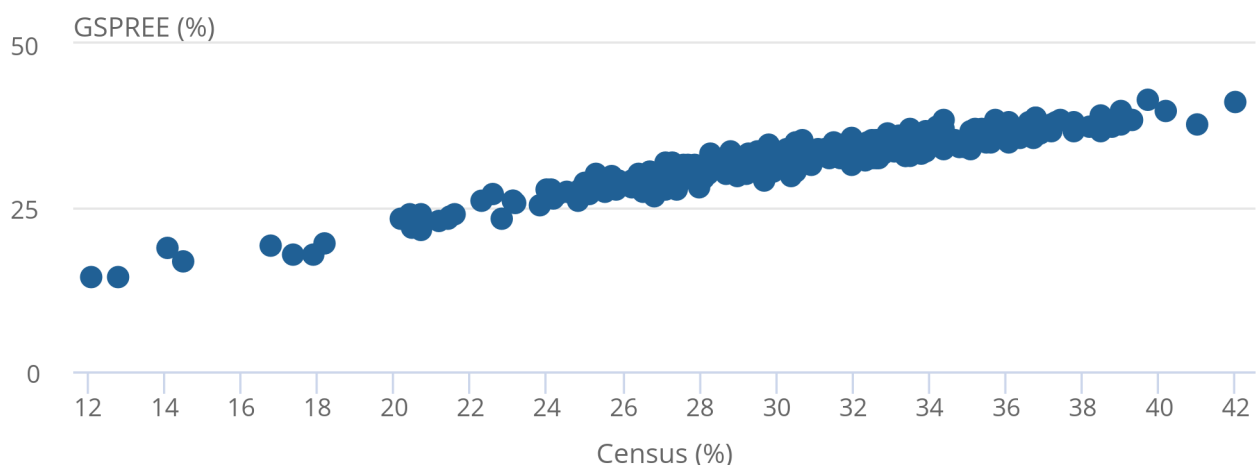
- the correlation for the percentage of owned-outright households between Census 2021 data and the GSPREE model is 0.98
- the correlation for the percentage of owned with a mortgage or loan households between Census 2021 data and the GSPREE model is 0.96
- the correlation for the percentage of privately rented households between Census 2021 data and the GSPREE model is 0.97
- the correlation for the percentage of socially rented households between Census 2021 data and the GSPREE model is 0.99

Figure 1: There is a strong correlation between the GSPREE method and Census 2021 data for households in all tenures

Correlation between GSPREE and 2021 Census data for the owns with a mortgage or loan tenure in households, local authorities, England 2021

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Correlation between GSPREE and 2021 Census data for the owns with a mortgage or loan tenure in households, local authorities, England 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Owned-outright households

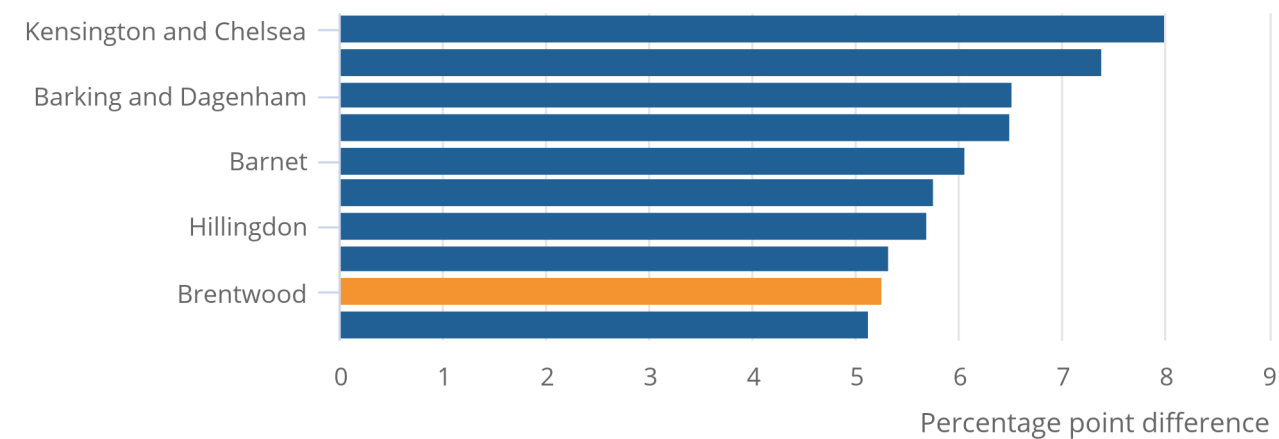
When comparing the percentage of households that were owned outright between Census 2021 and GSPREE-modelled data, 73.1% of local authorities had a difference smaller than 3 percentage points. The local authority with the highest percentage point difference was Kensington and Chelsea in London. In this local authority, the owned-outright percentage was 8 percentage points higher in the GSPREE model compared with Census 2021. In fact, for owned-outright households, 9 of the top 10 local authorities with the biggest percentage point differences were all in London. The only local authority outside of London in the top 10 was Brentwood in the East of England, with 5.26 percentage points. 15 of the top 20 local authorities were in London, with the other 5 in the surrounding regions of the East of England and the South East. Out of 308 local authorities, the GSPREE method only underestimates the owned-outright households in 25 local authorities compared with Census 2021. None of these local authorities were in London.

Figure 2: The difference for owned-outright households was higher in London than the rest of England

Largest percentage point difference in owned-outright percentages between GSPREE and Census 2021 data, England, 2021

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Largest percentage point difference in owned-outright percentages between GSPREE and Census 2021 data, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Notes:

1. Brentwood is highlighted as it is the only local authority not in London.

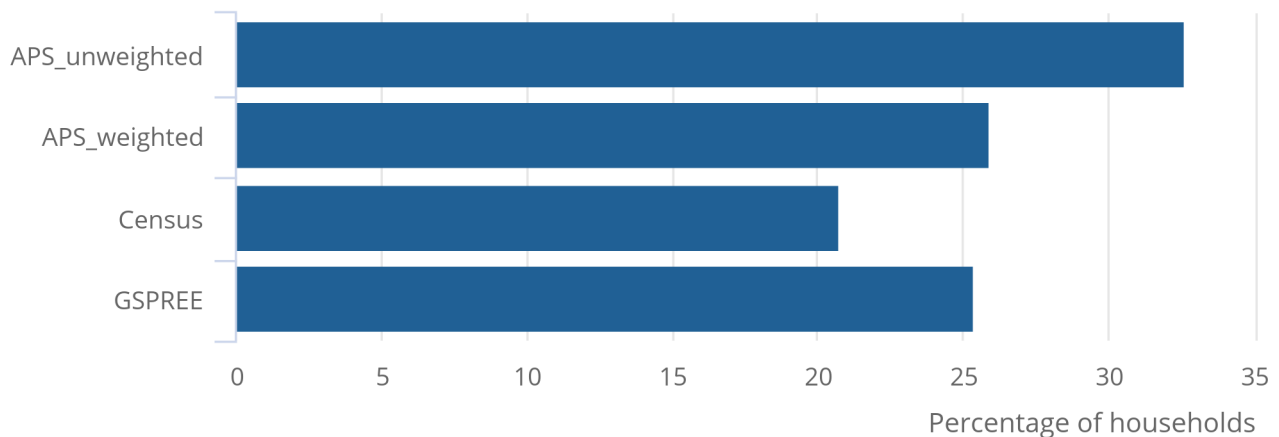
When comparing the (weighted and unweighted) Annual Population Survey (APS) data with the Census 2021 and with the aggregated GSPREE estimates, the unweighted APS estimates provided the higher percentage (32.64%) of owned-outright households in London. As unweighted APS data is an important input source for the GSPREE model, it explains the model's overestimation of owned-outright households in London. When applying the household weighting to the APS data, the owned-outright percentage for London is 25.91%, so adjusts for some of the bias in the sample.

Figure 3: The percentage of owned-outright households in London was nearly 7 percentage points higher in unweighted APS data, compared with weighted APS data

Owned-outright households, London, 2021

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Owned-outright households, London, 2021



Source: Annual Population Survey (APS), Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

The Census 2021 percentages for around two-thirds of local authorities in the owned-outright tenure for households fall within the confidence intervals (CI) of the GSPREE model. This means that for 202 local authorities out of 308, there was no significant difference between the two methods for this tenure. Of those local authorities that did not fall between the CIs, all but two fell below the lower CI limit: Copeland in the North West, and Richmondshire in Yorkshire and The Humber. There was no geographical pattern in local authorities which fell outside of the CIs.

Owned with mortgage or loan households

When comparing the percentage of households that are owned with a mortgage or loan between the GSPREE-modelled data and Census 2021 data, County Durham in the North East had the highest percentage point difference (5.03 percentage points). The local authorities in the top four all came from different regions. The GSPREE model overestimates the percentage of owned with a mortgage or loan tenure for households in 268 local authorities compared with Census 2021.

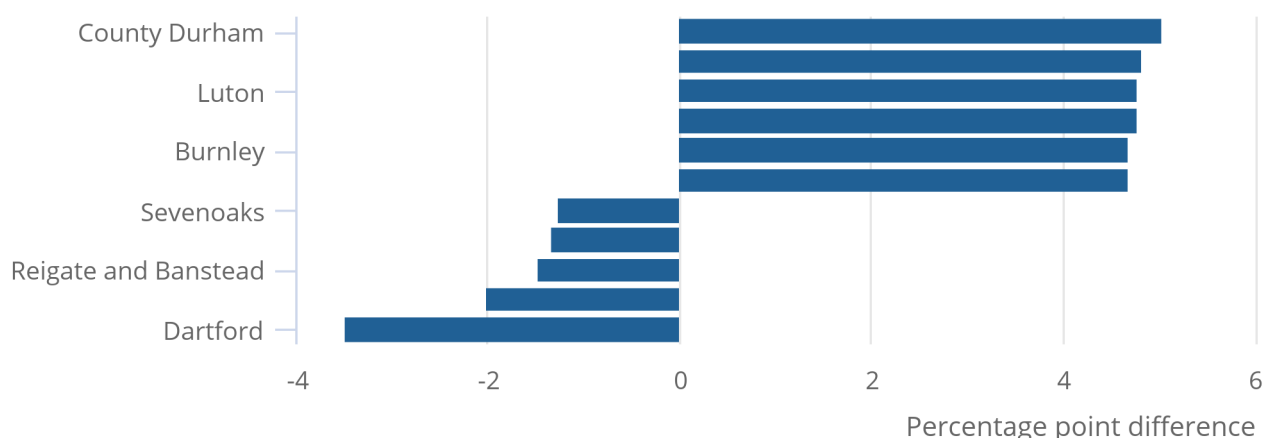
The GSPREE model underestimates the number of owned with a mortgage or loan households compared with the Census in 39 local authorities. The five local authorities that were underestimated by the GSPREE model with the largest percentage point differences all came from the South East, with Dartford the largest at negative 3.49.

Figure 4: The GSPREE model overestimated the percentage of owned with a mortgage or loan tenure for households in 268 local authorities compared with Census 2021

The largest over and underestimated difference between GSPREE and Census 2021 data, England, 2021

Figure 4: The GSPREE model overestimated the percentage of owned with a mortgage or loan tenure for households in 268 local authorities compared with Census 2021

The largest over and underestimated difference between GSPREE and Census 2021 data, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Notes:

1. The chart shows six overestimated bars, as Burnley and Sunderland had the same percentage point difference.

When comparing Census 2021 data for households that are owned with a mortgage or loan, 70 local authorities out of 308 fell outside the CIs produced by the GSPREE model. This indicates that the majority of local authorities do not have a statistically significant difference between Census 2021 percentages and the GSPREE-modelled data for this tenure. For most of these local authorities, the Census 2021 percentage is smaller than the lower CI limit, with only Ribble Valley (North West), Elmbridge, and Epsom and Ewell (South East) having a percentage that is greater than the upper CI limit.

Privately rented households

For households, the GSPREE model underestimates the privately rented tenure in all local authorities in England when compared with Census 2021. The range of percentage point differences are negative 0.44 in East Hampshire to negative 12.79 in the City of London.

The five local authorities with the highest percentage points differences are:

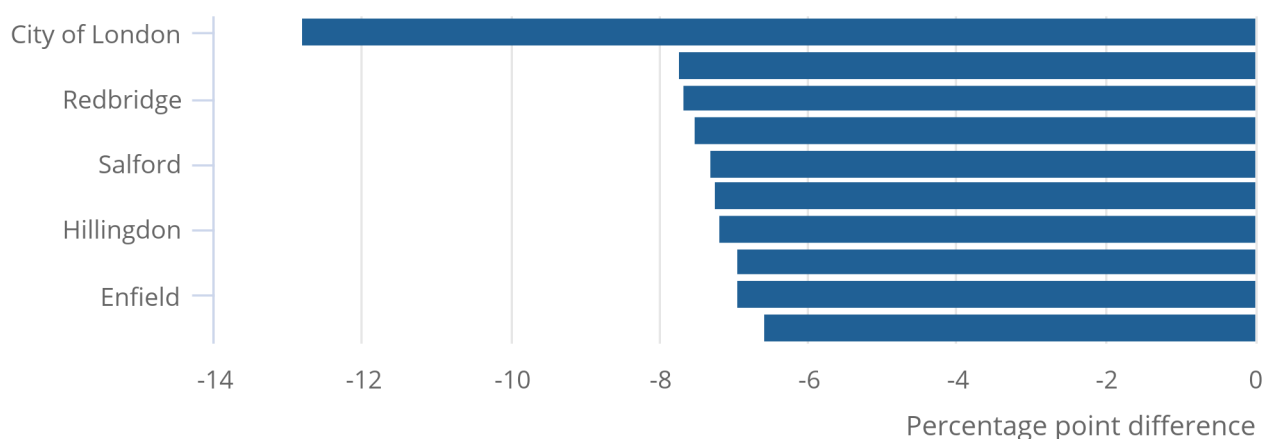
- City of London (negative 12.79), London
- Harrow (negative 7.72), London
- Redbridge (negative 7.67), London
- Watford (negative 7.5), East of England
- Salford (negative 7.31), North West

Figure 5: Salford showed the biggest difference in privately rented households of all the local authorities outside of London

Largest percentage point difference between GSPREE and Census 2021 data for privately rented households, England, 2021

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Largest percentage point difference between GSPREE and Census 2021 data for privately rented households, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

The City of London had the largest percentage point difference for privately rented households and the second largest for owned-outright households. One reason for this could be the size of the APS sample size used in the GSPREE model. The City of London has the smallest sample size, with only 10 households covering all tenures in the local authority. This means any change in the modelling may have a greater effect here than in local authorities with a large sample size. However, when analysing the correlation between APS sample sizes and the percentage point difference between Census 2021 and GSPREE data for all tenures, there was a very weak correlation. This means that the sample sizes of APS do not have a direct impact on the differences for most local authorities.

When comparing Census 2021 data for households that are privately rented, 234 local authorities out of 308 fell above the upper CI limit produced by the GSPREE model. However, no local authority had a percentage less than the lower CI limit. This indicates that most local authorities have a statistically significant difference between the Census 2021 percentages and the GSPREE-modelled subnational data for this tenure.

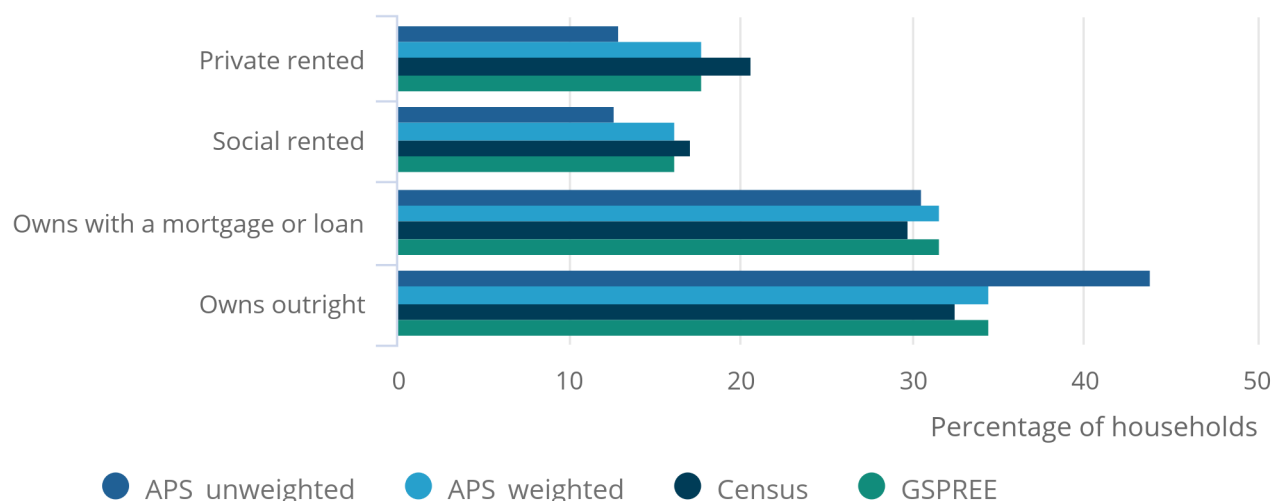
When comparing the privately rented percentages in England between the APS (weighted and unweighted) data with Census 2021 data and aggregated GSPREE estimates, the unweighted APS estimates provide a lower percentage (12.9%). As unweighted APS data is an important input source for the GSPREE model, it explains the model's underestimation of privately rented households in most local authorities. When applying the household weighting to the APS data, the private rent percentage for England is 17.74%, so applying weight takes the estimate closer to Census 2021 (20.59%).

Figure 6: The percentage of privately rented households is lower in APS unweighted data than other data sources

Households by tenure, England, 2021

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Households by tenure, England, 2021



Source: Annual Population Survey (APS), Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Socially rented households

Households that are socially rented had the smallest range of percentage point differences between Census 2021 and the GSPREE method. The range of percentage point differences ranged from negative 5.41 in Kensington and Chelsea and positive 0.71 in the City of London. The GSPREE model underestimates the percentage of socially rented households in 301 out of 308 local authorities when LAs, compared with Census 2021.

The five LAs local authorities with the biggest percentage points differences are:

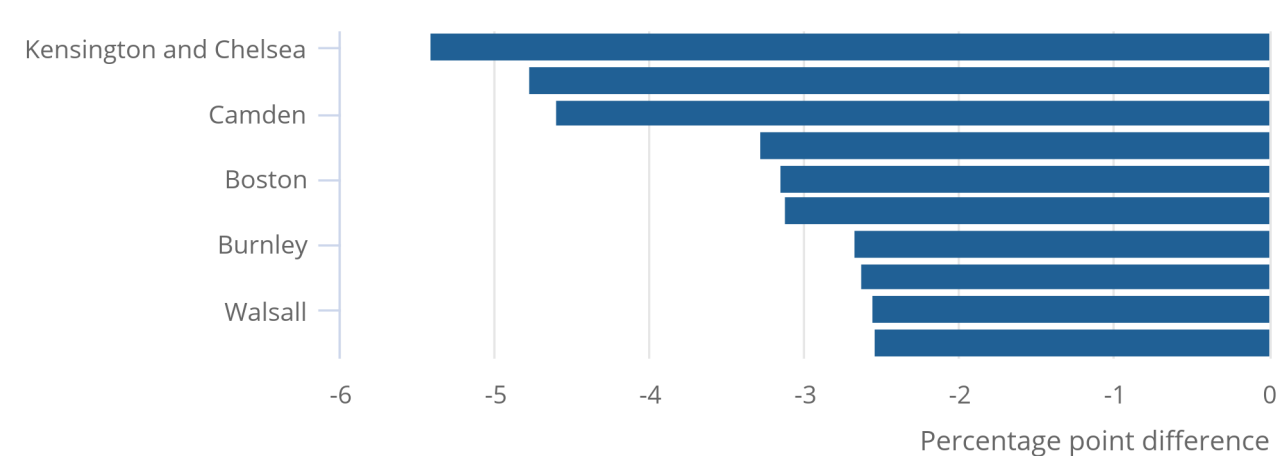
- Kensington and Chelsea (negative 5.41), London
- Westminster (negative 4.77), London
- Camden (negative 4.6), London
- Islington (negative 3.28), London
- Boston (negative 3.15), East Midlands

Figure 7: London has the top four local authorities with the biggest percentage point difference

Largest percentage point difference between GSPREE and Census 2021 data for social rented households, England, 2021

Figure 7: London has the top four local authorities with the biggest percentage point difference

Largest percentage point difference between GSPREE and Census 2021 data for social rented households, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

When comparing Census 2021 data for socially rented households, 62 local authorities out of 308 fell outside the CIs produced by the GSPREE model. All fell above the upper CI limit. This indicates that around 20% of local authorities have a statistically significant difference between Census 2021 percentages and the GSPREE-modelled subnational data for this tenure.

4 . Comparing data on dwellings

Owner-occupied dwellings

Census 2021 released data in March 2021 [on the tenure of occupied dwellings at the local authority level](#). Tenure data were not available for unoccupied dwellings. Instead, we apportioned the vacant dwellings into tenures using the latest English Housing Survey (EHS) vacancy rates. This allowed us to compare Census 2021 data with the data produced in the Generalised Structure Preserving Estimator (GSPREE) model. These vacancy rates do not split owner-occupied dwellings into owned outright and owned with a mortgage or loan dwellings, so we only compared owner-occupied data on dwellings.

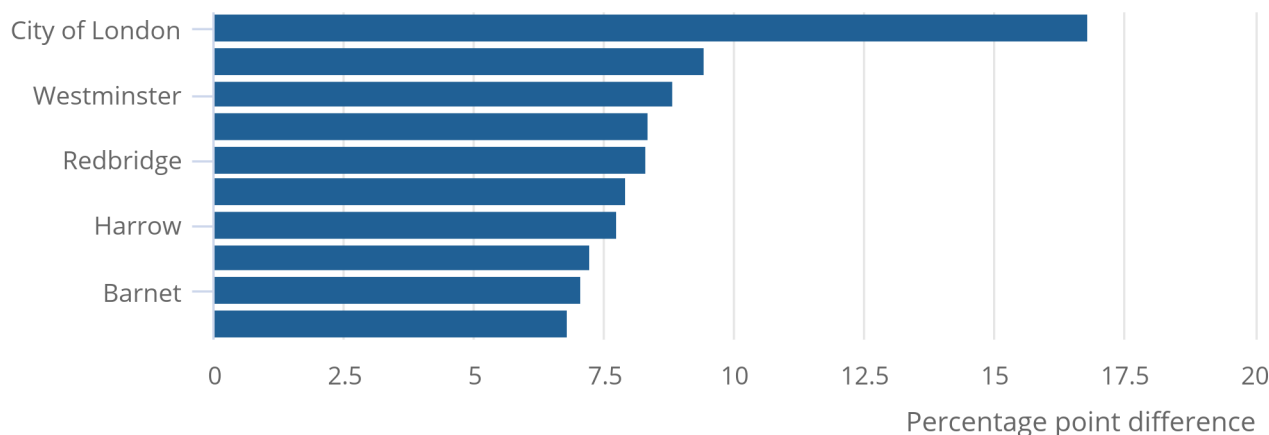
The GSPREE model overestimates the percentage of owner-occupied dwellings compared with Census 2021 in 283 local authorities. Local authorities in London make up 8 of the top 10 local authorities with the biggest percentage point differences between Census 2021 and the GSPREE model for owner-occupied dwellings. The City of London has the largest percentage point difference of 16.83. The biggest percentage difference outside of London was East Lindsey (8.35). The percentage point differences for local authorities in England ranged from positive 16.83 percentage points in the City of London to negative 2.59 percentage points in Rushmoor.

Figure 8: Local authorities in London make up 8 of the top 10 local authorities with the biggest percentage point differences

Largest percentage point difference between GSPREE and Census 2021 data for owner-occupied dwellings, England, 2021

Figure 8: Local authorities in London make up 8 of the top 10 local authorities with the biggest percentage point differences

Largest percentage point difference between GSPREE and Census 2021 data for owner-occupied dwellings, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Notes:

1. East Lindsey and North Norfolk are the only local authorities not in London.

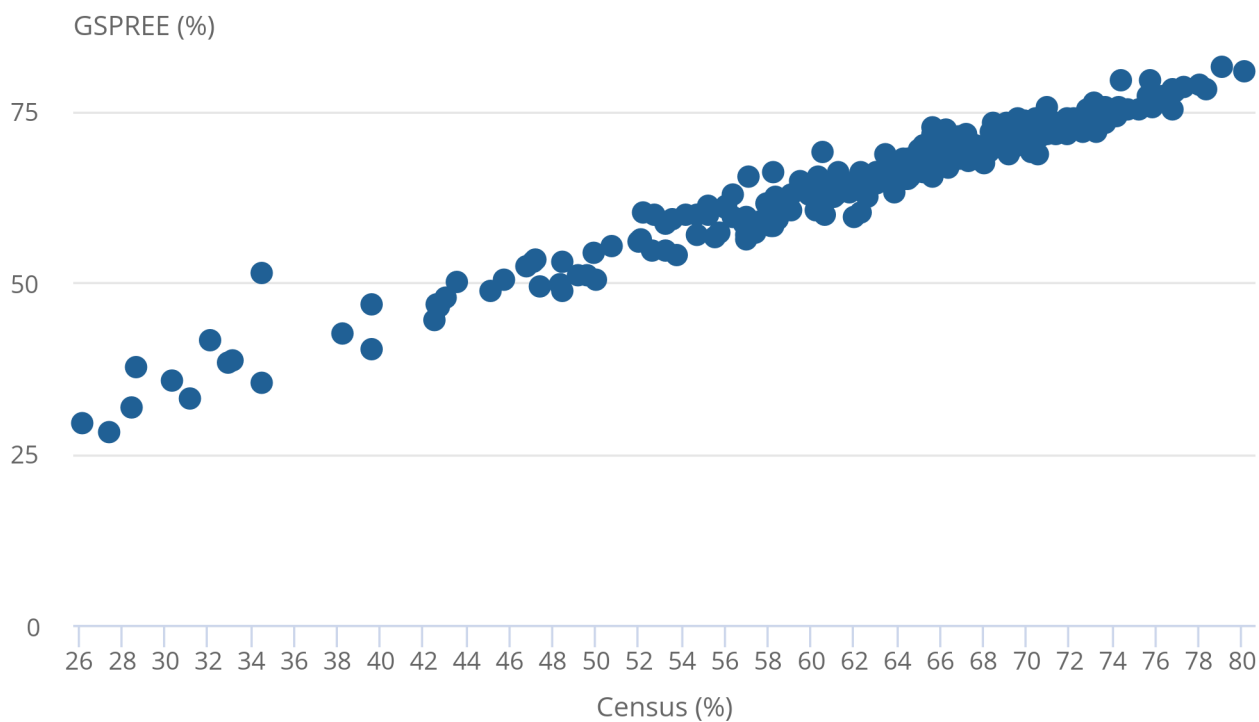
The correlation between Census 2021 data and the GSPREE model is 0.98. This means that for most local authorities, Census 2021 has a very similar proportion of owner-occupied dwellings compared with the GSPREE model.

Figure 9: There is a strong correlation between the GSPREE method and Census 2021 data for owner-occupied dwellings

Local authorities, England, 2021

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Local authorities, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

Privately rented dwellings

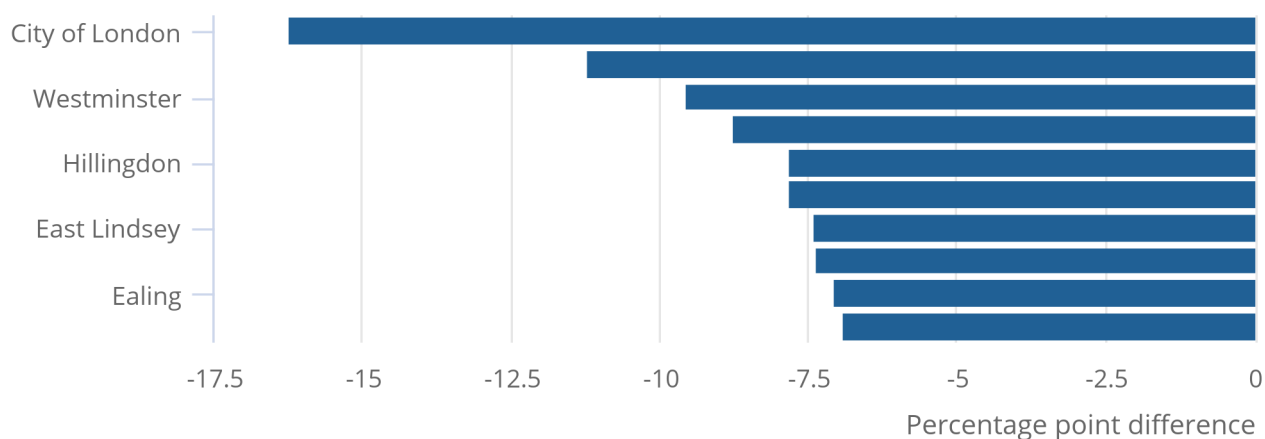
The local authority with the biggest percentage difference between Census 2021 and the GSPREE model for the privately rented tenure was the City of London, with a percentage point difference of negative 16.2. As this difference is a negative, it means that the GSPREE model underestimates the percentage for the City of London compared with Census 2021. This is the case with the majority of local authorities, with only 16 being overestimated by the GSPREE model.

Figure 10: The City of London has the biggest percentage point difference for privately rented dwellings

Largest percentage point difference between GSPREE and Census 2021 data, England, 2021

Figure 10: The City of London has the biggest percentage point difference for privately rented dwellings

Largest percentage point difference between GSPREE and Census 2021 data, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

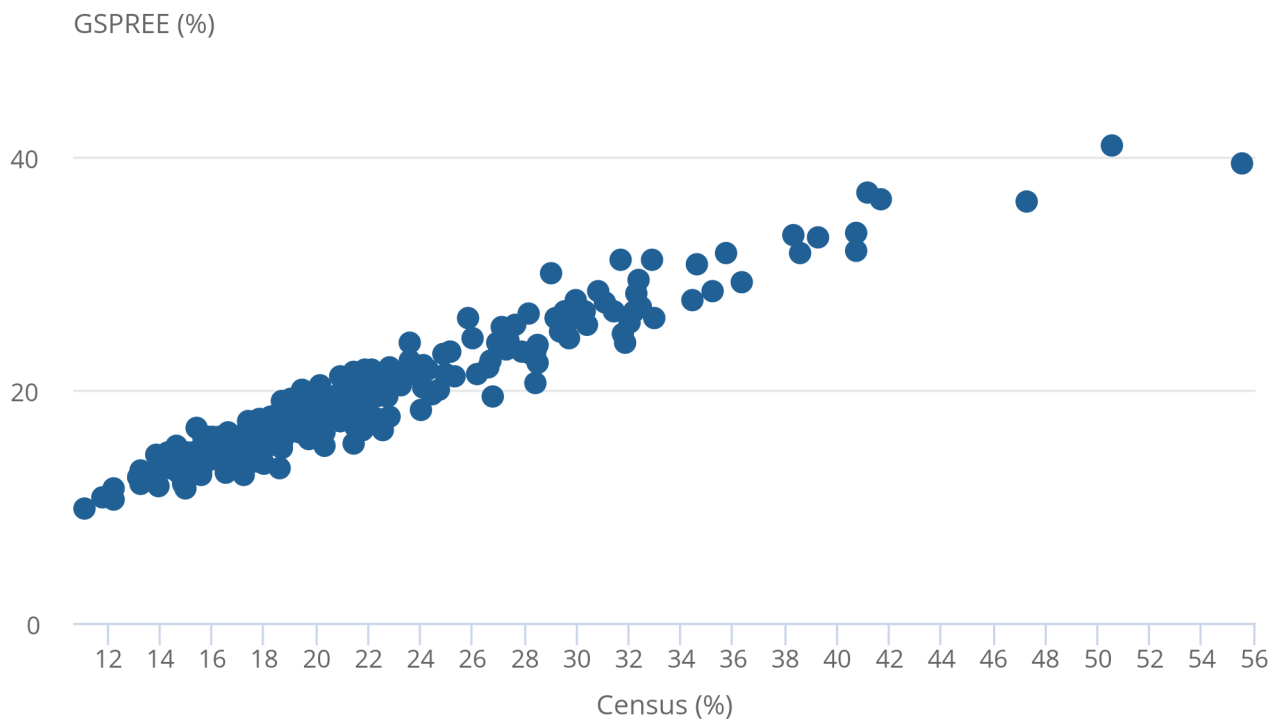
The correlation between Census 2021 data and the GSPREE model is 0.96. This means that for most local authorities, Census 2021 has a very similar proportion of privately rented dwellings compared with the GSPREE model.

Figure 11: There is a strong correlation between the GSPREE method and Census 2021 data for privately rented dwellings

Local authorities, England, 2021

Figure 11: There is a strong correlation between the GSPREE method and Census 2021 data for privately rented dwellings

Local authorities, England, 2021



Source: Subnational estimates of dwellings and households by tenure, Census 2021, from the Office for National Statistics

5 . Conclusion

When comparing the correlation for each tenure within households, there is a strong relationship between the two sets of data. This indicates that the Generalised Structure Preserving Estimator (GSPREE) model is a good comparison with the Census 2021 percentages.

We have found that households that were owned outright or owned with a mortgage or loan were generally overestimated by the GSPREE model when compared with Census 2021. Households in the rented tenures were generally underestimated by the GSPREE model when compared with Census 2021. The tenure pattern for households can also be observed for dwellings. However, we believe that is largely because of the sampling in the Annual Population Survey (APS) being affected by the impact of the coronavirus (COVID-19) pandemic on data collection.

A large proportion of local authorities had owner-occupied and socially rented percentages where Census 2021 data fell within the confidence intervals produced by the GSPREE model. There are confidence intervals available for Census 2021 for tenure by local authority, but for this analysis we assumed that the census has no uncertainty. This indicates that there was not a statistically significant difference between the GSPREE method and Census 2021 data. We found a lower proportion of local authorities with a privately rented percentage that fitted in with the confidence intervals.

We recommend continuing to use the GSPREE method for estimating subnational tenures for households and dwellings on an annual basis.

6 . Tenure estimates for households and dwellings, England: GSPREE compared with Census 2021 data

[Tenure](#)

Dataset | Released 5 January 2023

This dataset provides Census 2021 estimates that classify households in England and Wales by tenure. The estimates are as at Census Day, 21 March 2021.

[Subnational estimates of dwellings by tenure, England](#)

Dataset | Released 27 February 2023

Tenure estimates for dwellings at the local authority district level in England for 2012 to 2021. These data are produced using the Generalised Structure Preserving Estimator (GSPREE) method.

[Subnational estimates of households by tenure, England](#)

Dataset | Released 27 February 2023

Tenure estimates for dwellings at the local authority district level in England for 2012 to 2021.

7 . Glossary

Household

A household refers to a person living alone or a group of people living at the same address who share cooking facilities and living room, sitting room, or dining area.

Dwelling

A dwelling refers to the physical unit of accommodation which may have one or more household spaces.

Owner-occupied

This tenure category covers units of accommodation in which the occupier either owns the property in full (owned outright) or has taken out a mortgage or loan (owned with mortgage or loan) to help purchase their home and is still in the process of repaying the debt.

Owned outright

This tenure category covers units of accommodation in which the occupier owns the property in full and has no outstanding mortgage repayments or money owed in connection with the property in any other form.

Owned with mortgage or loan

This tenure category covers units of accommodation in which the occupier has taken out a loan or mortgage to help purchase their home and are still in the process of repaying the debt, including shared ownership.

Private rent

This tenure category includes all units of accommodation that are not occupied by the owner but are occupied by a tenant or group of tenants. Privately rented accommodation is owned by a landlord who can be, but is not limited, to:

- an employer
- private company
- a private individual
- a friend or family member

This tenure category also includes occupiers who are living in properties that they do not own but do not pay rent, and squatting tenants.

Social rent

This tenure category includes all units of accommodation that are owned or maintained by a local council, housing association (private registered provider), charitable trust or local housing company, and are occupied by a tenant or group of tenants.

8 . Future developments

We will continue to investigate ways of improving the overall quality of the Generalised Structure Preserving Estimator (GSPREE) model. For instance, there could be more use of administrative data and further investigation of confidence intervals for dwelling stock estimates.

We welcome users providing feedback on this research and the methodology used to produce them, including how they might be improved and potential uses of the data. Please email your feedback to better.info@ons.gov.uk and include "Subnational dwellings and households" in the subject line of your response.

9 . Related links

[Subnational estimates of dwellings and households by tenure, England: 2021](#)

Article | Released 27 February 2023

Annual estimates which provide the breakdown of dwellings and households by tenure for local authority districts in England.

10 . Cite this article

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