Measuring the 'housing squeeze' in high-income countries: simple measures for summarising household change

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Abstract
In several high-income countries, housing affordability has worsened dramatically in recent years, placing housing at the top of the political agenda. It would be valuable to understand how household patterns are changing in the context of this deteriorating affordability. Unfortunately, the toolbox of available measures for describing household change remains under-developed compared to those for fertility, mortality and migration. One of the simplest measures, average household size, is easily interpretable but comparisons over time and space are hindered by the fact it is a crude measure which does not account for changing population composition, especially age structure. Age-specific household representative rates are more useful, but the literature lacks an easily-interpretable summary metric of these rates. Building on the work of Thomas Burch, we suggest two summary demographic measures to describe the distribution of the population across households, Age-standardised Average Household Size, and Potential Additional Households. Age-standardised Average Household Size is a directly standardised measure in which the age-specific household representative rates of a population of interest are applied to a standard private household population. Potential Additional Households is an indirectly standardised measure which describes the potential number of households there would be in a population of interest according to a set of Standard household representative rates. It indicates the extent to which there is unmet demographic demand for housing relative to the Standard. We also define extended versions of the measures which standardise for both age and partnership status. We apply the measures to selected case study countries to demonstrate how household patterns have shifted during the period of deteriorating housing affordability in recent years. They require modest amounts of data and are simple to calculate. We believe they could be useful in summarising household demography changes to policymakers and a wide range of audiences.

Key words
Age-standardised Average Household Size; Potential Additional Households; household demography; housing affordability; unmet housing demand

1. Introduction

In many high-income countries, housing affordability has worsened in recent years (OECD 2024; Lee et al. 2022; The Economist 2024). Studies demonstrate how affordability has declined using a variety of measures, including mortgage repayments to income ratios, dwelling price to income ratios, rent to income ratios, and years needed to save for a deposit, with many of these measures using median incomes and median dwelling prices (NHSAC 2025). How have household trends and patterns shifted during this period of deteriorating affordability? Unfortunately, ways of describing household change, and thus our knowledge and understanding of household change, remain fairly limited. This is due, at least in part, to household data availability and a paucity of suitable measures in the literature for quantifying and summarising household demographic change. Adverse changes to household demography, particularly those in which individuals, couples, and families are no longer able to form the separate households they would like, are undesirable from a social equity perspective. But in order to shed light on such changes, robust and easily interpretable measures of household change are needed.

The literature on the measurement and quantitative analysis of household change in the academic journals is small; and, despite its public policy relevance, many introductory demography textbooks contain nothing about household demography. Over the last decade, contributions to measuring and documenting household demographic change have been made by a small number of authors (e.g. Catney and Simpson 2014) as well as most recently by the CORESIDENCE project (Esteve and Reher 2024; Esteve et al. 2024). Earlier relevant contributions include those from Burch (1970, 1980), Ermisch and Overton (1985), Kobrin (1976), Myers and Doyle (1990), and Sweet (1984). Our paper is primarily inspired by the work of Burch (1980), who proposed an age-standardised ratio of adults per household, a directly standardised measure using a stable population age distribution, and an Index of Overall Headship, an indirectly standardised measure. This Index is the ratio of the observed number of households in a population to the number that would exist if it experienced maximum age-sex-specific household representative (headship) rates.

Given the small literature, it is not surprising that the toolbox of available measures for describing and understanding household demography remains under-developed compared to those for fertility (e.g. Preston et al. 2001; Smith 1992), mortality (e.g. Carmichael 2016; Rowland 2003) and migration (e.g. Bell et al. 2002; Rees et al. 2000). One of the simplest measures, average household size, is easily interpretable, requires very little data to calculate, and succinctly describes the relationship of population to housing. But its ability to help understand household change over time and space is hindered by the fact it is a crude measure which does not account for changing population age structure. As its name makes clear, it simply describes the average number of people in a private household – but that is all. There is a risk that changes to average household size are misinterpreted as changes in the ability of families and individuals to access their own housing and form separate households. Adjustments in population composition, especially age structure, are crucially important. This includes population ageing and other shifts in the adult population age structure, such as growth of the younger adult population due to high net immigration, but also variations in the number of children in the population (Catney and

Simpson 2014; Sweet 1984). Changes in marriage and partnering trends may also affect household formation patterns and average household size due to partnering formation and dissolution but not as a result of housing market factors. Thus, changes in average household size over time and space may not be due to age-specific changes in the extent to which adults are able to form their own households.

Building on this literature, and especially the work of Burch (1980), this study suggests two simple measures of household demography to summarise the impacts of changing population age composition and household formation behaviours on the occupation of dwellings across space and time. The measures are Age-standardised Average Household Size and Potential Additional Households. We adopt standardisation over decomposition techniques due to its ease of calculation and straightforward interpretability. We define the measures in section 2 before applying them to three case study countries in section 3: Australia, the United States, and England & Wales. In section 4, we apply the extended age and partnership-standardised versions of the two measures. The results allow for easy interpretation of the relative significance of changing age composition and shifts in household formation behaviours on the distribution of population across the dwelling stock. We use these findings to summarise how household patterns have shifted during the period of 'housing squeeze' occurring in our case study countries in recent years. Section 5 consists of a discussion and conclusions.

2. Data and methods

2.1. Two age-standardised household demography measures

We suggest two measures to summarise change in household demography: **Age-standardised Average Household Size** and **Potential Additional Households**. They require modest amounts of data, are simple to calculate, and relatively easy to interpret. We believe they could be useful in summarising household demographic change to policymakers and a wide range of audiences.

Age-standardised Average Household Size

Age-standardised Average Household Size is a measure of average household size in which the influence of varying population age structure is removed. It isolates the effects of differences in age-specific household formation patterns, thereby permitting meaningful comparisons of average household sizes to be made over time or between populations. It is a directly standardised measure which incorporates the age-standardised ratio of adults per household proposed by Burch (1980) but adds the average number of children per household. The age-standardised average number of Adults per Household (APH_{AgeStd}) is calculated as the total number of adults in the Standard population divided by the number of household representatives that would exist if the population of interest had the same age structure as the Standard population:

$$APH_{AgeStd} = \frac{P_{adults}^{Std}}{\sum_a (hrr_a^i \; P_a^{Std})} \quad (1)$$

where P denotes the private household population, H the number of household representatives (or households), hrr household representative rate, Std the Standard population, i the population of interest, and a age group amongst the adult population. The age-standardised average number of Children per Household (CPH_{AgeStd}) is calculated as the total number of children in the Standard population divided by the same denominator as in equation 1:

$$CPH_{AgeStd} = \frac{P_{children}^{Std}}{\sum_a (hrr_a^i \; P_a^{Std})}. \quad (2)$$

The Age-Standardised Average Household Size (AHS_{AgeStd}) is the sum of these two components:

$$AHS_{AgeStd} = \frac{P_{adults}^{Std}}{\sum_a (hrr_a^i \; P_a^{Std})} + \frac{P_{children}^{Std}}{\sum_a (hrr_a^i \; P_a^{Std})}. \quad (3)$$

Age-standardised Average Household Size could be calculated directly without the separate adult and childhood parts, but these two measures are analytically useful in their own right. We calculated Age-standardised Average Household Size using five year age groups from 0-4 to 80-84, with ages 85+ being the final open-ended age group. The data requirements are:
(i) Standard private household population numbers by age group
(ii) household representative rates by age group for the population of interest.

The choice of what population to employ as the Standard depends on the aims of particular studies and on data availability. If the focus is on a single population and how its household demography has changed over a specified period, then it would usually be best to select the start-of-period population as the Standard. The difference between the Age-standardised Average Household Size for a selected year within the study period and its value at the start will be due to changes in

household representative rates. The difference between Age-standardised Average Household Size for a selected year and (unstandardised) Average Household Size will represent the effect of changing population age structure. If the study involves multiple populations, then there are several options. If the aim is to examine change over time in each population and measure household representative rate and age structure effects, then the best option would be to use the start-of-period population for each country separately. If the main purpose is to compare household representative rates across countries, then one of the populations could be chosen as Standard, or an average of all populations could be used. However, the temporal extent of available data may vary between countries, preventing an average population for a specific date being used as Standard.

Potential Additional Households

Potential Additional Households measures the additional number of households which would hypothetically exist in a population of interest if a Standard set of household representative rates applied compared to the actual number of households. It removes population age structure differences, measuring only differences in age-specific household representative rate age patterns between the population of interest and the Standard set of household representative rates. It is a form of indirect standardisation, and a modified version of the reciprocal of Burch's Index of Overall Headship (Burch 1980). First, the number of Potential Households which would exist in a population of interest if Standard household representative rates applied is calculated as:

$$PH^i = \sum_a \left(hrr_a^{Std} \ P_a^i \right) \quad (4)$$

where PH is the number of potential households. Then, Potential Additional Households (PAH) is calculated as the number of Potential Households minus the number of actual households.

$$PAH^i = PH^i - H^i \quad (5)$$

Often, we will express it as a percentage increase on the actual number of households. A positive value of PAH signifies that the population is being 'squeezed' into fewer households than would be the case if the Standard household representative rates applied. For example, a PAH of 5% means that there would be 5% more households in the population of interest if the Standard household representative rates applied. We calculated Potential Additional Households using five year age groups from 0-4 to 80-84, with ages 85+ being the final open-ended age group. The data requirements for calculating Potential Additional Households are:

(i) household representative rates by age group for the Standard population;
(ii) the private household population by age group for the population of interest;
(iii) the total number of households in the population of interest.

The choice of what rates to use as Standard household representative rates depends on the purpose of the study. If the aim is to examine how housing occupancy in a study population has changed over a specified period of time, then the household representative rates for this population at the start of the study period are the obvious choice. If the study involves multiple populations, then the rates of one population, or an average of all populations, could be used. Alternatively, a theoretical set of household representative rates could be formulated which represent an 'ideal' housing occupancy distribution.

2.2. Measures standardising for partnership status as well as age

The two measures, Age-standardised Average Household Size and Potential Additional Households, can be extended to standardise for both population age structure and partnership status of the adult population. The amount of partnering in a population affects the numbers of households as a result of relationship formation and dissolution decisions, rather than housing market and/or other life course decisions. A simple distinction is made between adults who are living with a partner (either married or de facto) and those who are not living with a partner (described here as single).

Age/partnership-standardised Average Household Size

Age/partnership-standardised Average Household Size is an average household size measure in which the influence of partnership status and population age structure is removed. It has adult and childhood components. The age/partnership-standardised average number of Adults per Household ($APH_{AgePtrStd}$) is calculated as the number of adults in the Standard population divided by the number of partnered and single household representatives that would exist if the population of interest had the same age and partnership structure as the Standard population:

$$APH_{AgePtrStd} = \frac{P^{Std}_{adults}}{\sum_a \left(hrr^i_{ptr,a}\ P^{Std}_{ptr,a}\right) + \sum_a \left(hrr^i_{sgl,a}\ P^{Std}_{sgl,a}\right)} \quad (6)$$

where ptr denotes partnered and sgl single. The age/partnership-standardised average number of Children per Household ($CPH_{AgePtrStd}$) is calculated as the total number of children in the Standard population divided by the same denominator as in equation 6:

$$CPH_{AgePtrStd} = \frac{P^{Std}_{children}}{\sum_a \left(hrr^i_{ptr,a}\ P^{Std}_{ptr,a}\right) + \sum_a \left(hrr^i_{sgl,a}\ P^{Std}_{sgl,a}\right)}. \quad (7)$$

The Age/Partnership-Standardised Average Household Size ($AHS_{AgePtrStd}$) is therefore:

$$AHS_{AgePtrStd} = \frac{P^{Std}_{adults}}{\sum_a \left(hrr^i_{ptr,a}\ P^{Std}_{ptr,a}\right) + \sum_a \left(hrr^i_{sgl,a}\ P^{Std}_{sgl,a}\right)} + \frac{P^{Std}_{children}}{\sum_a \left(hrr^i_{ptr,a}\ P^{Std}_{ptr,a}\right) + \sum_a \left(hrr^i_{sgl,a}\ P^{Std}_{sgl,a}\right)}. \quad (8)$$

The data requirements are:
(i) Standard private household population numbers by partnership status and age group;
(ii) household representative rates by partnership status and age group for the population of interest.

Potential Additional Households (Age and Partnership standardised)

This extended version of Potential Additional Households measures the additional number of households which would hypothetically exist in a population of interest if a Standard set of household representative rates by age and partnership status applied compared to the actual number of households. The number of Potential Households is calculated as:

$$PH^i_{AgePtr} = \sum_a \left(hrr^{Std}_{ptr,a}\ P^i_{ptr,a}\right) + \sum_a \left(hrr^{Std}_{sgl,a}\ P^i_{sgl,a}\right) \quad (9)$$

Potential Additional Households using age/partnership-standardised rates (PAH_{AgePtr}) is calculated as the number of Potential Households minus the number of actual households.

$$PAH^i_{AgePtr} = PH^i_{AgePtr} - H^i \quad (10)$$

The data requirements for calculating Potential Additional Households (Age and Partnership standardised) are:
(i) household representative rates by partnership status and age group for the Standard population;
(ii) the private household population by partnership status and age group for the population of interest;
(iii) the total number of households in the population of interest.

2.3. Data

The household measures were calculated using census data. For Australia, we extracted 2006, 2011, 2016, and 2021 census tables using the Australian Bureau of Statistics (ABS) TableBuilder tool (https://www.abs.gov.au/statistics/microdata-tablebuilder/tablebuilder). For the 1996 and 2001 censuses, which are not accessible via TableBuilder, we obtained custom census tables directly from the ABS. For the US, census data from 1990, 2000, 2010, and 2020 was obtained from IPUMS International (https://international.ipums.org/international/). For England & Wales, the required census data was obtained from various datasets published by the Office for National Statistics (ONS). 2001 Census data was extracted from the NOMIS website (https://www.nomisweb.co.uk/) from the 2001 Census Standard Tables. 2011 census data was obtained from 2011 census custom tables (http://bit.ly/2gk3Zrm and http://bit.ly/2fqSD3J), while those for 2021 were extracted from the 'Create a custom dataset' tool (https://www.ons.gov.uk/datasets/create). Note that all descriptions of household change in this paper make use of 'raw' census data. It is unadjusted for census undercount, individual question non-response, response errors, and any other errors. Household definitions and categories in the census data are those of the case study countries' statistical offices.

3. Household change standardising for age

3.1. Australia case study

In Australia, (unstandardised) average household size stood at 2.61 persons per household in 1996. It fell to 2.50 by 2006, and then changed little over the next 15 years, with average household size reaching 2.49 in 2021 (Figure 1). For Age-standardised Average Household Size, we used the 1996 Census household population as the Standard population. The year 1996 was selected as the start of our study period because it is the census year closest to the point in time that pre-dates a substantial decline in housing affordability (Daley and Coates 2018). In contrast to average household size, Age-standardised Average Household Size increased from 2.61 in 1996 to 2.75 by 2021, with most of the increase occurring over a period when (unstandardised) average household size underwent little change. In other words, if Australia's population had remained fixed in population age structure from 1996, average household size would have risen by 0.14 persons per household, or by 5.5%.

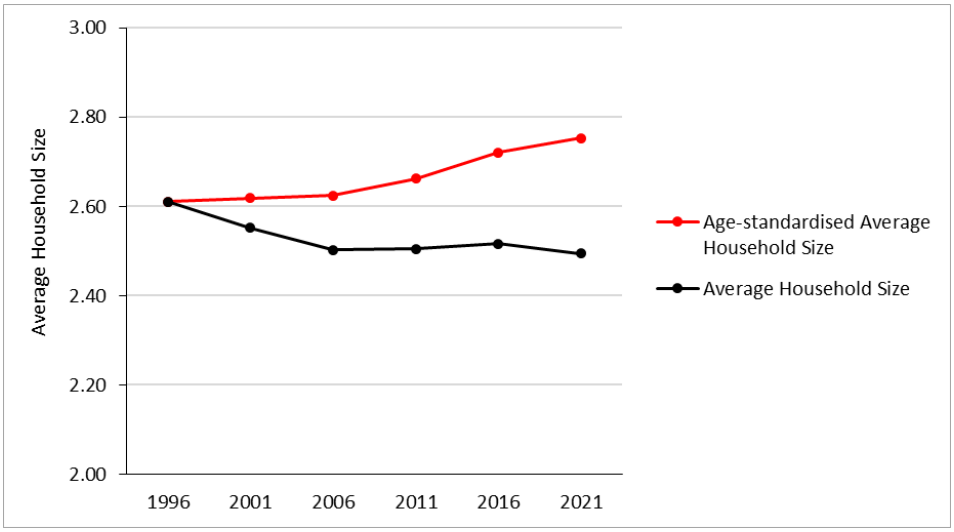

Figure 1: Average household size, age-standardised and unstandardised, Australia, 1996-2021
Source: calculated using census data from the Australian Bureau of Statistics
Note: the Standard population is the 1996 Census household population

The difference between Age-standardised Average Household Size in any year of the study period and its initial value in 1996 indicates the influence of changing age-specific household representative rates. By 2021, the increase of 0.14 persons per household demonstrates that household representative rates declined overall and therefore Age-standardised Average Household Sizes increased. The difference between the two lines in Figure 1 indicates the effect of population age structure change since the start of the study period in 1996. By 2021 the difference is 0.26 persons per household (2.75 minus 2.49 persons per household). Recall that Age-standardised Average Household Size in 2021 is calculated using the household representative rates of 2021 and the age-specific populations of 1996, while (unstandardised) average household size effectively uses the 2021 rates and 2021 populations. The overall change in average household size in

Australia between 1996 and 2021 was -0.12 persons per household, the net result of -0.26 due to population age structure change and +0.14 due to household representative rates.

How does this compare to the results obtained from decomposition? Das Gupta's decomposition method (Das Gupta 1993, pp 55-57) gives similar values. The overall change in average household size between 1996 and 2021 was -0.116. Das Gupta's decomposition reveals an age structure effect of -0.252 and a household representative rate effect of +0.136. Our simple method gives an age structure effect of -0.259 and a household representative rate effect of +0.143.

Table 1 shows average household size broken down into its adult and childhood components. In Australia, individuals must be 15 years of age or above for ABS to count them as household representatives, so we use age 15 as the cut-off between adult and childhood ages. With (unstandardised) average household size, the average number of children per household fell from 0.59 in 1996 to 0.47 in 2021, while the average number of adults per household changed little. This was not the result of a large reduction in family sizes. In fact, the number of children aged 0-14 as a ratio of adults aged 20-49 only decreased a little between 1996 and 2021, but the proportion of household representatives aged 50+ increased substantially. The number of children per household, on average, is lower in 2021 because of relative population and household growth at older ages. In terms of Age-standardised Average Household Size, where the 1996 household population age structure is held constant, the average number of children per household increased from 0.59 in 1996 to 0.62 in 2021, and the average number of adults per household increased from 2.02 to 2.13 over the same period. It indicates a moderate increase in the concentration of population in dwellings after standardising for population age structure change. More simply, this can be interpreted as an increase in the average number of people per household in each age group.

Table 1: Adult and child components of average household size, Australia, 1996-2021

	1996	**2001**	**2006**	**2011**	**2016**	**2021**
(Unstandardised) Average Household Size	2.61	2.55	2.50	2.50	2.52	2.49
Average no. of children per household	0.59	0.55	0.52	0.50	0.49	0.47
Average no. of adults per household	2.02	2.00	1.99	2.00	2.02	2.02
Age-standardised Average Household Size	2.61	2.62	2.62	2.66	2.72	2.75
Average no. of children per household	0.59	0.59	0.59	0.60	0.61	0.62
Average no. of adults per household	2.02	2.03	2.03	2.06	2.11	2.13

Source: calculated using census data from the Australian Bureau of Statistics
Note: the Standard population is the 1996 Census household population

Potential Additional Households provides a complementary perspective on changing household demography. We used 1996 Census household representative rates as the Standard set of rates and applied these to the household populations recorded at later censuses. The observed number of households recorded by the 2021 Census was 9.28 million. However, if the 1996 age-specific household representative rates had applied there would have been 9.78 million households, about half a million, or 5.5%, more than the number of observed households. This provides a simple indication of the extent of 'hidden' demographic demand for housing (relative to Standard rates).

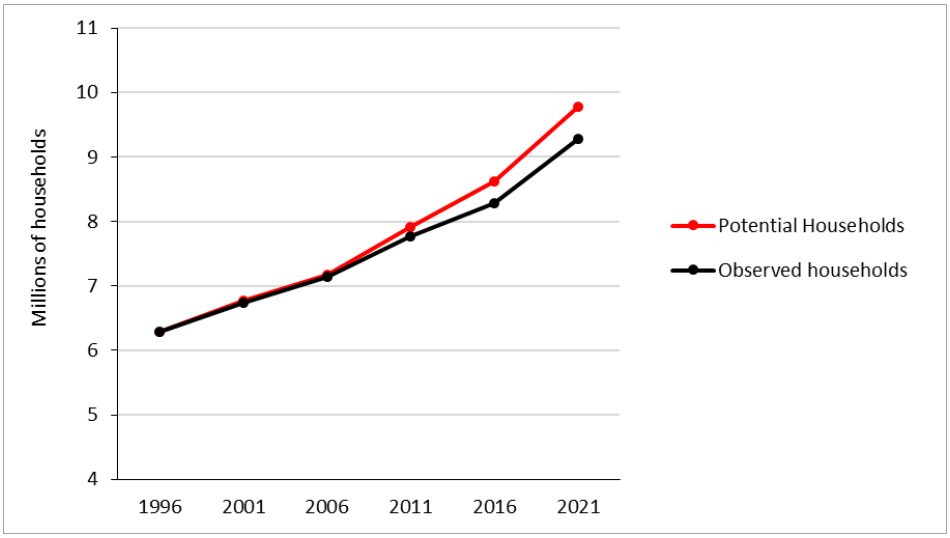

Figure 2: Number of observed and potential households, Australia, 1996-2021
Source: calculated using census data from the Australian Bureau of Statistics
Note: the Standard set of household representative rates is from the 1996 Census

More information about Potential Additional Households is available by examining how the potential additional number of household representatives varies by age group. Figure 3 illustrates the potential additional household representatives in 2021. They are clearly concentrated among young adult age groups, as might be expected given housing affordability trends, but also at older ages, which is perhaps less expected. It means that people in these two age ranges are not forming as many households as they did in 1996.

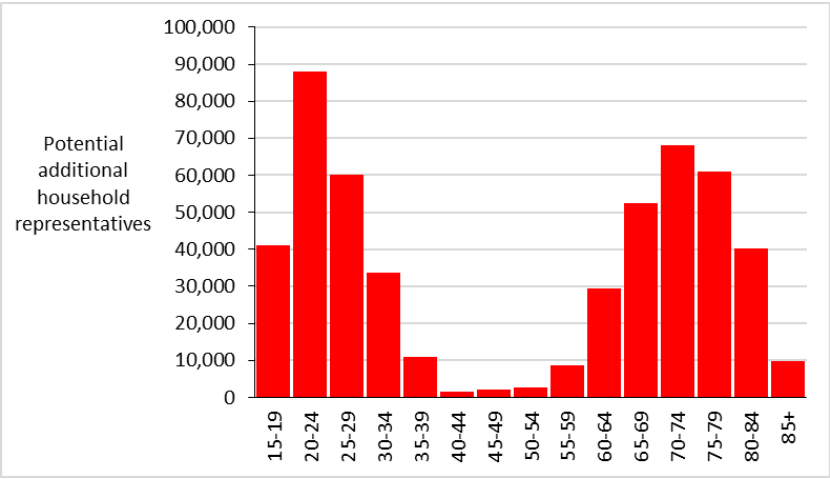

Figure 3: Number of potential additional households by age group, Australia, 2021
Source: calculated using census data from the Australian Bureau of Statistics
Note: the Standard set of household representative rates is from the 1996 Census

3.2. US case study

In the US, (unstandardised) average household size stood at 2.70 persons per household in 1990. It varied little over the next three decades and was recorded as 2.67 in 2020 (Figure 4). We used the 1990 Census household population as the Standard population in calculating Age-standardised Average Household Size. Age-standardised Average Household Size increased marginally from

2.70 in 1990 to 2.71 in 2000, but then rose substantially over the next two decades, reaching 2.91 by 2020. So if the US population had experienced a fixed population age structure from 1990, changes to household living arrangements would have increased average household size by 0.20 persons per household, or 7.6%.

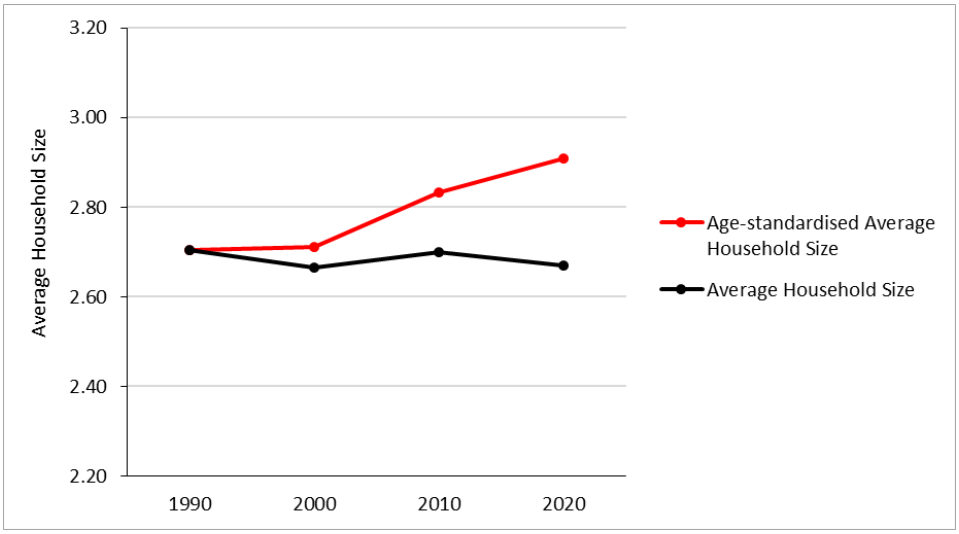

Figure 4: Average household size, age-standardised and unstandardised, US, 1990-2020
Source: calculated using census data from IPUMS International
Note: the Standard population is the 1990 Census household population

The contribution of declining household representative rates to average household size between 1990 and 2020 is the difference in Age-standardised Average Household Size between these two years, which is 0.20. The difference between Average Household Size and Age-standardised Average Household Size indicates the effect of changing population age structure, which is 2.67 - 2.91 = -0.24. In other words, population age structure change in the US has operated to reduce average household size, while declining household representative rates have almost fully counteracted that effect, with the net result being little change in Average Household Size.

Table 2 shows average household size broken down into its adult and childhood components. As before, children are defined as ages 0-14 and adults as ages 15+. The average number of children per household in (unstandardised) average household size declined from 0.58 in 1990 to 0.50 by 2020 while the average number of adults per household increased a little over the same period, from 2.12 to 2.17. However, both childhood and adult components of Age-standardised Average Household Size increase. This indicates an increased concentration of population in dwellings once the effect of population age structure change is removed.

Table 2: Adult and child components of average household size, US, 1990-2020

	1990	2000	2010	2020
(Unstandardised) Average Household Size	2.70	2.67	2.70	2.67
Average no. of children per household	0.58	0.57	0.54	0.50
Average no. of adults per household	2.12	2.10	2.17	2.17
Age-standardised Average Household Size	2.70	2.71	2.83	2.91
Average no. of children per household	0.58	0.58	0.61	0.63
Average no. of adults per household	2.12	2.13	2.22	2.28

Source: calculated using census data from IPUMS International

Note: the Standard population is the 1990 Census household population

How many additional households would there have been in the US in 2020 if 1990 household representative rates applied? There would have been 130.5 million households rather than the 122.4 million recorded in the 2020 Census (Figure 5). The Potential Additional Households in 2020 is therefore 8.2 million, or 6.7%, more than were observed.

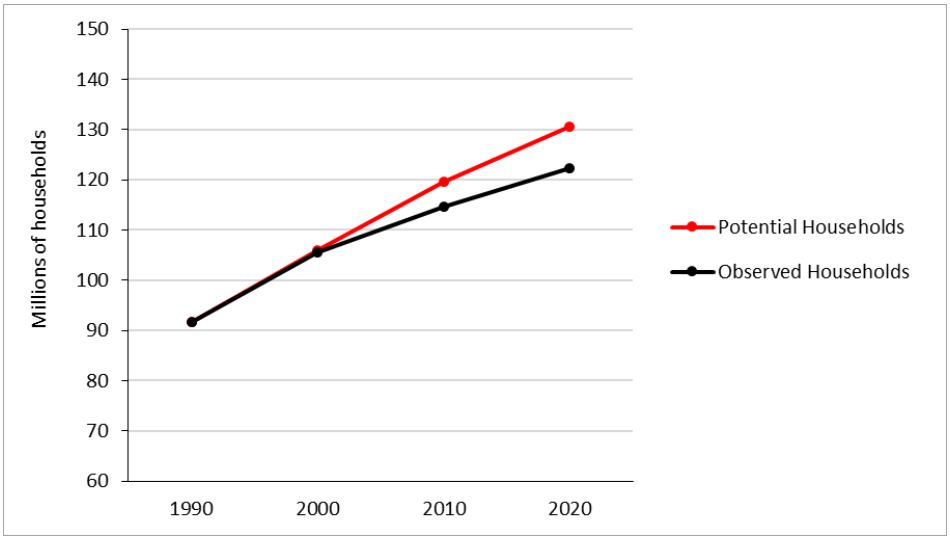

Figure 5: Number of observed and potential households, US, 1990-2020

Source: calculated using census data from IPUMS International

Note: the Standard set of household representative rates is from the 1990 Census

The distribution of Potential Additional Households in 2020 across age groups is shown in Figure 6. The largest number of additional households are in the younger adult ages, but the numbers are considerable at all ages except the youngest and oldest. In fact, in the 85+ age group, there would be 510,000 fewer households.

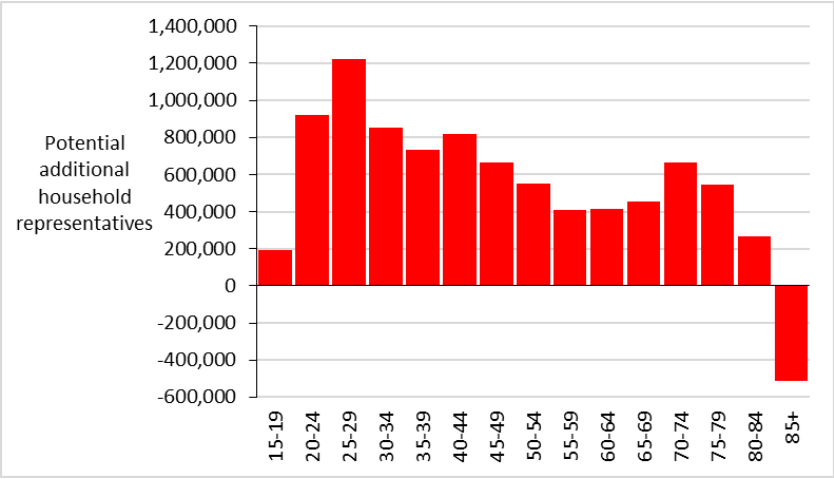

Figure 6: Number of potential additional households by age group, US, 2020
Source: calculated using census data from IPUMS International
Note: the Standard set of household representative rates is from the 1990 Census

3.3. England & Wales case study

In England & Wales, (unstandardised) average household size was observed as 2.36 persons per household in 2001, 2011 and 2021 (Figure 7). Using the 2001 household population as the Standard, Age-standardised Average Household Size increased to slightly to 2.39 in 2011 followed by a larger increase to 2.47 by 2021. These results demonstrate that the contribution of shifting household representative rates working to increase average household size was exactly offset by the changing population age structure working to reduce it. The net outcome was no change in average household size between 2001 and 2021.

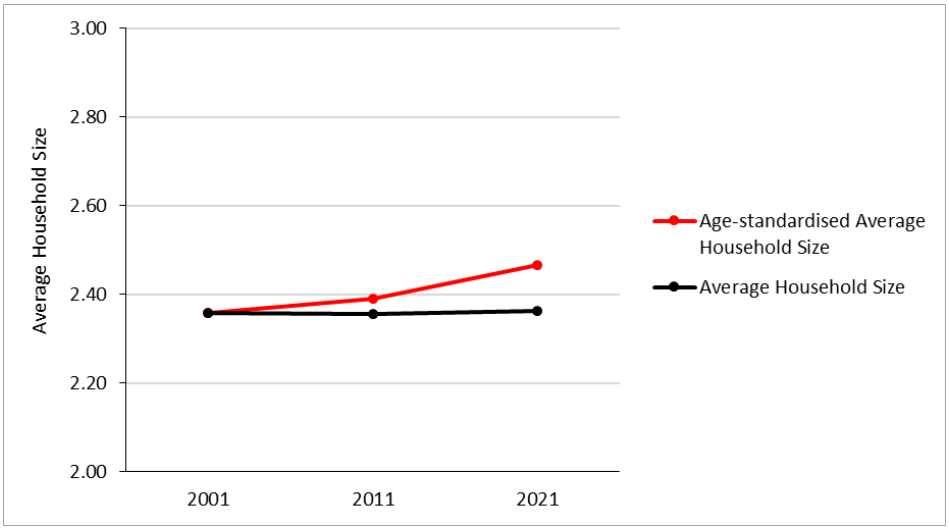

Figure 7: Average household size, age-standardised and unstandardised, England & Wales, 2001-2021
Source: calculated using census data from ONS
Note: the Standard population is the 2001 Census household population

Table 3 reports the adult and childhood components of average household size. As before, children are defined as ages 0-14 and adults as ages 15+. The average number of children per household in

(unstandardised) average household size declined slightly from 0.45 in 2011 to 0.42 in 2021 while the average number of adults per household increased slightly over the same period, from 1.91 to 1.95. For Age-standardised Average Household Size, the childhood component increased marginally, while the adult component grew from 1.91 to 1.99 adults per household. Therefore, when taking the perspective of the average number of people in households by age group, the population is being concentrated in dwellings to a greater extent than previously.

Table 3: Adult and child components of average household size, England & Wales, 2001-2021

	2001	2011	2021
(Unstandardised) Average Household Size	2.36	2.36	2.36
Average no. of children per household	0.45	0.42	0.42
Average no. of adults per household	1.91	1.93	1.95
Age-standardised Average Household Size	2.36	2.39	2.47
Average no. of children per household	0.45	0.46	0.47
Average no. of adults per household	1.91	1.93	1.99

Source: calculated using census data from ONS

Note: the Standard population is the 2001 Census household population

The number of additional households in England & Wales in 2021 if 2021 household representative rates had applied is shown in Figure 8. There would have been 25.9 million households rather than the 24.8 million recorded in the 2021 Census. The number of Potential Additional Households in 2021 is therefore 1.1 million, or 4.4%, more than were recorded.

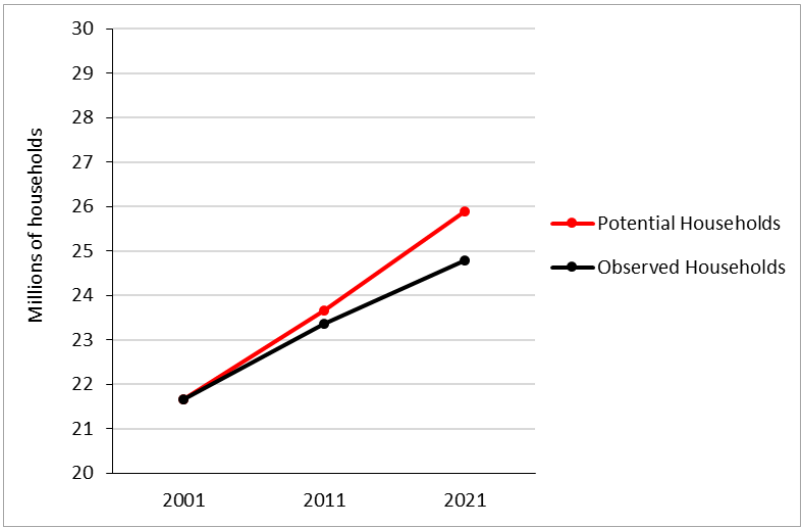

Figure 8: Number of observed and potential households, England & Wales, 2001-2021

Source: calculated using census data from ONS

Note: the Standard set of household representative rates is from the 2001 Census

4. Household change standardising for age and partnership status

4.1. Australia case study

For the calculation of Age/Partnership-Standardised Average Household Size ($AHS_{AgePtrStd}$), we only have the necessary data from 2006 onwards. We therefore used the 2006 Census household population by age group and partnership status as the Standard population. This shows an increase in $AHS_{AgePtrStd}$ in Australia from 2.50 persons per household in 2006 to 2.62 by 2021. In contrast, (unstandardised) average household size in 2021 is 2.49. For comparison, we also calculated Age-standardised Average Household Size using the 2006 population as Standard and the results were very close, only differing at the third decimal place. So, if Australia's household population in 2021 had the same age and partnership structure as it did in 2006, average household size would be 0.12 persons per household higher. Table 4 shows the adult and childhood components of $AHS_{AgePtrStd}$. The childhood component increases only slightly between 2006 and 2021, with the adult component contributing most of the increase in $AHS_{AgePtrStd}$.

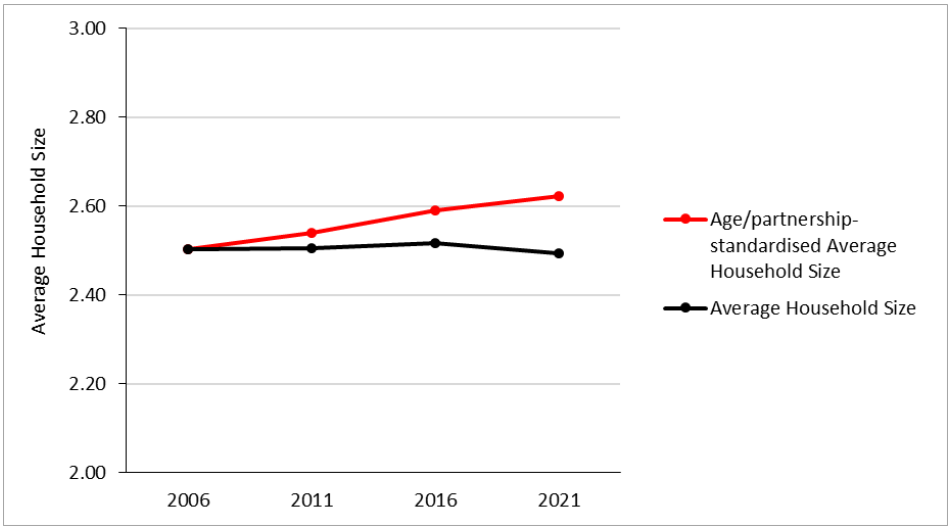

Figure 9: Average household size, age/partnership-standardised and unstandardised, Australia, 2006-2021

Source: calculated using census data from the Australian Bureau of Statistics

Note: the Standard population is the 2006 Census household population

Table 4: Adult and child components of average household size, Australia, 2006-2021

	2006	2011	2016	2021
(Unstandardised) Average Household Size	2.50	2.50	2.52	2.49
Average no. of children per household	0.52	0.50	0.49	0.47
Average no. of adults per household	1.99	2.00	2.02	2.02
Age/partnership-standardised Average Household Size	2.50	2.54	2.59	2.62
Average no. of children per household	0.52	0.52	0.53	0.54
Average no. of adults per household	1.99	2.02	2.06	2.08

Source: calculated using census data from the Australian Bureau of Statistics

Note: the Standard population is the 2006 Census household population

The number of Potential Households in Australia, if the 2006 Census household representative rates by age and partnership status applied, is shown in Figure 10. Instead of the 9.28 million households counted by the census in 2021, the number of Potential Households is 9.76 million. This means the Potential Additional Households is 483,000, or 5.2% greater than the observed number of households. About three-quarters of these additional households are amongst the single adult population, even though it is a smaller population than the partnered adult population. It shows that changes to living arrangements between 2006 and 2021 have been much greater among the single adult population.

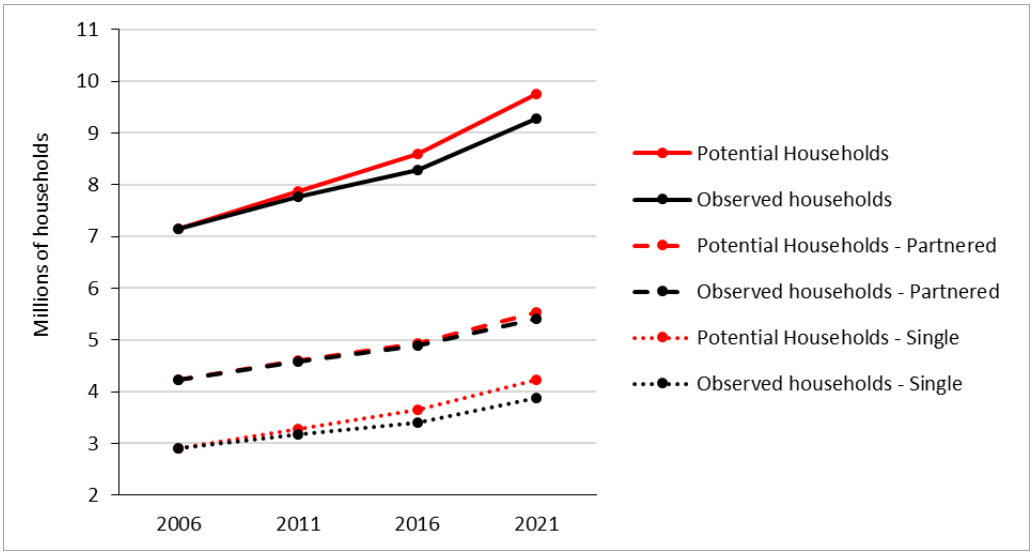

Figure 10: Number of observed and potential households by partnership status of the household representative, Australia, 2006-2021

Source: calculated using census data from ABS

Note: the Standard set of household representative rates is from the 2006 Census

The contributions of single and partnered household representatives to the total number of Potential Additional Households in 2021 by age group is shown in Figure 11. This reveals that larger contributions from single adults occur in the younger adult ages, while for partnered adults the additional households are contributed almost wholly in older age groups. Most of the differences in household representative rates between 2006 and 2021 for partnered adults occur at ages 55 and above, with the 2021 rates being markedly lower. In other words, at each age group in the older ages, there are more partnered adults in households on average than there used to be.

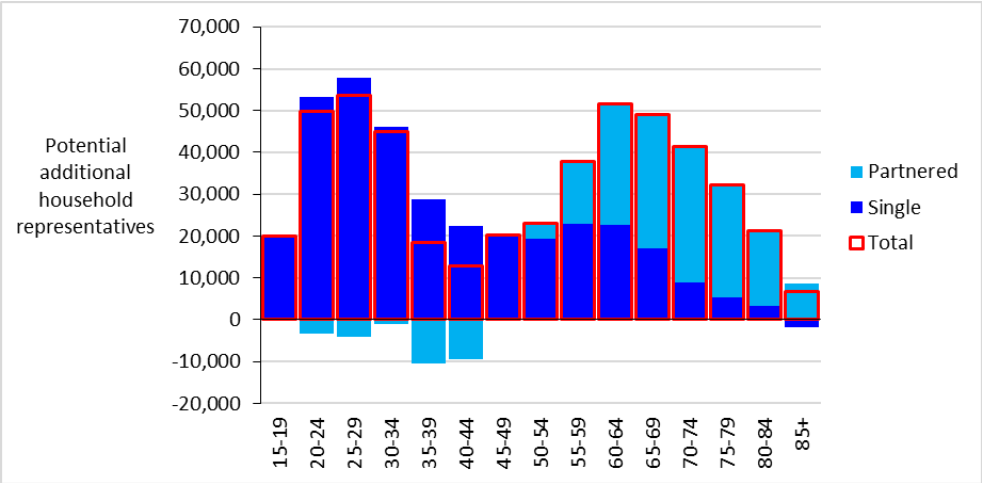

Figure 11: Number of potential additional households by partnership status and age group of the household representative, Australia, 2021

Source: calculated using census data from ABS

Note: the Standard set of household representative rates is from the 2006 Census

The disaggregation of the household population by partnership status allows for an alternative calculation of Potential Households which may prove useful in some circumstances. The Standard set of living arrangements might instead be defined as: all couples form a separate household (not sharing), while all single adults experience the Standard household representative rates for the single population (as before). Because some couples share housing, the number of couples is greater than the number of households containing couples. This alternative definition would require a modified formula in which the Potential Households for the partnered population would be set simply as the number of couples currently in the population (therefore not requiring Standard household representative rates for the partnered population). The Potential Households for the single population would be calculated as before. Because of differential census undercount[1], it is best to obtain counts of the number of couple families rather than the number of people living with a partner. In Australia in 2021, 5.55 million couple families were counted. Adding this to the 4.22 million Potential Households of the single population gives 9.77 million Potential Households, or 499,000 (5.4%) Potential Additional Households (compared to 483,000 calculated earlier).

[1] In the Australian census, the number of people who are recorded as being partnered (10.91 million) is a little less than twice the number of couple families (5.55 million). This is likely to be because when one person in a couple is away from home on census night, the one at home will be listed as the couple family reference person but the other will not be counted in the number of people living with a partner.

5. Discussion and conclusions

5.1. Main contributions

This paper has suggested some simple measures for describing household change that are easy to calculate and simple to interpret. We hope they prove useful for a wide range of users, including researchers, analysts and policymakers. Age-standardised Average Household Size removes the effect of changing or differing population age structure and measures what average household size would be if the Standard population age structure applied. Increases in Age-standardised Average Household Size over time therefore indicate increases in concentration of the population in households. Provided that the Standard population is set as the population at the start of any study period, the change in Age-standardised Average Household Size from the initial year is the effect of household representative rates on average household size, while the difference between standardised and unstandardised average household sizes reflects the effect of changing population age structure.

Potential Additional Households provides a complementary metric. It is the number of additional households there would be in population if a set of Standard household representative rates applied. Often, the selected Standard household representative rates would be those at the start of a study period. Where this is the case, Potential Additional Households equals the additional number of households there would be if the household representative rates at the start of the period applied. Alternatively, the Standard set of rates could be a hypothetical 'ideal' set of rates which reflect greater equity in the housing market (however defined). Whatever definition is used for the Standard set of rates, Potential Additional Households can be interpreted as the number of 'concealed' households in the population, or the unmet underlying demographic demand for housing relative to the Standard. In all three case study countries, we found a non-trivial number of Potential Additional Households based on household change in recent decades.

We also extended Age-standardised Average Household Size and Potential Additional Households to standardise for both partnership status and age. This requires more detailed data, but it has the advantage of removing changing partnership patterns from the analysis. We also showed that the separate consideration of partnered and single adults permits an alternative definition of Potential Households in which the number of Potential Households for the partnered population equals the total number of couples currently in the population.

5.2. Limitations

Limitations of our study include the small number of case study countries, which we plan to increase in future. In terms of limitations of the suggested measures, the values of these measures are dependent on the household populations and household representative rates which are selected as the Standard. They are also affected by the limitations of census household data. In addition, it is important to stress the suggested measures are *summary* measures, so they cannot provide a detailed analysis of changing household trends and patterns.

5.3. Further work

In further work we intend to expand the number of case study countries, and extend the analysis to subnational populations, defined both geographically and in terms of socio-economic and cultural/birthplace groups. We also plan to integrate the measure of Potential Additional Households into household projection models (Wilson 2013) to obtain an idea of how unmet demographic demand for housing might evolve in the future according to specified scenarios.

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