

Appendix 2 Technical information on household data, the Census and population

This appendix explains some of the technical issues around Census and other relevant data issues mentioned only briefly in Chapter 5. It covers the method for calculating the source of household growth, more detail on average household size and its relevance for the number of households, the revisions to population estimates and how these relate to the number of households, and the dwelling stock estimates derived from the Census.

Indicative Planning Council method for calculating components of household growth (Table 5.1)

The Indicative Planning Council (IPC) devised the following method for breaking down growth in the number of households into three components: that due to change in total population, that due to change in age structure of the population, and that due to change in household formation (referred to as 'other factors' in Chapter 5).

This explanation is adapted from the IPC's *Long-term Projections Report 1993*.

The total number of households (H) may be expressed as:

$$H = P \sum_i p_i h_i$$

Where subscript i refers to age group (that is 15–19, 20–24, ... 75+) and:

P is the total population

p is the proportion of population group i in the total population

h is the ratio of household reference persons of age i to population of age i.

The change in the number of households between any two periods (in this case each Census), t and t-1, may be broken down in the formula:

$$\Delta H = A + B + C$$

Where:

ΔH is change in the number of households between the two periods

A is change due to change in total population

B is change due to change in age structure

C is change due to change in 'other factors' (household formation).

These three components can then be expressed in terms of population and household variables in the following way:

$$A = \Delta P \sum_i h_i^- p_i^-$$

$$B = P^- \sum_i \Delta p_i h_i^-$$

$$C = P^- \sum_i \Delta h_i p_i^-$$

In these formulae, Δ denotes change between two periods, \sum denotes the sum of variables following it for all age groups, and the superscript '-' denotes the average of the two periods. The three formulae exclude a series of covariance terms that are typically very small.

Household size

The fact that the headline average household size essentially stabilised between 2006 and 2011 is significant in its own right. These data are not impacted by the change in the population count explained in Chapter 5 and below, as they are calculated from the raw Census count rather than from the total estimated number of people and households.

At a very high level of analysis of aggregate data it is true that an apparently small increase in average household size would see the shortfall 'disappear'. But this misses a crucial point around the age structure of the population and how it evolves.

The composition of the household population changes over time, specifically as the age profile evolves. Australia's population is ageing. The data in Table 5.2 illustrates how this would typically lead to more people being household heads, and therefore more households. Other things being equal, this should have led to a larger fall in average household size between the 2006 and 2011 Censuses than was actually observed.

That household size has not fallen as much as projected means that, on average and on an age-adjusted basis, the population was living in larger households than in the recent past. This is a clear divergence from the Council's projections. The Council's underlying demand model produces an average household size (for underlying demand in 2011) of 0.02 people per household fewer than the raw Census data suggest — this can be seen in Figure 5.1. This 0.02 difference equates to around 150,000 additional households for the 2011 population. The Council's projected

decline in household size was derived from previous demographic trends, much of it due to an ageing population tending to live in smaller households. The difference between the outcome and projection could be due to a wide range of factors, including social change and some of the assumptions that underpin the model, but may also reflect household formation decisions being affected by more limited choice (that is the supply shortfall).

No official estimate of the number of households is currently available from the Australian Bureau of Statistic (ABS). So it is not possible to fully reconcile the Census data with the final estimate of average number of people per household.

Population estimate

Some degree of error is to be expected each time the ABS rebases the Estimated Resident Population (ERP) after a Census. However, the 2011 intercensal error is much larger than usual.

Using Automated Data Linking (ADL), the Post Enumeration Survey (PES) conducted by the ABS better accounted for people who may previously have been recorded in two places at once. For example, it reduced the risk of recording a fly-in fly-out mine worker both in their normal home and at their place of work, or those otherwise away from their usual residence on Census night or absent in other parts of the country, such as on holiday in another state.

ADL, which was used fully for the first time in the 2011 Census, led to an estimate of nearly 247,000 persons less than the previous PES matching method would have delivered. Other, more typical, revisions associated with movements between the five-yearly Census benchmarks led to the ERP estimate being revised down by a further 47,000 persons, taking the total revision to 294,000 persons.

The latest Census-based estimate is preliminary, and a final estimate will not be available until mid-2013. At the time of writing this report, the ABS had not yet revised the June 2006 ERP, as the new method was not used when estimating the population at that time. The ABS has compiled a 'spliced' population series that effectively blends in the 294,000 over the past five years. This spliced series is effectively a hybrid of the new and old methodologies, phasing in the new over time. But the true impact of the revised methodology on earlier periods is not yet known. This means that the currently available data are not fully comparable pre and post 2006. The ABS notes that it is 'not possible to use the results to produce an alternative 2006 measure'.¹ The ABS is expected to produce revised population estimates back to 1991 in mid-2013. It has suggested indicative changes of 240,000 fewer people in 2006, 130,000 fewer in 2001 and 70,000 fewer in 1996 than the current published estimates.

1 ABS June 2012, *Australian Demographic Statistics* December 2011, cat no. 3101.0, p 68, note 16.

Household numbers

The ABS literature suggests that overestimation of the population does not necessarily lead to a commensurate error in the count of occupied private dwellings, and therefore of 'counted' households. This is because, among other reasons, Census collectors count dwellings better than they do people (houses are generally harder to miss and less likely to be double-counted).

Household estimates ultimately will also include residents absent overseas who have been 'allocated' to the supply of dwellings that were apparently vacant on Census night. As a result, the estimated number of households draws on both the ERP estimates and Census count.

In previous publications, the Council's own estimates of underlying demand have been benchmarked to June 2001. Estimates for 2002 to 2006 are projections based on trends in household formation from the four Censuses up to and including 2001 and a projected population from that point. Post-2006 estimates are based on (revised) trends in household formation between the 2001 and 2006 Censuses, and updated actual population estimates (which, with the release of the 2011 Census are now out-dated). The Council's post-2006 estimates of underlying demand incorporate adjustments to household formation rates that emerged in the period 2001 to 2006, including the downward effect of 'other factors' noted in Chapter 5. On this basis, the estimates of underlying demand after 2006 are discounted relative to those in the period 2001–2006. To the extent that the revised trends in household formation overestimated the actual changes that were observed to have occurred by 2006, the post-2006 estimates therefore include an element of unmet or underlying demand. Without the 2011 household estimates from the ABS it is difficult to know how the relationship between the actual number of households and underlying demand has evolved.

Dwelling estimates and vacancies

In aggregate, the raw Census data suggest that the Council's estimate of 9.29 million dwellings at June 2011 (both occupied and unoccupied) is reasonably accurate. In the absence of data on dwelling undercount for 2011, a simple estimate created by adjusting the 9.1 million dwellings counted on Census night by the ratio of dwelling to population undercount in 2006 (2.9 per cent/2.7 per cent) produces a near-identical figure to the Council's estimate.

But determining how many of these dwellings are actually available to live in is a key part of the puzzle. In theory the number of households should equate to the number of occupied dwellings. Final household estimates are calculated based on usual place of residence — that is after people away from home on Census night are 'reallocated' back to their usual area of residence. As noted, these estimates have not yet been produced by the ABS. However, there is no 'mirror' reallocation of dwellings from an

unoccupied to occupied status. If, for instance, a family is away from home on holiday on Census night they are counted as a household unit, but their usual home would still be recorded as unoccupied in the reported Census data.

In addition, the count of the dwelling stock and its composition are complicated by a range of other factors. Previous estimates of the total dwelling count have not attempted to decipher whether those missed in the initial count and added in from the PES are occupied or not. There are also complications around how some unconventional residencies are calculated — for example, a caravan or tent is counted as a dwelling if there is someone living in it but not if it is empty.

Summary

As explained in Chapter 5, there is a great deal of uncertainty around a number of the key variables the Council uses in estimating the adequacy of housing supply for the resident population. Some of these will become clearer over time, such as the historic revisions to the resident population. However, others will not be and present significant challenges.

The Council will continue to assess how to make the best use of available data to assess the housing situation in future reports.