Medium and long term projections of housing needs in Australia

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INTRODUCTION

Purpose

Information about future housing requirements is essential for planning by industry and governments at all levels. Since the demise of the Indicative Planning Council of the Housing Industry, no organisation in Australia has been responsible for the systematic production of estimates of medium- and long-term housing demand. With the reincarnation of the Australian Housing and Urban Research Institute (AHURI), a substantial Housing Futures Program was incorporated in the AHURI Research Agenda. This agenda called for proposals relating to the estimation of future housing demand and supply thus indicating the importance that AHURI attaches to projections of housing needs. This paper summarises the work plan for the construction of these projections by the AHURI ANU Research Centre and provides an update on work in progress. The AHURI ANU Research Centre is attached to the Demography and Sociology Program of the Research School of Social Sciences at ANU. The staff members of the project are Peter McDonald, Yohannes Kinfu, Rosangela Merlo and Rebecca Kippen. A detailed description of the project is provided in the project's Positioning Paper[1].

The overall aim of the project is to provide accurate and timely projections of future housing needs to assist government and industry stakeholders in planning and policy development. In particular, this project aims to:

1. project housing requirements at the national and State/Territory level for a period of 30 years according to a range of scenarios;

2. project housing supply and demand for a ten-year period at a regional level according to a range of scenarios;

3. conduct analyses of demographic, social and economic trends related to housing as inputs to the housing projection models using existing databases;

4. develop and specify appropriate projection methods to enable regular updating as new data become available;

5. consult widely with users about needs and the appropriateness of the projections; and

6. disseminate the findings of the project to all interested parties.

[1] The Positioning Paper is published at http://www.ahuri.edu.au/pubs/positioning/pp_projections.pdf

Policy Context

At present in Australia, as no organisation is producing projections of the housing market in a systematic way across the country, notions about future housing markets are just notions. It has been our recent experience that debates about population futures for Australia display an abysmally low level of understanding of the potential future paths of population. If this is true for population, how much more is it likely to be the case for housing given that population is just one of the inputs to housing futures?

Work on the projection of housing needs inevitably has a strong policy focus. As shelter is one of the three basic human needs, the provision of housing has a high priority in government policy at the national, State/Territory and local government levels. Aside from area planning, the relationship between appropriate housing and population welfare ensures that information about housing requirements is essential to the development of housing and social policy.

The housing industry is a very major employer and substantial amounts of capital are involved in the provision of housing. Housing is also vital to other developments such as urban and regional infrastructure and retailing. As a result, projections of underlying housing demand have applications beyond government. Financial institutions, land developers, the construction industry, and infrastructure and service bodies are key stakeholders who require information about future housing requirements for planning purposes.

The housing market, the supply of and the demand for housing is, therefore, a fundamental component of the economy. The future of the housing market is an essential factor in private and public planning.

A DESCRIPTION OF METHODOLOGY

Methods of projecting households and housing

Houses are occupied by households. Therefore, allowing for vacant dwellings, the projection of housing demand is equivalent to the projection of the number of future households. Also, different types of households have demands for different types of houses and so it is important also to project households by type. Conventional household types include couples with children, couples without children, sole parents, lone persons and group households. It is also useful to distinguish households by tenure type: owner/purchasers or renters, including public and private renters. Over a very long period of time, the rate of growth of households has exceeded the rate of growth of the population, that is, households have been getting smaller on average. This is why projections of the population are in themselves inadequate indicators of the growth in demand for housing. However, projection of the population is necessarily the first step in the projection of households. Once a population projection

is available, we must then consider the ways in which the population forms or dissolves its households.

The proposed methodology proceeds by dividing individuals in the population across nine household classification types (HCT) defined as follows:

1. Parent in a couple family with co-resident children.

2. Parent in a one-parent family.

3. Child in a couple family with children.

4. Child in a one-parent family.

5. Partner in a couple family without children.

6. Not partnered and no coresident children, living alone.

7. Not partnered and no coresident children, living with a couple family or a one-parent family, not including children in HCT3 and HCT4

8. Not partnered and no-coresident children, living with others

9. Usual residence is a non-private dwelling

Note there is no age limitation on the status of being a ‘child’, That is, for example, a 50-year old man living with his mother would be classified as HCT4 and his mother as HCT2. This is not problematic because age is always explicit in the model.

Individuals with these HCT classifications can be reduced by simple procedures to the following five forms of private households:

1. Couples with coresident children (defined by HCT1 and subsuming HCT3 and part of HCT7)

2. One-parent families (defined by HCT2 and subsuming HCT4 and part of HCT7)

3. Couples with no coresident children (defined by HCT5 and subsuming the remainder of HCT7)

4. Lone persons (defined by HCT6)

5. Group households, including households consisting of related individuals so long as the relationship is not a parent–child or a partner relationship (obtained by applying a factor of average size of group households to HCT8).

HCT9 persons, residents of non-private dwellings, are either allocated to private dwellings if they are temporarily in a non-private dwelling or remain as a separate category if they are long-term residents. Those who are long-term residents are identified by the census classification ‘enumerated at home’.

In technical terms, each HCT is known as a ‘state’. Projection involves the estimation of how many people will be in each state in a given year within each age, sex and

locality category. For example, for each year of the projection, we would need to estimate how many boys aged 10 in inner Sydney would be living with one parent and how many would be living with two parents. There are three basic approaches to estimate the numbers in each state:

1. Propensity models

2. Transition probability models, or macrosimulation

3. Dynamic microsimulation

A propensity is simply the chance that a person of a given age and sex and in a given locality will be in the particular state (20 per cent of boys aged 10 in inner Sydney will live with one parent and 80 per cent with two parents). The trick is to be able to predict these percentages. The usual approach to prediction is to make use of the observed trend over time. This is the approach that is presently used by the Australian Bureau of Statistics to obtain the official household projections.

A transition probability is the chance that a person in one state in Year 1 will, one year older, be in another state in Year 2. Thus, in the example, we would make use of the probability that a boy aged 9 living with both parents in Year 1 will be living with one parent in Year 2 at age 10. The method works by applying this probability to all 9 year old boys living with two parents in inner Sydney to get the number that would shift to living with one parent in the next year. Dynamic microsimulation also uses these probabilities but does not work with the population in group form (all 9 year old boys) but instead treats each individual separately and gives each individual an outcome (yes or no) to change state. The outcome for each individual is based on a random number generated by the overall probability for that category. Transition probabilities have a theoretical superiority compared with propensities because they represent a measure of behaviour and therefore are more amenable to projection on the basis of predicted future behaviour. That is, it is possible to go beyond time trends to predict future behaviour. This makes it easier to apply limits and to predict turning points.

Methodological sophistication and elegance increases as the model shifts through these approaches from propensity models to dynamic microsimulation. On the other hand, the difficulty of obtaining input data and computational complexity also increase as we shift from propensity models to dynamic microsimulation.

Proposed methodology

The approach of dynamic microsimulation has been rejected for this project because of the difficulty of obtaining the required data at a regional level and because of the computational demands of this approach. The difficulty of obtaining reliable data also makes it necessary to rule out a full, transitional probability model. Thus, this project will apply a combination of transition probabilities and propensities.

The approach adopted is to apply transition probabilities to the core transitions, but to use propensities to measure flow-on effects to other people. For women, transition probabilities are used for the processes of mortality, movement into a non-private

dwelling, fertility, coupling, uncoupling and leaving the parental home. It is possible that we shall also use a transition approach for movements between the categories of having a child and not having a child. For men, transition probabilities are used only for mortality, movement into a non-private dwelling and leaving the parental home. This means that the processes of fertility, coupling and uncoupling, and having/not having a child are assumed to be female-dominant. All other transitions, which in a sense are 'secondary' transitions consequent upon these core transitions, will be obtained using propensities. For example, we shall not use a transition probability to estimate how many 9 year old boys will shift from living with one parent to living with two parents by age 10. Rather we shall use a transition to predict the uncoupling of the parents and then allocate children to those parents who uncouple using a propensity approach (eg. 10 per cent of mothers aged 30 who uncouple have a 10 year-old son). These decisions ensure internal consistency in the estimates.

At this stage, because of the nature of the transition data that are available to us, it seems that the work will proceed in two stages: (i) population projections by age and sex and (ii) projections of the transitions from one HCT state to another.

An equally important part of the exercise is the estimation of transition probabilities and propensities across the years of the projection as, inevitably, the probabilities or rates pertaining to the core transitions will have to be projected. How will mortality, fertility and migration rates change in the future. How will rates of leaving home and moving into non-private dwellings change? How will rates of coupling and uncoupling change? This is the sharp end of any projection exercise. Independent of the AHURI Research Agenda, work is progressing in the Demography Program at ANU on new methods for the projection of fertility (Kippen and McDonald), mortality (Booth and Smith) and movement into non-private dwellings of aged persons (Mason).

McDonald (2000b) has recently examined trends in rates of first marriage and the ABS has published trends in divorce rates. As it becomes available, this work will be incorporated into the model. Work will proceed as part of the project on ways of projecting other transition probabilities. Investigation of associations between economic and social trends and household formation behaviour will form part of this work. For example, transitions from the single to the coupled state can be examined in relation to movements in mortgage rates, real housing prices, unemployment, real wages and measures of the recent balance of the supply and demand for housing. Rates of young people leaving home may be related to real rents and vacancy rates in the rental market. A range of plausible scenarios for future transition probabilities will be determined from this work, but it must be pointed out that demographic transitions are complex because of the difficulty of separating 'tempo' and 'quantum'. Using marriage as an example, tempo refers to the ages at which people marry while quantum refers to the proportion who ever marry at all. A fall in the rate of marriage at, say, age 27 can be due to either a delay in marriage or to a drop in the percentage who ever marry. Which of the two applies can make a considerable difference to the projection of future marriage rates.

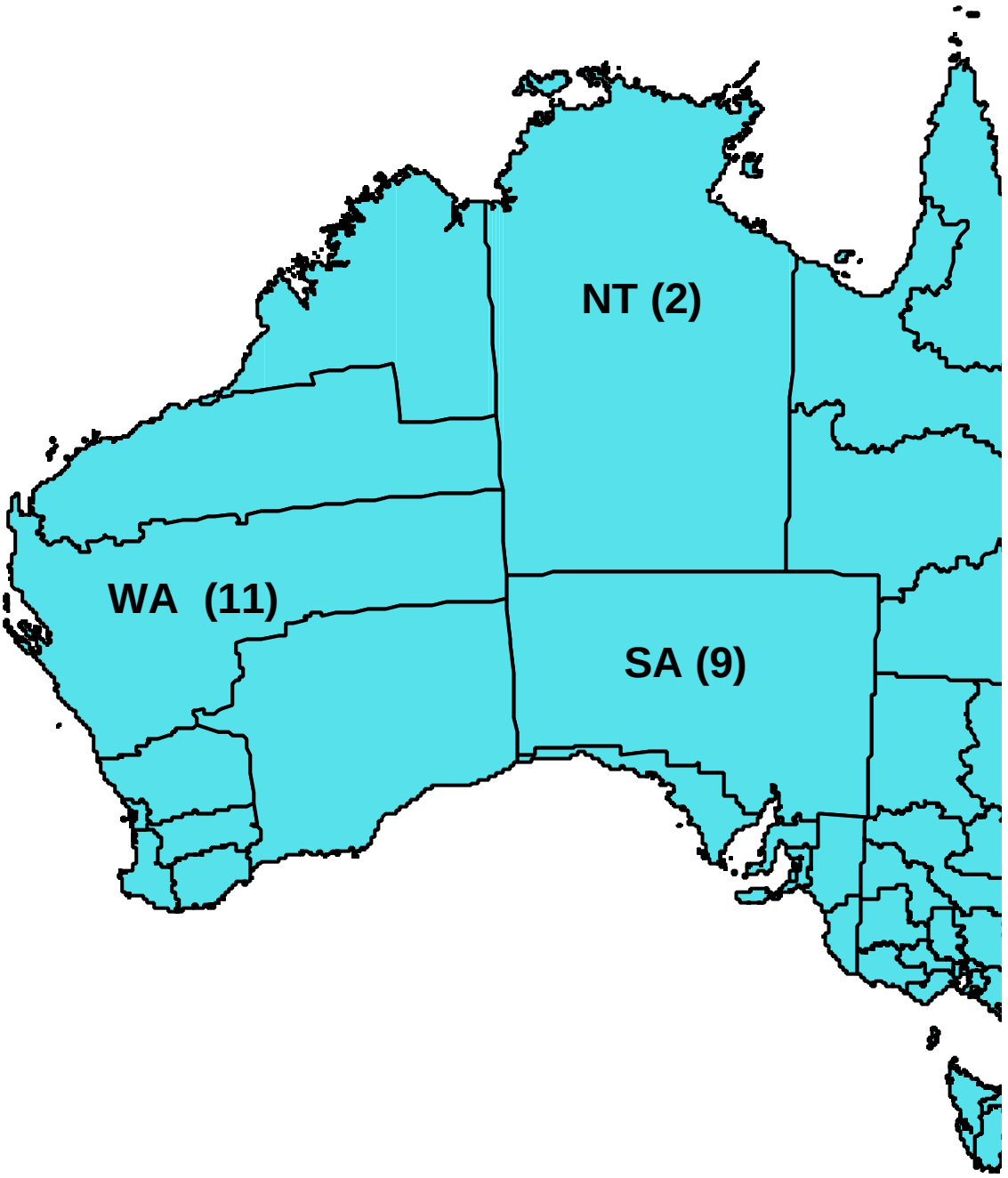
Once the projections of future households have been obtained, they will be compared with the number of dwellings of the appropriate type (tenure, structure, size) in the given locality available to house the projected households. These data will be obtained from the 1996 Census (and later the 2001 Census) and will be updated using

construction and demolition information. Discrepancies between supply and demand will be identified.

It is proposed that the 30-year projections and the 10-year projections should be consistent with each other: the 10-year projections being distinctive in that they relate to more geographic units and the 30-year projections being distinctive in that they involve projections of transition probabilities and propensities beyond 10 years. It would be desirable if proposed AHURI short-term projections (not part of this project) were also nested within this framework.

The ten-year projections will make use of the 69 Temporal Statistical Divisions of Australia developed by Blake, Bell and Rees[2]. However, one of their regions, the outer region of Sydney, has been divided into north and south components because of its size and socio-economic variability. Thus, projections will be undertaken for 70 regions. We refer to these regions as Temporal Census Areas as the Australian Bureau of Statistics objects to the use of the terminology, Statistical Divisions, to refer to these areas. In their view, this confuses with official Statistical Divisions. The TCAs are shown in the following map.

[2] Blake, M., Bell, M. and Rees, P. (2000) 'Creating a temporally consistent spatial framework for the analysis of inter-regional migration in Australia', *International Journal of Population Geography*, Vol. 6, pp.155-174.


NT (2)
WA (11)
SA (9)

DATA ACQUISITION

The crux of this project is maximisation of the matching of method to available data. The project involves the generation of a large new database and a considerable amount of data acquisition. Most of the data are to be obtained from the Australian Bureau of Statistics, particularly from special tabulations from the population censuses. As the most recent census from which data are available is the 1996 Census, inevitably the data employed are somewhat dated. There will be a need to revise the projections when the 2001 Census data become available. The following is a list of the data already acquired for the project:

- Estimated Resident Population (June 1999) by Age (single years to 85+) by Sex by SLA (1996 ASGC boundaries)
- Estimated Resident Population (June 1996) by Age (single years to 85+) by Sex by SLA (1996 ASGC boundaries)
- Estimated Resident Population (June 1991) by Age (5-year age groups to 85+) by Sex by SLA (1996 ASGC boundaries)
- Estimated Resident Population (June 1986) by Age (5-year age groups to 85+) by Sex by SLA (1991 ASGC boundaries)
- Births (1996) by Age of mother (5-year age groups to 45+) by SLA (1996 ASGC boundaries)
- Births (1999) by Age of mother (5-year age groups to 45+) by SLA (1996 ASGC boundaries)
- Deaths (1996) by Age (5-year age groups to 85+) by Sex by SLA (1996 ASGC boundaries)
- Persons (1996) by Place of Usual Residence (Temporal Census Area) in 1995 by Place of Usual Residence (Temporal Census Area) in 1996 by Age (5-year age groups to 95+) by Sex - 1996 Census of Population and Housing
- Usual Resident Population of mainland Australia (1996) by Age (single years to 100+) by Sex by Position/Relationship in Household (HCT) by Temporal Census Area (expanded) (1996 ASGC boundaries) - 1996 Census of Population and Housing
- Usual Resident Population of mainland Australia (1991) by Age (single years to 100+) by Sex by Position/Relationship in Household (HCT) by Temporal Census Area (1996 ASGC boundaries) - 1991 Census of Population and Housing
- Overseas visitors enumerated in occupied private dwellings (1996) by Tenure by Structure of Dwelling by Household composition (OS visitor only or not) by Temporal Census Area (1996 ASGC boundaries) - 1996 Census of Population and Housing

- Persons enumerated in non-private dwellings (excluding overseas visitors) (1996) by Age (single years to 100+) by Sex by Type of non-private dwelling by Whether enumerated at home by Temporal Census Area (1996 ASGC boundaries) - 1996 Census of Population and Housing

- Persons enumerated in non-private dwellings (excluding overseas visitors) (1991) by Age (single years to 100+) by Sex by Type of non-private dwelling by Whether enumerated at home by Temporal Census Area (1996 ASGC boundaries) - 1991 Census of Population and Housing

- Unoccupied Private Dwellings by Structure of dwelling by Reason dwelling unoccupied by SLA (1986 ASGC) - 1986 Census of Population and Housing

- Dwellings by Structure of dwelling by Whether occupied by SLA (1996 ASGC) - 1996 Census of Population and Housing

Much more data are yet to be obtained.

ESTIMATION APPROACHES AND ISSUES

The following discussion deals with issues that have arisen in the first months of work on the project.

Population projections

Base populations

The base populations by age and sex to be used in the projections are the estimated resident populations for TCAs provided by the Australian Bureau of Statistics. This means that the population of short-term overseas visitors (under 12 months residence in Australia) is excluded from the standard projection process. However, especially in areas such as inner Sydney, the visitor population may have an impact on housing demand and on the market. Because of this, the visitor population will be considered as a separate population to be taken into account. For this purpose, a special tabulation of the visitor population in private dwellings has been obtained from the 1996 Census. Obviously, its projection is subject to quite different influences to those of the resident population.

Mortality

The Estimated Resident Populations are also used as the denominators for the calculation of fertility and mortality at TCA level. There are two issues here. First, care needs to be taken that the boundaries used in obtaining the numerators (births, deaths) are precisely the same as those used for the denominators. This has involved considerable, careful checking. Second, some of the TCAs are quite small in population terms although large in geographic terms. This means that fertility and mortality rates can be unstable because of small numbers. This problem is more acute for mortality. Mortality patterns have been examined using a system of

parameterisation. The two estimated parameters (one for level and one for age pattern) were graphed so that TCA outliers could be identified. Complete life tables have also been obtained for each TCA and the levels of expectation of life have been examined to test their reasonableness. The study is now at the point where specific life tables for each TCA have been determined. These can be used to project future deaths. A simple trend in mortality will be assumed which applies the annual rate of improvement in mortality at each age for Australia as a whole to each TCA. This has the effect that, in absolute terms, mortality improves more in those areas that have high mortality at present. In the end, the effects of mortality upon the projections are small in all but a few high mortality TCAs so that errors in the estimation of TCA-level mortality would generally not have a significant effect on the projections. Nevertheless, it is possible to take these differences into account and we are doing so. This work, now completed, constitutes a major new analysis of regional mortality rates in Australia. A working paper will be prepared to describe the methods used and to present the results.

Fertility

Estimation of fertility rates at the TCA level has not been as problematic as the estimation of mortality rates because the small number problem is not as significant. However, the range of fertility rates across TCAs is much wider than it is for mortality rates and the differences cannot be dismissed as immaterial in terms of their effects upon projections. This is because, in large cities, there are parts of the city in which those who are having babies live and parts of the city where those who are not having babies live. Fertility rates are exceptionally low in inner parts of the major cities and this needs to be reflected in projections. A similar approach to the projection of mortality is applied to the projection of fertility. A general slow downward trend is assumed for Australia as a whole. This same rate of change is applied to the different fertility levels of TCAs meaning that the absolute projected change is smallest in the areas with low fertility and largest in the areas of high fertility. There is an issue of the linkage between the having of a child and a move to a different part of the city. An approach to transition probabilities described below is being tested to see whether it deals effectively with this linkage.

International migration

The final factor in the population projection is migration. Migration has two components, internal and international. International migration divides into six categories or three net movements:

A. Net permanent overseas migration defined as:

    1. Arrivals in Australia of new permanent settlers, minus

    2. Permanent departures of permanent residents of Australia

B. Net long-term movement of Australian permanent residents defined as:

    3. Arrivals of permanent residents of Australia who have been absent for 12 months or more, minus

4. Departures of permanent residents of Australia for a period of 12 months or more

C. Net long-term movement of persons who are not permanent residents of Australia (visitors) defined as:

5. Arrivals of visitors for a period of 12 months or more, minus

6. Departures of visitors who have been in Australia for 12 months or more.

McDonald and Kippen have recently conducted a study of these movements for the Department of Immigration and Multicultural Affairs[3]. They conclude that there is a net balance in Movement B. This means that this movement can be ignored for the purposes of these projections. Trends in the other movements (A and C) are available from ABS and can be projected on the basis of past trends and current government policy after corrections to the movements that are described in McDonald and Kippen. The issue is the allocation of the effects of international migration to TCAs. The 1996 Census provides information on the TCA location of those who were living overseas one year before the census. This gives a picture of the allocation of arrivals to Australia to TCAs. Will future arrivals live in different places than was the case in 1995-1996? This may be so but there is no good basis upon which to predict a change so the safest assumption to make is that the places of residence of new overseas arrivals will remain similar over the projection period. Because a high proportion of overseas arrivals and departures are in Movement C, the assumption can be made that overseas departures have the same TCA distribution as arrivals. Thus it is net overseas migration that is allocated to TCAs on the basis of 1995-96 arrivals. International migration has almost no impact on most TCAs.

Internal migration

Internal migration (movements between TCAs) is problematic because it is volatile. As we have chosen relatively large divisions for the TCAs, a great deal of housing-related movement is likely to be within TCAs. Movements across TCA boundaries, therefore, are more likely to be associated with major life course changes – leaving the parental home, getting married or having children, commencing tertiary education, starting a new job, retirement, etc. We have data from the 1996 Census on internal migration at the TCA level and we have changes in the estimated resident population of TCAs between 1991, 1996 and 1999 (incorporating ABS estimates of internal migration). Our strategy at this point is to make a first estimate and projections of internal migration and to then complete the household projections. A comparison of housing demand and housing supply might lead to a second iteration through adjustment of internal migration estimates. This is an area where a great deal of further research is required.

[3] McDonald, P. and Kippen, R. (forthcoming), The Impact of Long-Term Visitor Migration on Projections of Australia's Population, Canberra: Department of Immigration and Multicultural Affairs.

The base population by household classification type

The base population by household classification type is obtained from the 1996 Census distributions by age and sex of household classification type. As the census population (numbers) is different from the estimated resident population, the census distribution is applied to the estimated resident population to get the estimated base population. In doing this, the assumptions are made that:

- the census numbers on persons who are residents of non-private dwellings are correct,

- after allowing for residents of non-private dwellings, the remaining difference between the census population and the estimated resident population has the same distribution of household classification type within each age and sex category as the distribution recorded at the census.

This provides a base population by age sex, TCA and household classification type in 1996 which is consistent with the ABS estimated resident populations for TCAs. The same approach will be used to produce an estimated resident population by age, sex, TCA and household classification type in 1991. This is done because the changes between 1991 and 1996 play a vital role in the estimation of transition probabilities, as described in the next section.

Transition probabilities between household classification types.

The main transitions between household classification types are being estimated from intercensal changes for ages between the 1991 and 1996 Censuses. The approach used is indicated by the following example:

Let $f91_x$ = the proportion of women aged *x* who were at home with parents in 1991 as indicated by the 1991 Census,

and $f96_x$ = the same proportion in 1996.

If we interpolate linearly between these numbers we can obtain an estimate of $f95_x$. This is an estimate of the proportion of women aged *x* living at home with parents in 1995.

The ratio: $\frac{f96_{x+1}}{f95_x}$ can now be calculated. This ratio provides an estimate of the proportion of women aged *x* who were living at home with parents who were still living at home with parents one year later.

For Australia as a whole, this represents a good estimate of the net effect of movements in and out of the parental home as women aged from *x* to *x+1* from 1995 to 1996.

The same estimates can be made for TCAs but the estimates then include not only the impact of leaving the parental home but also the differential effect on these proportions of migration. Given that we are projecting the population including migration, this may be a favourable feature. For example, if we were dealing with a country area in which a large fraction of young people left the TCA, it is possible that those who remained behind are selective of those at home with parents, That is, from age *x* to *x+1* in this TCA, the proportion living at home with parents may actually rise. Our measure would incorporate this rise as it includes the differential impact of migration.

This same approach is applied to the estimation of all other transitions. Where possible, the estimated transitions can be compared to alternative sources such as age specific nuptiality tables.

PROJECT COMPLETION DATE

At this stage, it is difficult to estimate the project completion date because of the rate at which unexpected problems arise. These are mainly data-related problems. That is, at each stage, new ideas emerge about the best approach to estimation and this often requires new data. The new data take time to be produced by ABS and have to be verified. It seems clear that the project will not be completed until some time in December 2001.