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APPSIM – Modelling Family Formation and Dissolution

Bruce Bacon and Sophie Pennec

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About NATSEM

The National Centre for Social and Economic Modelling was established on 1 January 1993, and supports its activities through research grants, commissioned research and longer term contracts for model maintenance and development with the federal departments of Families, Community Services and Indigenous Affairs; Employment and Workplace Relations; Treasury; and Education, Science and Training.

NATSEM aims to be a key contributor to social and economic policy debate and analysis by developing models of the highest quality, undertaking independent and impartial research, and supplying valued consultancy services.

Policy changes often have to be made without sufficient information about either the current environment or the consequences of change. NATSEM specialises in analysing data and producing models so that decision makers have the best possible quantitative information on which to base their decisions.

NATSEM has an international reputation as a centre of excellence for analysing microdata and constructing microsimulation models. Such data and models commence with the records of real (but unidentifiable) Australians. Analysis typically begins by looking at either the characteristics or the impact of a policy change on an individual household, building up to the bigger picture by looking at many individual cases through the use of large datasets.

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The Australian Government has identified that future government outlays will exceed future government revenues. Resolving this budget shortfall will require either higher taxes upon future generations or reductions in spending programs (or some combination of these). The Australian Government currently has only limited ability to assess the future distributional and revenue consequences of changes in tax and outlay programs.

NATSEM in collaboration with 13 Government organisations and two international academics is developing a new dynamic microsimulation model, APPSIM, to enhance the planning and policy simulation capacity of the Australian Government.

The APPSIM working paper series covers the reasoning and decisions taken in regard to technical aspects of the development.

Abstract

Family formation and dissolution is a complex and (due to the mate matching process) a computationally time consuming modelling exercise. The focus of this paper is to provide an overview of the issues involved and to suggest ways of capturing the strong dynamics and interactions of the family formation process. This paper reviews international approaches to modelling family formation and dissolution, outlines the proposed order of the relevant processes in APPSIM, discusses the proposed 'marriage market', and examines how family formation can be modelled in APPSIM using linked microsimulation and macrosimulation models.

Authors note

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1 Introduction

> "Because dynamic microsimulation models rely on strong internal dependencies, inaccuracies in one module can have ripple effects throughout the model. The quality of matches produced is one such process that can have important ramifications on broad model results. For example, the quality of the marital matches produced will affect the accuracy of individual-level Social Security eligibility and benefit amounts. Age and income differences in married couples directly affect whether benefits will be granted on the basis of one's own earnings record or the earnings record of a spouse." (Perese 2002, p. 2)

1.1 Background

The dynamics of family size, family structure and family life course are central to the development of a model like the Australian Population and Policy Simulation Model (APPSIM). APPSIM is characterised as a dynamic microsimulation model where individuals, families and households are simulated at a micro level through time to project the distributional consequences of social and fiscal policy, in conjunction with a consistent macrosimulation environment.

The ageing of Australian society is occurring alongside major shifts in family formation behaviour. Marriage rates are falling while cohabitation and divorce rates are rising, resulting in a rise in the number of people who will never marry.

When these shifts are combined with the fact that the age pattern of childbearing is changing — with more females (families) having their first child later and life expectancy increasing — we observe significant changes in the size and structure of families and households. APPSIM uses projections of these trends and the power of microsimulation to provide policy analysts with 'what-if' tools to investigate the consequences of alternate long-term assumptions.

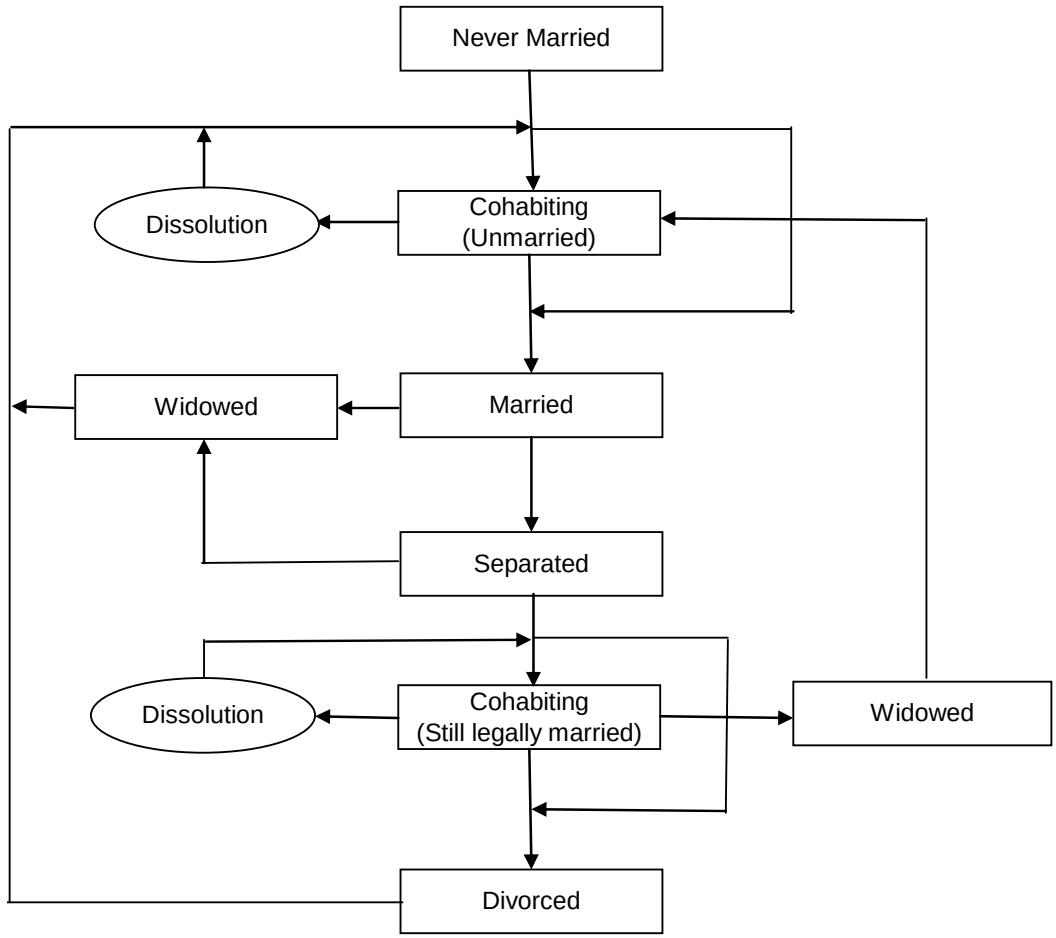
Family formation directly or indirectly affects most social and economic outcomes. It is known that health and wealth is correlated to one's family life course. Family/household size and their corresponding characteristics have major impacts on the outcomes of government initiatives arising from policies which focus explicitly on the family through, for example, policies which discriminate on marital status.

The all pervasive influence of family and household formation on the outputs of a microsimulation model necessitates a commensurate level of effort in the development of the family formation modules.

1.2 Family formation overview

Family formation results from cohabitation and/or marriage whist family dissolution results from separation of partners and, for those previously married, may be followed by divorce. Within cohabitations and marriages in APPSIM, the following events are identified: (a) cohabitation, (b) first marriage, and (c) remarriage. Clearly remarriage can only occur after divorce or on becoming a widow. Figure 1 represents these marital states and the flows between them.

Figure 1: **Partnership states and flows**



In summary, the events that determine family formation, family dissolution and family structure change are:

- Cohabitation;
- Marriage;
- Separation;

- Divorce;
- Births;
- Deaths; and
- Leaving parental home.

1.3 Modelling overview

Three kinds of models have been used to project household/family structure: headship, macrosimulation and microsimulation models.

Traditionally, *headship* models used census or survey data to project the age-sex-specific headship rates where one individual in the household was identified as the head of the household (Mason and Racelis 1992). Headship, however, is a nebulous concept, as it is not well defined and survey responses to the concept appear to have changed over time. The result has been poorly specified models, as the relationship of headship to other demographic concepts has been unclear.

Macrosimulation at the cohort level permits the development and analysis of stocks and flows of family formation and the ability to project the underlying trends in transition probabilities. Macrosimulation models are particularly suited to long-term projection, as they can include user specified long-term assumptions and provide a simple framework for alternate policy and scenario analysis (Bacon and Pennec 2007).

Dynamic *microsimulation* models (DMSM's) simulate the life-course of families/households in the population. The strength of DMSM's is that they capture the distributional outcomes of life-course decisions and can fully reflect the likely family structures within those distributions. The modelling of these decision processes can incorporate many more variables than those found at the macro level — and hence capture more of the detail of the dynamics of family formation (Cassells et al. 2006).

2 Family formation

Cohabitation and marriage and their respective dissolution are the fundamental processes through which the structure of the family changes. For example, new

families are created with each marriage and families are restructured with each remarriage as existing families are blended. Events such as birth and death will change a family's structure and will, on occasion, result in the respective creation of a new family or the demise of a lone person family.

These processes and resulting family dynamics will be modelled in APPSIM through a macrosimulation model (which predicts the long-term aggregate dynamics) and a dynamic microsimulation model (which reflects the marital life course of individuals and their respective family formation outcomes).

The macrosimulation model is concerned with predicting marital flows and consequential marital states for all defacto and registered marriages, separations and divorces. The relationships between the flows and states are shown in Figure 1.

The simulation of marriages in the microsimulation model is a three-step process. The first step involves calculating probabilities for each individual to enter into partnership in a given year. The second step stochastically selects those who will form a partnership and enter the "marriage market". The third step determines who will be matched with whom.

This section looks at data availability and, by way of illustration, selective analysis of some data to indicate underlying trends and dynamics that one would expect to see in the output of a simulation model.

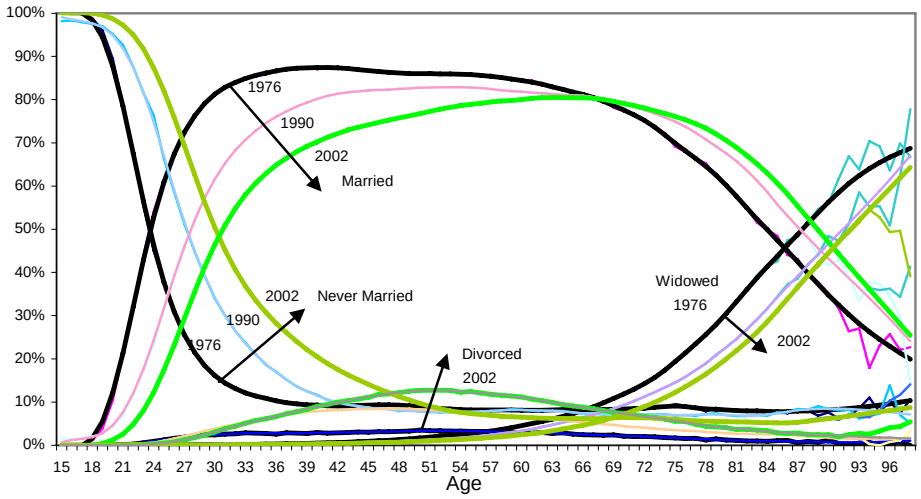
2.1 Registered marital status

The Australian Bureau of Statistics up until 2002 published detailed annual aggregate statistics on registered marriage, separation and divorce for Australia (ABS Cat. No. 3310.0).

Marital Stocks

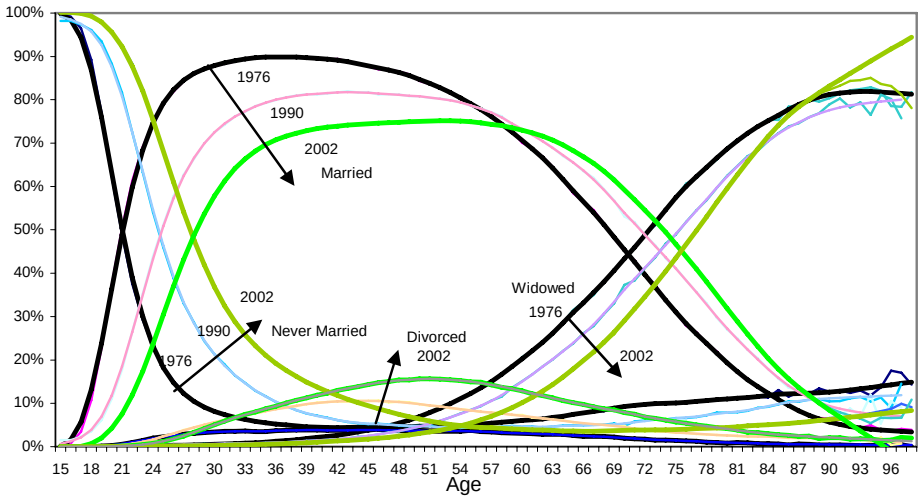
Figures 2 and 3 indicate the changes over time to the age-specific measures of marital status for males and females for 1976, 1990 and 2002. The charts show us that people in their 20s are less likely to get married, and that the number of divorced people is rising with a peak around 50 years of age.

Figure 2: **Marital status of males, proportions 1976, 1990 and 2002 – (actual and smoothed)**



Source: ABS Cat No 3310.0 Marriages and Divorces (various years)

Figure 3: **Marital status of females, proportions 1976, 1990 and 2002 – (actual and smoothed)**



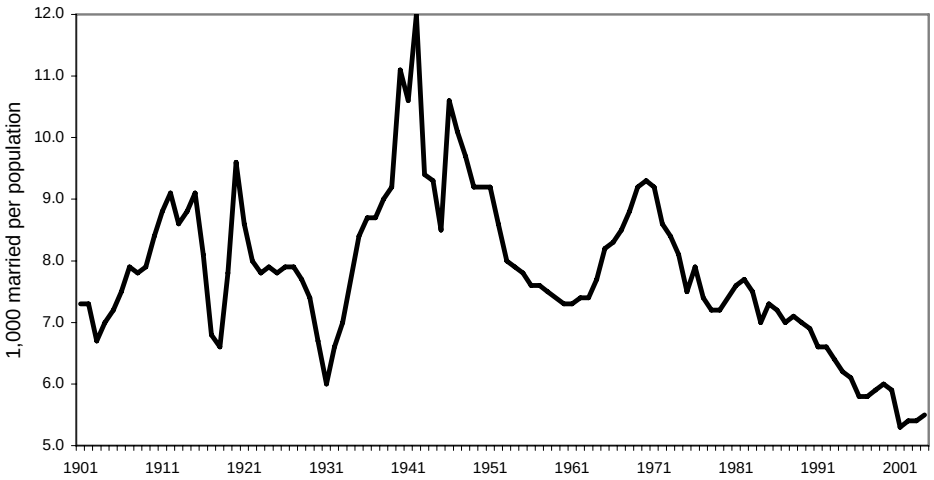
Source: ABS Cat No 3310.0 Marriages and Divorces (various years)

These changes have occurred continuously over some 25 years and projections of these data would be expected to capture these trends into the future.

Marital Flows - Marriages

To illustrate the long run behaviour of marriages, Figure 4 shows the crude marriage rate for Australia over the last century. Clearly, there have been many shocks and social changes up until the 1960s. However, since 1971 the crude marriage rate has trended down in relatively stable manner.

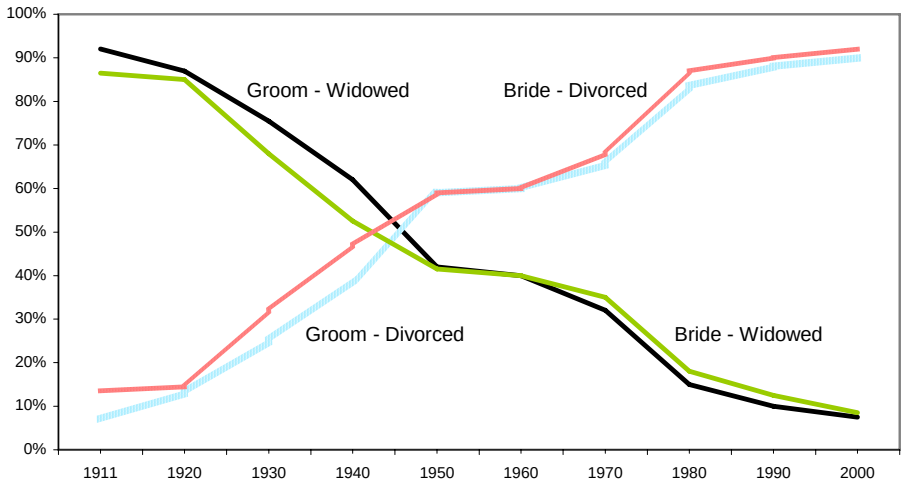
Figure 4: **Crude marriage rate, 1901 to 2005**



Source: ABS 2000

Notwithstanding the long-run volatility in the crude marriage rate, many of the underlying processes show relatively stable changes throughout the century. For example the long-term change in social acceptance of remarriage of divorcees can be clearly seen in Figure 5.

Figure 5: **Previous marital status at time of remarriage, proportions 1911 to 2004**

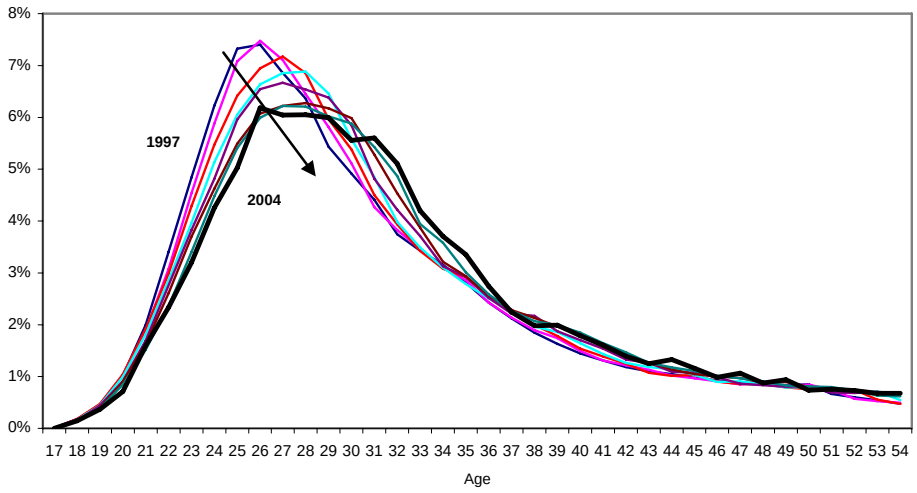


Source: ABS 2000

Age Distribution

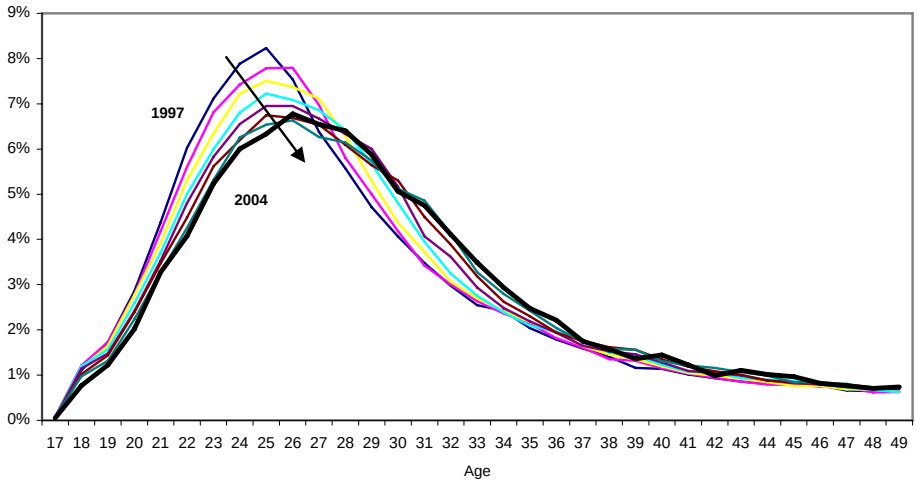
More detailed analysis on first marriage and remarriage from divorce and widowhood reveals more about the marriage process and the interactions of age and gender.

Figure 6: **Age distribution at marriage – males, 1997 to 2004**



Source: ABS Cat No 3310.0 Marriages and Divorces (various years)

Figure 7: **Age distribution at marriage – females, 1997 to 2004**

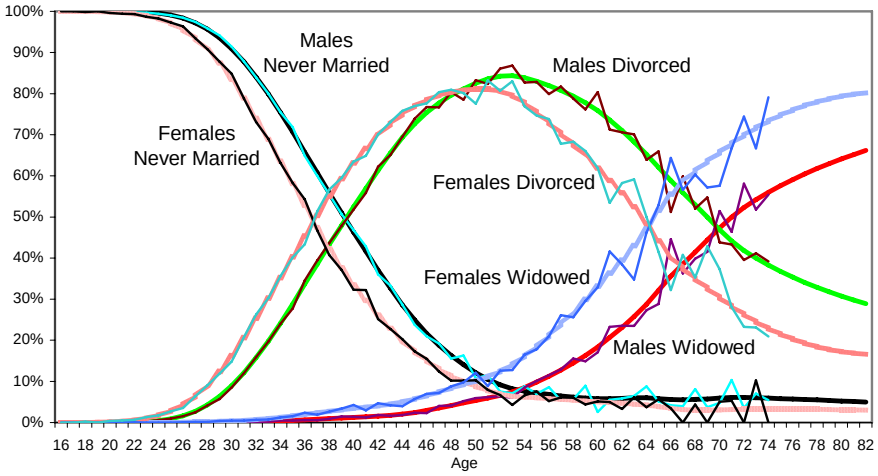


Source: ABS Cat No 3310.0 Marriages and Divorces (various years)

Clearly, the population levels shown in Figures 2 and 3 are outcomes flowing from the underlying martial market events. Figures 6 and 7 show us that the age distribution of marriage has been shifting in time with the proportion of the population married falling, along with a rise in the mean age of marriage.

Further disaggregation permits us to see how the these shifts in marriage are composed of age profiles of first marriage and remarriage as illustrated in Figure 8 for 2002. It is the probabilities from these profiles that drive marital status.

Figure 8: **Distribution of marriage by previous marital status, 2002 – (actual and smoothed)**

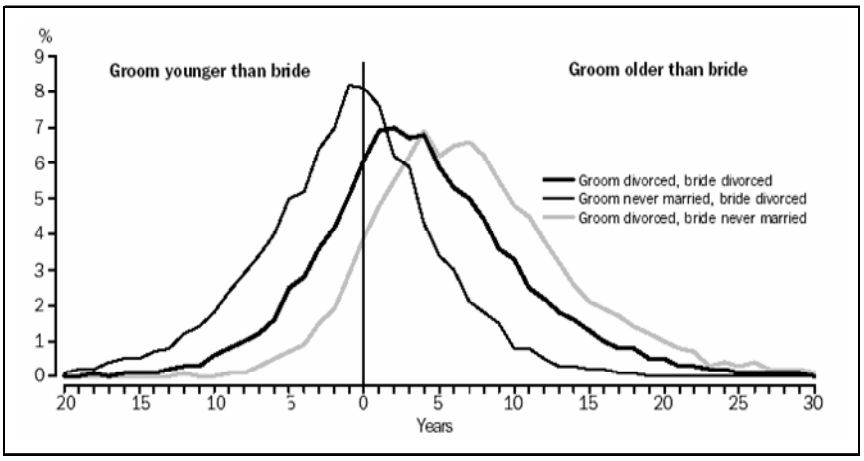


Source: ABS 2002

This data can be rearranged into a chart of the age difference between bride and groom for each combination of previous marital state of each person.

Figure 9 illustrates how the age difference distribution is shifted for three of the sixteen possible combinations and the probability of marrying a partner of differing age. Note however that there are strong compositional effects in operation here and that the shifts must be interpreted in terms of the distribution for the age groups contributing to the total distributions.

Figure 9: **Distribution of the age difference between couples remarrying, 1997**

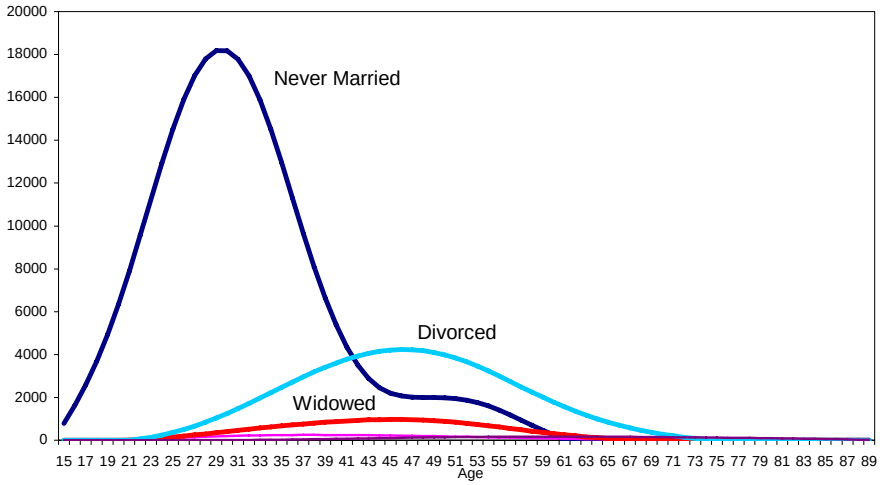


Source: Chart copied from ABS 1997

2.2 Cohabitation

Comprehensive time series data on cohabitation do not exist. Most information on cohabitation comes from the Census or special surveys, such as the Survey of Family Characteristics (ABS 2003). These data sources provide snapshots of the number of people cohabiting by age structure — but provide no information on the duration of cohabitation or whether they ended in marriage or separation.

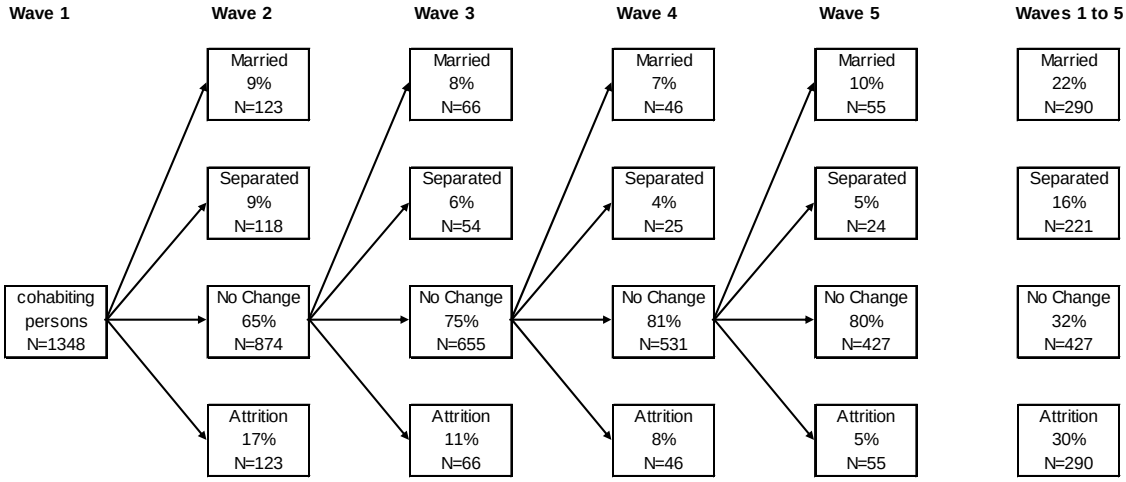
Figure 10: **Cohabitation by martial status, males – 2001 (smoothed number)**



Source: ABS 2002

HILDA on the other hand does provide some flow information, albeit from a very small sample (as shown in Figure 11).

Figure 11: **Flows for couples cohabiting in HILDA Wave 1**

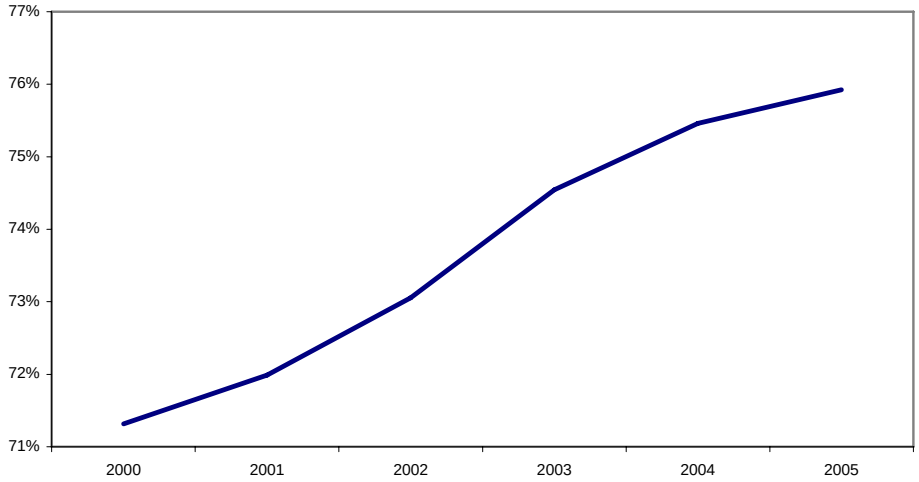


Source: HILDA Waves 1 to 5

Cohabitation before marriage

Aggregate statistics on cohabitation before marriage are available each year from the ABS but, again, no duration information is available. We do know that in 2005 some 76% of marriages were preceded by cohabitation. Figure 12 shows the growth in premarital cohabitation since 2000.

Figure 12: **Cohabitation before marriage, proportion of all marriages, 2000 to 2005**



Source: ABS Cat No 3306.0 Marriages (various years)

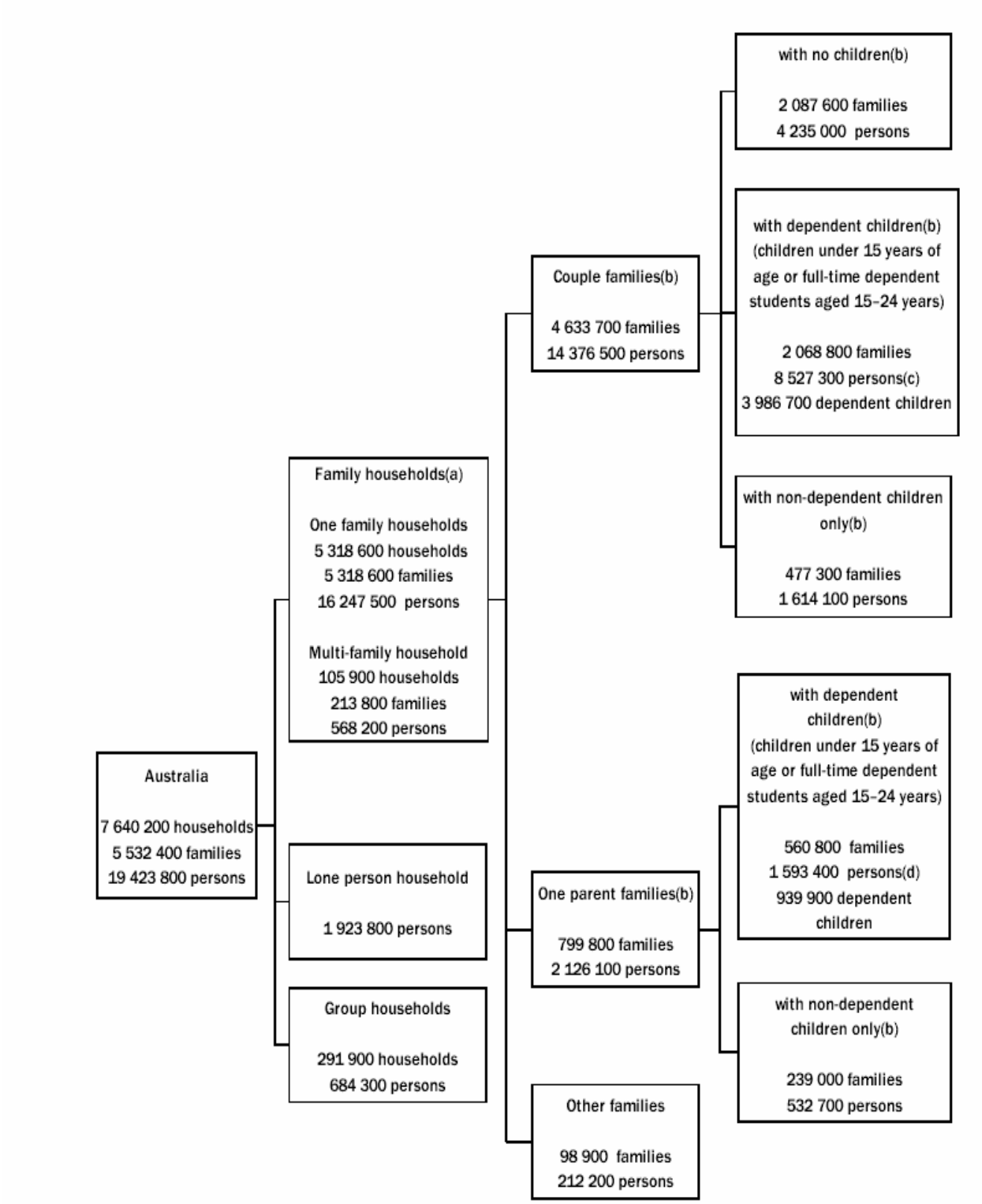
2.3 Family structure

Snapshots of family structures in Australia are provided by the Census and the Family Characteristics survey. The following charts from the ABS Family Characteristics Survey for 2003 show how the Australian population was distributed between families and households as at June 2003 (2003).

The first chart shows that only five per cent of households are either multiple family households or group households (with about six per cent of all Australians living in these mixed household types). Thus, the overwhelming majority of Australians live in single family households (including living by themselves). This suggests that, for the initial version of APPSIM, we might assume that families and households are the same entity or, at the very least, undertake some very simplistic modelling of these multiple family/group households.

As APPSIM is developed and richer structures for family formation and dissolution are developed, more detailed dynamics might be investigated to simulate the number of children in a family for different family types.

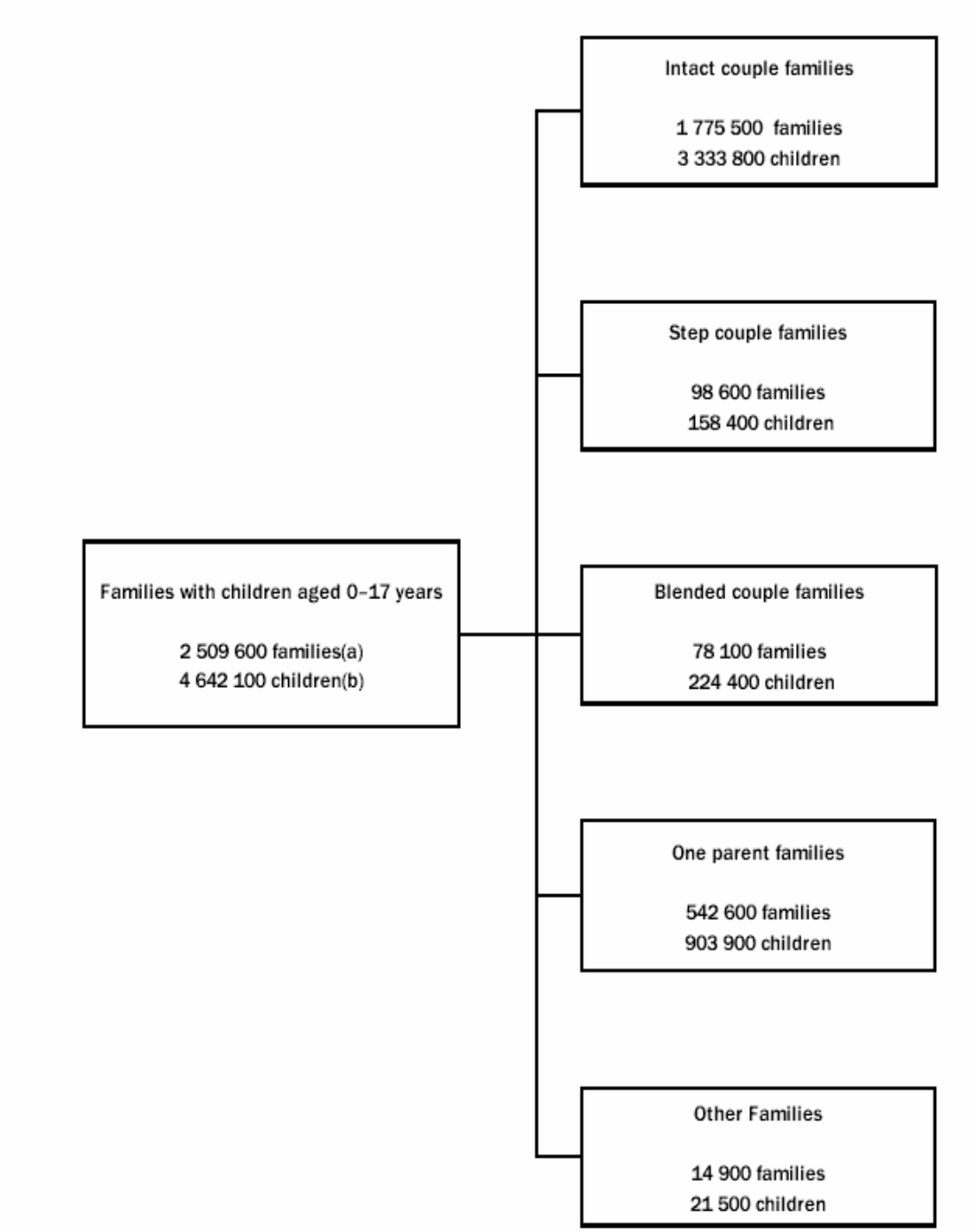
Chart 1: **Households, families and persons, June 2003**



Source: ABS 2003

Data from the ABS Family Characteristics survey for 2003, as shown in Chart 2, can be used as benchmarks to check the simulation outcomes against.

Chart 2: **Families with children aged 0-17 years, June 2003**



Source: ABS 2003

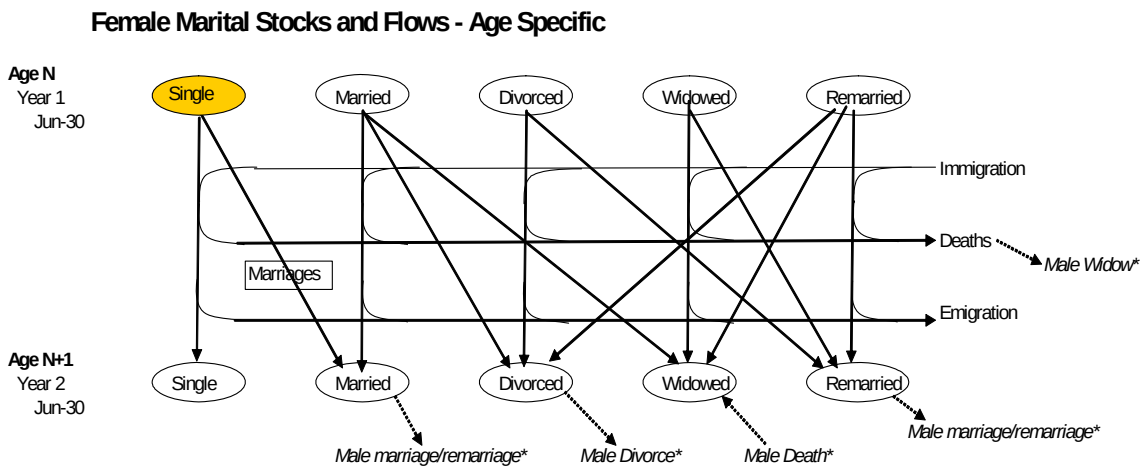
3 Macrosimulation modelling

As discussed in earlier papers, there can be advantages in constraining summed micro totals to reach desired macro aggregates. In this case, relevant aggregates might include, for example, the total number of marriages or divorces within a year.

3.1 Macrosimulation model outline

The final shape of the macrosimulation model to be associated with the family formation and dissolution module is still subject to further discussion and refinement, but could potentially be a cohort model of social marital stocks and flows. The model will be an annual model based at June 30 each year. All flows will have been converted from calendar year flows to financial year cohort flows (that is, the flows that track a single year of age cohort through to the next year where they are one year older). Figure 13 shows the possible flows for each year between the registered marital state at the start of the year and the end of year.

Figure 13: **Example of possible marital stocks and flows within model**

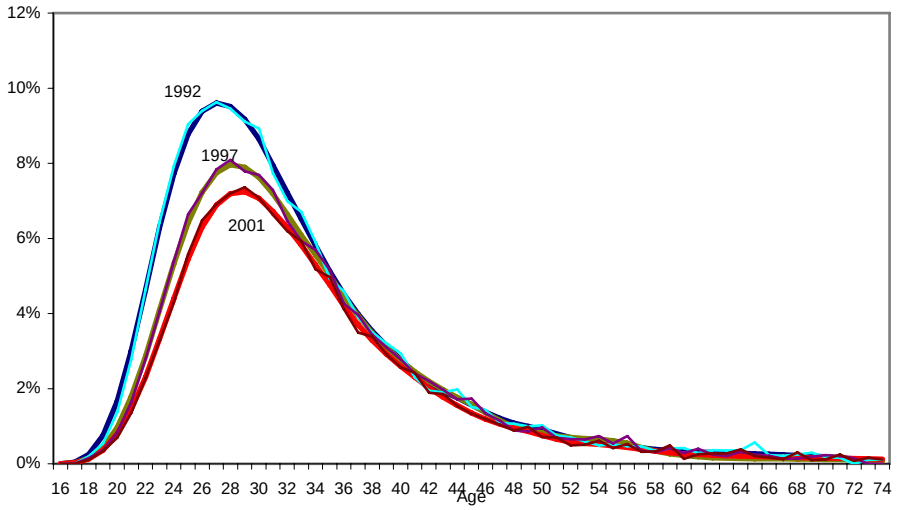


3.2 Marriage probabilities

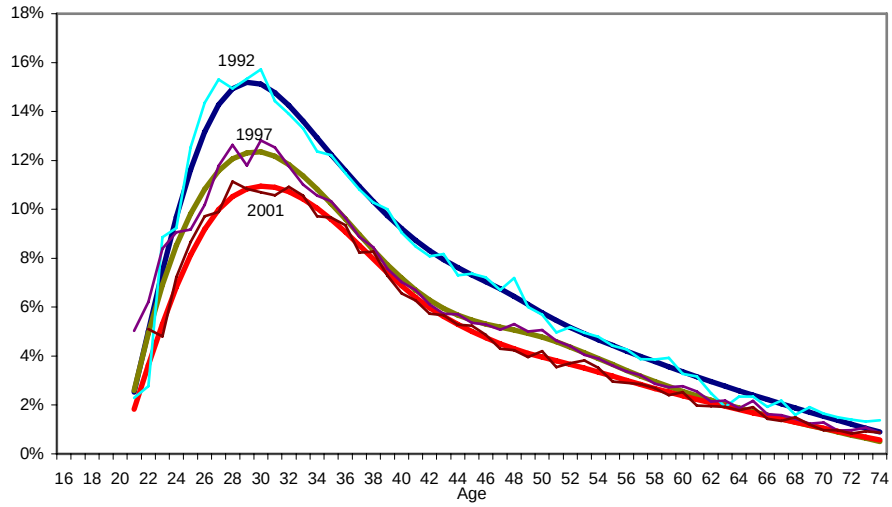
Central to the modelling of the macrosimulation model is the estimation and prediction of flow probabilities. Figures 14 and 15 illustrate the actual and smoothed marital probabilities for each type of marriage (first marriage and remarriage after divorce or widowhood) by age and sex. These probabilities can be projected forward to provide the parameters for the macrosimulation model.

Figure 14: **Probability of marriage by age – males (actual and smoothed)**

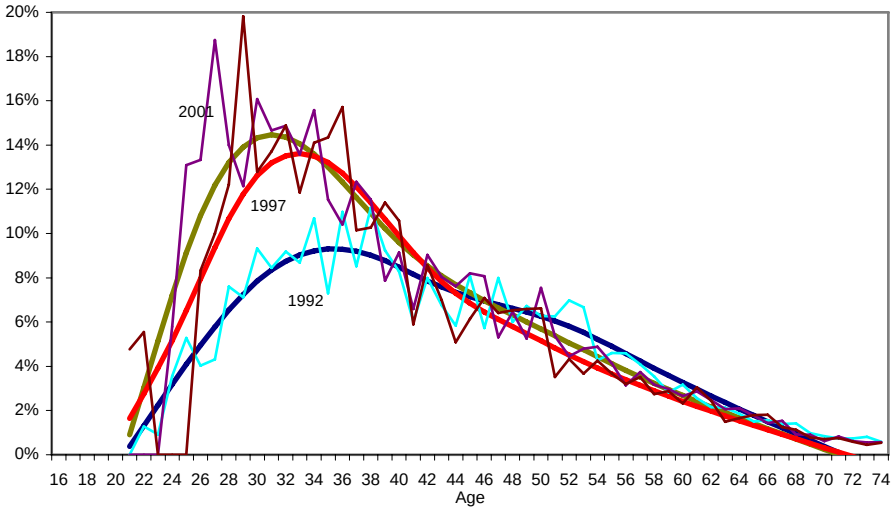
1st Marriage of Males



Remarriage by Divorced Males



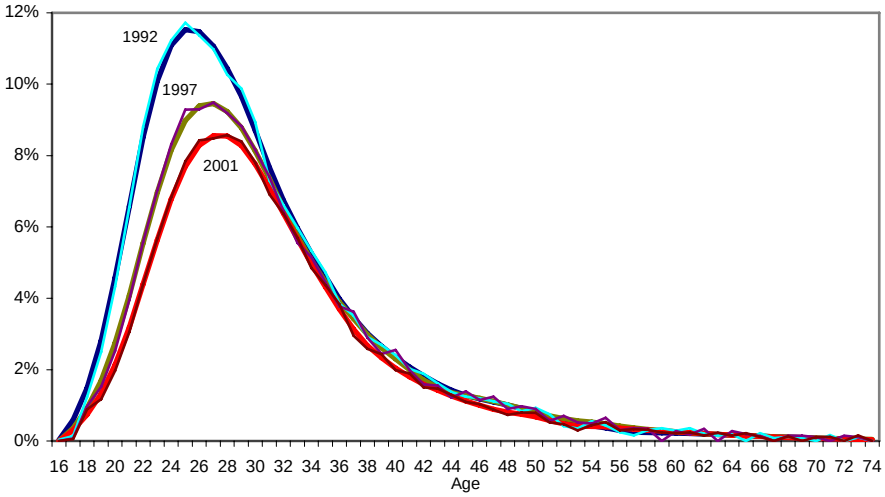
Remarriage by Widowed Males



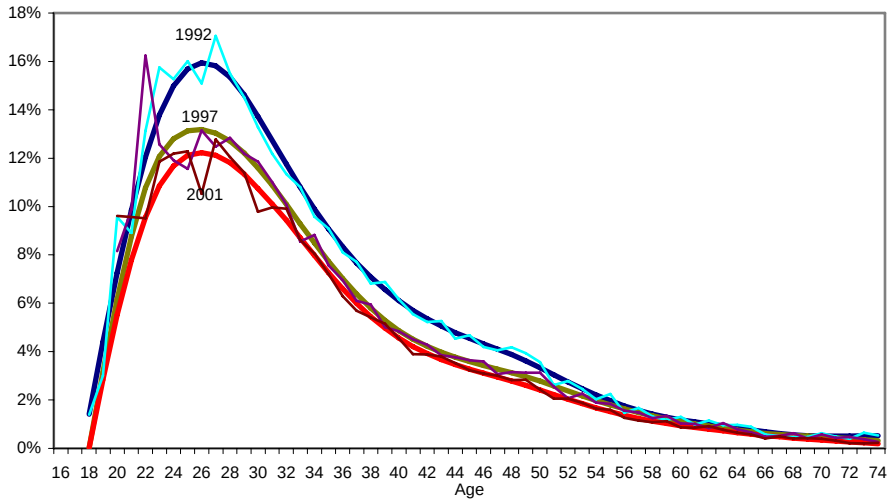
Source: Unpublished ABS

Figure 15: **Probability of marriage by age – females (actual and smoothed)**

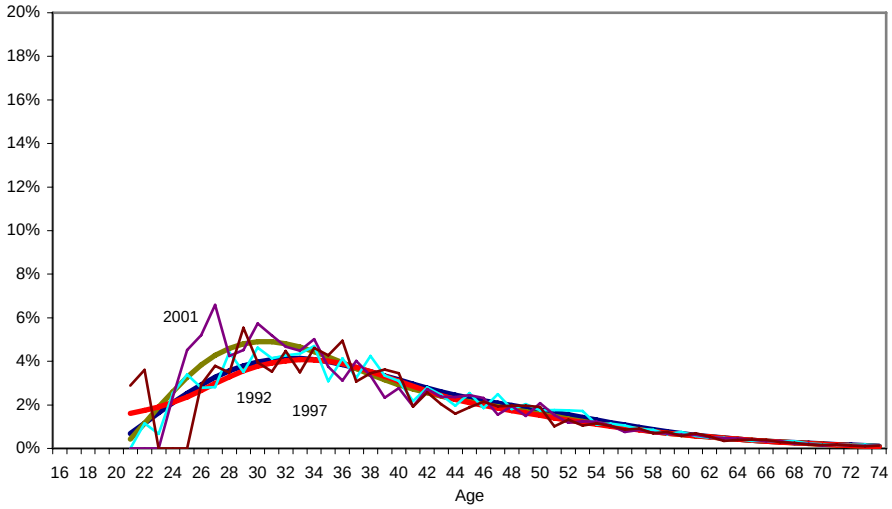
1st Marriage of Females



Remarriage by Divorced Females



Remarriage by Widowed Females



Source: Unpublished ABS

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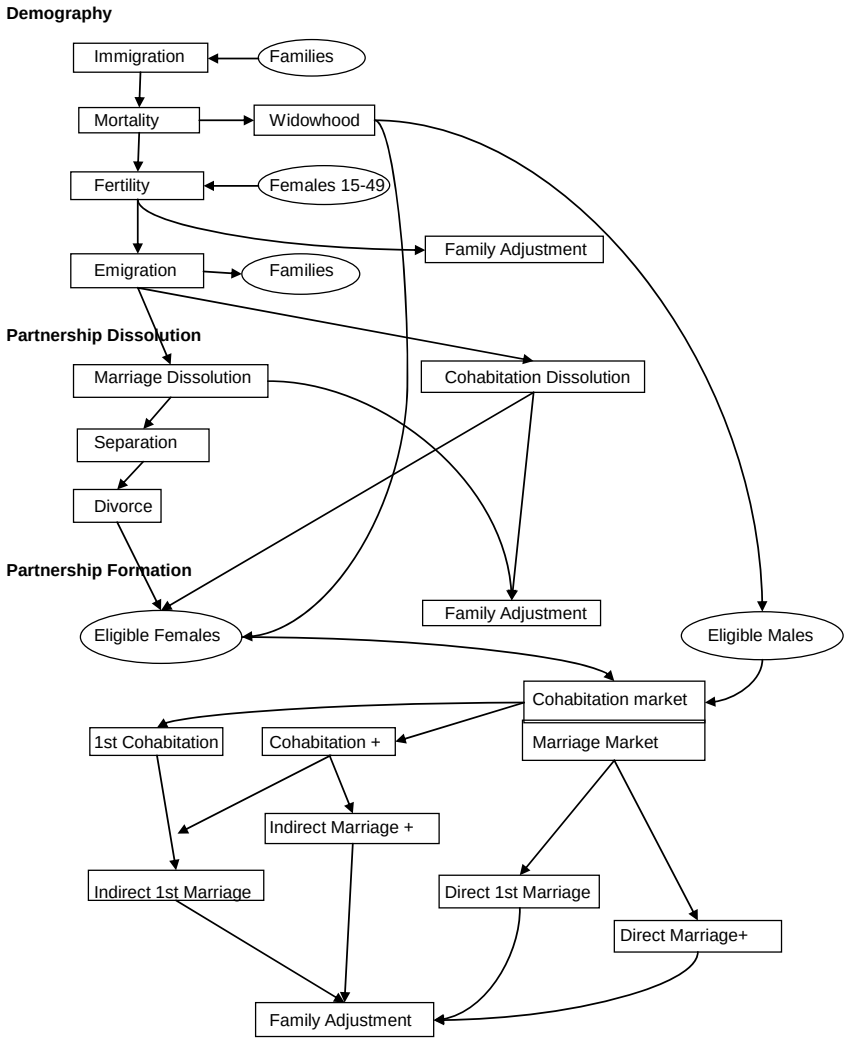
4 Microsimulation

4.1 International comparison

Appendix B reviews the family formation modelling from dynamic microsimulation models from around the world. Many models simply use age and sex as their explanatory variables, whereas others have very sophisticated equations and modelling procedures. Figure 16 maps out the proposed order of the microsimulation processes to be used in APPSIM. Table 1 lists the covariates we are proposing to use in APPSIM to predict the likelihood (probability) of a marital event occurring.

Figure 16: **Overview of proposed flows within the module**



4.2 Modelling Family Formation in APPSIM

Modelling of family formation and dissolution in APPSIM will follow a micro-macro modelling philosophy, although the degree of disaggregation in the macro aggregates is still being decided. This approach combines the advantages of both macrosimulation and microsimulation, by linking them together through an alignment process.

The principal features that the family formation model might capture include:

- Aggregate stocks at each family formation state as represented in Figure 1:
    - Never Married
    - Cohabiting (Unmarried)
    - Married
    - Separated
    - Cohabiting (Married).
    - Divorced
    - Widowed;

- Aggregate flows between each state;

- Age distribution of males and females at cohabitation and marriage; and

- Family structure including:
    - Lone person households
    - Lone parent families
    - Couple without dependent children
    - Couples with dependent children.

Having identified who lives or dies, which women will give birth and who separates from their partner, we move on to predict the likelihood of a woman forming a new partnership.

Table 1: **Proposed events and covariates within the APPSIM family formation and dissolution module**

Event	Population that can face the event	Covariates
Cohabitation - unmarried	persons not in any partnership and widow(ers) not in the year of widowhood aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth, no. of previous cohabitation
Cohabitation - still married	persons not in any partnership and widow(ers) not in the year of widowhood aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth, no. of previous union, current marital status (divorce, separated, widow)
Direct 1st marriage	never married persons aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth
Indirect 1st marriage	never married persons aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth, duration of cohabitation
Direct remarriage	persons not married and widow(ers) not in the year of widowhood aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth, marital status (divorcee, widow)
Indirect remarriage	persons not married and widow(ers) not in the year of widowhood aged over 15	age, sex, education level, labour force participation, education participation, pregnancy, parity, duration since last birth, duration of cohabitation, marital status (divorcee, widow)
Separation	persons married	age, duration of marriage, no. of children, age of the youngest
Dissolution	persons in cohabitation	age, duration of cohabitation, no. of children, rank of union
Divorce	persons married or separated from spouse following a registered marriage	age, duration of separation, no. of children, rank of union
Partner matching	women not in partnership and selected to enter into partnership	age, age difference, education level of women, education level of potential spouse, labour force participation, earnings level of both potential spouse.

Partner matching

The processes in family formation in APPSIM are 'female dominant', meaning that if the process requires interaction between a male and a female, the female probabilities drive the process and the males are 'followers'. For example, when a woman is simulated to form a couple, the selection of a partner is undertaken with reference to the woman's age and educational qualifications. Given the woman's characteristics, a partner is statistically selected from a pool of eligible partners expected to be chosen according to their age, educational qualifications and labour force status.

The selection procedure is applied for all pairs and also based on the number of previous unions of the women and on the legal status of the union being formed. Once a marriage or new de facto relationship starts, a new family is formed in the model. If required, the man and woman sever links with their former families to form a new one.

Cohabitation

To be in scope for cohabitation, a woman must not be living as a couple (registered marriage or cohabitation). She must be either separated, divorced or never married and not currently living with a partner. The probability to enter into cohabitation will depend on age, education level, previous marital status, parity of long term union and number of children.

Cohabitation by a divorced or never married person (unmarried cohabitation) may proceed to a marriage later on, but not for those separated who are still legally married (still married cohabitation).

Marriage

To be in scope for marriage, a woman must not be legally married (i.e., be never married or divorced). We will consider separately first marriage and subsequent marriages subcategorised as direct and indirect marriages. A direct marriage is a marriage not preceded by cohabitation and indirect marriage occurs when the couple were cohabitating before the marriage. The probability that a woman will marry is determined by age, education level, labour force participation, number of children, and when appropriate duration of 'premarital cohabitation' or duration since end of previous union.

Dissolution of Cohabitation

To be in scope for exiting cohabitation, a woman must be living with a partner in a de facto union. The probability that cohabitation ends will depend on its duration, age, education, labour force participation of partners, number of children and the presence of young children.

Separation

To be in scope for separation, a woman must be legally married. The probability that separation occurs will depend on its duration, age, education, labour force participation of both partners, number of children and the presence of young children.

Divorce

To be in scope for divorce, a woman must be married or separated (divorce is female driven). The probability that marriage legally ends depend on its duration to separation, age, education, labour force participation of both partners, number of children and the presence of young children, duration of separation if appropriate, and if the woman has entered into a de facto cohabitation.

The probabilities of separation are modelled separately for cohabiting and married couples in the APPSIM model, reflecting the very different likelihood of dissolution in the early years between these two types of partnership. Over 76% of marriages in Australia are preceded by cohabitation but less than one fifth of all cohabitations survive more than five years duration.

Leaving Home

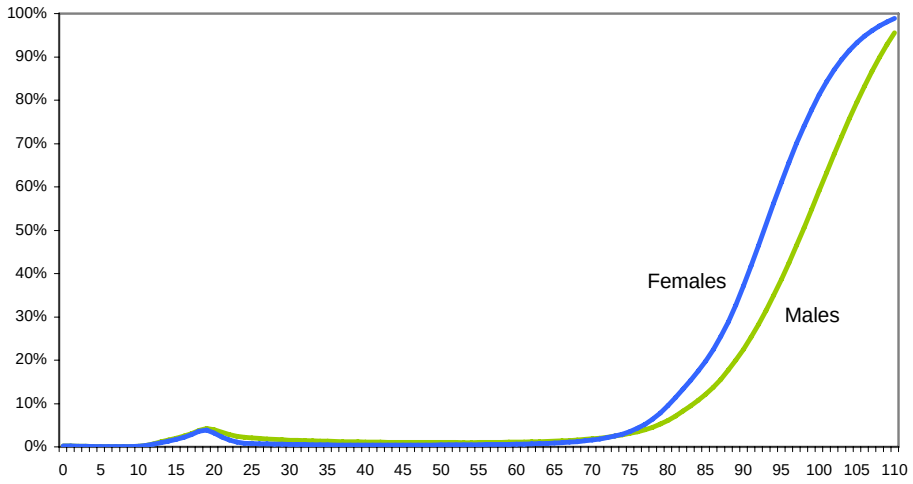
The chance of a person leaving home is considered each year for children living with their parents and aged 16 and over. The decision to leave home depends on whether they are at school or not.

The regression model for whether a person leaves home is based on the person's age, sex, disability status, educational status, education level and whether one or both parents were born overseas.

Non-private Dwellings

The movement of the population in and out of non-private dwellings is of particular interest at older ages. Unfortunately, little information is available on the dynamics of persons entering non-private dwellings (NPDs). Estimates of the persons in NPDs by age group are available from the 2001 Census. The last age group is open ended with persons aged 85+ lumped together. Techniques to interpolate the data and model the opened ended age group are used to estimate the age-specific proportion of the population in NPDs as shown in Figure 17.

Figure 17: **Proportion of persons in non-private dwellings by age and sex, 2001**



Source: ABS Census 2001 Estimates and NATSEM

These profiles will be used in APPSIM, pending further research on drivers for entering NPDs and the characteristics of the NPD populations (including those relating to family formation and dissolution).

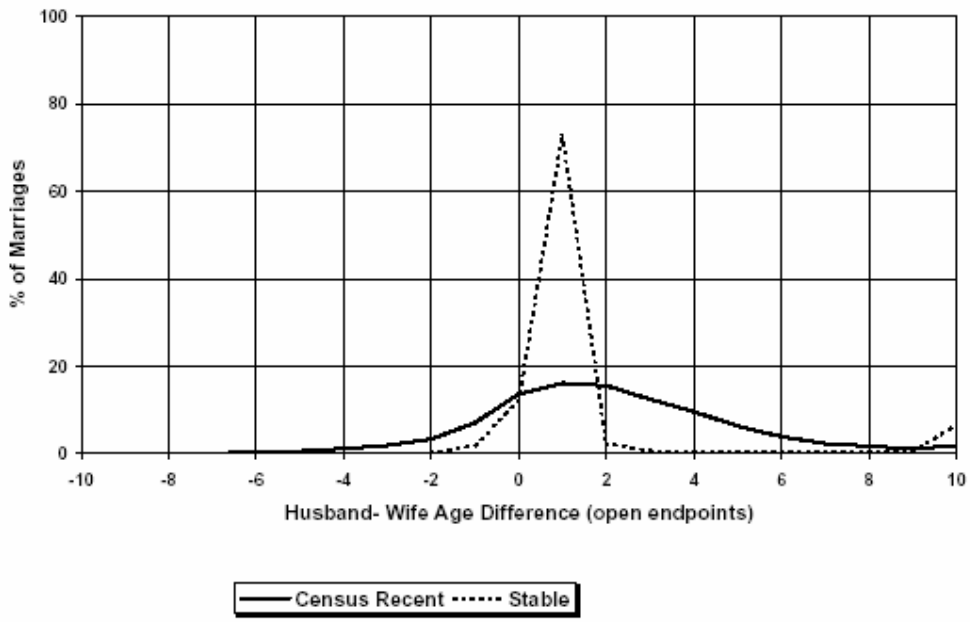
5 Mate Matching

There are two methodologies used to match couples in microsimulation models — a stable marriage approach and a stochastic approach.

To achieve a stable set of marriages, a measure of compatibility for all potential pairs is calculated, sorted in descending order and the best match married. The remaining potential pairs are re-ranked and the next most compatible couple is married.

Perese (2002) notes that "Bouffard and others (2001) examined the distributions of differences in age and differences in earnings produced in CORSIM/DYNACAN and compared those against distributions found in census data. They found that the stable marriage algorithm produced annual sets of marriages that have an exorbitant proportion of marriages occurring where the husband is one year older than the wife (relative to census data). Somewhat counter-intuitively, the stable marriage algorithm also produced too many 'extreme' marriages – or marriages where the difference in spouses' ages is greater than 20 years. This bimodal distribution of marriages is produced with the stable marriage algorithm because after the 'best' marriages are made, there are only relatively 'bad' matches left to be made." (See Figure 18).

Figure 18: **CORSIM mate matching algorithm results**



Source: Copied from Bouffard et al. 2001, p. 18

The stochastic matching routine simulates the likelihood of marriage using Monte Carlo techniques. It also starts with the calculation of the likelihood of union formation between two potential spouses. For each available female, the probability of marrying each available male is calculated with the following distance function:

$$P(Union_{mf}) = e^{-0.5\sqrt{[(Age_m - Age_f)^2 + (Edu_m - Edu_f)^2]}}$$

Rather than relying on stable marriage optimization to match spouses, a stochastic matching routine uses this information. If the probability of a marriage exceeds a random number drawn from a uniform distribution, then the marriage occurs.

The CBOLT model then uses a matching restriction to improve computational efficiency. "If this probability does not exceed the drawn number, then, a match is attempted between the first bachelor and the second available bachelorette. These comparisons continue until either a match is made or a match has been attempted with the first 10 available bachelorettes. If no match has been made after 10 attempts, then the match that has the highest probability is married" (Perese 2002).

APPSIM proposes to take this process further by embedding the alignment process in the mate matching model. In this case, the match will only be made if the number of males projected by the macrosimulation model of that age has not been exhausted.

6 Conclusion

Family formation and dissolution is a complex and, due to the mate matching process, a computationally time consuming modelling exercise. The focus of this paper is to provide an overview of the issues involved and to suggest ways of capturing the strong dynamics and interactions of the family formation process.

This paper has proposed how the various partnership formation and dissolution processes will be modelled in APPSIM and the order in which they will be modelled (as summarised in Figure 16). It has also outlined indicative explanatory variables to be included in the predictive micro equations (in Table 1). It has also proposed an approach to simulating the 'marriage market'.

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Attachment A: Family formation: definitions

Couple family

a family based on two persons who are in a registered or de facto marriage and who are usually resident in the same household. The family may include any number of dependants, non-dependants and other related individuals. It is not necessary for a parent-child relationship to be formed, thus a couple family can consist of a couple without children present in the household.

Reference: Family Characteristics, Australia (ABS cat. no. 4442.0).

Couple-only family

a couple family with no children (of any age) present.

Crude divorce rate

the number of decrees absolute granted during the calendar year per 1,000 estimated resident population at 30 June. It should be noted that for divorce rates relating to state and territory data, the numerator and denominator are based upon different types of data, reducing the accuracy. While state or territory of usual residence is used as the denominator, the numerator is based upon state or territory of registration. Therefore, divorce applicants may contribute to the divorce rates of states and territories where they are not usual residents.

Reference: Divorces, Australia (ABS cat. no. 3307.0.55.001).

De facto couple

two people (of the same or opposite sex) who live together in the same household who are not registered as married to each other but reported being either: de facto, partner, common law husband/wife/spouse, lover, boyfriend or girlfriend. Reference: 2001 Census of Population and Housing.

Divorce

decree absolute of dissolution of a registered marriage.

Reference: Divorces, Australia (ABS cat. no. 3307.0.55.001).

Divorces involving children

divorces of couples with unmarried children of the registered marriage who were aged under 18 years at the time of application for divorce. Under the Family Act 1975, adopted and ex-nuptial children and children from a former registered marriage may be included (in certain cases). Children who are registered as married or aged 18 years and over are not subject to custody and guardianship orders and are excluded.

Reference: Divorces, Australia (ABS cat. no. 3307.0.55.001).

Duration of marriage until separation

the interval measured in complete years between the date of marriage and the date of separation.

Reference: Divorces, Australia (ABS cat. no. 3307.0.55.001).

Estimated resident population

the official measure of the population of Australia based on the concept of residence. It refers to all people, regardless of nationality or citizenship, who usually live in Australia, with the exception of foreign diplomatic personnel and their families. It includes usual residents who are overseas for less than 12 months. It excludes overseas residents who are in Australia for less than 12 months.

Reference: Australian Demographic Statistics (ABS cat. no. 3101.0).

Family

two or more persons, one of whom is aged 15 years or over, who are related by blood, marriage (registered or de facto), adoption, step or fostering; and who are usually resident in the same household. The basis of a family is formed by identifying the presence of a couple relationship, lone parent-child relationship or other blood relationship. Some households will, therefore, contain more than one family.

Reference: Australian Labour Market Statistics (ABS cat. no. 6105.0).

Household

a group of two or more related or unrelated people who usually reside in the same private dwelling, or a person living alone in a private dwelling. Households include group households of unrelated persons, same-sex couple households, single-parent households as well as one-person households. A household usually resides in a private dwelling (including caravans etc. in caravan parks). Persons usually resident in non-private dwellings, such as hotels, motels, boarding houses, jails and hospitals, are not included in household estimates. This definition of a household is consistent with the definition used in the census.

Reference: Australian Demographic Statistics (ABS cat. no. 3101.0).

Income Unit

An income unit is defined as:
one person, or a group of related persons, within a household, whose command over income is shared. The relationships allowed for in the definition of income unit are restricted to those of marriage (registered or de facto) and of parent/dependent child who usually reside in the same household. (6549.0, p. 30)

Operationally, this means an income unit can be defined as:

- a couple with dependent children;
- a couple without dependent children;
- a sole parent with dependent children;
- a single person.

Reference: (ABS cat. No 6549.0, p. 30).

Lone parent

a person who has no spouse or partner present in the household but who forms a parent-child relationship with at least one dependent or non-dependent child usually resident in the household.

Reference: Australian Labour Market Statistics (ABS cat. no. 6105.0).

Lone person

a person who makes provision for their food and other essentials for living without combining with any other person to form part of a multi-person household. They may live in a dwelling on their own or share a dwelling with another individual or family.

Reference: Australian Labour Market Statistics, Australia (ABS cat. no. 6105.0).

Marriage

refers to registered marriages only.

Reference: Marriages, Australia (ABS cat. no. 3306.0.55.001).

One-parent family

a family consisting of a lone parent with at least one dependent or non-dependent child (regardless of age) who is also usually resident in the household. Reference: Australian Labour Market Statistics.

Reference: ABS cat. no. 6105.0

Attachment B: Summary of family formation and dissolution processes in international models

Model	cohabitation	cohabit separation	marriage	divorce	matching spouses	remarriage	marital status
Anac Model	age	age	age	age	age		
Belgian Dynamic model			sex, marital status				
Camsim			age				
Corsim			age, age2, education, ln (earnings), number of children, weeks worked, schooling status, sex, weeks worked	age difference, duration of union, husband's wages, race, wage advantage, earning status of wife, presence of children under 18	age difference, age difference*(1 if female older, 0 otherwise), abs(male's total income-female's total income), educational difference, interaction of labour force participation, male's education*(1 if older, 0 otherwise), racial interaction, state of residence, woman's number of children	age, age2, education, ln(earnings), divorced (v. Widowed),has child, (1-nowork)*loginc, weeks worked, race, sex, widowed or divorced, age (under 60/61+), race, sex, widowed or divorced	
Demogen		Duration of relationship, age, labour force experience, age at marriage, age and number of children	age, sex, education, previous common law union, fertility, labour force history and marriageability (assigned at birth)		age, education	age, sex, current marital status	
Destinie (version 2005 - M. Duee)	modified age at end of education according to the length of education, education (short, long), sex	women driven, duration of union, age at union, number of children of the current union, presence of children from previous union, education			age difference, age at end of education difference	sex, duration since disruption, age at dissolution of previous union, presence of children, education, widowhood	
Dynacan	age, cohort, race, sex, education, school attendance,	duration of union	age, cohort, race, sex, education, school attendance,	age, cohort, race, age difference, duration of marriage, presence of children, wages, wife's earnings	difference in age, difference in education, difference in income, race match, number of children, labour force status, employment, income, state of residence	age, race, sex, previous marital status (divorced/widowed), income, number of children, weeks worked, education	
Dynamite	weeks worked, earnings, number of children		age	age	age, education, wealth		
Dynamod	educ part, pregnancy, Year of birth	age at union, university degree, live births during union, employment status - person & partner	educ part, highest edu, pregnancy, year of birth, employment status person & partner, FT employment and 15-17, cohabitation	YoB, age at marr, usb age at marr, cohabit, pre-mar birth, employ status, husb 6 month unempl, YoB x FT employ, YoB x husb 6 month unemploy, marr duration	age difference, employment status and educational qualifications	time to remarriage - no of children, cohabit, duration since separation/widowed	
Dynasim II			marriage age 18-29: age, race, sex, previous marital status, income, education, region, weeks worked, hourly wage, asset income, welfare, unemployment compensation others: age, race, sex, previous marital status	distribution over time of expected divorces for this marriage cohort, age at marriage, education, previous marital status presence of young children, weeks worked, wages	difference in age, difference in education	marriage age 18-29: age, race, sex, previous marital status, income, education, region, weeks worked, hourly wage, asset income, welfare, unemployment compensation others: age, race, sex, previous marital status	
Dynasim III			1st marriage: Eight discrete time logistic hazard models for persons aged 15 to 34; depends on age, education, race, earnings, presence of children (for females); uses vital statistics outside this range (age, sex, previous marital status)	couple level outcome: discrete time logistic hazard model depends on marriage duration, age and presence of children, earnings of both spouses (also includes a separate model to predict separation by age (<30 or >=30) and race)	closed marriage market (spouse must be selected from among the unmarried, opposite-sex persons in the population); match likelihood depends on age, race and education	tables lookups; separate by sex for widowed and divorced	

Model	cohabitation	cohabit separation	marriage	divorce	matching spouses	remarriage	marital status
Famsim	Age, Age2, pregnancy duration, parity, duration since last birth, in education, duration of schooling, in work, duration working, trend	age, age2, pregnancy duration, parity, duration cohabiting, duration since last birth, in education, duration of schooling, in work, duration working, trend	Age, Age2, pregnancy duration, parity, duration cohabiting, duration since last birth, in education, duration of schooling, in work, duration working, trend	age, age2, pregnancy duration, parity, duration cohabiting, duration since last birth, duration married, in education, duration of schooling, in work, duration working, trend			
Famsim	parity, age, age2, interval since previous birth, enrolled in school, total years of school education since 15th birthday, paid work, total years paid work, trend, duration pregnancy in any pregnancy	from single to cohabitation: parity, age, age2, interval since previous birth, enrolled in school, total years of school education since 15th birthday, paid work, total years paid work, trend, duration pregnancy in any pregnancy, number of years in current partnership	from single to marriage: parity, age, age2, interval since previous birth, enrolled in school, total years of school education since 15th birthday, paid work, total years paid work, trend, duration pregnancy in any pregnancy from cohabitation to marriage: parity, age, age2, interval since previous birth, enrolled in school, total years of school education since 15th birthday, paid work, total years paid work, trend, duration pregnancy in any pregnancy, total number of years in current partnership	from marriage to single: parity, age, age2, interval since previous birth, enrolled in school, total years of school education since 15th birthday, paid work, total years paid work, trend, duration pregnancy in any pregnancy, total number years spent in current marriage			
Harding			age, sex	age, sex	age, education status (men initialising)	age, sex	
Irish dynamic microsimulation model			age, occupational group, In work gender, marital status	marital status, age, gender	age difference, age difference2, in work		
Italian cohort model			age	length of marriage	age, education		
Japanese dynamic model			age	age	age	age	
Kinsim (Evert)		union separation : age and sex	age, sex, previous marital status	age and sex (half the probability for women and half for men)	age		
Lifemod	age, sex	random sample of those in marriage or cohabitation	male driven, age, marital status		marital status, age, education		
Lifepath[revu par sp]	sex, age, pregnancy, employment status, education, year of birth, born in Quebec, born outside of Canada, age at first job and time employed since first job.	number of previous common-law unions, duration of the union, age, sex, pregnancy, year of birth, born in Quebec, born outside of Canada and measures of employment experience.	age, employment experience, fertility [sex, age, pregnancy, employment status, education, year of birth, born in Quebec, born outside of Canada, age at first job and time employed since first job.]	marriage duration, family composition, employment experience [year of birth, age at marriage, duration of the common-law union that became the marriage (if true), duration of the marriage without children, duration of the marriage with children, age of the youngest child, education, measures of employment history and historical period. The historical periods represent, respectively, the period before the divorce legislation reform (<1968), the period before the second change to divorce legislation (1968-1984) and the present (>1984).]	age, education level		

Model	cohabitation	cohabit separation	marriage	divorce	matching spouses	remarriage	marital status
Melbourne							age, marital status
Microhus	education, years of work experience	duration of union	education, years of work experience	duration of union			
Midas							age, gender, ethnicity, previous marital status
Mint			age, duration unmarried, number of marriages, ethnicity, education, widowhood, permanent income, time	age, duration of marriages, ethnicity, education, permanent income, time (pre-post 1980)			
Mosart			Women's age, marital status, whether women has children (female dominant)	wife's age (female dominant)	husband's age		
Nedymas			age, year of birth, education level, sex		age	age, year of birth, sex, education level, marital status	
Pensim/2 PRISM			age, sex, previous marital status	age of husband and wife	age of male, age of female		
Sage	age, prev marital status, empl status, preg (female dominant)	age at formation, duration, prev marital status, preg, empl status (fem dom)	age, prev marital status, cohabit status, empl status, preg (fem dominant)	age at formation, duration, prev marital status, preg, younger male, empl status (fem dom)	age difference, higher education, prev marital status, social class	captured in marriage	
Sesim	age, age difference	age	age, age difference	age			
Sfb3			age, sex	duration of marriage		age, sex, marital status	age, sex, previous marital status and nationality
Sverige		age, personal earning, education levelm sexm if person has at least one child, working status, marital status	if have already a partner: age of the women, dummy if the woman is older than the man, dummy if the couple has a child aged between 1 and 2 years, dummy for couples with children, dummy if woman earns more than the man, dummy if at least one partner was previously widowed or divorced, education level of the woman, dummy if education woman is higher than that of man, dummy if any partner is an immigrant.				