Australian Bureau of Statistics

Population Estimates : Concepts, Sources and Methods

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POPULATION ESTIMATES : CONCEPTS, SOURCES AND METHODS

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AUSTRALIAN BUREAU OF STATISTICS

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PREFACE

The Australian Bureau of Statistics (ABS) compiles and publishes time series estimates of the population and its major demographic components. Each of these estimates employs the concept of estimated resident population which links people to a place of usual residence within Australia.

This publication provides a description of the concepts, sources of data and methods used in the compilation of population estimates by the ABS. Chapter 1 gives an overview of the range of estimates published by the ABS and outlines the reasons why population estimates are compiled. Chapters 2 and 3 provide a description of the methods and the data used to produce the estimates at National/State level and sub-State level, respectively. (Throughout the publication references to States also include the two Territories unless otherwise stated.) Chapter 4 deals with the sources and quality of the data.

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Australian Statistician

CHAPTER 1

POPULATION ESTIMATION: AN OVERVIEW

Development of population statistics

Basic enumerations of the population have been made since the early days of European settlement in Australia. The early enumerations were known as 'musters'. A census conducted in New South Wales in 1828 became the first in a series of regular censuses in that colony and periodic censuses were taken in the other Australian colonies. The dates of these colonial censuses are shown in the table below. The first simultaneous censuses of all the Australian colonies was taken in 1881 and the first national census was taken in 1911. It was followed by others in 1921, 1933, 1947, 1954 and 1961. Since 1961 they have been conducted at five yearly intervals. The censuses provide comprehensive population data cross-classified by a wide range of socio-economic characteristics and for a variety of geographic areas. These data are referred to as 'census counts' and are available as at census dates only.

TABLE 1.1 POPULATION CENSUSES IN AUSTRALIA, 1828 TO 1901

Date	*NSW(a)*	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*
1828 – November	*						
1833 – 2 September	*						
1836 – 2 September	*						
1841 – 2 March	*						
27 September						*	
1844 – 26 February				*			
1846 – 26 February				*			
2 March	*						
1847 – 31 December						*	
1848 – 10 October					*		
1851 – 1 January				*			
1 March	*					*	
1854 – 26 April		(b)*					
30 September					*		
1855 – 31 March				*			
1856 – 1 March	*						
1857 – 29 March		*					
31 March						*	
1859 – 31 December					*		
1861 7 April	*	*	(b)*	*		*	
1864 1 January			*				
1866 – 26 March				*			
1868 – 2 March			*				
1870 – 7 February						*	
31 March					*		
1871 2 April	*	*		*			
1 September			*				
1876 – 26 March				*			
1 May			*				
1881 – 3 April(c)	*	*	*	*	*	*	(d)*
1886 – 1 May			*				
1891 – 5 April	*	*	*	*	*	*	(d)*
1901 31 March	*	*	*	*	*	*	(d)*

(a) Includes Australian Capital Territory. (b) Previously included with New South Wales. (c) The first simultaneous censuses of all the Australian colonies. (d) Included with South Australia for the censuses of 1866, 1871 and 1876. The Northern Territory was not transferred to the Commonwealth until 1 January 1911.

Source: Official Year Book No.54, 1968.

Since very early times these census counts have been updated quarterly to provide up-to-date totals of the population of Australia, States and Territories. These quarterly updates have been required by law since 1977 (see below).

Annual estimates of the population by single years of age and sex for Australia as a whole commenced in 1921 and for the States and Territories in 1961.

In the 1940s, on the basis of the early 'musters' and other colonial records, an annual series of population totals for the States and Territories was published for all years commencing from 1788, the year of the first European settlement in Australia. They are disaggregated by sex from 1796. (See ABS publication *Australian Demography Bulletin No. 65, 1947*).

Annual estimates of total population in Local Government Areas (now 'Statistical Local Areas', which in most cases are identical to Local Government Areas), have been published for New South Wales from 1911, Victoria from 1875, Queensland from 1911, South Australia from 1915, Western Australia from 1926, Tasmania from 1923, the Northern Territory from 1981 and the Australian Capital Territory from 1968.

Until 1967, section 127 of the Constitution required the exclusion of Aboriginal people when estimating the population: 'In reckoning the numbers of the people of the

Commonwealth or of a State or other part of the Commonwealth, Aboriginal natives shall not be counted'. This was interpreted as requiring the exclusion of 'full-blooded' Aboriginal and Torres Strait Islands people. Only 'half-cast', 'quarter-cast' etc people were included. (An exception to this rule occurred when Torres Strait Islanders were classified by the 1947 Census as Polynesian and by the 1954 and 1961 Censuses as South Pacific Islanders, resulting on these three occasions in their inclusion in the population).

This provision was repealed with the proclamation of the *Constitution Alteration (Aboriginals) Act 1967* so that officially since 10 August 1967 population statistics have included 'full-blooded' Aboriginal and Torres Strait Islands people. Population statistics prior to 10 August 1967 have been revised to include them. Population statistics by single years of age and sex for Australia, the States and Territories include them from 30 June 1966, and totals (not disaggregated by age) of the population for Australia, the States and Territories include them from 30 June 1961.

In censuses from 1971 onwards Aboriginal people were no longer asked to state their degree of Aboriginal descent. In 1991, for example, the census question asked 'Is the person of Aboriginal or Torres Strait Islander origin? For persons of mixed origin indicate the one to which they consider themselves to belong.' Changing social attitudes, political developments, improvements in census coverage and a broader definition of 'Aboriginal' are likely to have contributed to the rapidly rising numbers of Aboriginal people that have been recorded since 1971.

As from 1971 an important change was made to the concept of what constitutes the 'population'. Whereas it had been the practice to define the population as the number of people actually present at a given time (at the census this meant the number of people actually counted and therefore included foreign tourists but excluded Australians abroad), it was decided to define it as the number of 'residents' i.e. people who usually reside in Australia. Likewise the population of the States and Territories was to be the number of people who usually reside in those States/Territories. And so on, for cities, local government areas etc. The current 'population estimates', therefore, which are the subject of this paper, are the estimated numbers of Australian 'residents' i.e. people who usually reside in Australia. They are compiled initially at the census date by firstly adjusting the census count of residents upwards to compensate for census underenumeration, and then further adjusting (also upwards) to include an estimate of the number of Australian residents who were overseas on census night.

These population estimates, and the regular updates of them have been adopted as the official population series. A detailed account of the introduction of this series is available in the ABS technical paper *Methods and Procedures in the Compilation of Estimated Resident Population 1981 and in the Construction of the 1971-81 Time Series* (3103.0) issued on 11 March 1983.

As had been customary prior to 1971, the estimates are updated quarterly at State/Territory level and annually at the Statistical Local Area (SLA) level.

During the 1980s the service was further improved with the addition of three new annual series (included in the following table). A complete listing of the population estimates series now compiled and published by the ABS is given in the following table; additional unpublished estimates are available as indicated in the footnotes.

TABLE 1.2 POPULATION ESTIMATES SERIES

	Geographical level				
Type of population estimates	*National*	*State*	*SLA*	*Reference date*	
Total by sex	X	X		31 March 30 June 30 September 31 December	
Age (single years) by sex	X	X		30 June(a)	
Total persons			X	30 June	
Marital status by age (single years) and sex	X			30 June(b)	)
Country of birth by age (five year groups) and sex	X			30 June(c)	) New series
Age (five year groups) by sex			X	30 June(d)	)

(a) Unpublished quarterly estimates also available. (b) Available for 1976. Annual series commenced 1981. (c) Commenced 1981. Unpublished estimates by single years of age also available. (d) Commenced 1986.

Applications of population estimates

Population estimates have wide application in many aspects of modern society. Some estimates, which are acknowledged as being of particular importance to government are specifically required by Acts of Parliament to be compiled by the ABS.

The most important in the context of this paper, is subsection 9(2) of the *Census and Statistics Act 1905* which requires the ABS to compile quarterly estimates of the populations of each State.

The range of applications of population estimates can be gauged by the following brief summary of government and non-government requirements.

(a) Government

There are few government programs at any level of government which do not use population data in their work. Population statistics are needed in the formulation of most policies, particularly those involving service delivery. They are also needed to monitor existing government programs. The major requirements are for annual mid-year estimates of the population by age and sex for each State and Territory and for each Statistical Local Area (SLA). There are also requirements for estimates by other characteristics in addition to age and sex (e.g. birthplace).

For forward planning purposes, various Commonwealth and State government agencies produce regular population projections which rely on up-to-date population estimates as their base.

The annual *State Grants (General Revenue) Act* and the *Local Government (Financial Assistance) Act 1986* require the Statistician to provide estimates of the populations of each State as at 31 December of a year by 10 June of the subsequent year. Also associated with the administration of the State Grants Act, the Commonwealth Grants Commission requests the ABS to provide population statistics classified by a variety of characteristics to enable it to assess State relativities in 'needs' and revenue generation. Much of these requirements are satisfied by data from the five yearly population census, but annual mid-year and end-of-year population estimates for each State and Territory by age and sex and quarterly estimates of the total population for each State and Territory, are also required by the Commission. State Grants Commissions have similar data needs to the Commonwealth Grants Commission, although on a legal local government area basis.

The *Commonwealth Electoral Act 1918* requires the ABS to supply all such population statistics as requested by the Australian Electoral Commission for the regular review of the number of seats each State is entitled to have in the House of Representatives. An amendment in 1989 to the Commonwealth Electoral Act requires the Statistician to supply on request the 'latest statistics' for Territorial as well as State populations. In addition to the internal Territories — NT and ACT (which in the Act includes the Jervis Bay Territory) — population figures are required for the external Territories of Cocos (Keeling) Islands, Christmas Island, Heard Island and McDonald Islands, Ashmore and Cartier Islands, the Australian Antarctic Territory and the Coral Sea Islands Territory.

(b) Non-government

Applications in the fields of private enterprise and other non-government activities are too numerous to describe in detail. They might be broadly described as 'market research' and 'academic/demographic research'. Requirements for these applications vary a great deal. The demand for population data for very small geographic areas is generally satisfied by the five-yearly population census. More up-to-date population estimates are also required — usually at annual intervals. The main needs are for estimates by age and sex for various geographic areas.

Finally, many statistical indices and rates have a population estimate as their denominator. They range from per capita gross domestic product to fertility rates and educational participation rates. In the main, total populations by age and sex for States and Territories satisfy this demand, although in some cases disaggregation of the population by other characteristics is also required. For example, divorce rates (by age and sex calculated as a proportion of estimated married persons) are more appropriate than as a proportion of estimated total persons.

CHAPTER 2

METHODS OF ESTIMATION: NATIONAL AND STATE POPULATIONS

Population estimates by sex for Australia, and each of the States and Territories, are compiled and published quarterly as at 31 March, 30 June, 30 September and 31 December. Estimates by single years of age and sex are compiled quarterly but are only published annually as at 30 June.

The initial base populations from which subsequent quarterly and annual estimates are derived are provided by the census, and are called census date population estimates. The method used to update these estimates, called the cohort component method, brings forward the population by adjusting for subsequent births, deaths and overseas and interstate migration.

The following two sections discuss how census date estimates and the subsequent post-censal estimates are derived.

Census date population estimates

Census date population estimates are calculated for each State and Territory by sex and single years of age (to age 99 and the balance aged 100 and over).

There are three main steps involved in arriving at these estimates:

(i) Census counts of residents are compiled for each State and Territory by single years of age and sex. ('Counts of residents' necessarily means that people counted in the census who usually reside overseas, for example, visiting tourists, are excluded). The question in the 1991 Census from which these data were derived was as follows:

What is each person's usual address?

- 'Usual' address is that address at which the person has lived or intends to live for a total of 6 months or more in 1991.
- For persons who now have no usual address, regard this dwelling as their usual address.
- For boarders at boarding school or college, give address of school or college.

(ii) The census counts of residents are then adjusted upwards to compensate for census net undercount. About 2 per cent of the population are not counted by the census. The precise degree of adjustment is based on Post-Enumeration Survey results as well as comparisons between census results and independent 'demographic' and other estimates of the population.

The Post-Enumeration Survey is a sample survey conducted immediately after the census to estimate the number of people (and their characteristics) who for one reason or another did not complete or were not included on a census form. It also detects instances of double counting of individuals but the number of such cases is far outweighed by the number of people who are not counted. The net undercount is therefore the excess of the undercount (people not counted) over the number of instances of double counting. Details of the 1991 Post-Enumeration Survey are available in *1991 Census – Data Quality – Undercount* (2940.0).

The 'demographic' estimates are an annual population series for Australia as a whole, compiled solely from registered births and deaths and overseas migration data from 1925 onwards i.e. they are compiled irrespective of census counts (see Appendix A).

A detailed description of the 1991 adjustment for net undercount is contained in Chapter 4.

(iii) Estimates of the number of Australian residents temporarily overseas on census night are added to the adjusted census counts derived in (ii). Estimates of the number of Australian residents temporarily overseas on census night are obtained from passenger card statistics for those Australian residents returning in the twelve month period subsequent to the census date who indicated that they were overseas on census night.

(iv) If the census does not fall on 30 June, a further adjustment is necessary to arrive at estimates for that date. For example, the 1991 Census was held on 6 August, and after steps (i)–(iii) were finalised the population estimates at 6 August had to be back-dated to 30 June. This was accomplished using data from births and deaths registrations, overseas arrivals and departures data and estimates of interstate migration for the period 1 July–6 August.

Post-censal population estimates

(a) Estimates of total population

Using the census date (i.e. 30 June) population estimates as the initial base population, post-censal estimates at the national level are compiled in accordance with births, deaths, and overseas migration. At the State level, an additional item, interstate migration, is included.

This updating process can be expressed mathematically as follows:

$$P_{t+1} = P_t + B_{t,t+1} - D_{t,t+1} + O_{t,t+1} + I_{t,t+1}$$

where:

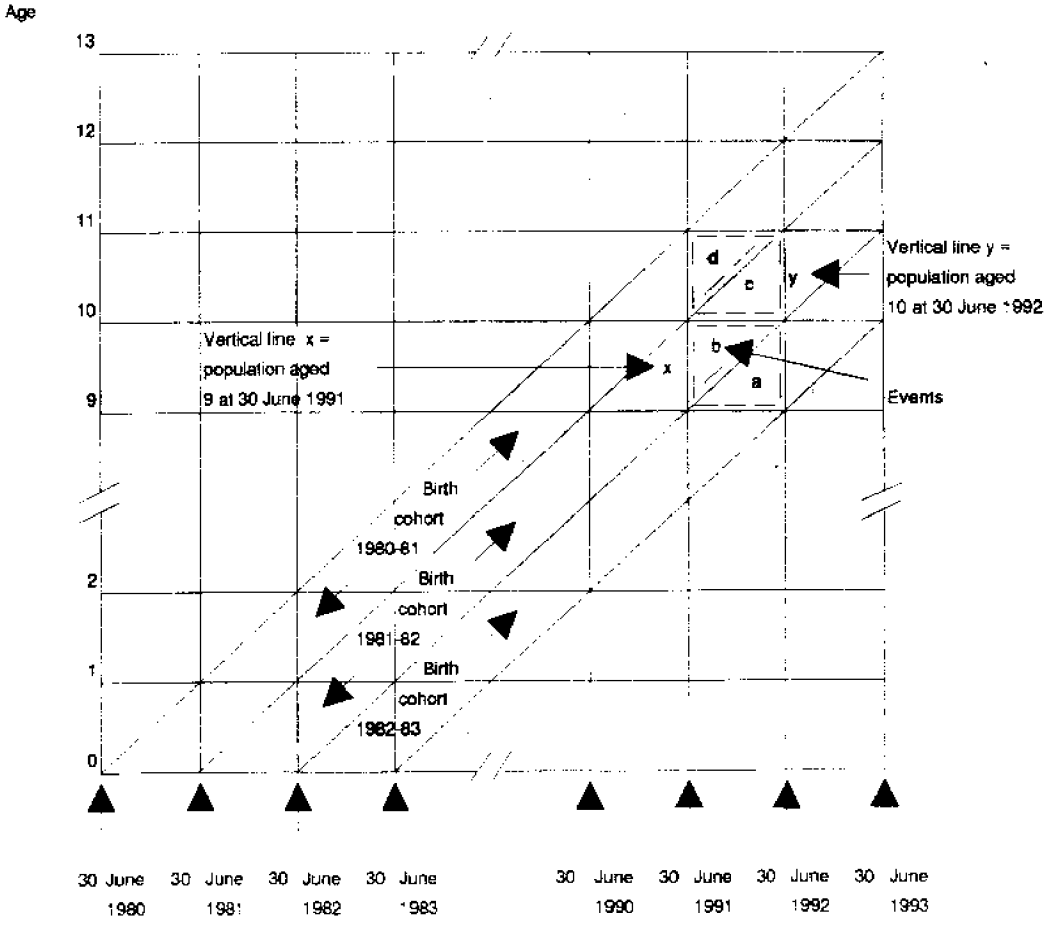
P_t = estimated population at the end of period t
P_{t+1} = estimated population at the end of period t+1
$B_{t,t+1}$ = births during period t,t+1
$D_{t,t+1}$ = deaths during period t,t+1
$O_{t,t+1}$ = net overseas migrants during period t,t+1
$I_{t,t+1}$ = net interstate migrants during period t,t+1

The resulting updated population estimates (i.e. P_{t+1}) then become the base populations in the calculation of estimates for the following period.

(b) Estimates by age

This basic procedure, outlined above, is used not only to update the total population, but also to update the age disaggregation of the population. Population estimates by single years of age are compiled annually as at 30 June, by updating the census date estimates by age. These annual updates require data for the components of population change to be classified by financial year of birth in order to match each event to its corresponding cohort in the population. (Population estimates by single years of age at 30 June in effect are a classification of the population according to financial year of birth.) However, classification by financial year of birth is only available for two of the three components of change i.e. births and migration. It is not available for deaths because, apart from a few exceptions (each State has its own notification form), death certificates only require notice of the deceased person's age at the time of death; they do not require date of birth. Knowledge of a person's age is not sufficient information to determine whether that person's birthday falls in the current financial year or the previous one. The problem can be illustrated in a Lexis diagram, (Chart 1) which displays the relationship between events classified by age at the time of event and events classified by birth cohort. The birth cohort aged 9 at 30 June 1991, i.e. those born between 1 July 1981 and 30 June 1982, for example, is represented by the vertical line x. The demographic events comprising the components of change between 30 June 1991 and 30 June 1992 for this cohort fall within the triangles 'b' and 'c'. The vertical line y represents the cohort at 30 June 1992 when it is aged 10. However, those demographic events occurring in the financial year 1991–92 and aged 9 at the time of occurrence are represented by triangles 'a' and 'b', while those occurring to 10 year olds are represented by triangles 'c' and 'd'. To estimate the population aged 10 years at 30 June 1992 by updating those aged 9 at 30 June 1991, the number of events represented by triangles 'b' and 'c' need to be separately estimated (i.e. 'b' to be separated from 'a', and 'c' to be separated from 'd'), so that these events can be matched to the birth cohort which experienced them.

CHART 1 : RELATIONSHIP BETWEEN AGE AND PERIOD OF BIRTH



Since death records do not contain data on date of birth, age at death of the deceased must be converted to financial year of birth. This is done by assuming an even distribution of deaths across the year for all ages except ages 0 (under 1) and 1. Infant deaths have a heavily skewed distribution (a large proportion of deaths at age 0 occur in the first four weeks of life), and the conversion of age 0 to financial year of birth takes this into account. The conversion of age 1 to financial year of birth also takes into account the slightly skewed distribution of deaths at that age.

The conversion from age to birth cohort is based on the following relationship:

$$D^x_{c(t,t+1)} = f^x (D^x_{t,t+1}) + (1 - f^x) (D^x_{t+1,t+2})$$

where:

$D^x_{c(t,t+1)}$ = deaths at age x to birth cohort c born in year t to t+1
$D^x_{t,t+1}$ = deaths at age x in year t to t+1
f^x = 'separation' factor for deaths at age x

For deaths aged 0, the separation factor calculated from Australian data is around 0.85, indicating that of the deaths aged 0 in a particular year, 85 per cent were born in that year and 15 per cent were born in the previous year.

For deaths aged 1, the separation factor is around 0.60. For deaths aged 2 and over, the separation factor is about 0.50, indicating an even distribution of deaths over time at those ages.

Updating population of the States and Territories by age involves an additional conversion from 'age' to 'birth cohort'. Interstate migration estimates, which are compiled by age, must also be converted to financial year of birth. This is done by assuming an even distribution of movers' date of birth within each age, including, in this case, ages 0 and 1.

Estimates by marital status

Annual estimates of the population by marital status are compiled as at 30 June by single years of age and sex for Australia as a whole. They commence initially from census date estimates and are updated using the component method i.e. using data from births, deaths, marriages, divorces and migration records.

The marital status categories for which the estimates are produced — single, married, widowed and divorced — refer to 'registered' marital status. People who state at the census that they are 'separated but not divorced', for example, are classified in the estimates as 'married'. People in de facto relationships are classified according to their registered status.

Census date population estimates by marital status

Compilation of population estimates by marital status, single years of age and sex at the census date, which provide the base population from which subsequent post-censal estimates are derived, involves the following steps:

(i) Census counts of residents are compiled by single years of age and sex for each marital status category. ('Census counts of residents' necessarily means that overseas visitors who are counted in the census are excluded.) Marital status is imputed for people who did not respond to this question on the census form.

(ii) Net undercount rates derived from the Post-Enumeration Survey for total (not disaggregated by age) males and total females in each marital status category, are applied to the totals of the census counts in (i) to obtain adjusted census counts of total males and females for each marital status.

(iii) Using an iterative proportionate fitting procedure (see Appendix B), the initial census counts of residents by single years of age and sex for each marital status in (i) are forced to add to the adjusted totals derived in (ii). These are in turn forced to add to the census counts of all residents by age and sex adjusted for undercounting as described above (see Census date population estimates — item (ii) on page 4).

(iv) Estimates of Australian residents temporarily overseas on census night by age and sex for each marital status are added to the adjusted census counts derived in (iii).

(v) If the census does not fall on 30 June, a further adjustment is necessary to produce estimates as at the nearest 30 June reference date. For example, the 1991 Census was held on 6 August, and after steps (i)–(iv) were finalised the population estimates at 6 August had to be back-dated to 30 June. This was accomplished using data on births, deaths, marriages and divorces registrations and overseas arrivals and departures for the period 1 July–6 August.

Post-censal estimates by marital status

Marital status estimates by age for post-censal years are compiled as at 30 June by updating the census year estimates according to changes to the overall size of the population resulting from births, deaths and overseas migration, as well as changes in the marital status category of the existing population due to marriage, divorce, and death of spouse.

Each component of change is first converted to financial year of birth in order to match events with the corresponding population birth cohorts. The population for each marital status for each birth cohort is then updated as follows:

$$P^s_t = P^s_{t-1} + B_t - D^s_t + O^s_t - MAR^s_t$$

$$P^m_t = P^m_{t-1} - D^m_t - DIV_t + MAR^d_t + MAR^w_t + MAR^s_t - WID_t + O^m_t$$

$$P^d_t = P^d_{t-1} - D^d_t + DIV_t - MAR^d_t + O^d_t$$

$$P^w_t = P^w_{t-1} - D^w_t + WID_t - MAR^w_t + O^w_t$$

where:

P^i_t = population at end of quarter t of marital status i for i = m (married), s(single), d(divorced), and w(widowed).

B_t = births in quarter t

D^i_t = deaths in quarter t of persons in marital status i

O^i_t = net overseas migrants in quarter t of marital status i

MAR^i_t = marriages in quarter t of persons with previous marital status i

DIV_t = divorces in quarter t

WID_t = widowhoods in quarter t

Data for each of the above events (except for widowhoods) are available by age from the various State Registrars (births, deaths and marriages), the Family Law Court (divorces) and the Department of Immigration and Ethnic Affairs (migration). Data on widowhoods by age are not available because Australian death certificates do not require notice of the age or date of birth of a surviving spouse. Age at widowhood is therefore estimated by assuming that the relative single year age distribution of husbands and wives at the last census applies to surviving spouses.

Estimates by country of birth

Annual population estimates by country of birth are also compiled as at 30 June for Australia as a whole. These estimates, which are by single years of age and sex, classify the population according to over 60 countries of birth.

Census date population estimates by country of birth

Population estimates by country of birth at the census date are compiled as follows:

(i) Census counts of residents are compiled by single years of age and sex for each country of birth. ('Census counts of residents' necessarily means that overseas visitors who are counted in the census are excluded.) Country of birth is imputed for those people who did not respond to this question on the census form.

(ii) Net undercount rates are derived from the Post-Enumeration Survey for total (not disaggregated by age) males and females classified into twelve groups of countries of birth. Undercount rates are assumed to be the same for each country within a group. These rates are applied to the totals of the census counts in (i) to obtain adjusted total census counts of males and females by country of birth.

(iii) Using an iterative proportionate fitting procedure (see Appendix B), the initial census counts of residents by single years of age and sex for each country of birth in (i) are forced to add to the adjusted totals derived in (ii). These are in turn forced to add to the census counts of all residents by age and sex of the total population adjusted for undercounting as described above (see Census date population estimates — item (ii) on page 5).

(iv) Estimates of Australian residents temporarily overseas on census night, by age, sex and country of birth are added to the adjusted census counts derived in (iii).

(v) If the census does not fall on 30 June, a further adjustment is necessary to produce estimates as at the nearest 30 June reference date. For example, the 1991 Census was held on 6 August, and after steps (i)–(iv) were finalised the population estimates at 6 August had to be back-dated to 30 June. This was accomplished using data on births and deaths registrations and overseas arrivals and departures for the period 1 July–6 August.

Post-censal estimates by country of birth

Population estimates by country of birth for post-censal years are compiled as at 30 June by updating the census year estimates in accordance with births, deaths and overseas migration. Each component of change is first converted to financial year of birth. The updates are then compiled, using the following equations, for each age and sex category separately. For brevity, subscripts to indicate age have been dropped from the equations.

For the Australian-born population

$$P^a_t = P^a_{t-1} + B_t - D^a_t + O^a_t$$

For all other countries of birth

$$P^b_t = P^b_{t-1} - D^b_t + O^b_t$$

where:

P^b_t = population at end of quarter t born in country b

B_t = births in quarter t

D^b_t = deaths in quarter t of persons born in country b

O^b_t = net overseas migration in quarter t of persons born in country b

Experimental estimates of indigenous population

Annual estimates of the indigenous (Aboriginal and Torres Strait Islander) population by age (in five year groups) and sex for the States, Territories and Australia were compiled for the first time for the years 1986 to 1991. (See *June 1986 to June 1991 Experimental Estimates of the Aboriginal and Torres Strait Islander Population* (3230.0)). The estimates are 'experimental' in that the standard approach to population estimation is not possible because satisfactory data on births, deaths and internal migration are not generally available. The estimates are also affected by changes in the propensity of people to identify as being of indigenous origin.

The experimental estimates used as their starting point the census count at 30 June 1991 adjusted for non-response to the Aboriginal/Torres Strait Islander origin question in the census, mis-statement of age, young adult undercount and net census undercount. Estimates of population for the years back to 1986 were then compiled retrospectively. For the purposes of these estimates it was assumed that there was no interstate or overseas migration and that therefore the only changes to population resulted from births and deaths. Synthetic data for births were compiled retrospectively by applying single year life table survival values to adjusted census counts of the population aged 1, 2, 3, 4 and 5 at 30 June 1991. Finally data for deaths were compiled retrospectively, one year at a time, by applying independently estimated age-specific death rates initially to the adjusted census count at 30 June 1991.

Intercensal revision of population estimates

When the census date (i.e. 30 June) population estimates become available for the States, Territories and Australia they can be compared with the alternative estimates for the same date already produced by updating the previous census date estimate (using births, deaths and migration data). The difference between the two estimates for each State, Territory and Australia is called the 'intercensal discrepancy'.

Of these two estimates, the first is customarily adopted as the true estimate i.e. the true estimate at the census date is the one based on the census at that date, not the one carried forward from the previous census.

To overcome the break in continuity that this would entail, all population estimates updated from the previous census are then revised. In doing so, it is assumed that the discrepancy is accumulated by an equal number each quarter over the intercensal period. For example, in the case of a five-year intercensal period i.e. 20 quarters, the population at the end of the first quarter is adjusted up or down by 1/20 of the intercensal discrepancy, the second quarter is adjusted by 2/20, the third by 3/20 etc until the final quarter, corresponding to the new census date, which is adjusted up or down by a number equivalent to the whole intercensal discrepancy.

Details of the intercensal discrepancy for the States, Territories and Australia at 30 June 1981, 1986 and 1991 are shown in the following table.

TABLE 2.1 INTERCENSAL DISCREPANCY BY STATE/TERRITORY OF USUAL RESIDENCE AT 30 JUNE

	1981	*1986*	*1991*
	PERSONS '000		
New South Wales	33.1	11.9	2.4
Victoria	48.5	3.9	7.0
Queensland	- 51.9	- 32.0	11.1
South Australia	1.7	- 9.4	10.4
Western Australia	1.0	- 18.4	29.9
Tasmania	4.7	0.4	- 6.3
Northern Territory	4.3	- 6.3	- 6.7
Australian Capital Territory	9.5	5.5	4.2
Australia	**50.9**	**- 44.4**	**51.9**
	PER CENT OF POPULATION		
New South Wales	0.63	0.22	0.04
Victoria	1.23	0.09	0.16
Queensland	- 2.21	- 1.22	0.34
South Australia	0.13	- 0.68	0.72
Western Australia	0.08	- 1.26	1.83
Tasmania	1.10	0.09	- 1.35
Northern Territory	3.51	- 4.08	- 4.05
Australian Capital Territory	4.17	2.12	1.45
Australia	**0.34**	**- 0.28**	**0.30**

NOTE: Positive figures indicate that the population estimate updated from the previous census was too high.

There are two possible sources of error which contribute to the intercensal discrepancy:

(i) errors in the census-based estimates of the population at the current or previous census date; and/or

(ii) errors in the estimates of any of the components of population change since the previous census.

An assessment of the accuracy of census date population estimates and the components of population change is given in Chapter 4.

Intercensal revision 1986–91

For the State and Territory estimates for the period 1986–91, it was possible to determine from the census how much of the intercensal discrepancy was due to inaccuracies in estimates of interstate migration. The 1991 census data which allowed this assessment were from the two census questions on usual residence 1 year ago and 5 years ago. Estimates of interstate migration based on census data were used to revise the interstate migration component of population updates for the intercensal period, before the remainder of the intercensal discrepancy was distributed.

(a) Revisions of interstate migration

Comparisons of the Medicare-based estimates of interstate migration (see Appendix F) for the 1986–91 period, with 1991 census counts of 1986–91 interstate migration (adjusted to include an estimate for ages 0 to 4), showed the following differences:

TABLE 2.2 NET INTERSTATE MIGRATION: COMPARISON BETWEEN MEDICARE-BASED ESTIMATES AND CENSUS DATA 1986–91

	Interstate migration 1986–91			*Preliminary intercensal discrepancy(b) 30 June 1991*
	Estimated(a)	*Census*	*Difference*	
New South Wales	– 119,819	– 98,967	– 20,852	– 1,300
Victoria	– 65,900	– 47,055	11,100	11,100
Queensland	154,827	131,535	23,292	5,900
South Australia	1,437	– 4,145	5,582	9,500
Western Australia	36,808	17,088	19,720	29,100
Tasmania	5,960	335	– 6,295	– 6,400
Northern Territory	– 13,754	– 4,093	– 9,663	– 7,900
Australian Capital Territory	12,361	5,302	7,059	3,800

(a) Medicare-based estimates cumulated quarterly. (b) Discrepancy between preliminary 1991 census-based population estimates and estimates at 30 June 1991 as carried forward from the 1986 Census. Revisions of interstate migration for 1986–91 were made before final 1991 census-based estimates became available.

When compared with the corresponding 1986–91 preliminary intercensal discrepancies at 30 June 1991, these differences can be interpreted as follows:

(i) The intercensal discrepancies for South Australia, Western Australia, Tasmania, Northern Territory and the Australian Capital Territory appear to be largely caused by errors in estimates of interstate migration. For Western Australia it appears that approximately 9,000 of the discrepancy was caused by a Post Enumeration Survey over-adjustment in 1986.

(ii) The estimates for New South Wales, Victoria and Queensland, although very different to census counts, are as expected. They include movements of overseas migrants who arrived in Australia after the 1986 Census, and subsequently moved interstate. Census data does not include such movements. The relatively low intercensal discrepancies for these three States support the Medicare-based 1986–91 interstate migration estimates for these States.

Based on the above interpretations, the following steps were undertaken to revise 1986–91 interstate migration estimates:

(i) For Tasmania, Northern Territory and the Australian Capital Territory the estimates were altered by the amount of the intercensal discrepancy, e.g. the Australian Capital Territory was adjusted from 12,361 to 12,361 – 3,800 = 8,561.

(ii) For Western Australia and South Australia, where errors in interstate migration cannot explain all of the intercensal discrepancy, the census counts were used.

(iii) For New South Wales, Victoria and Queensland the Medicare-based estimates were used but an adjustment was made to each of these States to ensure that the 1986–91 net interstate migration estimates summed to zero for Australia as a whole.

The resulting revised 1986–91 estimates were as follows:

TABLE 2.3 NET INTERSTATE MIGRATION, 1986–91

New South Wales	– 113,819
Victoria	-60,900
Queensland	158,629
South Australia	– 4,145
Western Australia	17,088
Tasmania	440
Northern Territory	– 5,854
Australian Capital Territory	8,561
Australia	**0**

(iv) The above revised 1986-91 estimates were then divided into two parts:

(a) Net movement for 1990–91. These data were available from the census question asking place of usual residence one year ago.

(b) Net movement for 1986–90. These data were obtained by subtracting the figures for 1990–91 from the totals for 1986–91.

(v) For South Australia, Western Australia, Tasmania, Northern Territory and the Australian Capital Territory the census counts of net interstate migration for 1990–91 (adjusted for age 0) were accepted. Net movement for 1986–90 therefore remained the difference between the

revised totals for 1986–91 and census counts for 1990–91 as calculated in (iv) (b).

As for the 1986–91 estimates, the pre-census estimates of interstate migration for New South Wales, Victoria, and Queensland for 1990–91 were accepted over the census counts, because they included the significant net movement of overseas migrants from New South Wales and Victoria to Queensland. However, adjustments were made to these estimates to ensure that net interstate migration for Australia as a whole summed to zero. Net movement for 1986–90 was obtained by subtracting the 1990–91 pre-census estimates from the revised totals for 1986–91.

(vi) Quarterly net interstate migration estimates for 1990–91 and for the four years 1986–90 were calculated by spreading the total net gain/loss for each State/Territory over the 4 quarters for 1990–91 and the 16 quarters for 1986–90 pro rata the original quarterly Medicare-based estimates.

(b) Distribution of remainder of intercensal discrepancy
The remainder of the intercensal discrepancy for the 1986–91 period, after adjusting for errors in interstate migration estimates, was distributed evenly over the intercensal period for each birth cohort as follows:

For cohorts born prior to the 1986 census date, i.e. the start of the intercensal period,

$ID^R i$ = $ID^R/20$ for each quarter i of the intercensal period (20 quarters)

where:

$ID^R i$ = remainder of intercensal discrepancy for quarter i

ID^R = total remainder of intercensal discrepancy

For cohorts born between the two censuses, the remainder of the intercensal discrepancy was split over those quarters comprising and following the financial year of birth, that is,

$ID^R i = ID^R/4n$

where n is the number of financial years that the cohort has been represented in the population including the financial year of birth of the cohort. For example the discrepancy for the cohort born in the 1990–91 financial year can only be distributed over the 1990–91 period, while the discrepancy for those born in 1989–90 can only be distributed over the two financial years 1989–90 and 1990–91.

These formulae were also used for distributing the intercensal discrepancy over the quarterly State and Territory estimates as well as national estimates by marital status and country of birth which, although only published on an annual basis, are compiled quarterly.

(c) Final revised intercensal population estimates
The revised estimates of the population for the intercensal period were calculated simply by adjusting the quarterly population estimates calculated prior to census results becoming available, in accordance with the intercensal discrepancy allocated to the interval between the beginning of the intercensal period and the reference quarter being estimated, i.e.

$$P_q = P_q + \sum_{i=1}^{q} ID_i^{IM} + \sum_{i=1}^{q} ID_i^{R}$$

where:

P_q = revised population at end of quarter q

P_q = original population at end of quarter q

$\sum_{i=1}^{q} ID_i^{IM}$ = intercensal discrepancy (interstate migration) for quarters 1 to q

$\sum_{i=1}^{q} ID_i^{R}$ = intercensal discrepancy (remainder) for quarters 1 to q

(d) 1991 Northern Territory correction
In 1994 an additional check on 1991 census-date population estimates was made. This entailed estimating the indigenous population (using newly derived experimental estimates) and the non-indigenous population separately for each State and then adding the two together. The result was then compared with the final estimate in (c).

The check identified an additional undercount of 1,045 persons in the Northern Territory which will eventually form part of the 1991–96 intercensal discrepancy. No other State was affected. As an interim measure adjustments were made to the quarterly Northern Territory estimates from September 1991 to December 1993 to include these people.

CHAPTER 3

METHODS OF ESTIMATION: STATISTICAL LOCAL AREA POPULATIONS

Population estimates at sub-State level are compiled for geographical areas known as Statistical Local Areas (SLAs) in accordance with the Australian Standard Geographical Classification (ASGC) of the ABS. These SLAs, which generally conform to Local Government Areas, are the basic unit of a hierarchy of geographic areas within each State and Territory for which estimates are compiled. (For more details see the Glossary).

While national and State/Territory population estimates are compiled quarterly, SLA estimates are compiled for 30 June each year only. All SLA estimates are constrained to add to their respective State/Territory population totals.

An age/sex disaggregation of all SLA population estimates has been produced annually since 1986. The estimates are published in five year age groups and are also available by single years of age for census years.

For each year's SLA estimates, a database is created for years back to the beginning of the last intercensal period according to current boundaries. This is not, in those cases where boundaries have changed, a revision of past estimates, but rather a statistical base for time-series analysis.

Census date SLA estimates

The method used to compile census date SLA estimates is similar to that used for national and State/Territory estimates.

Census counts of usual residents by SLA are adjusted for undercounting using data from the census Post-Enumeration Survey. Estimates of Australian residents temporarily overseas are then added to these adjusted census counts. If the census does not occur on 30 June (for example the 1991 Census was run on 6 August) then a further adjustment is made to produce estimates at the nearest 30 June reference date. A variation of the component method is used for this adjustment.

The small sample size relative to the large number of SLAs (approximately 1,300 in 1991), places restrictions on the reliability of the PES as a measure of undercounting for SLAs. Consequently, undercounting is estimated using an iterative proportional fitting method (see Appendix B). Based on the premise that undercounting is related to age, sex and location, it is assumed that differentials for these characteristics at the SLA level reflect differentials at the State/Territory level for age and sex, and capital city/rest of State level for location.

The iterative proportional fitting method uses the following three data sets:

(i) For each SLA, census counts of usual residents compiled by single years of age and sex.

(ii) For States and Territories, census counts of usual residents by single years of age and sex, adjusted for undercounting.

(iii) For capital cities/rest of State, census counts of total usual residents by sex, adjusted for undercounting.

Using the data sets in (ii) and (iii) as marginal controls, the census counts in (i) are adjusted in two stages:

(i) The first stage is to derive census counts of residents in capital cities/rest of State by single years of age and sex, adjusted for undercounting. These are forced to add to both data sets (ii) and (iii) above.

(ii) The second stage is to adjust the census counts for SLAs by age and sex to match the estimates which were derived in the previous step. In the States, but not the two Territories, this is done separately for SLAs in the Capital City and balance of State.

Finally, estimates of the number of Australian residents temporarily overseas, derived from data on residential addresses reported by these residents on returning to Australia after the census date, are added to their respective SLAs. (All persons arriving in Australia, including Australian residents returning, are required to report their intended address which is taken to be the usual residence.)

Post-censal SLA population estimates

Unlike post-censal population estimates at the national and State levels, estimates for each State's SLAs are compiled independently, so that although there is a degree of standardisation, local circumstances lead to variations between the methods used in different States. This applies particularly to the estimation of *total* population in each SLA; the methods used for estimating the age/sex composition of the population are the same for all States.

Population totals

Although annual births and deaths data are available for SLAs, the absence of migration data for non-census years means that it is not possible to use the component method to update SLA population totals. Instead, a variety of regression and other updating techniques are applied.

'Regression techniques', which are used for most States, first establish a relationship based on past data between population growth and the growth in 'symptomatic indicator(s)'. Symptomatic indicators are any available set of data which in some way relate to changes in population size. The choice of symptomatic indicators varies from State to State. Some examples are: the number of dwellings in the area, school enrolments, and the number of Medicare enrolments. The relationships between population growth and symptomatic indicators are expressed mathematically in terms of 'regression coefficients' and, with the knowledge of the growth in the *indicators* for the current time period they enable population growth to be

estimated. The regression technique used is the 'difference correlation' method which is explained in Appendix C.

As well as, or in association with regression techniques, a range of alternative procedures based on established relationships between changes in symptomatic indicators and population change are used to update total SLA population estimates.

Dissaggregation of post-censal SLA population totals by age and sex

Post-censal estimates of the age and sex distributions of SLA populations are made by updating the age/sex profile at the census date using annual births (by sex), deaths (by age and sex) and a derived age and sex profile of migration.

While annual data on births by sex and deaths by age and sex are available for each SLA, data on migration into and out of SLAs for post-censal years are not available and have to be derived indirectly:

(i) The estimate of total population growth (see above) for each SLA for the twelve months is split into natural increase and net migration components. Natural increase is derived for each SLA from birth and death registration statistics. Net migration is derived for each SLA as the difference between total population growth and natural increase. Net migration is then split into internal and overseas migration components pro rata a combination of 1986 census data on internal movements for 1985-86 (comparable data are not available from the 1991 Census), and overseas passenger card as well as 1986 census data on overseas movement for 1985-86, all supplemented by more recent observations.

(ii) The age/sex profiles of internal migration are assumed to be the same as those established in a set of profiles that were derived for each SLA from 1986 census data on comparisons with usual residence one and five years prior to the census date. These profiles were produced for:

(a) Inter-SLA arrivals — persons residing in the SLA whose usual residence one year ago was in another SLA within Australia.

(b) Inter-SLA departures — persons whose SLA of usual residence one year ago was that SLA but whose residence at the date of the census was another SLA within Australia.

(iii) An SLA's overseas arrivals/departures profile is assumed to have the same age/sex profile as 1991 census counts for that SLA of people whose usual residence one year ago was overseas. The departure profile for each SLA is assumed to be the same as the arrival profile in the absence of age-sex data of overseas departures at the SLA level from either the census or outgoing passenger cards. For arrivals, the total of all SLAs is constrained to the age/sex profile of permanent and long-term arrivals for 1990–91 for the State/Territory in which it lies. For departures, the total of all SLAs is constrained to the age/sex profile of permanent and long-term departures for 1990–91 for the State/Territory in which it lies.

In greater detail, the process involves the following procedures:

(i) Estimation of net migration totals during year t to t+1 for each SLA

This step requires population estimates for each SLA as at year t and t+1, and recorded births and deaths occurring during the period t to t+1.

The net migration is calculated as:

$$N = P_{t+1} - P_t - B + D \quad (1)$$

where P denotes the total population, B births, D deaths, and N net migration during the twelve month period from t to t+1.

It should be noted that net migration for age 0 (under 1) must be estimated separately from ages 1 and over because the age/sex profiles compiled for migration (see (iii) below) are for ages 1 and over only. Based on the age distribution of Medicare change of address data, net migration at age 0 is estimated by assuming it to be 60 per cent of the net migration for age 1.

Having obtained net migration at age 0, net migration at ages 1 and over is obtained as follows:

$$N_{1+} = N - N_0 \quad (2)$$

(ii) Split of net migration at ages 1 and over into four components

Net migration obtained in equation (2) is now split into internal arrivals and departures and overseas arrivals and departures. For brevity, subscripts for age have been dropped from the following equations.

$$\text{Thus, } N = IA - ID + OA - OD \quad (3)$$

where IA and ID are internal arrivals and departures, and OA and OD are overseas arrivals and departures.

The first estimate of the four components of migration is obtained by multiplying the total population at time t+1 by a 'movement rate' specific for each component and calculated from 1986 census movement data for SLAs for the period 1985–86. (These data were not available from the 1991 Census.)

$$\text{Thus, } IA = (P^{t+1})\,(IA^{I}) \quad (4)$$

where IA^I is the 'movement rate' for internal arrivals and is obtained from equation (5).

$$IA^I = (IA^{t,t+1})/P^t \quad (5)$$

ID, OA, and OD are calculated in the same way. Once a first estimate of each of the four components of migration has been obtained (equation (4)), a plus-minus pro-ration procedure is used to satisfy equation (3). The pro-ration is

also done in a manner to ensure that when all SLAs in a State are added, the components equal the State levels. The plus-minus pro-ration procedure is explained in Appendix D.

(iii) Determination of the age-sex profile for each component of migration

Although the total numbers of movers, as determined in (ii) above, may change from year to year, their proportionate age/sex profiles are assumed to remain constant. This assumption is supported by the stability of profiles observed in the 1981 and 1986 Censuses (IA, ID and OA) and in records of overseas departures (OD).

To establish the constant age/sex profiles for IA and ID, four trial profiles were tested against data for 1986-91. For each SLA the trial profile giving the best results was selected for use. All based on 1986 census questions asking place of usual residence one and five years ago (the full range of data was not available from the 1991 census questions), the trial profiles were:

(i) 1 year movement data, SLA-specific;

(ii) 5 year movement data, SLA-specific;

(iii) 1 year movement data, clustering socio-demographically similar SLAs; and

(iv) 1 year movement data, clustering SLAs on the basis of similarity of migration profiles.

Derivation of the age/sex profiles for overseas migration is described above (see previous page).

(iv) Age-sex SLA population estimates

Having established estimates of the migration component, the census date population estimates for each SLA by age and sex are then updated in the normal way i.e. after converting to financial year of birth, when necessary — by adding births, subtracting deaths and adding/subtracting migration. (A more detailed account of this procedure at the national/State level is given in Chapter 2.)

Intercensal revision of population estimates

When the census year (i.e. 30 June) population estimates become available for the SLAs they can be compared with the preliminary estimates for the same date already produced by updating the previous census (using the method described above). The difference between the two estimates for each SLA is called the 'intercensal discrepancy'.

Of these two estimates, the first is customarily adopted as the true estimate i.e. the true estimate for each SLA is the one based on the census at that date, not the one carried forward from the previous census.

To overcome the break in continuity that this would entail, all population estimates updated from the previous census are then revised. In doing so, it is generally assumed that the discrepancy accumulated by an equal number each year over the intercensal period. For example, in the case of a five-year intercensal period, the population at the end of the first year is adjusted up or down by 1/5 of the intercensal discrepancy, the second year is adjusted by 2/5, the third by 3/5 etc until the final year, corresponding to the new census date, which is adjusted up or down by a number equivalent to the whole intercensal discrepancy.

Details of the intercensal discrepancy for the SLAs at 30 June 1991 are shown in the following table:

TABLE 3.1 INTERCENSAL DISCREPANCY AT 30 JUNE 1991: STATISTICAL LOCAL AREAS

Percentage error	*NSW(a)*	*Vic.(a)*	*Qld(a)*	*SA(a)*	*WA(a)*	*Tas.(a)*	*NT(a)*	*ACT(b)*	*Aust.(a)*
				NUMBER OF SLAS					
5.0 < pe	11	15	71	7	34	3	9	14	164
2.0 < pe < = 5.0	24	48	71	19	28	11	11	13	225
0.0 < pe < = 2.0	50	57	62	30	20	19	9	19	266
2.0 < pe < = 0.0	46	48	64	34	14	5	9	26	246
5.0 < pe < = – 2.0	25	33	50	18	11	2	9	9	157
pe < = 5.0	23	8	94	5	9	-	7	6	152
Total	**179**	**209**	**412**	**113**	**116**	**40**	**54**	**87**	**1,210**
				PER CENT					
5.0 < pe	6.2	7.2	17.2	6.2	29.3	7.5	16.7	16.1	13.5
2.0 < pe < = 5.0	13.4	23.0	17.2	16.8	24.1	27.5	20.3	15.0	18.6
0.0 < pe < = 2.0	27.9	27.2	15.1	26.6	17.2	47.5	16.7	21.8	22.0
– 2.0 < pe < = 0.0	25.7	23.0	15.5	30.1	12.1	12.5	16.7	29.9	20.3
– 5.0 < pe < = 2.0	14.0	15.8	12.2	15.9	9.5	5.0	16.7	10.3	13.0
pe < = – 5.0	12.8	3.8	22.8	4.4	7.8	-	12.9	6.9	12.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Excludes non-metropolitan SLAs with population less than 1,000 at 30 June 1991. (b) Excludes SLAs with population less than 200 at 30 June 1991.

The estimated population at 30 June 1991 derived by updating the previous census, exceeded the 1991 census-based population by 51,900 — see Chapter 2. In other words the intercensal discrepancy was 51,900. It followed that the number of SLAs for which population was over-estimated (655) exceeded the number under-estimated (555).

The same pattern was particularly evident in Western Australia, the State with the highest intercensal discrepancy, where the number of SLAs over-estimated (82) far exceeded the number under-estimated (34).

In Queensland and South Australia however, where the intercensal discrepancy was also positive, there was no imbalance at all. In other words the number of SLAs over-estimated equalled the number under-estimated. The imbalance therefore lay in the degree of over/under estimation rather than the number of SLAs where this occurred. Comparison between the quality of SLA population estimates in the various States must also take into consideration variations in the area, population size and distribution, and growth rates within SLAs which goes beyond the scope of this paper.

CHAPTER 4

DATA SOURCES AND THEIR ACCURACY

The accuracy of population estimates is dependent on the quality of population census data, and the statistics of the components of population change which are used to update the census year population. This chapter discusses these various sources of data and their accuracy.

Base population

Census count of residents

The base population for population estimates, which is derived from the latest available Population Census, comprises residents only i.e. people whose place of usual residence is in Australia. Censuses, however, are currently enumerated on a 'de facto' basis i.e. they include all persons actually located within the geographic boundary of Australia except for foreign diplomats and their families. They therefore include visitors to Australia even if they are only visiting for short durations e.g. tourists. Nevertheless the census question on address (see beginning of Chapter 2; see also Glossary) provides the information needed to identify these non-residents so that they can be excluded for the purpose of estimating the population.

The same census question provides the information needed to identify the residents of each State/Territory. For example, the residents of a particular State are only those people whose place of usual residence, as declared in the question, is in that State.

Similarly, the same principle applies for smaller areas such as Statistical Local Areas.

Non-response to census questions

Besides the question on address, questions on age, sex, marital status, country of birth and indigenous origin are particularly important in the context of estimating population. Instances in which people do not answer these questions therefore have a bearing on the accuracy of census counts, although wherever possible information is imputed by the ABS from other details supplied on the census form or, failing that, using a variety of imputation techniques. Details are imputed for all instances in which there is no response to questions on age and sex.

The table below shows that non-response to the questions which are of importance to population estimates has remained low in recent censuses. There is, however, a rising trend in non-response to the country of birth question, though from a low base. The higher rates of non-response to the question on marital status, especially in 1991, are believed to be related to the current high incidence of de facto marriages and divorce.

TABLE 4.1 RATE OF NON-RESPONSE TO CENSUS QUESTIONS, 1976 TO 1991
(per cent)

Variable	*1976 Census*	*1981 Census*	*1986 Census*	*1991 Census*
Sex	(a)	(a)	(a)	(a)
Age	2.8	1.8	1.8	2.0
Usual residence	1.5	1.3	1.1	(c)
Marital status(b)	4.1	3.6	3.3	6.9
Country of birth	(c)	1.2	1.6	2.2
Indigenous origin	(c)	3.8	1.7	3.2

(a) Not available but believed to be insignificant. (b) As a per cent of the population of all ages. However a considerable proportion of non-responding persons were aged under 15 years and never married. All persons aged under 15 were coded to never married. (c) Not available.

Census undercount

The level of coverage of the Australian Census is considered to be excellent, and compares favourably with censuses in other countries. Census data are used for a variety of purposes, without prior adjustment for undercounting. However, because population estimates are used in important ways such as government funding and electoral representation (noted in Chapter 1), and given that the level of undercounting is related to important variables such as country of birth, geographic area, age and sex which are used for population estimates, it was decided that as from 1971, for the purpose of estimating population, adjustments should be made to compensate for undercounting.

Census undercounting is measured primarily by the Post-Enumeration Survey, a sample survey conducted immediately after the Census. Details of the 1991 survey are available in *Census 91: Data Quality — Undercount* (2940.0).

Census undercount in States and Territories

The remarkably consistent rate of undercount for Australia as a whole for the last three censuses — it was 1.9 per cent in 1981 and 1.8 per cent in 1986 and 1991 — mask variations in the rates for the individual States and Territories. Only South Australia has been stable (1.6 per cent), although New South Wales, Victoria and the Australian Capital Territory have shown relatively small variations. In Queensland there has been a considerable decline — from 3.0 per cent in 1981, to 2.4 per cent in 1986 and 1.8 per cent in 1991. In Western Australia the rates have been higher than average at 2.2 and 2.1 per cent in 1986 and 1991 respectively. In the Northern Territory the rate was very high in 1981 (4.2%) and 1986 (5.5%), but fell to 2.9 per cent in 1991. (The Northern Territory has shown the highest rate of undercount of all States and Territories since post-enumeration surveys began in 1966 — see '1991 Northern Territory correction' at the end of Chapter 2.)

TABLE 4.2 UNDERCOUNT RATES BY STATE OF USUAL RESIDENCE

	1981 Census		*1986 Census*		*1991 Census*	
	Rate %	*Standard error*	*Rate %*	*Standard error*	*Rate %*	*Standard error*
New South Wales	1.8	0.1	1.5	0.2	1.9	0.1
Victoria	1.5	0.1	1.8	0.2	1.8	0.1
Queensland	3.0	0.2	2.4	0.2	1.8	0.1
South Australia	1.6	0.1	1.6	0.3	1.6	0.1
Western Australia	1.6	0.1	2.2	0.3	2.1	0.2
Tasmania	1.0	0.3	1.1	0.3	1.7	0.2
Northern Territory	4.2	1.3	5.5	1.4	2.9	0.7
Australian Capital Territory	1.4	0.5	1.6	0.8	1.4	0.2
Australia	**1.9**	**0.1**	**1.8**	**0.1**	**1.8**	**0.1**

Census undercount by age and sex

The rates of census undercounting by age and sex determined by the Post-Enumeration Survey show that the undercount is greatest in the young adult range, from approximately 15 to 35 years. This is so for both males and females. At all ages undercounting is greater for males than for females, averaging 2.2 per cent and 1.5 per cent respectively, for example, in 1991. The highest rates observed in 1991 were for males aged 20–29, averaging 4.3 per cent. The highest rate for females was approximately 3.0 per cent for the 20–24 year age group.

Census undercounting by age and sex is also assessed by comparison between census counts and 'demographic' estimates of the population. 'Demographic' estimates (see Appendix A) are population estimates for Australia as a whole compiled solely from data on demographic events i.e. births, deaths and overseas migration. They do not take into account any census data. For 1991, they were compiled from all events since 1925, resulting in estimates of the population age 0-64 years at 30 June 1991. When compared with census counts adjusted for undercounting according to the findings of the PES, the 'demographic' estimates indicated that the PES had not fully detected the extent of undercounting for males aged 15–29 years.

The third means by which age/sex census counts were assessed in 1991 was comparison with the sex ratio (males per 100 females) in each age group of people enrolled for Medicare.

The following table summarises adjustments that were made to compensate for undercounting in the 1991 Census in five-year age groups for both males and females. The three measures by which undercounting was assessed, namely the PES, the 'demographic' estimates and Medicare were each given weight i.e. none was allowed to over-ride the others where adjusting might have led to unrealistic results.

TABLE 4.3 CENSUS COUNTS BY AGE AND SEX, 30 JUNE 1991, AND ADJUSTMENT FOR UNDERCOUNTING ('000)

Age group (years)	*Census count(a)*	*PES estimate(a)*	*Demographic estimate(b)*	*Difference PES – Demographic*	*Adjusted PES estimate*	*Total adjustment rate (%)*
			MALES			
0–4	638.4	649.0	650.0	-1.0	649.0	1.7
5–9	640.4	649.9	646.5	3.4	649.9	1.5
10–14	628.9	636.2	630.9	5.3	636.2	1.2
15–19	674.8	689.4	696.4	-6.9	694.7	3.0
20–24	672.7	696.5	706.6	-10.1	702.3	4.4
25–29	662.3	690.4	698.7	-8.3	690.4	4.2
30–34	685.7	703.7	702.4	1.3	703.7	2.6
35–39	641.7	654.0	646.4	7.6	654.0	1.9
40–44	632.6	644.3	642.6	1.8	644.3	1.9
45–49	509.4	516.8	538.4	-21.6	516.8	1.4
50–54	418.0	425.0	428.8	-3.7	425.0	1.7
55–59	354.2	359.6	368.8	-9.2	359.6	1.5
60–64	353.8	356.2	367.8	-11.6	359.0	1.5
			FEMALES			
0–4	607.1	616.3	618.5	-2.2	616.3	1.5
5–9	609.3	617.3	615.5	1.8	617.3	1.3
10–14	595.3	601.0	597.2	3.8	601.0	1.0
15–19	646.0	658.7	662.0	-3.2	660.7	2.3
20–24	662.3	682.8	675.7	7.0	682.8	3.1
25–29	666.9	685.2	675.3	10.0	685.2	2.8
30–34	695.7	704.4	685.1	19.3	704.4	1.2
35–39	650.9	654.7	634.5	20.2	656.4	0.8
40–44	626.6	631.4	613.7	17.6	632.6	1.0
45–49	489.6	495.5	494.3	1.2	495.5	1.2
50–54	401.5	405.7	394.7	11.0	405.7	1.0
55–59	346.2	351.0	344.2	6.8	351.0	1.4
60–64	357.8	362.8	355.5	7.4	362.8	1.4

(a) Usual residence basis. (b) Based on post 1925 demographic events. This restricts age-grouping comparisons to under 65 years of age.

Census undercount by marital status and country of birth

The 1986 and 1991 undercount rates and their standard errors for the marital status categories and for selected countries of birth are shown in the following table. To a certain extent the rates reflect the age structures of the various categories. For example, the never married category, which has the highest undercount rate in the marital status classification, includes a higher proportion of people in the 15–19, 20–24 and 25–29 year age groups, for whom the rate of undercounting is higher. Similarly, in the country of birth classification, the population of the older source (of immigrants) countries, such as Italy and Greece, have older age profiles and lower undercount rates. New Zealand-born immigrants, on the other hand, include a higher concentration in the 15–29 year age groups.

TABLE 4.4 UNDERCOUNT RATES BY MARITAL STATUS AND COUNTRY OF BIRTH

	1986 Census		*1991 Census*	
	Rate %	*Standard error*	*Rate* %	*Standard error*
Marital Status				
Never married	2.2	0.1	2.8	0.1
Married	1.4	0.1	1.3	0.1
Divorced	(a)	n.a.	(a)	n.a.
Widowed	1.6	0.2	1.7	0.2
Country of birth				
Australia	1.8	0.1	1.8	0.1
New Zealand	4.5	0.7	3.5	0.6
U.K. & Ireland	1.6	0.2	1.6	0.2
Germany	1.8	0.6	0.9	0.5
Greece	1.0	0.4	1.0	0.4
Italy	0.4	0.2	1.3	0.3
Netherlands	1.3	0.5	1.1	0.6
Former Yugoslav Republics	2.0	0.5	0.7	0.4
Other Europe	1.8	0.6	1.5	0.3
Viet Nam	1.0	0.5	(a)	n.a.
Other Asia	2.1	0.5	2.2	0.4
All others	3.0	0.3	2.2	0.4

(a) Rate not considered to be a reliable measure of undercounting.

Births and Deaths

The registration of births and deaths in Australia has been compulsory since the middle of the nineteenth century when legislation was passed by the various colonies. Since Federation, each State and Territory has maintained its own system of registration governed by independent legislation.

The collection, processing, compilation and dissemination of births and deaths data are the joint responsibility of the various State and Territory Registrars of Births, Deaths and Marriages and the Australian Bureau of Statistics. The Registrars have the responsibility of administering the registration process, and the Australian Bureau of Statistics of producing statistics from relevant data. This cooperation between the State and Territory Registrars and the Australian Bureau of Statistics has a long history and has resulted in the availability of a long time series of quality statistics.

The process of birth registration is closely linked with the administration of hospitals and maternity clinics where an overwhelming majority of births in Australia take place. Although no country-wide statistics are kept on home births these are believed to comprise a very small portion of all births. By arrangement with the Registrars, birth registration forms are supplied to hospitals and clinics for distribution to parents. Together with registration forms, applications for the Family Allowance are also distributed. Where needed, assistance to complete the various forms is given by hospital and clinic staff.

Completed registration forms are either sent in by post or delivered to local Registrars' offices. Some hospitals assist with the despatch of completed forms to local Registrars. Most registrations, however, are forwarded through the mail.

The Registrars are sometimes further assisted by hospitals and clinics which, in addition to distributing registration forms to parents, notify local Registrars regularly of births which occur in those institutions. Mid-wives and doctors are also required to report births which they deliver away from hospitals and clinics. For those births known to Registrars (through the notification system and from other sources) but not registered within a prescribed time period, the Registrars remind the parent(s) or other qualified informants of their duty to register the birth. Reminders are sent by post to the persons concerned. (If there is no response the Registrar may register the birth with the information available). This reminder system together with the general recognition among the population that a birth certificate is an essential identification document, ensures almost complete registration of births.

The process of death registration is closely linked with the certification of cause of death and disposal of the body.

The law requires the medical practitioner who attended a deceased person before his or her death to sign a certificate of cause of death and to deliver or forward this certificate to the Registrar either directly or indirectly through the funeral directors or through the person responsible for completing the registration form. In all cases, registration of a death is not complete and the disposal of the body not permitted without a medical certificate or a document or order from the coroner. Although no systematic research has been conducted to assess the accuracy of death data, there is no reason to expect them to be deficient to any degree given the tight control over death registration and the disposal of bodies.

Comparison of estimates of the population of very young ages based on birth and death registrations with data from the Census provide some confirmation of the high quality of vital registrations in Australia.

Marriages and Divorces

Unlike the registration of births and deaths, the provisions for the registration of marriages and divorces are governed

by Commonwealth Acts. The *Matrimonial Causes Act 1959* and the *Marriage Act 1961* replaced State and Territory legislation and provided uniformity in the administration and registration of marriages and divorces. The Matrimonial Causes Act was later replaced by the *Family Law Act 1975*. (Western Australia passed a State Family Law Act based on the Commonwealth Act). Although State and Territory Registrars are responsible for the registration of marriages celebrated in their areas, the procedure of registration and the particulars required for registration are common to all.

(i) Marriages

Under the *Marriage Act 1961*, marriages may be celebrated by a minister of religion registered as an authorised celebrant, by a State Registrar, or by other persons authorised by the Attorney-General. Notice of the intended marriage must be given to the celebrant at least one month but not more than three months before the marriage. A celebrant is required to transmit within 14 days an official certificate of the marriage for registration to a district registrar in the State in which the marriage took place. The 1961 Act also introduced uniform minimum ages at marriage of 18 for males and 16 for females. Marriages of minors (for males aged 16 or 17 and for females aged 14 or 15) were allowed only if a judge or magistrate issued an order permitting the marriage. Further amendments to the Marriage Act in 1991 brought the minimum ages for females into line with those for males. They designated the minimum age at which persons are legally free to marry to be 18 years. Persons aged 16 and 17 years may marry with parental or guardian consent and an order from a judge or magistrate. Any two persons under the age of 18 years may not marry each other.

(ii) Divorces

Divorce statistics are derived from legal records kept by the Family Court which administers the Family Law Act. Under the *Family Law Act 1975* the concept of fault which was incorporated in the *Matrimonial Causes Act 1959* and relevant previous State legislations was abandoned and only one ground of divorce is now recognised — irretrievable breakdown of a marriage. This is established under the law if the husband and wife are separated and have been living apart from each other for 12 months or more and there is no reasonable likelihood of reconciliation.

Overseas migration

Comprehensive statistical records on overseas arrivals and departures have been maintained since the colonial days. This has been made possible by the relative isolation of Australia, the absence of direct land links with other countries, and the limited number of ports of entry. These natural advantages have been reinforced by government control of arrivals and departures.

Early migration statistics were derived from passenger lists (manifests) which masters of ships were required to submit to the authorities on arrival or departure from Australia. Migration statistics were published in varying detail in Statistical Registers or Year Books of the Colonies, and after 1901 also in the Commonwealth Year Book and statistical bulletins.

With the advent of air travel, people arriving in or departing from Australia lodged a passenger card containing information identical to that previously provided on shipping manifests.

In 1965, the use of shipping manifests for statistical purposes was abandoned. The control of all passenger movement became the responsibility of the immigration authorities and incoming and outgoing passenger cards were prescribed for use by all sea and air passengers.

Information declared on the cards includes intended duration of stay, for people commencing their journey, and actual duration at the completion. This information is used for the classification of movements into three categories: short-term (less than twelve months), long-term (twelve months or more) and permanent. For national and State population estimation purposes, permanent and long-term arrivals are added into the population and permanent and long-term departures are subtracted.

There are four possible causes of error in the overseas migration data which can contribute to inaccuracies in population estimates:

(i) Mis-statement of the State or Territory of usual residence by permanent and long-term departures.

The extent of this type of error is believed to be small because such people are, or have been permanent residents and can therefore be expected to report their address correctly.

(ii) Mis-statement of State or Territory of intended residence by permanent and long-term arrivals.

The magnitude of this type of error is illustrated in the following table which compares the distribution by State/Territory of permanent and long-term arrivals for 1975–76, 1980–81, 1985–86 and 1990–91 with the census distribution of Australian residents whose usual residence one year ago was overseas.

TABLE 4.5 PERMANENT AND LONG-TERM ARRIVALS AND CENSUS COUNTS OF NEW RESIDENTS BY STATE AND TERRITORY, CENSUS YEARS 1976–1991
(Per cent)

	1975–76		1980–81		1985–86		1990–91	
State of usual residence	*Permanent and long-term arrivals*	*Census count (a)*	*Permanent and long-term arrivals*	*Census count (a)*	*Permanent and long-term arrivals*	*Census count (a)*	*Permanent and long-term arrivals*	*Census count (a)*
New South Wales	38.23	35.61	38.35	36.37	39.59	36.84	40.01	36.73
Victoria	25.49	25.95	23.84	23.58	25.02	24.39	24.99	22.58
Queensland	11.94	12.13	14.61	15.86	12.51	13.88	13.60	16.21
South Australia	6.94	7.97	6.21	6.56	5.61	5.87	5.10	6.08
Western Australia	11.26	12.06	12.07	12.79	11.66	13.46	12.12	13.06
Tasmania	1.55	1.83	1.20	1.29	1.13	1.27	0.86	1.36
Northern Territory	0.97	1.37	1.07	1.14	1.21	1.38	0.81	1.28
Australian Capital Territory	3.62	3.08	2.65	2.41	3.26	2.90	2.51	2.70
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

(a) Census count of residents whose usual residence one year ago was overseas.

Apart from the disparity between the definition of permanent and long-term residence and 'usual residence' in the Census, the only differences which may affect comparability between these two data sources arise from:

(a) the possibility that permanent and long-term arrivals in the year prior to the census may depart or die before the census is taken. The numbers of such cases are unlikely to be large enough to affect comparisons; and

(b) the potential disparity between the definition of 'intended address' on the passenger card and 'place of usual residence' on the census form. There are no data on the effects of this disparity though the potential for error is greatest for settlers and visitors since they are more likely to change address than are Australian residents returning.

Notwithstanding these differences, the comparison in the above table illustrates important differences between the two distributions. Overseas migration statistics show New South Wales and Victoria having a larger share of permanent and long-term arrivals than is shown in census data, while most other States and Territories have a smaller proportion than that shown by the census. Queensland and Western Australia, in particular show a significantly higher proportion of permanent and long-term arrivals in the census as compared with passenger card data. This indicates that there is a proportion of migrants who record New South Wales and Victoria as their State of arrival on the passenger card, but move interstate during their first year in Australia.

These differences between overseas migration data and census data do not affect population estimates as long as the interstate migration estimates reflect the interstate moves of migrants in their first year in Australia. However, accurate data are not available to measure the extent to which interstate migration estimates cover the movements of migrants within their first year of settlement.

(iii) Errors in the estimates of 'category jumping'.

'Category jumping' arises, in the context of overseas migration statistics, when the duration of a person's journey differs from that originally indicated (on the arrival/departure card at the beginning of the journey) in such a way as to affect his/her categorisation. For example as when an Australian resident departing for a short-term visit overseas (with a stated intention to stay abroad for less than twelve months) in fact stays more than twelve months, thereby changing the travel category from short-term to long-term. Changes such as this (i.e. between short-term and other categories and vice versa) would lead to errors in post-censal updates of the population. This is explained in Appendix E. To avoid these errors an adjustment is made to net permanent and long-term migration, when updating population estimates, to compensate for category jumping. However this adjustment cannot be compiled from individual records because of the difficulties attempting to compare arrival and departure records for each individual traveller and because of the complications of lags arising from incompleted journeys. Category jumping must therefore be estimated and is consequently subject to a degree of error. For an outline of the method used in estimating the extent of category jumping see Appendix E.

As category jumping estimates are based on short-term overseas arrivals and departures data (see Appendix E), which are derived from a sample, sampling error must be taken into account when assessing the extent of error in the estimates. The sample size, however, is sufficiently large that any contribution arising from sampling error to errors in the estimate of category jumping can be expected to be small. For example, estimates of 10,000 or more have a standard error of about 6 per cent.

(iv) Errors from unrecorded arrivals and departures.

These are movements which have not been recorded by any immigration control mechanism and are different from 'category jumping' identified in (iii). The numbers are believed to be insignificant although it is not possible to quantify them.

Interstate migration

Unlike overseas migration, interstate migration in Australia is totally unregulated. It falls within the unwritten freedoms enjoyed by Australians to live wherever they please and to move from one address to another without being accountable to government. In the absence of regu-

lation, however, problems arise when data is required on interstate movements — for example when updating the populations of the States and Territories. It has therefore always been necessary to estimate interstate arrivals and departures for this purpose.

The first attempt to compile estimates was made for a period prior to 1966 when net interstate movements were estimated from records of all movements (including short-term movements) by sea, air and rail. From June 1966 to 1981, interstate movements were based on records of interstate changes of address on child endowment (now family allowance) registers and electoral rolls. Holiday, business and other short-term movements were no longer taken into account. The change was made in the recognition that estimates based on air, sea and rail travel were inadequate as measures of total net interstate movements (travel by car, for example, was not recorded) and that measuring all movements including short-term moves was neither necessary nor practicable.

At the time, the family allowance was paid universally (to all mothers of children under the age of 17 years) but in November 1987 means testing was introduced. An upper income limit for entitlement was set, graduated according to the number of children in the family.

The Department of Social Security (DSS) was unable to estimate the impact of means testing. In October 1987 there were 2.1 million families collecting the allowance, one month later it declined to 1.8 million. It then started to gradually increase, reaching 1.9 million in August 1989. At the time of introduction of means testing the Department had no data on income of parents. As a result, the department could not exactly explain whether the decline since November 1987 was due to:

- income testing; or
- families with the youngest child turning 17 years (and therefore becoming ineligible).

Whatever the answer, it was clear that means testing, by reducing coverage of the population, reduced the effectiveness of the family allowance register as an indicator of interstate migration. In addition, effectiveness was subject to changes over the years to the age limit of children for which family allowance was applicable.

Electoral roll data are much less reliable than family allowance data as a source of interstate migration statistics. While the registration of electors, voting, and notification of a change of address are compulsory in law, several factors affect the quality of the data. First, a proportion of the population are not entitled to vote and are therefore not on the electoral roll. Second, registration of persons entitled to vote is incomplete. Third, the timing of elections has affected the timing of notification of change of address. Fourth, the timing of Electoral Office surveys to check the coverage of their rolls (called 'habitation' reviews) also affect the timing of notification of change of address.

All these factors affect both the coverage of the data and the reliability of the interstate migration estimates. The electoral data usually showed a much lower level of residential moves and very large fluctuations reflecting the timing of elections. The quality of electoral transfer data deteriorated after 1976 and by 1981 was no longer considered a reliable source of interstate migration statistics.

Because the combined scope of electoral data and family allowance data did not provide full coverage of the entire population, adjustments were made to allow for the persons not covered, namely persons over 15 years of age but below voting age, and others not eligible to vote.

The deterioration of the electoral transfer data led to their abandonment in 1981. From 1981 to 1986, family allowance data only were used but in October 1987, when the means test for family allowance payments was introduced, it was also replaced.

A detailed assessment of the quality of the family allowance data, the internal migration survey (a former annual survey on change of usual residence) and, the electoral roll transfer data, are presented in an ABS Occasional Paper, *Post-censal interstate migration estimates 1966-1981* (O.B. Di Iulio, ABS Occasional Paper No. 1984/2).

As from 1986, transfer (interstate migration) data became available from the nationwide compulsory Medicare system and they were assessed to be of high quality. They have been used since then, in place of family allowance data, to estimate interstate migration. Appendix F describes the method being used to generate interstate migration statistics from Medicare transfer data.

The quality of Medicare transfer data has been assessed against interstate migration data from both the 1986 and 1991 Population Censuses based on the comparison between usual residence at the census date and usual residence one year before the census. An extract from the comparison for 1990–91 is shown in the following table.

TABLE 4.6 COMPARISON BETWEEN MEDICARE AND CENSUS DATA ON INTERSTATE MOVERS, 1990–91

State	*Aged 1–14 years*			*Aged 15–29 years*		
	Census(a)	*Medicare*	*Ratio(b)*	*Census(a)*	*Medicare*	*Ratio(b)*
			MALE ARRIVALS			
New South Wales	8,349	8,574	1.03	17,962	11,709	0.65
Victoria	5,559	5,784	1.04	11,047	7,818	0.71
Queensland	9,903	10,052	1.02	16,115	11,620	0.73
South Australia	2,955	3,203	1.08	5,171	4,144	0.80
Western Australia	2,727	2,971	1.09	5,473	3,994	0.73
Tasmania	1,369	1,372	1.00	2,310	1,642	0.71
Northern Territory	1,556	1,540	0.99	3,443	2,187	0.64
Australian Capital Territory	1,887	2,195	1.16	4,526	2,921	0.65
			MALE DEPARTURES			
New South Wales	10,410	11,078	1.06	18,013	13,852	0.77
Victoria	7,164	7,321	1.02	13,883	9,285	0.67
Queensland	6,416	6,797	1.06	13,093	9,161	0.70
South Australia	2,588	2,922	1.13	5,160	3,920	0.76
Western Australia	2,926	2,923	1.00	6,508	3,871	0.59
Tasmania	1,209	1,115	0.92	2,382	1,802	0.76
Northern Territory	1,755	1,636	0.93	3,399	1,780	0.52
Australian Capital Territory	1,837	1,899	1.03	3,499	2,364	0.68
			FEMALE ARRIVALS			
New South Wales	7,871	8,309	1.06	15,976	15,122	0.95
Victoria	5,176	5,531	1.07	10,066	10,014	0.99
Queensland	9,183	9,385	1.02	14,395	13,974	0.97
South Australia	2,923	3,191	1.09	4,665	4,768	1.02
Western Australia	2,561	2,799	1.09	4,780	4,820	1.01
Tasmania	1,286	1,303	1.01	2,040	1,956	0.96
Northern Territory	1,374	1,403	1.02	3,034	2,637	0.87
Australian Capital Territory	1,924	2,098	1.09	4,568	3,813	0.84
			FEMALE DEPARTURES			
New South Wales	9,773	10,620	1.09	17,176	17,031	0.99
Victoria	6,909	7,114	1.03	11,836	11,085	0.94
Queensland	6,078	6,454	1.06	11,749	11,662	0.99
South Australia	2,418	2,682	1.11	4,656	4,878	1.05
Western Australia	2,680	2,710	1.01	5,379	4,789	0.89
Tasmania	1,152	1,149	1.00	2,286	2,156	0.94
Northern Territory	1,589	1,510	0.95	2,994	2,322	0.78
Australian Capital Territory	1,699	1,780	1.05	3,448	3,186	0.92

(a) Adjusted for undercounting. (b) Medicare movers as a proportion of census movers.

Estimates of interstate migration based on Medicare data, like estimates based on family allowance transfers, are expected to be higher than census data (see above).

With this in mind, the table shows that Medicare data are consistent with census data for both males and females under the age of 15 years. For ages 15 years and over, however, Medicare data for both males and females are deficient, being lower than census data in most cases. This deficiency is particularly apparent for males aged 15 to 29 where Medicare data are considerably lower than census data.

For this reason the current method of estimating interstate migration relies only on Medicare data for ages 1 to 14. The number of movers aged 15 and over is estimated by expanding the figure for ages 1 to 14 pro rata the number of interstate movers in those two age groups at the latest census. The method is described in Appendix F.

APPENDIX A

DEMOGRAPHIC ESTIMATES OF CENSUS UNDER-COUNTING

In the 1960s, before the Post-Enumeration Survey (PES) was fully operational, a computer file was created by H.P.Brown of the Australian National University (ANU) to enable an assessment of census under-counting and age mis-statement by demographic analysis. Called the ANU Demographic Data Bank, this file contained a time-series of national demographic events (births, deaths and overseas arrivals and departures) and census counts of population for all years back to 1921. The data, which was by single years of age and sex, was obtained from the ABS, as was additional data used by A.R.Hall (*) of the ANU to update the file for the period 30 June 1966 to 30 June 1976.

The purpose of this file was to construct 'pure' populations by by-passing censuses and the adjustments made from time to time to conform to census counts of the population. For example, it was possible to estimate the population at 30 June 1991 by commencing from the 1921 census count and, using the cohort component method, updating only for subsequent demographic events. Any census could be used as the base, and, once chosen, could be updated for any required number of years. In particular, though, these 'pure' populations were compiled for census dates to enable comparison with the census count at that date.

For the years since 1976, the Data Bank has been maintained and updated by the ABS, and is now called the National Demographic Data Bank. It is a useful supplement to the PES as a measure of the quality of census data.

Revisions have been made to the data base to conform to the changes, as from 1971, in the definition of 'population' i.e. defining population as the number of people who usually reside in Australia (see Chapter 1). These revisions entailed the exclusion of all short-term overseas arrivals and departures back to 1925. (It was not possible to go back to 1921 because data for short-term movements were not available for years prior to 1925).

Although it would have been possible to maintain the old series as well as the revised one, it was decided that only the revised series would be maintained and updated for future use.

As from 1991, a satisfactory (for the purposes of assessing census undercount) age range could be derived for the population estimate from the Data Bank without using a census as the base. Compiled solely from births, deaths and migration data from 1925 onwards, an estimate of the population was obtained at 30 June 1991 for all ages 0 - 64 years. This age range was considered sufficient for the purposes of assessing the 1991 census undercount, while PES and other data on undercount was available for the higher age groups. The problem of not having short-term migration data before 1925 was therefore resolved and use of 1921 census data as base discontinued. The age range of the Data Bank estimates will naturally increase as the years go by.

* A.R.Hall 'Australian Demography Data Bank, Vol.1 (1968) and Vol.2 (1969)' Department of Economics, RSSS, Australian National University

APPENDIX B

THE ITERATIVE PROPORTIONAL FITTING PROCEDURE (IPF)

This procedure is used when reliable estimates for a desired cross-classification cannot be obtained directly, but estimates of the variables of interest, and possibly some related variables, are available at a higher level of aggregation. An additional requirement for the use of the IPF procedure is information on the relationship between the variables available at the higher level of aggregation.

In the IPF procedure, these two sources of information appear as two distinct classes of inputs known as the association structure and the allocation structure. The association structure, representing the relationship between available estimates, is typically a multi-dimensional table of estimates, and the allocation structure consists of estimates of various 'marginals' of the table. (A 'marginal' of a table is the set of quantities obtained by adding across all categories of any one or more of the cross-classifying variables in the table.

The IPF procedure produces new estimates for each cell in the table by adjusting the initial estimates (the association structure) to agree with the marginal constraints provided by the allocation structure, in a cyclic iterative fashion. For illustration, take the case where the association structure is a two-dimensional table, with two one-dimensional marginals. First the elements of each row of the table would be pro-rated so that their total equals the corresponding marginal estimate, and then the elements of each column would be pro-rated so that their total equals the corresponding estimate in the other marginal. After this step, the estimates in the table would no longer add across the rows to agree with the first marginal, and so the steps would be repeated until the procedure converged to the unique solution which adds to the marginals while preserving the relationships as specified by the association structure.

This iteration will continue until, after some number n of iterations, convergence is achieved.

After convergence, the latest set of revised estimates then become the IPF estimates for the full cross-classification.

For a more detailed description of the IPF procedure, see Purcell, N.J., and Kish L. (1979) *Estimations for small domains*, Biometrics, 35, pp 365-384.

APPENDIX D

PLUS-MINUS PROPORTIONATE ADJUSTMENT TECHNIQUE

This is a procedure for pro-rating a distribution with positive and negative frequencies. The procedure minimises the adjustments to the original distribution. It requires the use of two factors, one for the positive frequencies and one for the negative frequencies. The formulae are as follows:

Adjustment Factor for positive items :

$$\frac{\sum_i |n_i| + (N - n)}{\sum_i |n_i|}$$

Adjustment Factor for negative items :

$$\frac{\sum_i |n_i| - (N - n)}{\sum_i |n_i|}$$

where :

$\sum_i |n_i|$ = the sum of absolute frequencies

n = the algebraic sum of frequencies

N = the assigned total that the distribution must sum to

Having calculated the adjustment factors for positive and negative items, the adjusted values of these items are obtained by multiplying the positive items by the positive factor and the negative items by the negative factor.

The technique is illustrated in the following table where the algebraic sum of the frequencies is adjusted from 10 to 15.

TABLE D1 PRO-RATA ADJUSTMENT OF PLUS/MINUS FREQUENCY DISTRIBUTION

i	n_i	*Adjustment factor* *	*Adjusted* n_i
1	30	1.045	31
2	-50	0.955	-47
3	30	1.045	31
Total	10		15

Where:

$n = 10$

$N = 15$

$N - n = 5$

$\sum_i |n_i| = 110$

and (*) Positive Adjustment Factor $= \frac{110 + 5}{110} = 1.045$

Negative Adjustment Factor $= \frac{110 - 5}{110} = 0.955$

APPENDIX C

DIFFERENCE CORRELATION METHOD FOR UPDATING SMALL AREA POPULATION ESTIMATES

The method is based on determining the relationship between population growth and growth in one or more 'symptomatic indicator(s)' using regression techniques. Symptomatic indicators refer to any available body of data which is in some way related to population size. Some examples are the number of Medicare enrolments, the number of school enrolments, number of dwellings in the area, and so on.

Once the relationship between population growth and growth in the symptomatic indicator(s) has been determined, on the assumption that this relationship is stable over time, it is possible to obtain population estimates for future time periods provided the data on the symptomatic indicator(s) are available for that future date.

To understand the difference correlation method let us define the following:

P^t_{SLA} , P^t_{State} = SLA and State populations respectively at time t

S^t_{SLA} , S^t_{State} = symptomatic indicator for SLA and State respectively at time t

$P^{t,t+n}_{SLA}$ = a measure of population growth in an SLA for the period t to t+n

$S^{t,t+n}_{SLA}$ = a measure of growth in the symptomatic indicator in an SLA for the period t to t+n.

In the difference correlation method, growth is measured in terms of differences between proportions of the State total in the small area (for example SLA). Thus population growth between time t and t+n is expressed as

$$P^{t,t+n}_{SLA} = \frac{P^{t+n}_{SLA}}{P^{t+n}_{State}} - \frac{P^{t}_{SLA}}{P^{t}_{State}} \qquad (1)$$

Similarly, growth in the symptomatic indicator is given by

$$S^{t,t+n}_{SLA} = \frac{S^{t+n}_{SLA}}{S^{t+n}_{State}} - \frac{S^{t}_{SLA}}{S^{t}_{State}} \qquad (2)$$

Regression analysis established the following relationship between the two growth rates:

$$P^{t,t+n}_{SLA} = a + bS^{t,t+n}_{SLA} + e_{SLA} \qquad (3)$$

Where regression coefficients 'a' and 'b' are estimated from data available on all SLAs, e_{SLA} is an error term, and t and t+n refer to two successive census dates.

With this information, growth in SLA population estimates from time t+n to time T can be obtained from equations (1), (2) and (3) as follows:

$$P^{t+n,T}_{SLA} = a + bS^{t+n,T}_{SLA}$$

substituting for $P^{t+n,T}$ from equation (1),

$$\frac{P^{T}_{SLA}}{P^{T}_{State}} - \frac{P^{t+n}_{SLA}}{P^{t+n}_{State}} = a + bS^{t+n,T}_{SLA}$$

or

$$P^{T}_{SLA} = (P^{T}_{State}) \left[\frac{P^{t+n}_{SLA}}{P^{t+n}_{State}} + (a + bS^{t+n,T}_{SLA})\right] \qquad (4)$$

where $S^{t+n,T}_{SLA}$

is known and the coefficients a, b are estimated from equation (3).

It should be pointed out that the difference correlation method can be easily modified to accommodate more than one symptomatic indicator. In this case, the simple linear regression equation, equation (3), is replaced by a multivariable linear equation of the form

$$P^{t,t+n}_{SLA} = a + b1S1^{t,t+n}_{SLA} + b2S2^{t,t+n}_{SLA} + \ldots\ldots bkSk^{t,t+n}_{SLA} + e_{SLA}$$

where, $Si^{t,t+n}_{SLA}$

refers to the ith symptomatic indicator of growth in the SLA; a, b1.....bk are regression coefficients and e_{SLA} is an error term.

APPENDIX E

ESTIMATES OF 'CATEGORY JUMPING' IN OVERSEAS MIGRATION STATISTICS

Category jumping arises, in the context of overseas migration statistics, when the duration of a person's journey differs from that originally indicated (on the arrival/departure card at the beginning of the journey) in such a way as to affect his/her categorisation. For example an Australian resident departing for a short-term visit overseas (stating that he/she intends to stay abroad for less than twelve months) in fact stays more than twelve months, thereby changing his/her travel category from short-term to long-term. Such changes are of consequence when updating population estimates only when they are from permanent/long-term to short-term or when they are to permanent/long-term from short-term. This is because only permanent/long-term arrivals and departures are taken into account when updating population estimates.

If no adjustments were made for category jumping, a resident who states on the passenger card that he/she is departing on a short-term trip but never returns to Australia would not be subtracted from Australia's population. However, if this resident returned after an absence of more than a year he/she would be added to the population even though he/she had not been subtracted on departure. Similarly, a visitor who arrives on a short-term trip but who never departs would not be added to the population; and if he/she departs after one year he/she will be subtracted from the population even though he/she had not been added in on arrival.

The accompanying chart identifies the type of category jumping that may logically occur. People who are in shaded areas in the chart are considered to have jumped a category.

The types of category jumping which cause difficulties in population estimates are:

1) Visitors or residents who were in the category of short-term movement on arrival (visitors) or on departure (residents) respectively but were not in the same category on completion of their journeys, and

2) Visitors or residents who are not in the short-term category on arrival (visitors) or on departure (residents) but were in that category on completion of their journeys.

These are represented by the more darkly shaded boxes in the chart.

Category jumping between the long-term category and the permanent category does not affect population estimates although this may affect the usefullness of the statistics on these movements for other purposes.

In estimating category jumping for each quarter, there are two components to be calculated:

1. Overseas visitor component — this is derived by calculating the difference between the number of short-term visitors who enter Australia in a reference quarter, and the number of visitors who depart Australia over the year following the reference quarter and state that they arrived in the reference quarter.

2. Australian resident component — this is derived by calculating the difference between the number of Australian residents departing Australia in a reference quarter for a period less than 12 months, and the number of Australian residents who return to Australia over the following year and state that they departed Australia in the reference quarter.

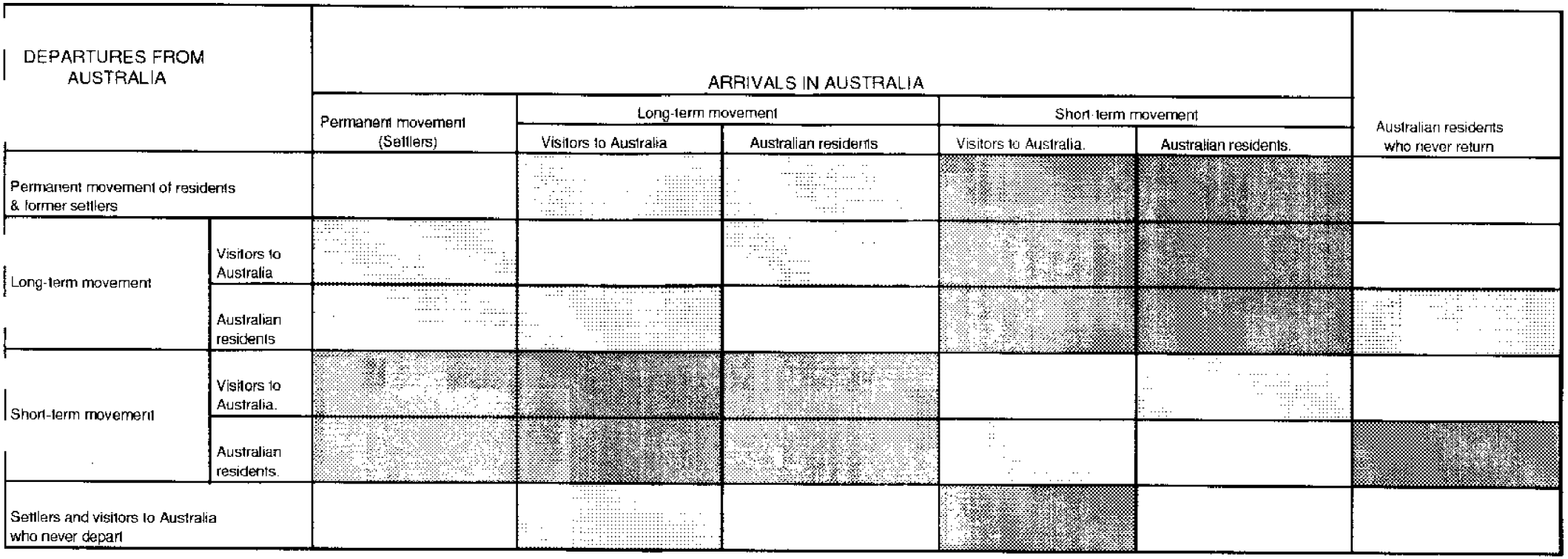
Category jumping is then derived by subtracting the Australian resident component (this component reduces the population estimate) from the overseas visitor component (this component increases the population estimate). The following table shows the relative size of each of these components since 1986 and their effect on category jumping.

TABLE E1 COMPONENTS OF CATEGORY JUMPING YEARS ENDED 31 DECEMBER 1986 TO 1992

	Residents	*Visitors*	*Total*
1986	24,483	30,907	6,424
1987	35,362	47,608	12,246
1988	28,635	52,331	23,696
1989	45,043	56,512	11,469
1990	45,256	45,807	551
1991	44,580	32,726	-11,854
1992	84,100	59,080	-25,020

Preliminary estimates of category jumping have proven difficult to estimate to the desired level of accuracy since the ABS began adjusting population estimates for category jumping in the September quarter 1976. This is because it is necessary to estimate the number of residents returning and the number of overseas visitors departing in the four quarters following the reference quarter of their 'first leg movement'. To illustrate this problem, the following table shows the pattern of return from 1986 to 1993 of residents who departed in the March quarter:

CHART 2: CATEGORY JUMPING IN OVERSEAS MOVEMENT



Category jumping for which adjustments are not made when updating population estimates.

Category jumping for which adjustments are made when updating population estimates.

TABLE E2 AUSTRALIAN RESIDENTS RETURNING FROM OVERSEAS: RESIDENTS WHO DEPARTED IN THE MARCH QUARTER 1986 TO 1993

	Quarter of return						
	Same qtr	*Q+1*	*Q+2*	*Q+3*	*Q+4*	*Remainder*	*Residents departing*
Year	*Per cent and cumulative per cent*						*(No.)*
1986	65.2	25.1	3.4	2.4	1.8	2.1	310,352
		(90.3)	(93.7)	(96.1)	(97.9)		
1987	66.0	23.5	3.5	2.9	1.5	2.6	324,724
		(89.5)	(93.0)	(95.9)	(97.4)		
1988	67.2	24.1	3.2	2.4	1.5	1.5	346,185
		(91.3)	(94.5)	(96.9)	(98.5)		
1989	65.8	24.3	3.3	2.3	1.3	3.1	415,287
		(90.1)	(93.3)	(95.6)	(96.9)		
1990	70.3	21.5	3.5	2.2	1.6	0.9	439,713
		(91.8)	(95.3)	(97.5)	(99.1)		
1991	66.9	23.5	3.0	2.6	1.5	2.4	424,507
		(90.4)	(93.5)	(96.1)	(97.6)		
1992	66.5	20.9	3.6	2.6	1.5	4.9	454,176
		(87.3)	(91.0)	(93.6)	(95.1)		
1993	68.4	21.9	3.2				460,290
		(90.3)	(93.5)				

When making a preliminary estimate of category jumping to be used in compiling the population estimate for the March quarter 1992, only March quarter 1992 overseas arrivals data are available. This means that an estimate has to be made of the number of Australian residents who will return in the June, September and December quarters 1992, and the March quarter 1993 (the same estimation has to be made for overseas visitors).

Estimation methods

Since the commencement of adjusting population estimates for category jumping, a number of methods of producing a preliminary estimate of category jumping have been tried:

1. A regression model based on the relationship between the intended length of stay stated by short-term movers at the commencement of their journey, and the actual length of stay as stated on completion of their journey. This method was discontinued when it was realised that superior estimates could be made by assuming that there was no category jumping.

2. The application of category jumping rates by country of birth, to quarterly estimates of visitors arriving and residents departing. These rates looked relatively stable over time, and produced good estimates for a couple of years before a sudden rise in 1993 in the number of Australian residents overstaying overseas.

The method used was to apply category jumping rates by country of birth to estimates of visitors arriving and residents departing. This method was developed after recognising that there were definite differences in the propensity to jump categories between various birthplace groups. The following table shows the major birthplace groups which influence category jumping numbers, split by the two components, Australian residents and overseas visitors from 1988 to 1991.

TABLE E3 MAJOR BIRTHPLACE GROUPS CONTRIBUTING TO CATEGORY JUMPING, 1988 to 1991
(Per cent, all birthplaces)

Country of birth	*1988*	*1989*	*1990*	*1991*
AUSTRALIAN RESIDENTS				
Australia	0.8	19.4	13.6	19.6
U.K. & Ireland	20.4	13.9	9.9	14.3
Hong Kong & Macau	1.1	2.3	4.4	10.8
Malaysia	0.2	3.8	5.6	6.8
New Zealand	17.1	16.6	19.8	6.5
China	1.0	0.8	6.0	5.3
Yugoslavia	6.9	2.6	1.9	3.2
OVERSEAS VISITORS				
Australia	3.4	2.0	3.9	21.8
New Zealand	19.7	14.2	20.3	15.1
U.K. & Ireland	20.5	8.1	10.2	11.8
China	14.3	27.9	25.5	8.8
Papua New Guinea	1.4	1.3	2.6	6.2
Philippines	3.5	2.4	3.7	4.7
Fiji	5.6	3.7	1.3	1.4

3. The current method involves delaying the compilation of quarterly population estimates until an extra quarter of overseas migration data becomes available. As Table E2 shows, if the compilation of the quarterly population estimate can be delayed until an extra quarter of migration data becomes available, the accuracy of preliminary category jumping estimates can be improved significantly, as more than 90 per cent of Australian residents return within six months of departing, whereas less than 70 per cent return in the same quarter as that in which they departed. Estimates of the percentage of Australian residents who will not return, and the percentage of overseas visitors who will overstay are made, based on the experience of recent years for the quarters not yet available. The advantage of this method over previous ones used is that it can take account of sudden changes in category jumping patterns.

Having estimated the quarterly category jumping adjustment for Australia as a whole, it is distributed amongst the States and Territories pro rata permanent and long-term arrivals for the same quarter.

A detailed description of the concept and procedures in deriving estimates of category jumping is available in an ABS technical paper, *Estimates of Residents Temporarily Overseas, Visitors in Australia and Category Jumping* (3104.0), which was published in March 1983.

APPENDIX F

ESTIMATING INTERSTATE MIGRATION

Medicare interstate movement data for ages 1–14 are used as a base to estimate the interstate movement for all ages. The method used is a ratio expansion method whereby the most recent census ratios of interstate movers aged 15 and over to movers aged 1–14 are applied to quarterly interstate movers aged 1–14 as measured by Medicare to obtain an estimate of quarterly interstate movers for all ages 1 and over. An expansion is made for each interstate flow, for example, from New South Wales to Victoria, New South Wales to Queensland, New South Wales to South Australia etc and vice versa, in order to allow for variation in the age profiles of the different flows.

The expansion method can be expressed as follows:

$$T^{ts} = \frac{C^{s}}{C^{s}\,(1\text{–}14)} \times M^{ts}\,(1\text{–}14)$$

where:

T^{ts} = the estimated interstate movers aged 1 and over for quarter t and State s

C^{s} = the interstate movers aged 1 and over for State s from the latest census

C^{s} (1–14) = the interstate movers aged 1–14 for the State s from the latest census

M^{ts} (1–14) = the Medicare interstate movers aged 1–14 for quarter t and State s

The age pattern of interstate movers for the most recent census is then applied to the estimate of total movers aged one and over (T^{ts}) and an adjustment is made to each age to allow for census undercounting. The ageing of the population in recent decades has resulted in increasing census ratios of movers aged 15 and over to movers aged 1–14 over the last four censuses. These increases in the ratios for interstate movers show a close correlation with the increases in the ratios between the same age groups in the population as a whole. An adjustment is therefore made to the number of movers aged 15 and over to reflect the ageing of the population since the most recent census.

For each sex,

$$T^{ts}\,(15+) = T^{ts}\,(15+) \times \left[\frac{P^{ts}(15+)}{P^{ts}(1\text{–}14)} + \frac{P^{cs}(15+)}{P^{cs}\,(1\text{–}14)}\right]$$

where:

T^{ts} (15+) = the final estimated total interstate movers aged 15+ for quarter t, State s

T^{ts} (15+) = the estimated total interstate movers aged 15+ obtained prior to this adjustment

P^{ts} (15+) = the estimated population aged 15+ at the end of quarter t for State s

P^{cs} (1–14) = the estimated population aged 1–14 at the most recent census for State s

GLOSSARY

Estimated resident population

The concept of estimated resident population links people to a place of usual residence within Australia. Usual residence is that place where each person has lived or intends to live for six months or more in a reference year.

Estimated resident population is based on Population Census data and updated according to changes in the number of residents as indicated by records of births, deaths and migration.

The 1991 Census defined usual residence as:

- 'that address at which the person has lived or intends to live for a total of six months or more in 1991', or
- for people who did not have a usual address

  'regard this dwelling (i.e. the dwelling where the person was located and counted on census night) as their usual address', or
- for boarders at boarding school or college

  'give the address of the school or college as their usual address'.

Overseas arrivals and departures

Statistics on overseas arrivals and departures relate to the number of movements of travellers rather than the number of travellers (i.e. the multiple movements of individual persons during a given reference period are all counted). However, the statistics exclude the movements of operational air crew and ships' crew, transit passengers who pass through Australia but are not cleared for entry, and passengers on pleasure cruises commencing and finishing in Australia aboard ships not then engaged on regular voyages.

Category of movement — Passengers are classified according to their length of stay (in Australia or overseas) or 'category'. This is primarily determined by the passenger's selection of his or her own category on the passenger card, which is accepted provided it is consistent with other information on the card. There are three main categories:

> *Permanent movement* — Arrivals of settlers (i.e. persons who hold migrant visas, regardless of stated intended period of stay, and New Zealand citizens who indicate an intention to settle) and those who are otherwise eligible to settle (e.g. overseas born children of Australian citizens), and
>
> — Departures of Australian residents (including former settlers) who on departure state that they do not intend to return to Australia.
>
> *Long-term movement* — Arrivals of visitors (with the exception of those who hold migrant visas — see above) and the departures of Australian residents who intend to stay, in Australia or abroad respectively, for twelve months or more, and
>
> — Departures of visitors and the return of Australian residents who had stayed, in Australia or abroad, for twelve months or more.
>
> *Short-term movement* — Arrivals and departures of travellers whose intended or actual period of stay is less than twelve months, with the exception of those who on arrival hold migrant visas. A significant number of travellers (i.e. visitors to Australia on arrival and Australian residents going abroad) state exactly twelve months or one year as their intended period of stay. Many of them stay for less than that period and on their departure from, or return to Australia are therefore classified as short-term. Accordingly in an attempt to maintain consistency between arrivals and departures, movements of travellers who report their actual or intended period of stay as being one year exactly are randomly allocated to long-term or short-term, in proportion to the number of movements of travellers who report their actual length of stay as up to one month more, or one month less than one year.

Estimation method — Overseas arrival and departure statistics are derived from a combination of full enumeration and sampling. All permanent movements and all movements with a duration of stay of one year or more are fully enumerated and processed. On the other hand, statistics relating to movements with a duration of stay of less than one year are compiled from a sample of these movements and are therefore estimates which may differ from the statistics that would have been obtained if details of all these movements had been processed.

Statistical areas

Population estimates are compiled at sub-State level for areas defined according to the Australian Standard Geographical Classification (ASGC) of the ABS. Under this classification, statistical areas are defined as follows:

(a) *Statistical Local Areas (SLAs).* These geographical areas are, in almost all cases, identical with, or formed from a division of, whole legal local government areas (LGAs) comprising cities, district councils, community government councils, municipalities, shires, rural cities and towns. In other cases, they represent unincorporated areas. In aggregate, SLAs cover the whole of a State or Territory without gaps or overlaps. In some cases legal LGAs overlap statistical subdivision boundaries and therefore comprise more than one SLA.

(b) *Statistical Subdivisions (SSDs).* These consist of one or more SLAs and form the intermediate size spatial unit for the presentation of regional data.

(c) *Statistical Divisions (SDs).* These consist of one or more statistical subdivisions (SSDs). The divisions are designed to be relatively homogeneous regions characterised by identifiable social and economic units within the region, under the unifying influence of one or more major towns or cities.

Further information concerning statistical areas is contained in the ABS publication *Australian Standard Geographical Classification* (Catalogue No. 1216.0).

ACRONYMS

ERP Estimated resident population
PES Post-enumeration survey
SLA Statistical Local Area

RELATED PUBLICATIONS

Population estimates are published by the ABS in the following publications. Catalogue numbers are shown in brackets.

Australia —

1991 Census — Population Growth and Distribution in Australia (2822.0)
Australian Demographic Statistics (3101.0)
Estimated Resident Population by Sex and Age: States, Territories and Australia (3201.0)
Regional Population Growth, Australia (3218.0)
Estimated Resident Population by Marital Status, Age and Sex (3220.0)
Estimated Resident Population by Country of Birth, Age and Sex (3221.0)
Projections of the Population of Australia, States and Territories (3222.0)
Experimental Estimates of the Aboriginal and Torres Strait Islander Population (3230.0)

New South Wales —

Estimated Resident Population by Age and Sex in Statistical Local Areas, New South Wales (3209.1)
Estimated Resident Population of Statistical Local Areas, New South Wales, Preliminary (3210.1)
Demography, New South Wales (3311.1)

Victoria —

Estimated Resident Population in Statistical Local Areas, Victoria, Preliminary (3203.2)
Estimated Resident Population by Age and Sex in Statistical Local Areas, Victoria (3207.2)
Demography, Victoria (3311.2)

Queensland —

Estimated Resident Population and Area, Queensland, Preliminary (3201.3)
Age and Sex Distribution of the Estimated Resident Population, Queensland (3224.3)
Demography, Queensland (3311.3)

South Australia —

Estimated Resident Population by Age and Sex in Statistical Local Areas, South Australia (3204.4)
Demography, South Australia (3311.4)

Western Australia —

Estimated Resident Population by Age and Sex in Statistical Local Areas, Western Australia (3203.5)
Estimated Resident Population in Statistical Local Areas, Western Australia, Preliminary (3204.5)
Demography, Western Australia (3311.5)

Tasmania —

Population Statistics, Tasmania (3204.6)
Demography, Tasmania (3311.6)

Northern Territory —

Resident Population Estimates for Statistical Local Areas, Northern Territory, Preliminary (3201.7)
Estimated Resident Population by Age and Sex in Statistical Local Areas, Northern Territory (3207.7)
Demography, Northern Territory (3311.7)

Australian Capital Territory —

Estimated Resident Population in Statistical Local Areas, Australian Capital Territory (3205.8)
Estimated Resident Population by Age and Sex in Statistical Local Areas, Australian Capital Territory (3207.8)
Demography, Australian Capital Territory (3311.8)

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Methods and Procedures in the Compilation of Estimated Resident Population 1981 and in the Construction of the 1971–81 Time Series (3103.0)

Estimates of Residents Temporarily Overseas, Visitors in Australia and Category Jumping (3104.0).

1991 Census — Data Quality — Undercount (2940.0).

June 1986 to June 1991 Experimental Estimates of the Aboriginal and Torres Strait Islander Population (3230.0).

'Trans-Tasman Migration: Trends, Causes and Consequences' (Ed.) Gordon A. Carmichael, Bureau of Immigration Research (1993). See Chapter 2: Sources of data.

Survey Methodology, December 1988 Vol. 14(2). See p173–190 *'Adjusting the 1986 Australian Census Count for Underenumeration'*, C.Y. Choi, D.G. Steel and T.J. Skinner.

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