
2 What has been happening recently?

Key points

There were around 285 000 births registered in Australia in 2007, the highest number of births on record, and significantly more than the 267 000 births registered in 2006.

- Population growth was the main reason for the near record numbers of babies.
- The recent increase in Australia's fertility rate has also contributed strongly to growth in births. The (estimated) total fertility rate for 2007 was 1.93 babies per woman. This is the highest level since the early 1980s, but still considerably below the peak of 3.56 babies per woman in 1961. (The most recent *official* measure was 1.81 for 2006, still the highest in a decade.)

This recovery in Australia's total fertility rate parallels the experience in a range of Scandinavian and English-speaking countries.

- Overall, Australia's total fertility rate lies at the upper end of the distribution of developed countries. Its rate is much higher than those of the former Eastern European bloc, Southern Europe or the rich countries of Asia (which have TFRs below 1.5).

There are three likely reasons for the rise in the total fertility rate, though the relative contribution of these is hard to pinpoint:

- Much of it is likely to reflect 'recuperation'. Over the last few decades, younger women postponed their childbearing. Having reached older ages, they are now having these postponed babies. This has shown up as higher fertility rates for older women.
- Some of it is likely to be due to a 'quantum' effect — an increase in lifetime completed fertility. This is revealed by evidence that the fertility rate for young women is on the rise and a recent increase in younger women's expected completed lifetime fertility levels.
- Some of it is likely to reflect women bringing forward children they were going to have later. While, the effects of timing on fertility ultimately dissipate, they can still have persistent impacts on birth rates and population dynamics.

Overall, the evidence suggests that after its long downward trend after the Second World War, Australia's fertility rate may have stabilised around 1.75 to 1.9 babies per woman.

Changing patterns of fertility are often described in dramatic language: the ‘baby boom’ (the post-war rise in fertility), the ‘baby bust’ (its eventual collapse), and most recently an apparent revival in fertility — the ‘baby bounce’. There is little question that over the last few years the *number* of babies born has risen significantly in Australia. However, by itself this reveals little about underlying fertility behaviour, since births will also be influenced by Australia’s changing age structure and the population of women in their fertile years (section 2.1).

The underlying fertility behaviour of Australians is best measured through fertility *rates* (section 2.2). Unfortunately (as noted in chapter 1), interpreting these rates is not straightforward. Statistical measurement difficulties contaminate the data (section 2.3). Even after adjustment, it is hard to distinguish clearly the relative importance of three factors that can (simultaneously) increase the total fertility rate:

- a ‘quantum’ effect — an increase in lifetime fertility above what it would have been otherwise
- ‘recuperation’ — older women catching up on their previously postponed births
- ‘anticipation’ — bringing forward babies that women were going to have later.

Their respective roles are important for diagnoses about the future trends in fertility levels in Australia and for understanding the causal factors (including policies) that can encourage or frustrate fertility.

Accordingly, were the rise to mainly reflect an increase in lifetime fertility, then it would suggest something was different about the last decade that had stimulated that change — such as family policy, social institutions or the economy.

On the other hand, were the rise in the TFR an outcome of recuperation then it implies that it was mainly pre-ordained by women’s past decisions about when to have babies, rather than a change in their lifetime fertility behaviour. That would tend to downplay the role of government policy or economic circumstances in the recent rise — with implications for the role of these factors in the future.

Finally, were the rise mainly the consequence of bringing childbearing forward in time without any change in women’s lifetime fertility, then it would suggest that the present rise in fertility levels may be ultimately reversed — whereas the two other factors result in sustained change to fertility.

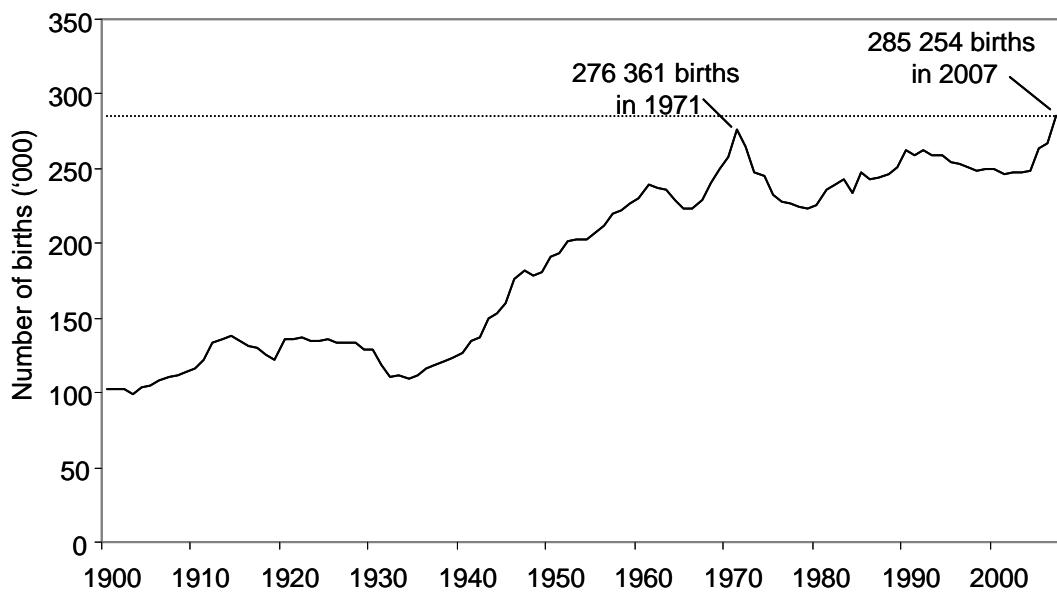
The judgment of this chapter is that all three are likely to have played a role in the recent rise in fertility rates — and particularly quantum and recuperation effects. Why this is the case is explored in sections 2.4 to 2.10.

2.1 Trends in births

There were around 285 000 births registered in 2007, exceeding the previous maximum number of 276 000 in 1971 (figure 2.1). The high number of births has attracted considerable media attention and has contributed to the recent debate over whether Australia is experiencing a ‘mini baby boom’. However, the absolute number of births is at least partly the consequence of the continued growth in the population of women of childbearing age, which reached an historical high in 2007. It is more striking that the current population of around 21 million Australians yields only around the same number of births as the population of around 13 million in 1971. Indeed, if commentators from 1971 could have seen into the future, they would have been surprised to learn *how few* births would actually occur in 2007.

Figure 2.1 **Births are at an historical high**

1900 - 2007



Data source: ABS, *Australian Historical Population Statistics*, Cat. no. 3105.0.65.001 and ABS, *Births*, Cat. no. 3301.0.

In that context, it is useful to identify the varying roles of population numbers, the age structure of the population and age-specific fertility rates (ASFR) in determining the number of babies born. Using the method outlined in box 2.1, the contribution of these factors to the number of births was estimated for the period 1971 – 2006 (figure 2.2).¹

¹ While data on registered births are available to 2007, at present, age-specific fertility rates are only available to 2006, hence the time period covered by figure 2.2.

Box 2.1 Linear interpolation

The number of births at time t (B_t) can be represented by an identity that captures the roles of the age-specific fertility rate (ASFR), the proportions of women in given (reproductive) age brackets (P_i) and the population of women aged between 15 and 49 (N) (ABS 2006a):²

$$B_t = \sum_{i=15}^{i=49} ASFR_{i,t} \times P_{i,t} \times N_t$$

One way of approximating the partial effect of any given factor is to take the difference between the observed number of births and the hypothetical number of births that would have occurred had just that factor been held constant (whilst the others varied according to their observed values). However, the sum of the three partial effects this procedure produces will not explain the total change in births — and will significantly underestimate the total change if the underlying yearly changes in the factors are large. The problem is that each of the three factors interacts with the others, and the partial approach above misses these interaction effects.

One way to deal with this issue is to consider the impacts of each of the three factors as the sum of their impacts over a series of very short periods, since in infinitesimally small periods, the interaction effects disappear. This can be achieved by linearly interpolating the yearly data on the relevant factors into many more frequent intervals. In that instance, the partial effects sum to the total change in births. Using this approach, it can be shown that for every age i and each transition from $t-1$ to t , the change in births due to the change in each factor can be decomposed as follows.

$$\Delta B \text{ due to } \Delta ASFR = \Delta ASFR \times \left\{ P_{t-1} \times N_{t-1} + \frac{1}{2} \Delta N \times P_{t-1} + \frac{1}{2} \Delta P \times N_{t-1} + \frac{1}{3} \Delta P \times \Delta N \right\}$$

$$\Delta B \text{ due to } \Delta P = \Delta P \times \left\{ ASFR_{t-1} \times N_{t-1} + \frac{1}{2} \Delta ASFR \times N_{t-1} + \frac{1}{2} \Delta N \times ASFR_{t-1} + \frac{1}{3} \Delta ASFR \times \Delta N \right\}$$

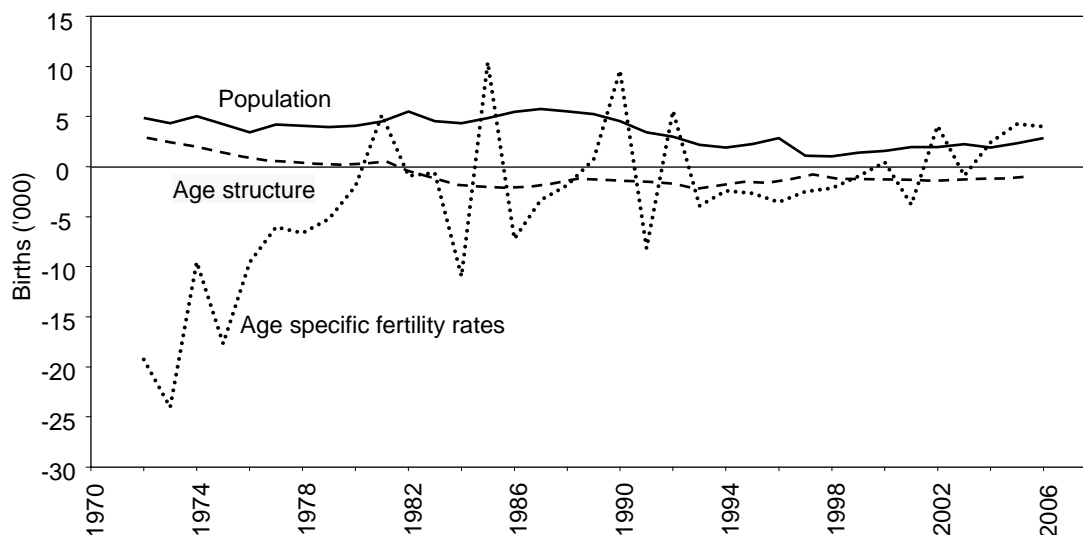
$$\Delta B \text{ due to } \Delta N = \Delta N \times \left\{ ASFR_{t-1} \times P_{t-1} + \frac{1}{2} \Delta ASFR \times P_{t-1} + \frac{1}{2} \Delta P \times ASFR_{t-1} + \frac{1}{3} \Delta ASFR \times \Delta P \right\}.$$

Whilst more computationally complex procedures can theoretically improve the accuracy of these estimates, the improvement is likely to be negligible (see Productivity Commission 2005a). The results described in this working paper are calculated using this linear interpolation method.

Source: Further technical details are in appendix A.

² A deeper and more complex question is the determinants of the fertility rate itself. This is considered in Chapter 4.

Figure 2.2 **Growth in births is mainly due to population growth**
1971 to 2006



^a Derived used method outlined in box 2.1.

Data sources: ABS, *Births*, Cat. no. 3301.0, ABS, *Population by Age and Sex, Australian States and Territories*, Cat. no. 3201.0.

This shows that:

- changes in the age structure of the population initially had a positive effect on births, but became negative after 1981, as a greater proportion of women shifted into ages where age-specific fertility rates are low
- the yearly increase in the population of women of childbearing age has (by definition) increased the number of recorded births in every year over the period, but the magnitude of the contribution has declined
- while, over the full period, changes in the fertility rate had a strong, negative effect on the number of babies born, in more recent years it had a positive impact on births.

In contrast to most of the last 35 years, changes to the fertility rate from 2000 onwards have mainly had a positive effect on the number of births (table 2.1). Increases in age-specific fertility rates in 2004, 2005 and 2006 resulted in considerably more additional births than those resulting from growth in the adult female population growth. Nevertheless, growth in the population of women of childbearing age is still the more important factor driving births over the entire seven-year period. The combined increase in births stemming from these factors more than matches the negative influence of an ageing population, leading to growth in the overall number of babies.

Table 2.1 Change in number of births attributable to changes in ASFR, age structure and population^a

	<i>ASFR</i>	<i>Age structure (P)</i>	<i>Population (N)</i>	<i>Total change in births</i>
	No.	No.	No.	No.
2000	446	-1 260	1 580	766.0
2001	-3 804	-1 391	1 952	-3 242.1
2002	4 077	-1 443	1 960	4 594.1
2003	-905	-1 169	2 246	173.0
2004	2 415	-1 234	1 904	3 085.0
2005	4 260	-1 065	2 350	5 545.0
2006	4 000	-678	2 836	6 158.0
Total from 2000–2006	10 489	-8 239	14 829	17 079

^a Derived using the method outlined in box 2.1.

Source: ABS, *Births*, Cat. no. 3301.0, ABS, *Population by Age and Sex, Australian States and Territories*, Cat. no. 3201.0.

This analysis indicates that increasing fertility rates have contributed to the high number of births observed recently. By itself, it does not establish the extent of the underlying behavioural change. Whether the increase in the fertility rate is a temporary aberration or the beginning of a new trend is relevant for demographic forecasts and family policy. Determining this requires a more detailed investigation of fertility rates.

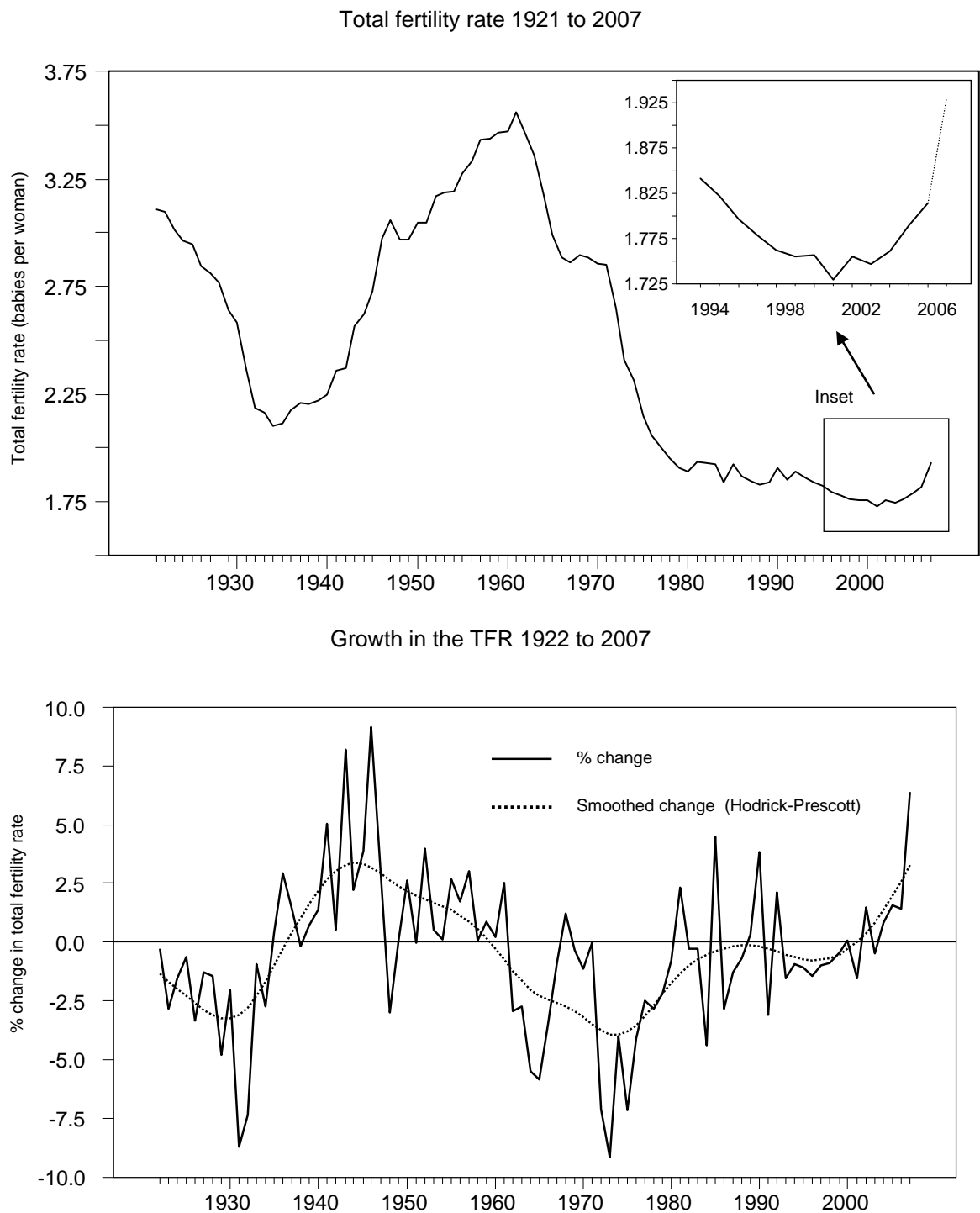
2.2 Trends in fertility

The official ABS estimate of the total fertility rate (TFR) was just over 1.81 in 2006 — the highest figure in a decade.³ Given the recent strong growth in births, it is estimated that the TFR will be around 1.93 in 2007, the highest fertility rate since the early 1980s (section 2.8). This is striking given that TFR has, with brief intermissions in the late 1960s and early 1980s, trended downwards since 1961 (figure 2.3).

However, periods of resurgence have occurred before, only providing a temporary interlude before further reductions. There were, for example, such ‘blips’ in 1985, 1990 and 1992 (figure 2.4). As pointed out in chapter 1, the TFR exhibits greater variation than the CFR, as it is also affected by changes in people’s decisions about *when* to have their children. If people postpone childbearing (an important factor in the past, and an issue discussed later) then the TFR falls and then eventually recovers for a given CFR.

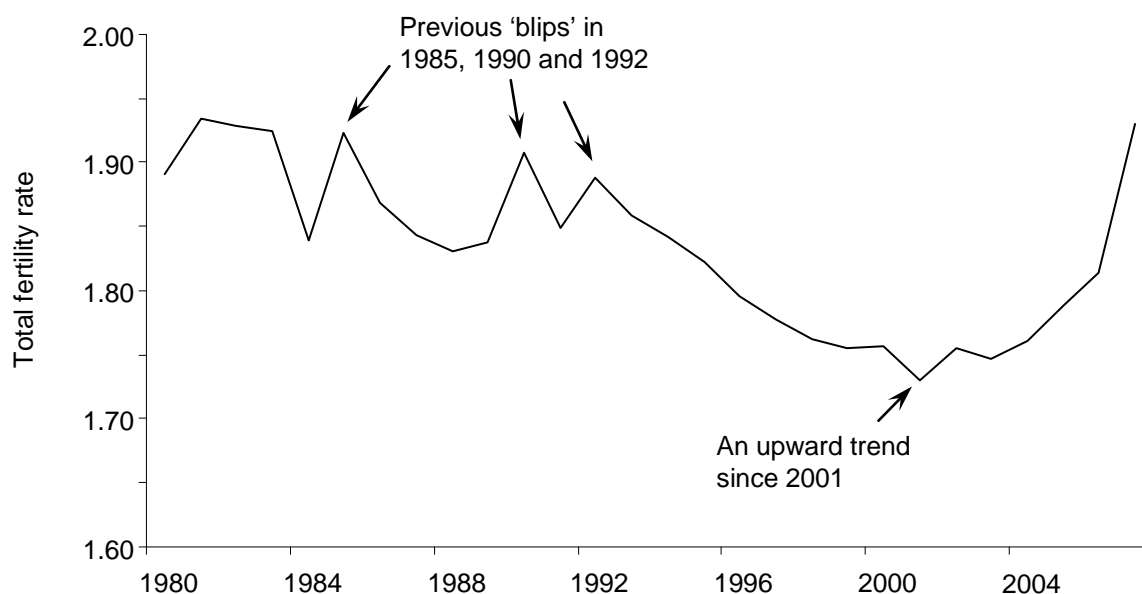
³ In 1995, the TFR was 1.82, before dipping to as low as 1.73 in 2001.

Figure 2.3 Long term patterns in the total fertility rate
1921 to 2007 (estimated)^a



^a ABS, *Australian Historical Population Statistics*, Cat. no. 3105.0.65.001, ABS, *Births*, Cat. no. 3301.0; and PC forecast for 2007 (see later).

Figure 2.4 Total fertility rate, 1980 to 2007



Data sources: ABS, *Births*, Cat. no. 3301.0, *Australian Demographic Statistics*, Cat. no. 3101.0 and PC calculations.

On the other hand, if women bring forward the timing of their births by a short period — prompted by, among other things, economic circumstances or government incentives — but do not alter their lifetime births, then the TFR rises before falling later. Such changes in timing will often involve only short perturbations to fertility (producing ‘blips’). The latter could explain part of the recent upturn, but there is reasonable evidence that it does not explain all of it. The upturn, while moderate,⁴ has been sustained for longer than the upturns of the past, with the TFR increasing in four of the last five years (and as shown later, likely to rise in the future). Furthermore, while the TFR was generally falling prior to the upturn, it tended to do so by progressively smaller amounts. There was, as a result, a general upward trend in the annual rate of *change* in the TFR from 1992. Given this pattern, the recent upturn in the TFR is not surprising.

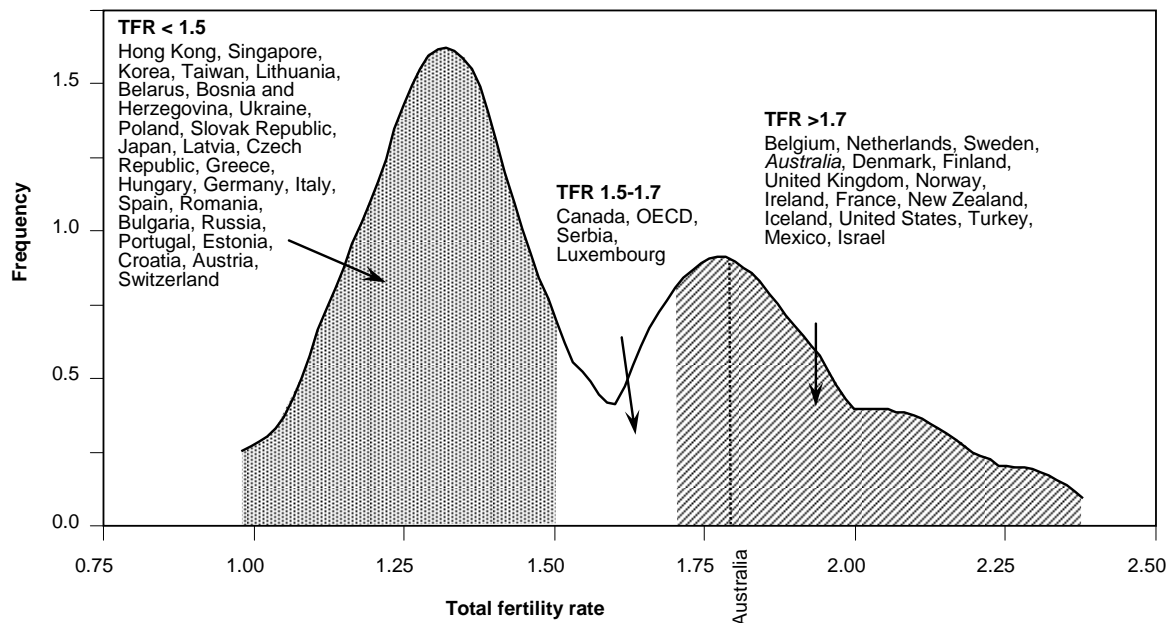
The international context

Fertility rates among developed countries tend to be above 1.7 or below 1.5, with few countries occupying the middle ground (figure 2.5). Australia sits at the higher end and, in 2005, was well above the OECD average TFR of 1.63. At that time, it was the 12th highest of the 30 OECD countries and 12th of 45 developed countries.

⁴ In fact, the blips apparent in figure 2.3 were greater in absolute and proportionate terms than any of the single year increases observed recently.

English speaking countries,⁵ like Australia, form part of the group of ‘higher’ fertility countries along with the Scandinavian countries, France, the Netherlands, Denmark, Turkey and Mexico. None of this group has a TFR below 1.7 (OECD 2008). At the other end of the spectrum, fertility rates are very low in Southern Europe, the former Eastern bloc countries and the most developed Asian economies.

Figure 2.5 **Australia has a higher than average fertility rate^a**
Distribution of the total fertility rate in developed economies



^a Data for Australia has been updated to reflect revisions for 2005. The data for non-OECD countries are for 2007 (estimated) and are from the CIA database. The distribution above is estimated using a kernel-smoothing program based on the Epanechnikov distribution.

Data source: OECD Health Data 2007 and CIA Database (2008).

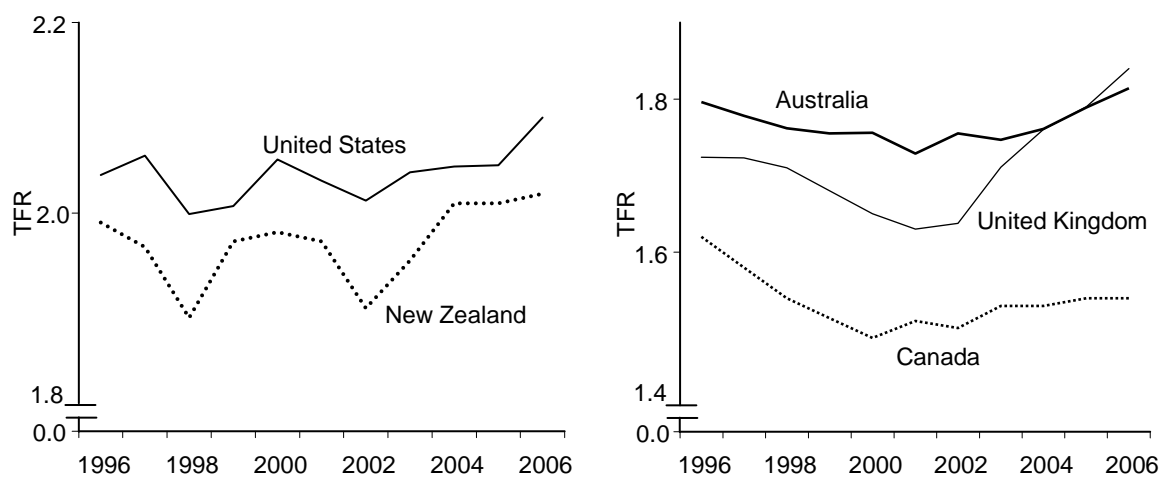
Despite the wide range of fertility rates among developed countries (and their varying economic, social and institutional circumstances), they share some historical experiences:

- They have all experienced a significant long-term decline in their fertility rates, which are generally now below replacement levels.
- The reductions in fertility rates have generally slowed and, in many cases, have given way to typically modest recoveries (appendix B). For example, like Australia, the TFR has been trending upwards for other Anglo-Saxon countries (the United States, New Zealand, the United Kingdom, Canada), most Scandinavian countries and even several southern European (Italy and Spain) and former Eastern bloc countries (the Slovak and Czech republics).

⁵ With the exception of Canada.

The upturn in fertility in Australia bears a particular resemblance to the other English speaking countries,⁶ with rising TFRs apparent from around 2002 (figure 2.6). For most of the other countries experiencing increasing fertility, the upturn began in the mid to late 1990's, coinciding with a period of general expansion in the world economy.

Figure 2.6 The TFR has been increasing in English speaking countries



Data source: OECD (2008).

The fact that the trends appear common to a range of countries that have overlapping cultural values and institutions, and that are all experiencing a period economic prosperity, suggests that they do not reflect measurement problems in the fertility data.⁷ (Such measurement errors are unlikely to be correlated across countries.) Nevertheless, measurement errors can at least partly obscure underlying fertility trends — as discussed in the next section.

2.3 Measurement errors in the fertility statistics

Yearly changes to TFR are small, usually in the order of 0.03 of a child (or three children for every hundred women of reproductive age). Measurement errors or biases in the reported statistics can easily create changes of this magnitude. There

⁶ With the exception of Ireland.

⁷ Delayed childbearing is also a common phenomena, which raises the possibility that recuperation may be a common cause for the upturn. As decisions about when to begin having children, and how many to have, are influenced by the same factors, this may explain some of the rise in fertility. However, the timing and trajectory of trends in postponement have tended to be different in the past. For example, the mean age at first birth in the United Kingdom was 29.2 in 2006, whereas in the U.S. it is just 25.2.

are three major potential sources of bias: under-registration; delays in registration; and intercensal error in estimating the resident population.

Under and delayed registration

The official (ABS) records of births are based on data collected by state and territory Registrars of Births, Deaths and Marriages. This dataset suffers from two significant limitations for the accurate and timely enumeration of births. First, a significant number of parents fail to meet the legal requirement for registration (under-registration). Second, late completion of registration forms by parents and delays in processing times by the relevant registries mean that births in one period are not recorded until a later period.

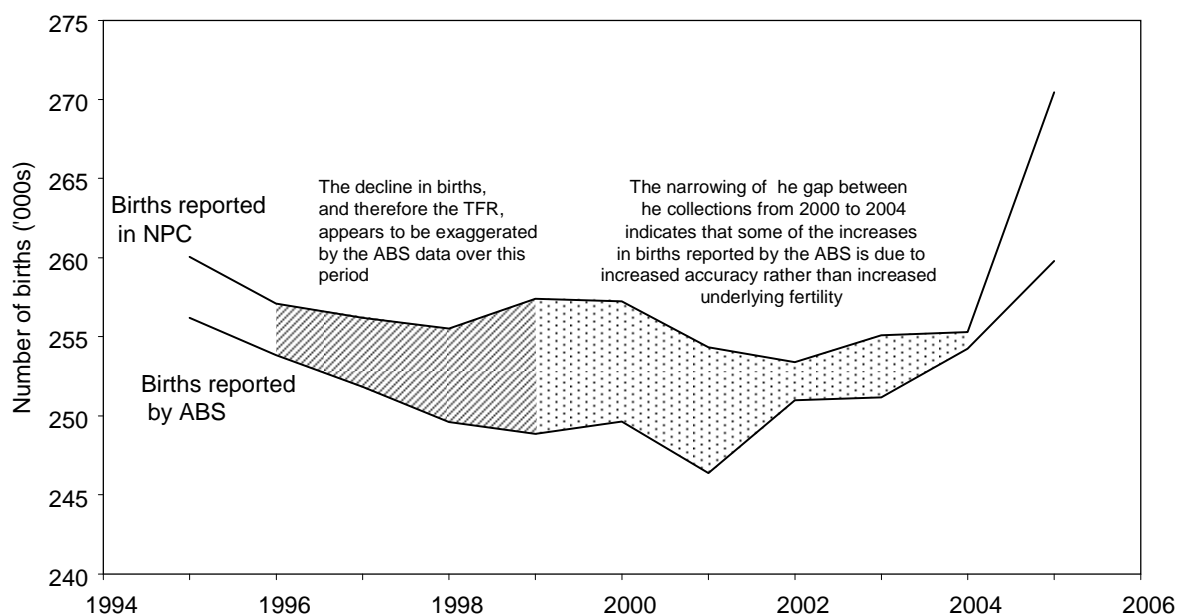
Under-registration

An overall indication of under-registration is the disparity in the number of births reported by the ABS and the National Perinatal Data Collection (NPDC). The NPDC is collected from midwives and other hospital staff, and so can record births that are not subsequently registered by parents. The NPDC has reported a higher number of births than the ABS in every year since 1994 — reaching a gap of more than 8500 births in 1999 (McDonald 2005). This exerts a downward bias on the official level of TFR (which is based on ABS data).

Moreover, the gap between the two statistical datasets generally exceeded the yearly change in the number of births, so variations in the extent of under-registration can bias official trends in the TFR. The TFR consistently declined in the late 1990s, but during this period, the gap between the datasets increased (figure 2.7). This suggests that the real underlying decline in the TFR was more muted. More significantly, the large increases in births recorded in the ABS data in 2002 and 2004 are not observed in the NPDC, but rather correspond to substantial reductions in the gap between the two datasets. This implies that the increase in the TFR in these years may partly reflect the correction of past underestimation.

That said, under-registration is unlikely to account for the entire recent increase in the TFR as the NPDC also recorded increases in the number of births in some years. In particular, under-registration cannot account for the rise in the TFR observed in 2005, as the increase in births recorded by the ABS was significantly less than that of the NPDC. According to the NPDC, the number of births increased by over 15 000 in 2005, which is the largest single year increase since 1971. This suggests a substantial increase in TFR that is not yet captured in the annual ABS data (the dominant source for the analysis in this report).

Figure 2.7 Births recorded by the Australian Bureau of Statistics and the National Perinatal Collection



Data source: ABS, *Births*, Cat. no. 3301.0 and *Australia's Mothers and Babies*, Perinatal statistics series — various years (available from <http://www.npsu.unsw.edu.au>)

The role played by delay

Delayed registration is significant. For instance, around 12 per cent of births registered in 2006 related to births occurring in past years and nearly one percentage point of these related to births occurring 6 years or earlier (ABS 2007a).

When these delays are constant over time, then births missed in a given year are roughly compensated by the inclusion of missed births from the previous year. However, if the delays in registration are increasing, then fertility rates will diverge from their true value and it will falsely appear as if they are falling. Likewise, if the delays in registration are falling, then fertility rates will approach their true value and it will falsely appear as if they are rising.

The average length of delay in birth registration increased from 1995 to 2004, but decreased markedly in 2005, due largely to the improvements in the registration process in NSW. This implies that fertility rates preceding 2004 were underestimated and the subsequent improvement in reporting methods artificially inflated the growth in TFR in 2005.

However, this bias is only present in 2005 and, as it was largely localised to NSW, cannot account for the increases in TFR recorded in all other States in this year. To put this into perspective, the number of births that occurred in Australia increased

by 5545 in 2005, whereas the number of births that occurred in NSW increased by 695 (ABS 2006a). Thus, the impact of registration delay on the aggregate TFR to 2006, is likely to be very small. Improved registration processes are also likely to contribute to the increase in TFR expected in the 2007 data.⁸ While the predicted increase in TFR (see section 2.8 and box 2.3) is too large to be caused by registration delay alone, this may lead to an overestimation of TFR in 2007 followed by a small correction in 2008.

Additionally, registration delay may be more important for some sub-groups, such as Indigenous Australians. The average interval between the occurrence and registration of the birth was 6.4 months for all Indigenous births registered in Australia in 2006. In contrast, in 2005, the average interval was 2.2 months for all births (ABS 2007a).⁹

Registration delay and the Baby Bonus

From 1 July 2007 onwards, parents have been required to lodge their child's birth registration form prior to receiving the Baby Bonus (as suggested by McDonald 2005, pp. 3). This provides a strong incentive for parents to register the birth of their child promptly. It is highly likely that it will shorten the average delays in registration. The effect of a one-off decrease in registration times will be a one-off increase in the measured TFR that will subside in subsequent periods. This effect is likely to be concentrated in the 2007 and 2008 fertility data,¹⁰ though its magnitude is difficult to anticipate.

Intercensal error

Fertility is generally measured as a proportion of the population. As such, its accuracy is subject to the precision of the underlying population estimate. If the underlying population is underestimated (overestimated) then the apparent fertility rate will be more (less) than its actual value. The ABS measures the population

⁸ Improved processes at the Queensland registry of Births, Deaths and Marriages have contributed the high number of births registered in Queensland in March and December quarter of 2007. An anomaly in the reporting of births from the Victorian Registry of Births Deaths and Marriages may also affect recorded births and the TFR estimate in 2007. (ABS 2008, *Population, Australian States and Territories, December 2007*, Cat. no. 3239.0.55.001).

⁹ There is significant variation in registration times of Indigenous Australians between states. In 2006, the average time to registration was 10.4 months in Western Australia. In contrast, in the Northern Territory, a community worker completes the mother's form and the average registration time is only 1.4 months.

¹⁰ To be released by the ABS in 2008 and 2009 respectively.

directly every five years using the Census of Population and Housing. During the interim years, population is updated quarterly as new information of births, deaths and migration is collected. As births, deaths and migration are imperfectly measured, the resulting estimate of the population will inevitably be different from the population count taken at the next census. This is known as ‘intercensal error’. The ABS customarily adopts the population estimate based on the census as the ‘true’ estimate, although the census itself is also subject to some error (ABS 1999).

This means more caution needs to be taken in interpreting TFRs as the time since the last census increases. Following the 2006 census, the ABS has revised its TFR estimates retroactively to 2002. For this reason, intercensal error is not of great concern to the findings of this chapter, but it may well emerge as another factor muddying the interpretation of fertility data over the next few years.

2.4 A quantum effect or only the end of postponement?

As noted in chapter 1, tempo effects can give the spurious impression of rising (falling) lifetime fertility when women bring forward (postpone) childbearing. Of the two tempo effects, postponement appears to have had the greatest impact on fertility trends in Australia and many other developed countries in the past few decades.

When postponement occurs the measured fertility falls during the initial transition to a new set of ages at which women have babies. This is because young women are having fewer children, while the fertility rates of older women have not yet risen. Over time, this pattern changes. The fertility rate of young women falls by less and finally stabilises, while that of older women increases to a new higher level (‘recuperation’) to achieve their desired lifetime fertility rate. In this part of the transition, the TFR will rise back to its long-run level.

This effect can be demonstrated by imagining an extreme case where all women aged 25 years decide to delay childbearing by five years, but still intend (and are able) to maintain the same completed fertility. The TFR would fall for five years and then rise again with the recuperation of the formerly postponed fertility. The reported increase in TFR at the end of the five year period will then give the spurious appearance of a positive quantum effect when, in fact, it is merely a symptom of past delay.

In reality, the transition has been much more gradual than this example, occurring slowly over the last 35 years. Nevertheless, at some point the trend towards delayed childbearing must subside. This natural limit depends on future behaviour and changes in fertility technology. Goldstein (2006) suggests that, with the prevailing

parity distribution and rate of childlessness prevalent in Denmark, the mean age at first birth could rise as high as 33 years there. Were this (extreme case) to hold for Australia, at the current rate of increase, postponement of fertility could potentially continue for several decades. However, the TFR may still rise over this period if the rate of postponement is slower than the rate of recuperation.

A central question is the extent to which there has been any quantum effect or whether recuperation (or other tempo effects) fully explains the current upturn in fertility. A number of attempts to adjust the TFR for the effects of postponement have been made, though there is no consensus on how best to deal with this problem.¹¹ In addition, some of the more promising indicators rely on data that only become available after a significant lag. In any case, the observed changes in fertility are too small and too recent to decisively confirm the presence of a quantum effect.

In that context, using a range of indicators may provide suggestive evidence about the possibility of a quantum effect in the recent Australian fertility recovery. In any case, it is useful to clarify the advantages and limitations of the various indicators, since they are sometimes misused in prognoses of future fertility levels. In particular, some indicators have little sensitivity to turning points in fertility and can *appear* to suggest future declines in fertility when that is not true. The indicators considered below include parity data (section 2.5), the median age of mothers (section 2.6), an analysis of Age-Specific Fertility Rates (ASFRs) (section 2.7), fertility data from three national datasets (section 2.8), and finally, analysis of various fertility measures from the HILDA longitudinal survey of Australian households (section 2.9). These collectively build up a picture of what may be happening to underlying fertility behaviour in Australia.

2.5 Parity data

In Australia, the most important determinant of cohort fertility rates has been the distribution of first births by age, and second births by age and the interval since first birth (McDonald and Kippen 2007). A quantum effect is therefore most likely to show up as growth in first and second order parities at young ages or diminution in the intervals between them. Testing this requires data on the pattern of fertility for the first child, second child and higher parities.

Unfortunately, parity data from the two main statistical sources available in Australia for this purpose are limited. On the one hand, the National Perinatal

¹¹ Bongaarts and Feeney (1998) provide the most widely known measure. See Schoen (2004) or Imhoff and Keilman (2000) for criticisms of the approach adopted by Bongaarts and Feeney.

Collection provides information on the parity of women giving birth, but identifying the parities for the whole population of women is problematic. On the other, the Population Census data are free of this problem,¹² but the ABS collects these data only every ten years. The latest available ABS evidence on parity covers the 10 year period from 1996 to 2006 (figure 2.8), which straddles an initial period of apparent fertility decline and a subsequent period of apparent recovery. Accordingly, these data cannot be used to consider changing parity patterns over the period from 2000.

What the Census data do not reveal is that over the whole span of the last decade there has been:

- an increase in childlessness (well documented by many others). For example, the proportion of 40-44 year old women who were childless increased from 9 to 16 per cent from 1981 to 2006 (Gray et al. 2008, p. 4)
- a decline in the share of women of a given age having two or three children
- associated with the reduction in parities two and three, a commensurate increase in the share of women at older ages having just one child.

It is these sorts of figures — and especially the rising incidence of childlessness — that have particularly prompted concerns about prospective fertility levels in Australia.

But without sufficiently high frequency data on parities, it is hard to determine how parity trends are developing. Postponement of child bearing inevitably means that many more young women will have had no children *so far*. Whether they go on subsequently to have two or three children depends on trends in the transition probabilities to higher parities at given ages.¹³

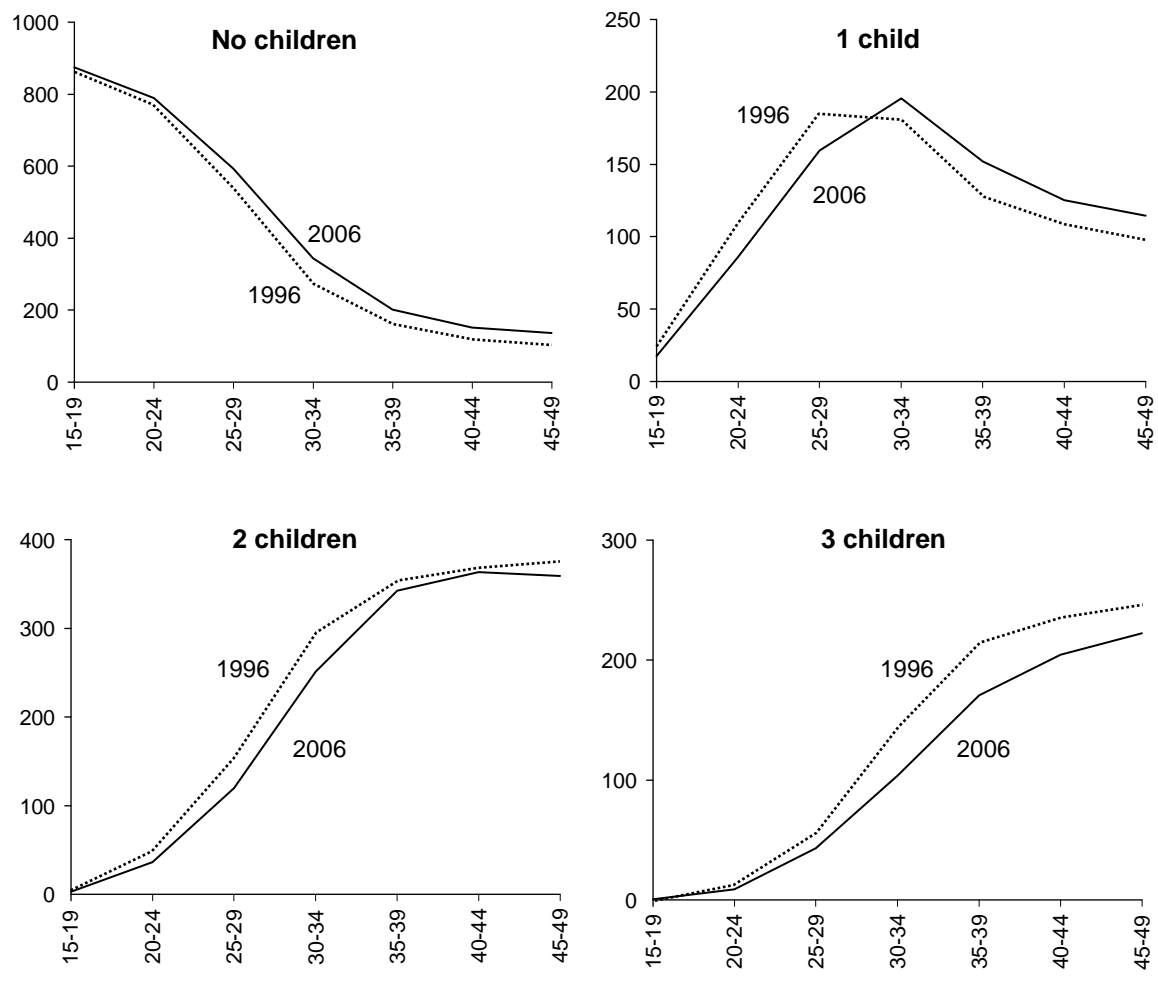
While fully consistent data needed to create Age and Parity Specific Fertility Rates (APsFRs) (and the changing transition probabilities based on these) are not available from a single source for Australia, Kippen (2003) has created a useful dataset by combining NPDC and ABS census data. She finds that the rate at which women *of a given age* who already have two children progress to three (and to higher-order parities) has been relatively constant over time. Consequently, while the share of women who have three or more children over their lifetimes has been falling, this reflects the fact that some women are failing to achieve parity two at all,

¹² The census question covers the complete population of women, asking ‘how many children have you ever had?’

¹³ Gathering parity information in every census, as opposed to every second census, would help with this type of problem. Corr and Kippen (2006) discuss this issue, along with several other minor changes to data collection processes that could significantly improve our knowledge of fertility in Australia.

or are achieving it at older ages, when progression to later order parities is less likely. These data only cover the period from 1991 to 2000, which precedes the upturn in TFR. A forthcoming version of this paper by McDonald and Kippen will make an important contribution to understanding recent trends in Australian fertility.

Figure 2.8 Number of women with zero, one, two and three children
Per 1000 women, 1996 and 2006



Data source: ABS, *Population Census*, Cat. no. 2068.0.

At present, the available parity evidence for Australia cannot corroborate or contradict whether the observed increase in TFR represents a quantum effect.

2.6 Age of mothers

There are several measures of postponement based on the mother's age. The most direct indicator is the median age at first birth for married women (first nuptial confinement).¹⁴ This has increased at a roughly constant rate over the last thirty years (figure 2.9), though the increases slow in the last two years of available data (2005 and 2006).¹⁵ However, this measure relates only to the current marriage, and so excludes exnuptial births (around one third of all births) and births to previous marriages. Exnuptial births are growing in their significance and tend to occur earlier in women's lives. As a result, the median age of the first nuptial confinement will tend to exaggerate the 'ageing of motherhood'.

Moreover, while an indicator of long-term trends in postponement, this measure will not detect a turning point in postponement until some years later. This is because past postponement by older cohorts of women biases these kinds of measures. So even when young women are no longer delaying the age at which they commence childbearing, older women are having babies that they originally postponed several years previously (McDonald and Kippen 2007). This pushes up the various summary measures of the childbearing age of women, even where postponement is no longer significant.

One measure that overcomes these deficiencies is the age at which successive cohorts of women achieve an average of one child (figure 2.9). This age grew strongly for mothers born after the Second World War, but the pace of its increase has been trending downwards for women born after the mid-1950s, suggestive of weakening postponement.

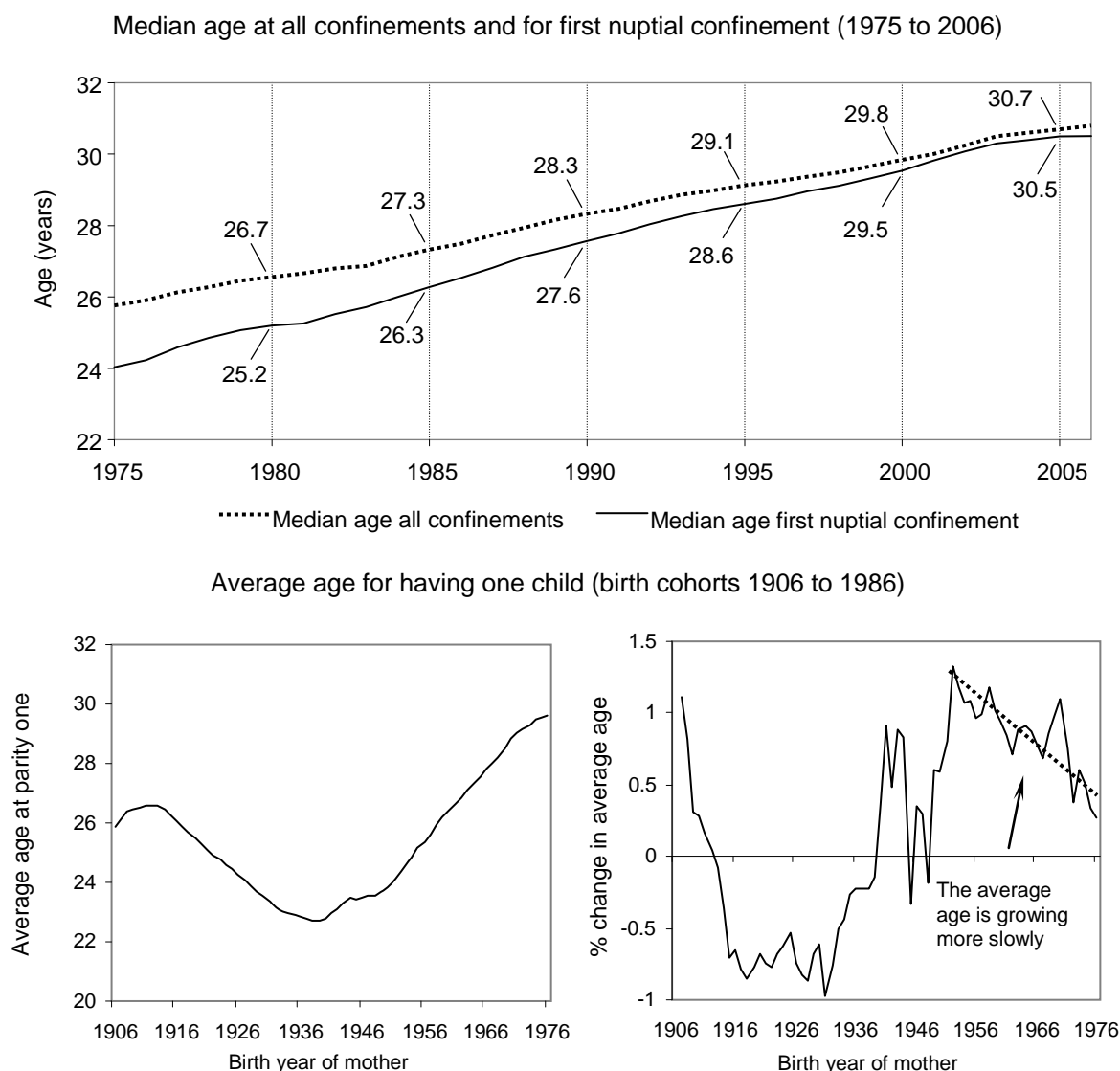
2.7 Changes to age-specific fertility rates

The movement of the distribution of ASFRs over time gives some indication of the changing patterns of fertility behaviour (figure 2.10). As the area under each ASFR distribution reflects the TFR in that year, the difference between the area 'lost' and the area 'gained' describes the overall change in TFR.

¹⁴ A nuptial first confinement is the first confinement in the current marriage and therefore does not necessarily represent the woman's first ever confinement resulting in a live birth (ABS 2006).

¹⁵ Other similar indicators — such as the median age of all confinements, the median ages of confinements for unmarried mothers and the median age of fathers at their child's birth — continued to increase.

Figure 2.9 Median age at all confinements and for first nuptial confinement



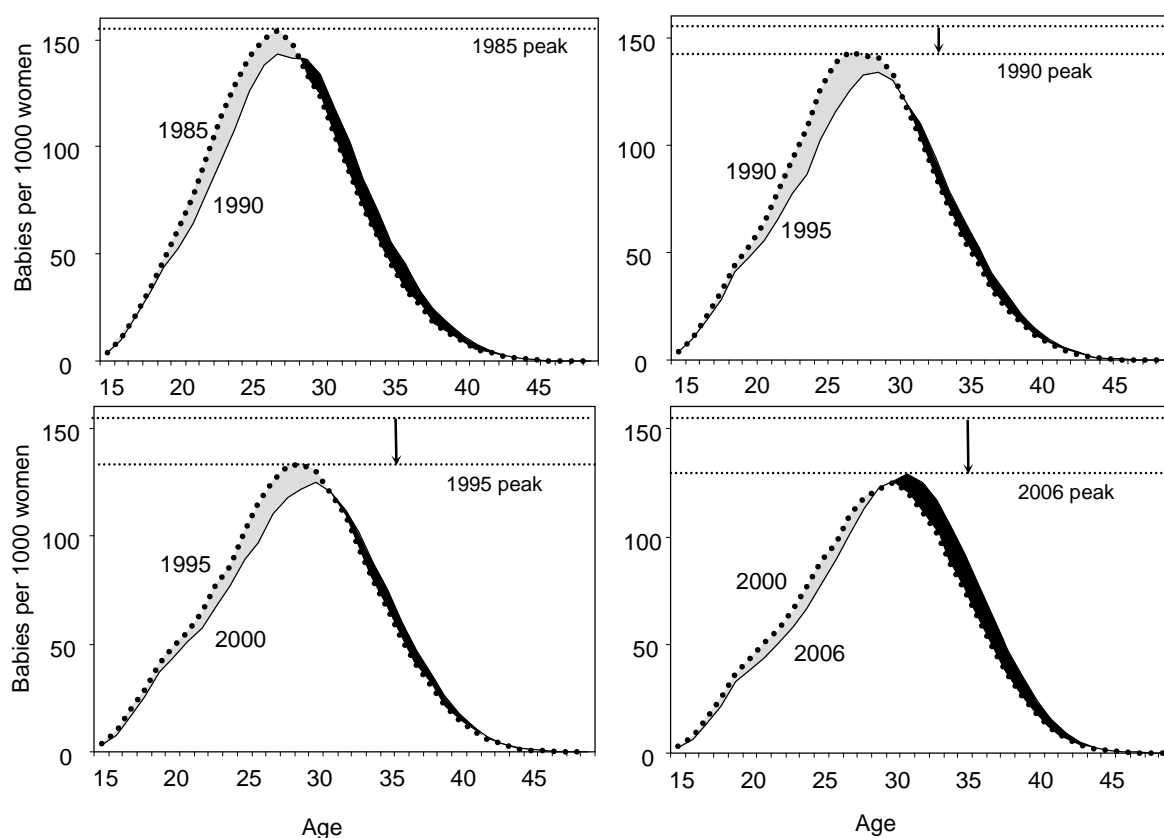
a Age-specific *cohort* fertility rates were derived from (period) age-specific fertility rates and used to calculate the age at which the average cumulative births of each cohort reached one.

Data source: ABS, *Births*, Cat. no. 3301.0 and unpublished data from the ABS.

The experiences of the last 20 years reveal two distinct phases. In the first phase, from 1985-2000, the fall in the TFR appears to be driven by:

- the decline in ASFR of younger women exceeding the growth of ASFRs of older women. (the area ‘lost’ on the left side of the distribution exceeding the area ‘gained’ on the right side)
- the decline in the height of the distribution.

Figure 2.10 Distributions of ASFRs from 1985 to 2006^a



^a The shaded areas represent the excess (deficit) of the earlier year's ASFRs over the later year's ASFRs.

Data source: ABS, *Births*, Cat. no. 3301.0.

The rightward movement of the distribution is caused by the postponement of childbearing by younger women and the partial recuperation of childbearing by older women (who had previously postponed). This introduces the downward bias in the TFR described above. However, it is also likely to be associated with lower completed fertility if delay in childbearing leads ultimately to fewer lifetime babies (for example, due to lower fecundity, relationship difficulties or other emerging obstacles to childbearing). The decline in the height of the distribution probably also indicates a negative quantum effect.

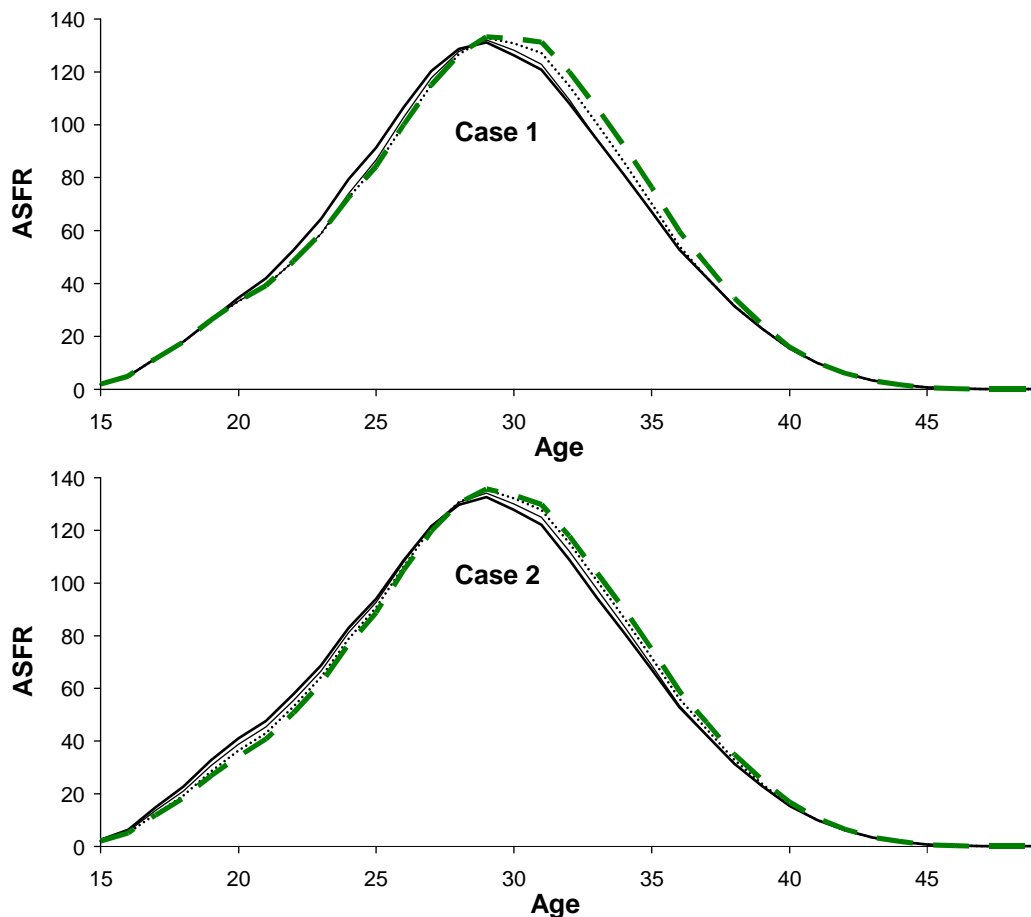
The pattern displayed in the ASFRs from 2000 to 2006 is very different. In particular, the fertility of younger women fell by less, while the fertility of older women increased by more. This, combined with an increase of age-specific fertility rates for the peak fertility ages, resulted in the increase in TFR over this period.

The interpretation of this development is difficult, as it is consistent with both an increase in lifetime fertility (a quantum effect) and a slowing of the trend towards delayed childbearing (box 2.2).

Box 2.2 A simulation of postponement and quantum effects

A useful way of demonstrating how quantum shocks and the end of postponement would influence the shape of the ASFR distribution is through simulating each effect independently. We did this by initially constructing an underlying model of fertility (a so called 'data generating process' or DGP) that flexibly incorporates any kind of quantum and tempo effect. In case 1, the simulation involves no quantum shock and postponement slowly concluding over ten years. This shock changes the ASFRs but does not affect the CFR. In case 2, postponement continues over the period considered and a positive quantum shock occurs gradually. This changes both the ASFR and the CFR.

Simulation of the DGP demonstrates that the current changes actually observed could equally come from the end of postponement, or from a quantum shock. However, as there are many ways to model a quantum shock and the end of postponement, the results from simulating the DGP are not definitive.



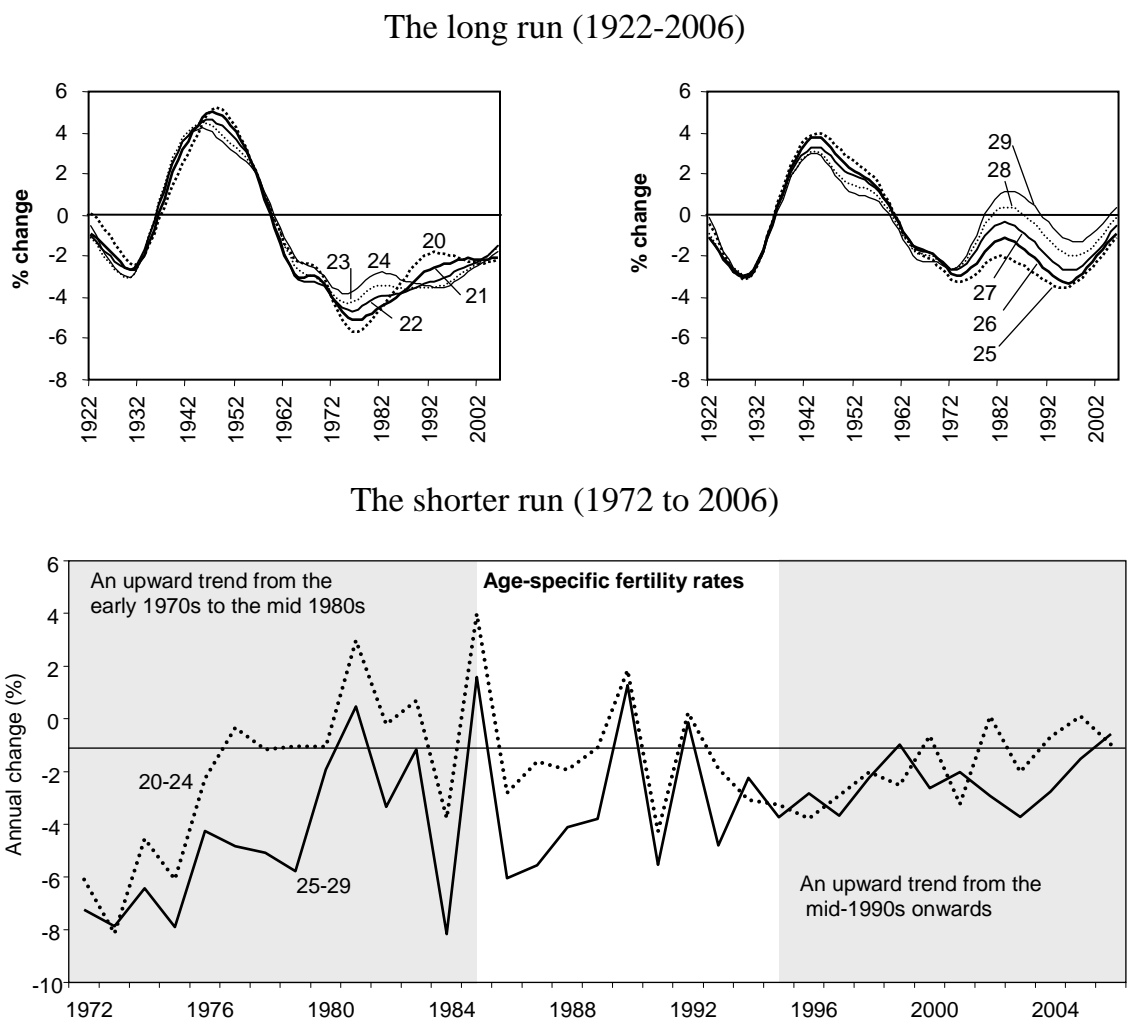
On the one hand, a quantum shock that affected all ASFRs would appear to cancel the declines in younger women's ASFRs, whilst reinforcing the increases in older women's ASFRs.

On the other hand, the conclusion of postponement would cause the ASFRs of younger women to stop falling, while recuperation of previously foregone childbearing would continue to raise fertility rates among older women.

Both could potentially generate the ASFR distribution observed since 2000, yet their underlying mechanisms are different.

The rate of change of the ASFRs over time suggests that the pace of postponement is slowing — and that this could play a prominent role in the recent rise in the TFR. While most of the ASFRs for women under 30 are still falling, there is an upward trend in the rate of change, beginning in the mid 1990s (figure 2.11).

Figure 2.11 Percentage changes in ASFRs – raw and smoothed



Data source: ABS, *Births*, Cat. no. 3301.0.

The two lower graphs in figure 2.11 illustrate the long-term trends more clearly by removing the random variation using a simple smoothing function (the

Hodrick-Prescott filter). This does not necessarily mean the imminent end to postponement. Decelerations in the pace of postponement have occurred in the past, such as from the early 1970s to the mid 1980s, but were followed by a period (albeit, short-lived) of further postponement.

2.8 What do other data on age-specific fertility rates show?

While ABS Births data provide the most widely used measures of fertility rates, there are two other useful sources of information.¹⁶ The first is the NPDC (discussed earlier), which collects births data, and can be combined with the ABS population estimates to generate ASFRs and the TFR. The second is the ABS Australian Demographic Statistics (ADS) data.¹⁷ The ADS data use the same data collection as the ABS Births series but is based on year of occurrence (as opposed to the year of registration as in the Births data).

These datasets capture a number of salient features not yet apparent in the ABS *Births* publication. Both datasets point to further increases in the TFR. This is evident in the NPDC as early as 2005, when the TFR increased to around 1.85.¹⁸ Although these estimates are preliminary and subject to revision, the ADS corroborates an increase in the TFR from 1.8 to 1.85 in the fiscal years from 2005-06 to 2006-07. (As shown below, new births data from the ADS suggest a further increase in the TFR to more than 1.9 in the calendar year 2007).

The NPDC and ADS data largely attribute the increase in TFR to a rise in the fertility rates of women over 30 years. However, interestingly, there have also been increases in the fertility rates of some younger women as well. There is a clear increase in the ASFRs of women aged 20 to 24 and 25 to 30 in the NPDC in 2005 (figure 2.12). The change is less dramatic in the ADS data, but the ASFRs of these women increase in both 2005 and 2006 (figure 2.13).

This suggests that there is more than a deceleration in postponement driving the upturn in fertility. As postponement subsides, we would expect to see the TFR rise as the ASFRs of younger women stopped falling and the ASFR of older women continue to increase as they recuperated previously foregone childbearing. However, there is no obvious reason why the ASFRs of younger women should begin to *rise*. This is consistent with a more general increase in fertility (a quantum

¹⁶ ABS, *Births, Australia*, Cat. no. 3301.0.

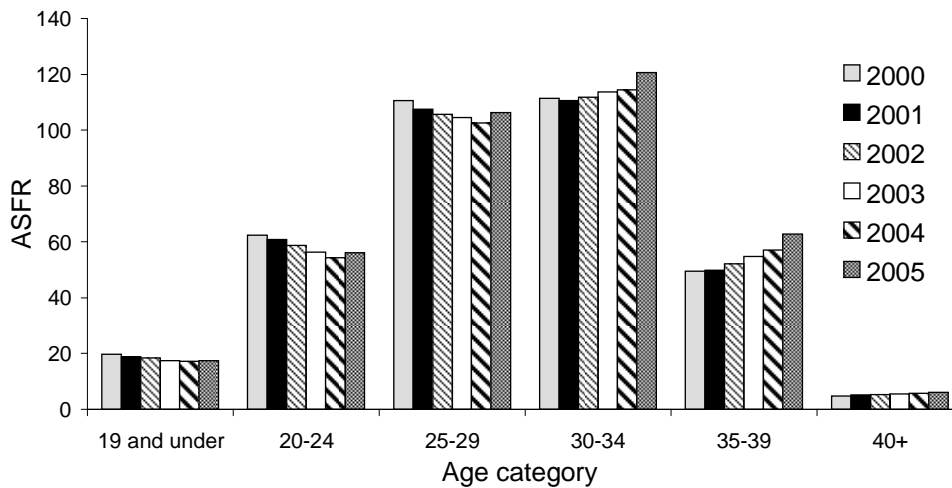
¹⁷ ABS, *Australian Demographic Statistics* Cat. no. 3101.0.

¹⁸ PC estimate based on NPDC and ABS data.

effect) and potentially a shift to earlier childbearing by new cohorts of women. However, it is too soon to tell whether the increases in the ASFR of younger women will be sustained or not.

Figure 2.12 Age-specific fertility rates, 2000 to 2005

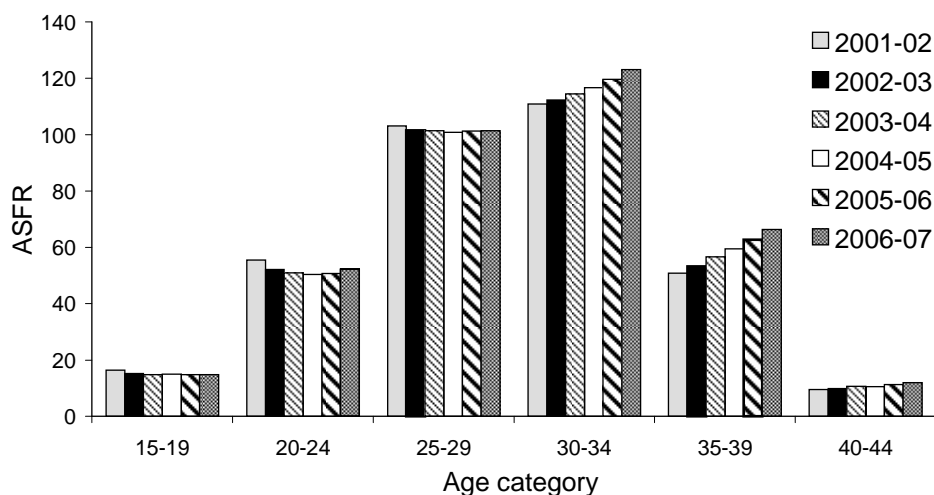
National Perinatal Data Collection



Data source: PC estimates based on Australia's Mothers and Babies, Perinatal statistics series — various years.

Figure 2.13 Age-specific fertility rates, 2001-02 to 2006-07^a

Australian Demographic Statistics dataset



^aThe ASFR estimates for 2006-07 are based on preliminary birth registration data (on a date of registration basis) and use the age of mother distribution from births occurring in the previous financial year to apportion the births by age of mother for 2006/07. ASFR estimates for earlier years are on a date of occurrence basis using reported age of mother.

Data source: ABS, Australian Demographic Statistics Cat. no. 3101.0.

The most recent ADS data show there have been 285 254 births in Australia in 2007, around seven per cent higher than the previous year. This means that more babies have been born in 2007 than in any other year in Australia's history. These data are consistent with a TFR for 2007 of around 1.93 children per woman (box 2.3).¹⁹ This is the highest rate since the early 1980s.

2.9 Longitudinal evidence

The Household Income and Labour Dynamics in Australia (HILDA) Survey measures desired and expected fertility, as well as actual births achieved. By adding the number of children ever had by a woman to the number of future intended children, a synthetic measure of likely completed fertility can be created. The potential extent of quantum effects can then be directly gauged by comparing (for given ages) the changes in this synthetic measure between successive waves of the survey. Furthermore, it is also possible to assess the extent to which women's incipient desire for children (and the likelihood that those desires will be met) have changed over recent periods).

The quantitative analysis of these waves involves relatively sophisticated econometric modelling, partly due to changes in the survey design and partly because the relevant measures of fertility at the individual level are categorical and ordered (a person cannot have 1.07 babies, but 0, 1, 2, 3 or ...etc). Appendix G contains the details of the analysis.

The results of the analysis suggest that

- between 2001 and 2006 there was an increase of around 0.15 babies in expected lifetime fertility for younger woman
- fewer women expected to experience lifetime childlessness in 2006 than in 2001. (Childlessness may still rise, but at a lower rate than previously.) There was a corresponding increase in the expectation of just having one child (and for more recent cohorts, also two and three children)
- there was an increase in women's subjective view about the desirability and likelihood of future children (table G.5).

These results are consistent with a positive quantum effect over the 2000s (but cannot be used to accurately assess the percentage contribution of quantum effects to the change in period fertility — the TFR — over this period).

¹⁹ The published data for this quarter relate only to births, with no TFR or ASFR data provided.

Box 2.3 Deriving an estimate of the TFR for 2007

The ADS data (Cat. no. 3101.0) provides more up-to-date estimates of births than the corresponding official measure (Cat. no. 3301.0). It is possible, with some assumptions, to use the ADS data as a leading indicator of the official total fertility rate.

In the year ending December 2007, births in Australia were 285 254. A simple way of predicting the TFR is as follows. A rough estimate of the number of births (B) in 2007 can be calculated as the dot product of the age-specific fertility rates (A) of 2006 and the relevant female population in 2007: $\hat{B}_t \equiv \sum_{age=15}^{49} POPF_{age,t} \times A_{age,t-1}/1000$.

The TFR for 2007 can then be estimated by adjusting this simple estimate by the deviation of observed to predicted births so that $B_t/\hat{B}_t \times TFR_{t-1} = 1.932$ children per woman.

A more sophisticated measure can be derived by taking account of the fact that changes in the TFR are often accompanied by shifts in the distribution of age-specific fertility rates (if nothing else, because recuperation implies larger increases in older age-specific fertility rates). One reasonable basis for calculating the trends in age-specific fertility rates is the past ratio of A_t/A_{t-1} . In that case, first define an adjusted ASFR for 2006 (A) as: $\hat{A}_{age,2006} = (A_{age,2006} / A_{age,2005}) \times A_{age,2006}$ and then convert these to shares: $S_{age,2006} = \hat{A}_{age,2006} / \sum_{age=15}^{49} \hat{A}_{age,2006}$.

Then calculate the implied age-specific fertility rates for 2006 that are consistent with the actual TFR observed for that year (\tilde{A}), that is $\tilde{A}_{age,2006} = TFR_{2006} \times S_{age,2006} \times 1000$.

Then, as before estimate $\hat{B}_t \equiv \sum_{age=15}^{49} POPF_{age,t} \times \tilde{A}_{age,t-1}/1000$ and proceed as previously. Historically, this method has greater predictive capacity than the simple method (with less than 1/20th of the squared errors for the predictions from 2003 to 2006). Nevertheless, in this case, it gives much the same estimate, at 1.930 children per woman.

In the absence of adjustments by the ABS to the underlying births or population data, it is very likely that the TFR will be around 1.93 in 2007. There is an important qualification in interpreting these data. As discussed earlier, registration delays affects data on births. The requirement for parents to register births to obtain the baby bonus, combined with improvements in the processes used by the various State and Territory registrars is one contributor to the high rate observed in 2007.

2.10 The increase in fertility and the slowing of postponement are not independent

The collective evidence discussed above suggests the possible coexistence of deceleration of postponement and a quantum effect over the last 10 years. Their coincidence is not surprising:

- Over the whole population of women of childbearing age, choices about when to have children are likely to affect completed fertility. Fecundity of females (and, to a lesser extent, males as well) declines significantly with age (Dunson, Colombo and Baird 2002). Moreover, in any given year, certain events reduce the potential for child bearing — illness, partnership problems, income downturns, career demands. That need not affect completed fertility much since one year for bearing a child is a close substitute for another one. However, shorter windows for childbearing provide couples with a smaller buffer to accommodate unexpected adverse events. As an extreme example, suppose that a woman's fertility ceases at age 50 and a woman aspiring to two children delays childbearing to her 42nd year. A few adverse events could easily disrupt those intentions in a way that would not have affected a woman who planned to have children any time after age 25 years. Any factor that brings forward childbearing (compared with its counterfactual timing) is therefore also likely to stimulate completed fertility.
- Desired lifetime fertility and the age distribution of childbearing are often causally linked. Conditions that are conducive to earlier childbearing are also likely to prompt increased fertility (and vice versa). For example, the quantum increase in fertility during the post-war baby boom, was associated with a decrease in the median age of mothers. This may be due people making a decision to have more children and thus beginning childbearing earlier. Equally, the material conditions and social atmosphere may have encouraged people to have children earlier, which in turn led to them ultimately having more children. Similarly, the quantum decrease that has occurred since the mid 1970s has been associated with a steady increase in the median age of mothers.

It is likely that much of the increase in recent years reflects so-called 'recuperation' of previously postponed children, potentially buttressed by the possibility that women have also brought forward childbearing at later ages (for example, a woman having a second child at 41 rather than 42). But, given the continued increase in the TFR and the evidence from the HILDA survey, it is also likely that some quantum effects are at work.

There are reasonable prospects that Australia's relatively high fertility rates will be sustained over the long run:

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- Recuperation reveals the underlying fertility rate that had been artificially depressed by past postponement.
 - Although future cyclical downturns may well temporarily depress fertility, the nature of the Australian economy has changed in a way that better accommodates having children while working (chapter 3). This is likely to be reinforced by emerging social initiatives encouraging greater work-life balance.
 - Policy is generally supportive of families in Australia and is broadly endorsed by the community.

Understanding the nature and power of the latter environmental factors in shaping fertility in the last decade is the subject of the next chapter.