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Recent Trends in Australian Fertility

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Staff Working Paper

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Ralph Lattimore
Clinton Pobke

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Publications Inquiries:
Media and Publications
Productivity Commission
Locked Bag 2 Collins Street East
Melbourne VIC 8003

Tel: (03) 9653 2244
Fax: (03) 9653 2303
Email: maps@pc.gov.au

General Inquiries:
Tel: (02) 6240 3200 or (03) 9653 2100

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Foreword

The fertility of Australia’s population — how many children women have on average — is an important determinant of this country’s demographic future. As the debate surrounding population ageing and its economic and fiscal impacts has intensified, so too has interest in fertility from a policy perspective. This interest is buoyed by the significance that many people in our society have always placed on children and childbearing.

For these reasons, the long-run decline in fertility in Australia, and its more recent partial revival, have attracted considerable public attention. This staff working paper explores what has happened to fertility levels in Australia and why. It also considers what may happen in the future and assesses whether we should be worried by current fertility rates.

The report finds that there are strong grounds for avoiding very low fertility. However, at existing aggregate levels, fertility appears to be in a ‘safe’ zone and should not be of significant policy concern in Australia. Indeed, policy measures directed specifically at promoting fertility above current levels could have unanticipated adverse impacts. That said, there are policies that incidentally affect fertility, but which are premised on other considerations, and may be worthwhile regardless of their impact on Australia’s fertility levels.

This staff working paper is part of a stream of Productivity Commission research that originates from the Commission’s 2005 study for CoAG on the *Economic Implications of the Ageing of Australia’s Population.* The Commission is also currently engaged in a separate public inquiry into the design and impacts of paid parental leave in Australia, which will issue a draft report in September.

Gary Banks AO
Chairman

July 2008

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The views in this paper remain those of the authors and do not necessarily reflect the views of the Productivity Commission or of the external organisations and people who provided assistance.

Contents

Abbreviations and explanations

Abbreviations

ABS	Australian Bureau of Statistics
ADS	Australian Demographic Statistics
AIHW	Australian Institute of Health and Welfare
ASFR	Age specific fertility rate
CCB	Child Care Benefit
CCTR	Child Care Tax Rebate
CFR	Completed fertility rate
FACSIA	Department of Family, Community Services and Indigenous Affairs
FTA	Family Tax Allowance
FTB(A)	Family Tax Benefit (Part A)
FTB(B)	Family Tax Benefit (Part B)
HILDA	Household Income and Labour Dynamics in Australia Survey
IGR	Intergenerational Report
NPDC	National Perinatal Data Collection
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
SEIFA	Socio-Economic Indexes for Areas
TFR	Total fertility rate

Explanations

Age cohort	A group of people born during the same year.
Age-specific birth rate	The number of live births at each age of mother per 1000 females of that age.
Anticipation	Bringing forward births that a woman would otherwise have had later. If completed fertility rates are held constant, this shifts the distribution of age-specific birth rates to younger ages.
Baby Bonus	One-off payment on birth or adoption of a child.
Completed fertility rate	The average number of births a cohort of females have borne over their reproductive lifetimes.
Crude birth rate	The crude birth rate is the number of live births registered during the calendar year per 1000 estimated resident population at 30 June of that year.
Maternity Allowance	One-off payment on the birth or adoption of a child (now renamed the Baby Bonus).
Nuptial birth	A nuptial birth is the birth of a child born of parents who are legally married at the time of the child’s birth.
Parity	The number of children a woman has had to date.
Postponement	Delaying births that a woman would otherwise have had earlier. If completed fertility rates are held constant, this shifts the distribution of age-specific birth rates to older ages.
Quantum effect	An increase in the completed fertility rate (as compared with tempo effects that shift the timing, but not necessarily the average number, of births).
Recuperation	Women having more children at later ages because they postponed children at earlier ages.
Replacement fertility	Replacement level fertility is the number of babies a female would need to have over her reproductive life to replace herself and her partner. Replacement fertility is estimated at around 2.1 babies per female. It is the level of fertility that would achieve long run zero population growth were there to be no net overseas migration.

continued

Tempo effect	Changes in the timing, rather than the ultimate number, of lifetime births. Tempo includes postponement, anticipation and recuperation.
Total fertility rate	The sum of age-specific fertility rates. It represents the number of children a female would bear during her lifetime if she experienced current age-specific fertility rates at each age of her reproductive life. (It will differ from the crude birth rate because the age-specific rates are not weighted to reflect the population shares of women in various age groups.)

OVERVIEW

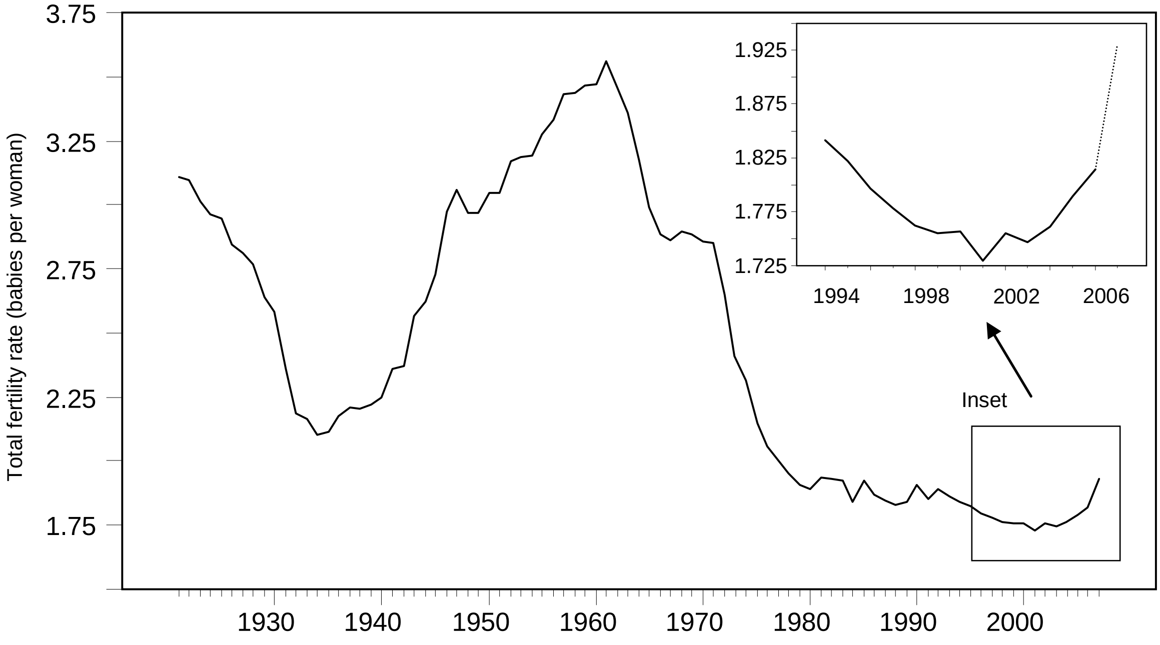
Key points

- Births in Australia are at an historical high — with around 285 000 babies born in 2007. This corresponds to an estimated total fertility rate of 1.93 babies per woman, the highest since the early 1980s.
  - This is not a one-off event as fertility rates have been generally rising for the last 6 years. Overall, the evidence suggests that after its long downward trend after the Second World War, Australia's fertility rate may have stabilised at around 1.75 to 1.9 babies per woman.
- Much of the recent increase in the fertility rate is likely to reflect the fact that over the last few decades, younger women postponed childbearing and many are now having these postponed babies (so-called 'recuperation'). This has shown up as higher fertility rates for older women.
- However, some of the increase is also likely to be due to a 'quantum' effect — an increase in the number of babies women will ultimately have over their lifetimes. For example, today's young women say they are expecting to have more babies over their lifetime than those five years ago.
- Rising fertility reflects several factors:
  - Buoyant economic conditions and greater access to part-time jobs have reduced the financial risks associated with childbearing and lowered the costs associated with exiting and re-entering the labour market.
  - With more flexible work arrangements, women today are more able to combine participation in the labour force with childrearing roles.
  - A recent increase in the generosity of family benefits (such as family tax benefit A and the 'baby bonus'), though not targeted at fertility, is also likely to have played a part. However, that role has probably only been a modest one. Family policies are more powerful in providing income support, improving child and parental welfare, and serving other social goals than in affecting fertility rates.
- Overall, Australia appears to be in a 'safe zone' of fertility, despite fertility levels being below replacement levels. There is no fertility crisis.
  - Australia's population should continue to grow at one of the highest rates in the developed world because of migrant inflows.
  - Feasibly attainable increases in fertility would not significantly allay ageing of the population, nor address its fiscal and labour market challenges.

Overview

Births in Australia have reached their highest level — with around 285 000 births in 2007. These high numbers partly reflect Australia's larger population, but more importantly, given contemporary anxieties about the adequacy of fertility, they also reflect an increase in the so-called 'total fertility rate' (TFR) (figure 1). In 2006, the TFR was 1.81 babies per woman, appreciably higher than its lowest level of 1.73 in 2001. It is likely to be around 1.93 in 2007, but reflecting the effects of the slowdown in global growth, there may be a short-lived 'relapse' in fertility in 2008 and 2009 (as has occurred during other slowdowns).

Figure 1 **After a long decline, the fertility rate is now rising**
1921 to 2007



a The 2007 TFR is estimated.

The key question for Australia's demographic future is, short-term business cycle effects aside, whether fertility levels will stay at roughly their current level, or resume the downward trend apparent before the recent recovery. That is difficult to surmise. For example, measurement issues — such as changing patterns of birth registration, in part prompted by the 'Baby Bonus' — muddy the interpretation of fertility trends. And, in the past, there have been short-lived 'blips' in fertility before recurrence of subsequent declines. It is possible, that after a pause, fertility will decline again if some of the long-run drivers of lower fertility — such as later partnership formation, reduced housing affordability and the greater educational status of women — continue to exert a powerful influence.

Box 1 What is the total fertility rate?

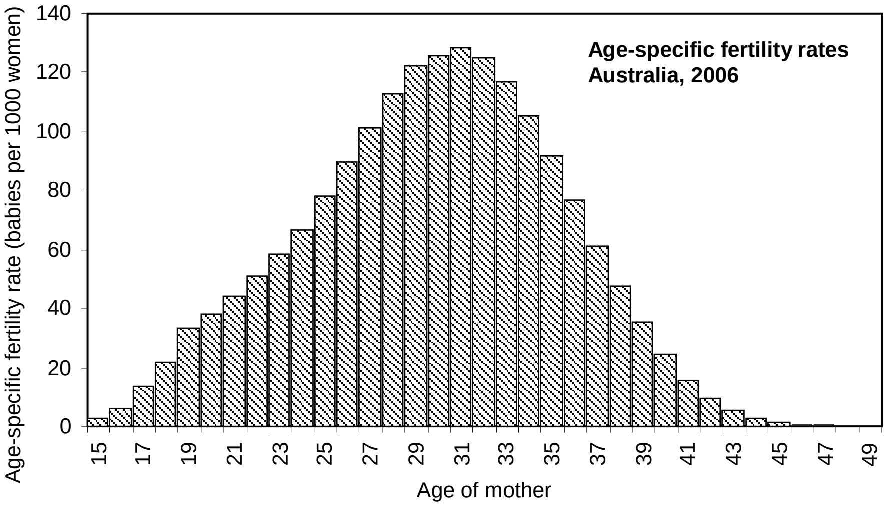
To avoid misunderstanding the key indicator of fertility — the total fertility rate (or TFR) — it is important to know how it is constructed and what it means.

In any given year, fertility rates can be calculated for women of different ages. These 'age-specific' fertility rates are calculated for women of each age from 15 to 49 years (with any births to women outside these ages being included in the fertility rates of 15 year olds and 49 year olds respectively) The age-specific fertility rates for Australian women in 2006 are shown in the figure below.

The TFR will then be the simple (non-weighted) sum of these rates. This is equivalent to stacking the bars in the figure below on top of one another (and dividing by 1000). The TFR is equivalent to the average number of children that would be born to a woman over her lifetime were she to experience current age-specific fertility rates through her lifetime.

A woman is unlikely to actually experience this lifetime fertility. For example, on average, 15 year olds today will not, when aged 16 in 2009 experience the age-specific fertility rate of 16 year olds apparent in 2008. It is even more unlikely that they would experience, when aged 40 in 2033, the age-specific fertility rate of 40 year olds apparent in 2008. This reflects the fact that age-specific fertility rates change over time.

While the TFR is not a reliable indicator of the number of children that young women of today will eventually have over their lifetimes, it is still a useful measure. Unlike the 'crude' birth rate (the sum of births divided by the population), the TFR controls for the age structure of the fertile female population. Were this not done, then as the relevant population of women aged, fertility rates would fall (as older women have lower fertility rates), though nothing would have happened to intrinsic fertility behaviour.



However, several factors suggest that the fertility rate may have stabilised at around 1.75–1.90, with a reduced likelihood that it will fall below 1.75, as anticipated only a few years ago:

- The increase in TFR is more sustained than would be suggested by random variation.
- Younger women have revised upwards their expectations of having children.
- The recent increases are consistent with the preceding deceleration of the downward trend in fertility, suggesting that the factors impeding past fertility — such as postponement of childbearing — have a weakening influence.
- The upturn in fertility in Australia is not an isolated event, but rather has been observed in many OECD countries. In particular, Australia's experience appears to parallel that of other English speaking countries such as New Zealand, the United States, the United Kingdom and Canada.

Three distinct, but inter-related, factors have contributed to the rising total fertility rate:

- *Recuperation* — older women catching up on their previously postponed births. As in many other countries, the timing of Australian fertility behaviour has changed fundamentally over the past three decades. Women have delayed childbearing to later ages because of workforce participation, lifestyle choices, shifting social attitudes, and changing patterns of partnership formation, among a variety of other complex factors. Measured fertility falls during the initial transition to a new set of (older) ages at which women have babies. This is because younger women are having fewer children, while the fertility rates of older women have not yet risen. Eventually cohorts of women who had previously postponed childbearing start having children, which exerts a positive force on the TFR. This is recuperation.
- *Anticipation* — some women bringing forward babies that they were going to have later, in response to good economic times and family policy incentives.
- *Quantum* effects — an increase in the completed fertility above what it would have been otherwise. In contrast, recuperation and anticipation are timing (or tempo) effects that need not affect the lifetime number of babies had by women. The long-run demographic effects of fertility are dependent on lifetime fertility rates. Consequently, the presence of quantum effects in the recent fertility increase mean that the increase will have long-run, not merely ephemeral, effects.

It is hard to assess how much these various factors have contributed to the recent rise in fertility — in part because small changes in any of them are difficult to distinguish from each other over short periods, and because they are conceptually linked. Timing decisions (inherent in recuperation and anticipation) are likely to affect lifetime fertility. Bringing births forward, or not delaying by as much, reduces the likelihood that unanticipated events will curtail childbearing (illness, partnership problems, and the natural decline of fecundity with age). Moreover, the three phenomena are likely to share common causes — conditions that are conducive to increased fertility are also likely to prompt earlier childbearing or slow the trend towards postponing childbirth.

Why has fertility been rising?

Recuperation has almost certainly been a major driver of the increase in fertility — the legacy of past postponement. But other factors are likely to have also contributed significantly. In particular, the recent period of prosperity experienced in Australia has probably played a decisive role in the upturn in fertility. This reflects greater household income, but probably more importantly:

- strong labour demand driving historically low levels of unemployment, as well as shorter average durations of unemployment
- low levels of output volatility
- flexible labour markets that have allowed part-time and casual jobs to flourish
- optimism about the future.

These factors promote childbearing by lowering the costs associated with exiting and re-entering the workforce, reducing the financial risks involved in family formation, and enabling parents to negotiate a better balance between work and caring responsibilities.

Other factors, such as greater educational achievement by women, later partnering and rising house prices are likely to have exerted a counterbalancing force and reduced the extent to which fertility may have otherwise risen.

The increased generosity of family policies — including the 'Baby Bonus' and Family Tax Benefit (A) — over the last eight years is also likely to have played a part, albeit probably a modest one. It may also be that the greater emphasis on family policy has highlighted community norms about the importance of children and that this, more than the monetary value of family policies, has had the bigger effect on fertility.

The international empirical evidence suggests that family policy has a small but statistically significant effect on fertility. However, the estimated effects are typically found to be too small to explain the increase in fertility observed in Australia. The implication is that any effect has been achieved at a relatively high cost.

Were Australian fertility to have the same sensitivity to family allowances as OECD countries as a whole, then this implies that changes in allowances over this period increased the total fertility rate by about 3.7 per cent (around 0.07 babies per woman). This equates to a budget cost of about $300 000 per additional baby (appendix D). Were a lower sensitivity of fertility to benefits assumed, the cost per additional baby could readily be significantly more. Such an assumption would not be far-fetched. There are several reasons why Australia's responsiveness to family policy is probably lower than that found in the international literature and why family policy is unlikely to have been a major factor in the recent upturn:

- family policy in Australia is not explicitly designed with pro-natalist objectives (unlike a number of countries analysed in the international literature)
- fertility in Australia has traditionally been unresponsive to increases in family policy of the type currently employed
- even with the recent increases, family payments in Australia still only represent a small fraction of the cost of raising a child.

In saying this, however, it is important to emphasise that since Australian family policies aim to promote social and economic goals other than fertility, finding only an incidental, supportive effect is neither surprising nor problematic.

Should we be worried by Australia's fertility levels?

There are widespread perceptions that Australia's fertility level is too low. This concern is driven by many factors, such as the future care for the old, countering the demographic effects of population ageing (including on workforce participation and economic growth) and the implications for Australian society.

The social implications of very low fertility levels are significant. Were Australia to have a very low fertility rate of around 1.0 to 1.2 babies per woman, then it would imply an older age distribution, a much lower visibility of children and (to make up the numbers) a significantly bigger proportionate representation of migrants in the Australian population. All of these would have cultural and social ramifications, might be hard to reverse readily, and arguably would be regretted by many Australians. It is notable that in those countries where fertility levels have dipped to around these levels, encouragement of fertility has become a major preoccupation of policy and a central concern for the community as a whole.

However, Australia has a high fertility level compared with many other developed nations, the visibility of children will not change by much in the future, and only small migrant intakes are required to maintain population growth. Consequently, it is premature to contemplate any acute social implications of the kind raised above.

Another important social dimension to fertility is the gap between people's personally ideal number of children and the number they actually expect to have. On average, this gap is around 0.4 babies per woman. To some extent, this gap may indicate the failure of policy or social institutions to support families in accordance with community norms. But there are other reasons for the gap that have less policy relevance. For example, people will tradeoff their ideals in family size for other things they wish to achieve, such as freedom. That part of the gap is not necessarily a problem and less evidently one that government policy should or could close.

Other social concerns relate to the fertility of specific groups, rather than aggregate fertility. For example, teenage pregnancies often lead to parental and child disadvantage. Births at older ages involve risks for mothers and babies.

The implication is that, at current levels of aggregate fertility, social policy should probably be more oriented towards the problems associated with the fertility levels for specific groups, rather than towards aggregate fertility levels.

While the social dimensions of fertility are a legitimate consideration in determining family policy, attempts to foster fertility primarily on economic and demographic grounds are not well-founded. Among other things:

- The fact that Australia's fertility rate is below the 'replacement level' of 2.1 babies per woman does not have long-run implications for the sustainability of Australia's population. The replacement level is the number of children a woman would need to have to ensure zero long-run population growth *in the absence of migration*. But in the presence of even a small fraction of Australia's current net migration levels, the sustainability of Australia's population is not at risk. Indeed, with current fertility rates, Australia's population is projected to grow at the third highest rate among developed countries to 2051.
- Feasible increases in fertility do little to change the future age structure of the population. For example, were the total fertility rate to climb to 2.1 babies per woman (the 'replacement' level) from 1.85 babies per woman, then the proportion of people aged 65 years or more in 2051 would change from 26.0 to 24.9 per cent.
- Even over the medium term, increases in fertility actually reduce the ratio of the prime workforce (those aged 15–64 years) to the number of people aged under 15 and over 64 years — the 'support' ratio. Likewise, higher fertility depresses

labour supply per capita growth over the next 50 years — precisely the period when the baby boom generation are withdrawing from the labour market. In the long-run there are positive effects of higher fertility on labour supply per capita and a reduction in dependency — but, for realistic changes in fertility, both effects are small.

- Higher fertility actually aggravates Australia's fiscal pressures before it helps them, since the costs associated with raising extra children occur upfront, whereas the fiscal benefits are deferred for a long period. (Unlike many European countries, Australia has no impending pension crisis.)

Implications

Taking account of all of the existing evidence, there is no current or looming impending fertility crisis in Australia — Australia's present fertility level is likely to be roughly at levels that avoid the problems of excess or insufficient fertility. Problems are only entailed if Australia were to move outside this 'safe zone'.

The judgment that Australia has, and will continue to experience, relatively high fertility levels does not mean that there are no grounds for fertility policy. Australia's current fertility levels are, in part, an outcome of social institutions and policies that lower the costs of raising children and that reduce the tradeoffs between careers and bearing children. While there are legitimate questions about the impacts and design of some of these policies, a wholesale retreat from such policies would risk a long-run shift to much lower fertility levels.

Finally, there are a wide range of family policies that may incidentally affect fertility, but which are premised largely on improving parental and child welfare, encouraging gender equity, achieving social justice and encouraging workforce participation, rather than more babies per se. Such policies may still have sound foundations, regardless of any diagnosis about the adequacy of a country's fertility levels. The Commission's current inquiry into the design and impacts of paid parental leave in Australia is assessing several issues in one such area of public policy.

1 Introduction

Background

Fertility has declined significantly in Australia since its peak in 1961, an outcome of the sweeping social and economic changes that have occurred since that time. Declining fertility rates have been accompanied generally by public anxiety, heightened in recent times by concerns about the growing fiscal burden an ageing population will place on the proportionately declining workforce. This has been accentuated by concerns that low fertility is an outcome of an economic or social environment that is hostile to childbearing, as well as the problems for the preservation of society and its culture posed by below replacement fertility.

However, since 2001, fertility rates have risen somewhat, at times being misleadingly characterised as a new 'baby boom'. The contemporary pre-occupation with declining fertility has meant that the recent upturn has been mainly perceived as positive, yet its permanence, causes and relevance are not well understood.

The aim of this working paper

This paper describes Australia's recent fertility experiences, while also synthesising the existing theory and evidence that explains these experiences. The paper provides a perspective on:

- the extent to which the increase in measured fertility is a result of changes in the timing of births or a shift in the likely fertility levels women achieve over their lifetimes
- the major factors that influence fertility generally and their role in the Australian context
- the significance of the increase in fertility and whether current and impending levels of fertility should be a cause for concern
- the usefulness and limitations of current ways of thinking about fertility behaviour, including a detailed explanation of misconceptions about Australia's recent fertility experiences and their implications.

Fertility is a complex issue. Understanding it draws on many disciplines, including demography, physiology, economics and sociology. This paper has relatively limited ambitions, with a focus on recent trends in aggregate fertility and their policy significance. It does not cover many important aspects of fertility, such as:

- the detailed fertility behaviour of specific sub-populations (regions, migrants, indigenous people, disadvantaged groups, women with different parities and ages), which are also of social and policy interest
- the precise roles of social norms in shaping fertility decisions, such as views about gender equity
- changing social patterns, such as later partnering, growing numbers of single-parent families and de-facto couples, as well as changing attitudes to childlessness
- the impacts of infertility and sub-fecundity.

So what is fertility?

Fertility is the natural capacity for creating new life. The term embraces many different aspects of this capacity, depending on the context. It sometimes refers to the likelihood of being able to conceive (fecundity). Alternatively, it is often used as a measure of the number of babies being born in total or per capita at a given time (period measures). This measure is most relevant to immediate provision of services, such as maternity services and child care. However, the number of children produced by a given generation of women once they have come to the end of their childbearing years (which are between 15 and 49 years) — the completed fertility rate (CFR) — matters most to the long-run analysis of the size and age structure of the population.[1] This cohort measure is, therefore, relevant to long-run planning and economic and social policy.[2]

The most problematic feature of the completed fertility rate is that, by definition, policymakers cannot observe it until a woman's reproductive life is over. For example, the most recent cohort for whom the CFR is available are women born in 1958. Accordingly, the CFR is of only limited value to the analysis of current

[1] Conceptually, the CFR is calculated by tracking age-specific fertility rates (ASFR) through time (that is, for a woman born in 1950 the CFR will be: $ASFR_{age=15}$ in 1965 + $ASFR_{age=16}$ in 1966 +…. + $ASFR_{age=49}$ in 1999). To be technically correct the CFR must take account of the fact that a women born in 1950 will turn 15 in 1965 but may experience births at age 15 in either 1965 or 1966. This is because, unless she was born on 1/1/1950, she will be 15 for some of 1966. CFR is then estimated by $0.5[ASFR_{age=15,1965} + ASFR_{age=15,1966} + ASFR_{age=16\ 1966} + ASFR_{age=16,1967}...]$

[2] A cohort is a group born in a given year.

fertility behaviour. Analysts therefore typically try to infer what might be happening to long-run fertility from other measures.

The most simple and timely measure of fertility is the Crude Birth Rate (CBR), which is the ratio of babies born to the population in a given year, or $CBR_t = 1000 \times n_t / p_t$, where n is the number of babies born and p is the population. However, changes in the timing of births over women's lifetimes and the age structure of the female population mean that the CBR will often provide a distorted picture of the underlying lifetime fertility behaviour of women. For example, as the population ages, a greater proportion of women will have completed their reproductive lives and the CBR will fall. Even if p is restricted to the population of women of reproductive age (aged 15–49 years), changes in their age composition will still conceal underlying fertility trends. At best, the CBR is an indicator of fertility behaviour over the short-run.

The Total Fertility Rate (TFR) is a more useful measure of fertility than the CBR as it is both timely and controls for the age structure of the population. The TFR is the usual 'headline' measure cited in public discussions about fertility. It is constructed by summing all age-specific fertility rates (ASFRs) in a given year:[3]

$$TFR_t = \frac{\sum_{a=15}^{49} ASFR_{t,a}}{1000}$$

The TFR is the average number of children that would be produced by a woman over her lifetime, if for every year of her life she experienced the currently prevailing age-specific fertility rates.

Many debates about fertility stem from confusion about the interpretation of the TFR. The TFR is a synthetic measure of fertility that will often not correspond to the actual lifetime fertility experiences of women. This is because the age-specific fertility rates in a given year (which are added together to form the TFR) relate to different cohorts of women, who will often experience different lifetime fertility rates. For instance, the age-specific fertility rate of 15 year old women in 2006 relate to women born in 1991, while the age-specific fertility rate of 49 year old women in the same year relate to women born in 1957. These different generations of women have faced different social and economic environments over their lifetimes. As a result, the assumption — implicit in the construction of the TFR — that 15 year olds in 2006 would, by 2040, have the same age-specific fertility rate as 49 years olds in 2006 is unrealistic.

[3] This expression is divided by 1000 as ASFRs are typically expressed as births per 1000 women, and TFR is expressed as babies per woman.

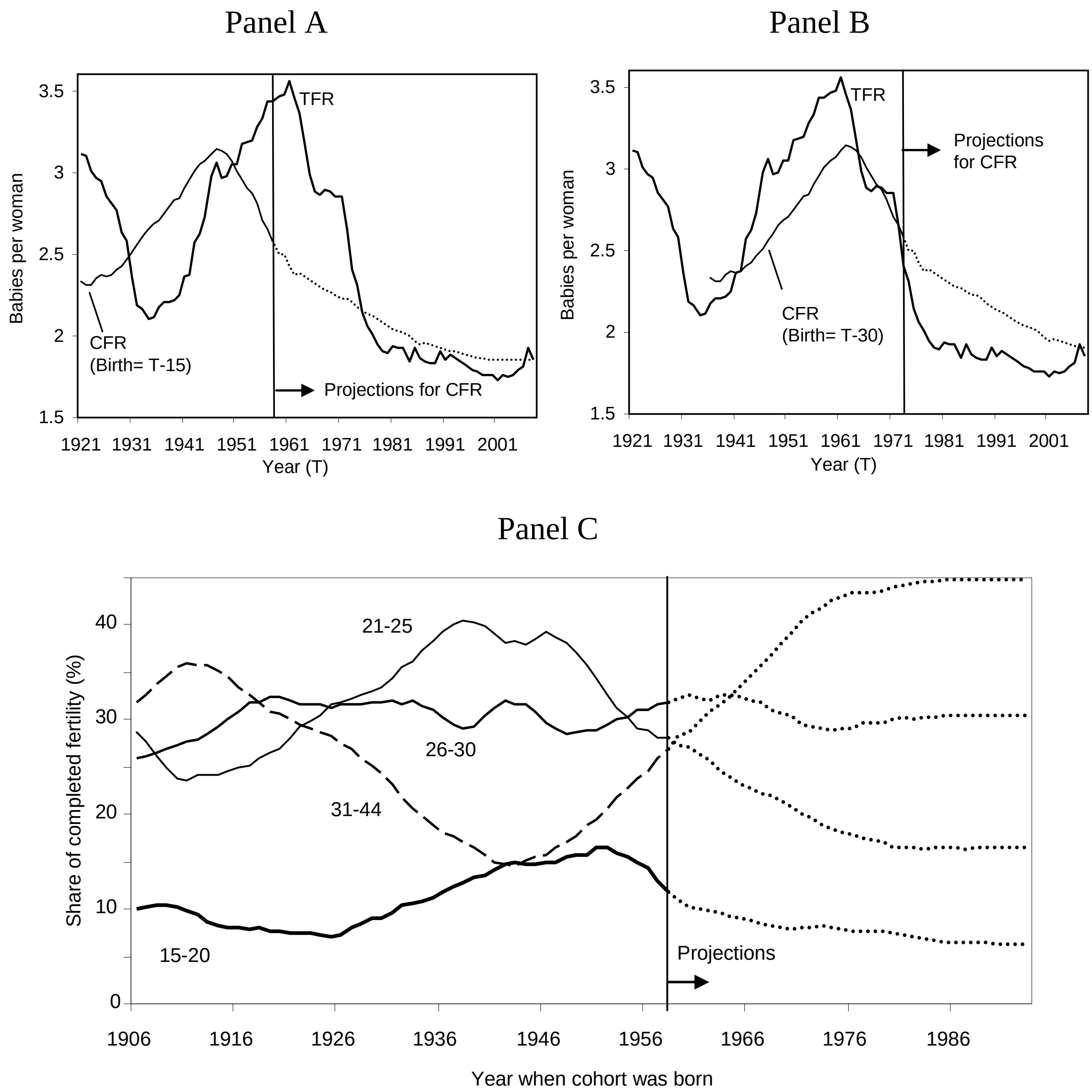
Changes in the TFR are less susceptible to this ‘generational’ problem, but are still as sensitive to changes in people’s decisions about *when* to have babies (‘tempo’ effects) as to changes in the desired number over a lifetime (‘quantum’ effects). For example, if a group of women brought forward their childbearing for some reason, the TFR would increase, regardless of whether or not they intended to have more children over their lifetimes. Postponement and eventual recuperation has the opposite effect. Accordingly, changes to period measures of fertility may not presage low or high ultimate completed fertility. Due to tempo effects, the TFR exhibits a greater volatility than the CFR (panel A, figure 1.1). In any given year, quantum effects are often hard to distinguish from so-called ‘tempo’ effects.

The presence of tempo effects is illustrated by Australia’s experiences during the baby boom (an issue taken up further in appendix H). The group of women born in the 1930s — the baby-boom mothers — had higher completed fertility than the generations around them. This was the major reason why the TFR was higher at that time. However, some of the increase in the TFR reflected women bringing forward their childbearing (a tempo effect). This is why the TFR at the peak of the baby-boom years was significantly higher than the completed fertility rate of women giving birth at that time (evident as the gap shown in panel B, figure 1.1 between the TFR and the CFR of birth cohorts when aged 30 years). In this period, women had babies earlier in their lives than those either after or before the boom. So, for instance, by the time they turned 26 years old, the cohorts of women born in the mid 1930s had given birth to around half of the children they were ever going to have. In contrast, the 1914 cohort of women had only around 30 per cent of their lifetime children by that age (panel C, figure 1.1). (For the generation of women born in 1985, the comparable figure is likely to be around 20 per cent.)

The baby-boom period indicates how tempo effects can exaggerate the apparent lifetime fertility of women. However, tempo effects can also lead to underestimation of the underlying lifetime fertility of women, which is relevant to more contemporary periods.

While possible tempo distortions mean that short-term movements should be interpreted with caution, a change in TFR, sustained over a long enough period, will necessarily be embodied in the CFR (and therefore will represent a quantum effect). Additionally, in the absence of further shocks (tempo or quantum), the TFR will converge to the CFR over time, making it a more reliable indicator as fertility behaviour becomes more stable over time.

Figure 1.1 **A comparison of the total and completed fertility rates**



a The shares of the CFR are derived by first estimating the age-specific cohort fertility rates of each birth cohort of women. Then it is possible to calculate the extent to which the CFR of that cohort is accounted for by particular childbearing ages. Since the reproductive years of women born after 1958 has not yet finished, the CFR for these cohorts was estimated by supplementing the available ABS data on age-specific fertility rates with projections from the PC FERTMOD model. **b** In Panel B, the CFR is shifted forwards by 30 years after the birth of each cohort of women for better comparison with the TFR. This reflects the fact that the total fertility rate is an unweighted average of women's fertility, with the mean age of the relevant group of women being around 30 years old. Hotz, Klerman, and Willis (1997) describe a more sophisticated method of ascertaining the 'mean age of fertility' but this only marginally changes the appearance of panel B.

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

'Parity' statistics help to interpret whether changes in the TFR represent quantum effects. A women's parity is the number of children born up to that point in her life — such as none, one or two. A useful parity indicator is the likelihood of a woman having a further baby given the number of babies so far born. Parity data that also account for age (age and parity-specific fertility rates — APSFR) unpack changes to fertility in a way that can illuminate the implications for the CFR. However, these data are often gathered infrequently, constraining its availability and timeliness.

Despite its limitations, the TFR provides a reasonable basis for approximating trends in fertility behaviour. It is timely, controls for age structure, has (over longer periods) some correspondence with the CFR, and is widely used and understood. It is the upturn in this indicator, along with the increase in the number of babies born, that has generated much of the recent interest in fertility trends in Australia. Chapter 2 focuses on the extent to which the increase in the TFR reflects changes in women's likely completed fertility.

A guide to the paper

This paper proceeds as follows:

Chapter 2 examines the demographic data for Australia. This involves the presentation and interpretation of the various measures of fertility and their implications. A new measure is used to estimate the contribution of population and fertility to the changes in births. The chapter also explores the possible contribution to the measured increase in fertility of:

- measurement error (implying no behavioural phenomena)
- tempo effects (bringing births forward and the slowing of postponement)
- quantum effects (signifying an increase in women's lifetime fertility levels).

Chapter 3 considers the underlying determinants of the recent rise in fertility, including an assessment of the role of policy.

Finally, chapter 4 assesses whether present or impending Australian fertility patterns are problematic, and dispels some common myths about the economic and demographic implications of changes in fertility.

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.

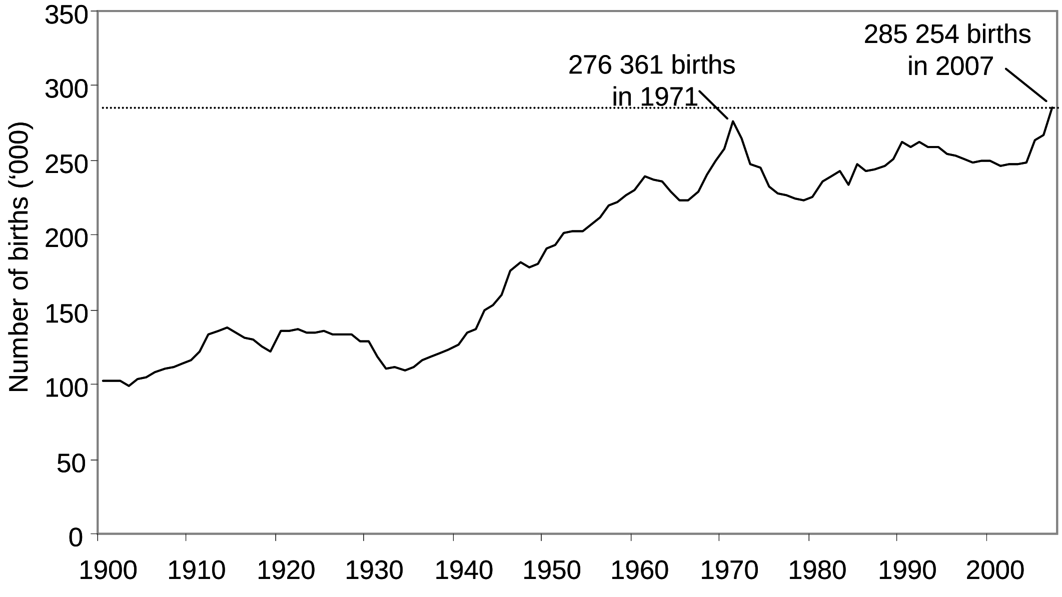
The judgment of this chapter is that all three are likely to have played a role in the recent rise in fertility rates — and particularly quantum and recuperation effects. Why this is the case is explored in sections 2.4 to 2.10.

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.

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

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

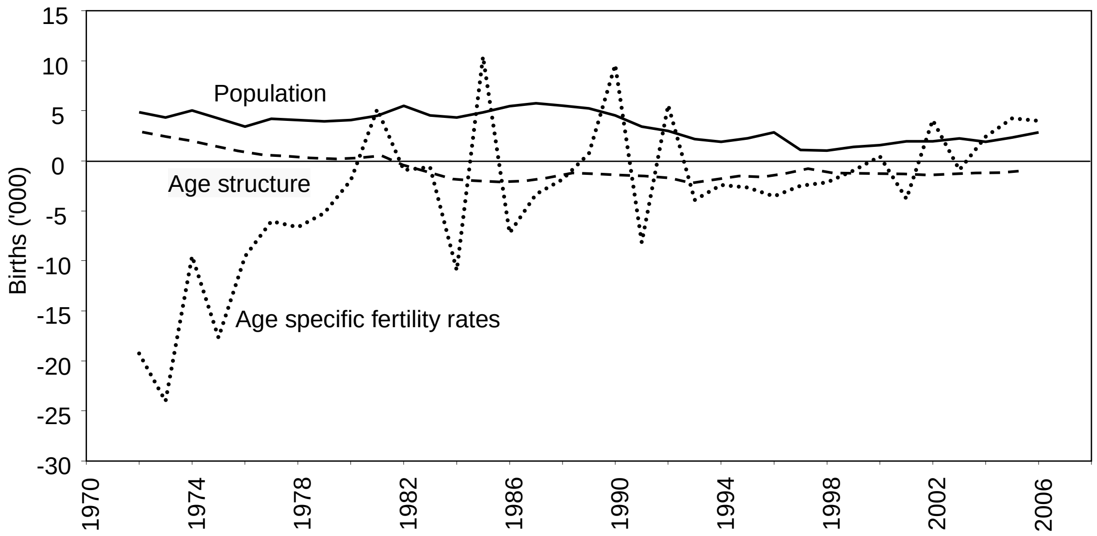
$$\Delta\text{B due to }\Delta N = \Delta N \times \left\{ ASFR_{t-1} \times P_{t-1} + \frac{1}{2}\Delta ASFR \times P_{t-1} + \frac{1}{2}\Delta P \times ASFR_{t-1} + \frac{1}{3}\Delta ASFR \times \Delta P \right\}.$$

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]**

	ASFR	*Age structure (P)*	*Population (N)*	*Total change in births*
	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.

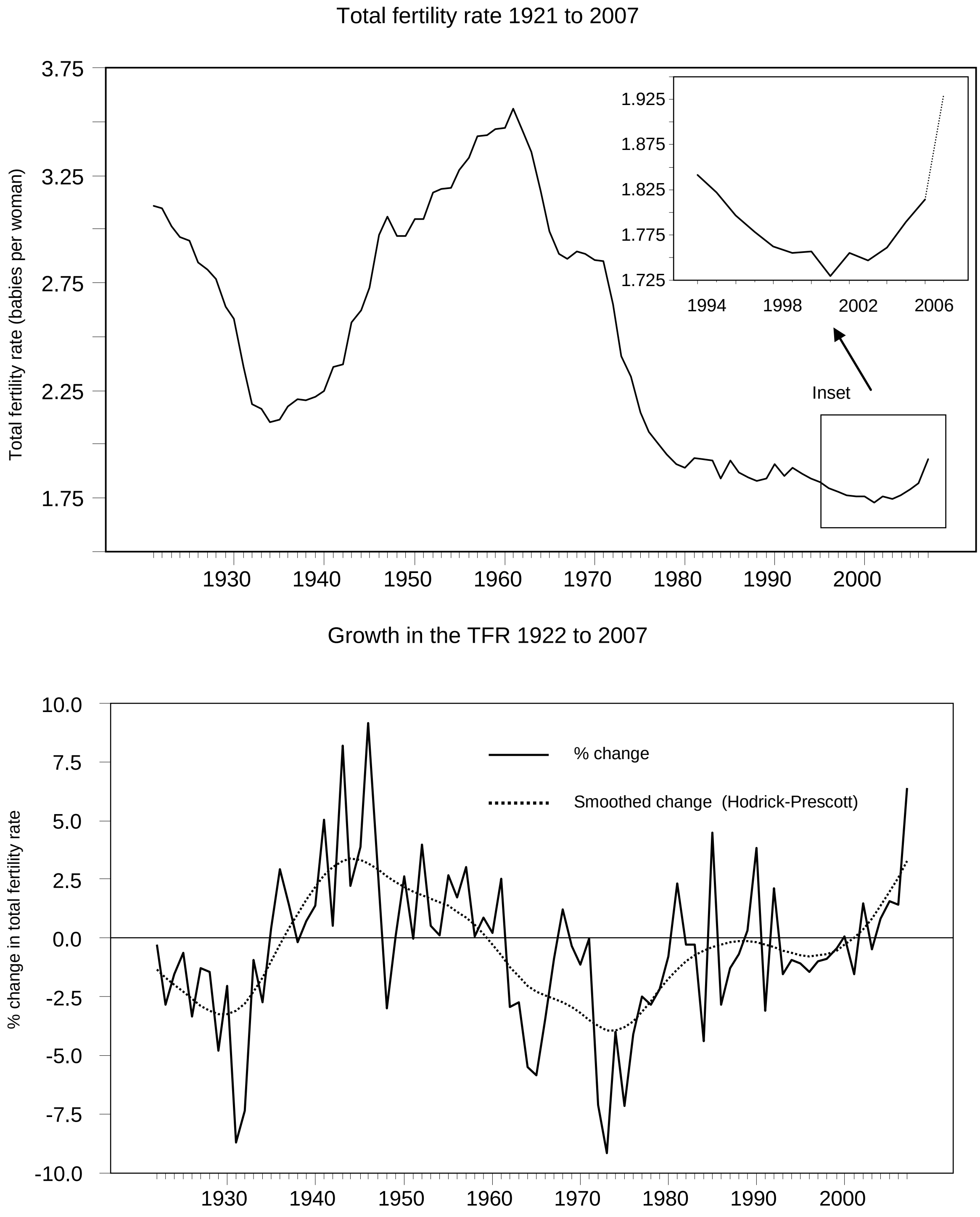
2.2 Trends in fertility

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.

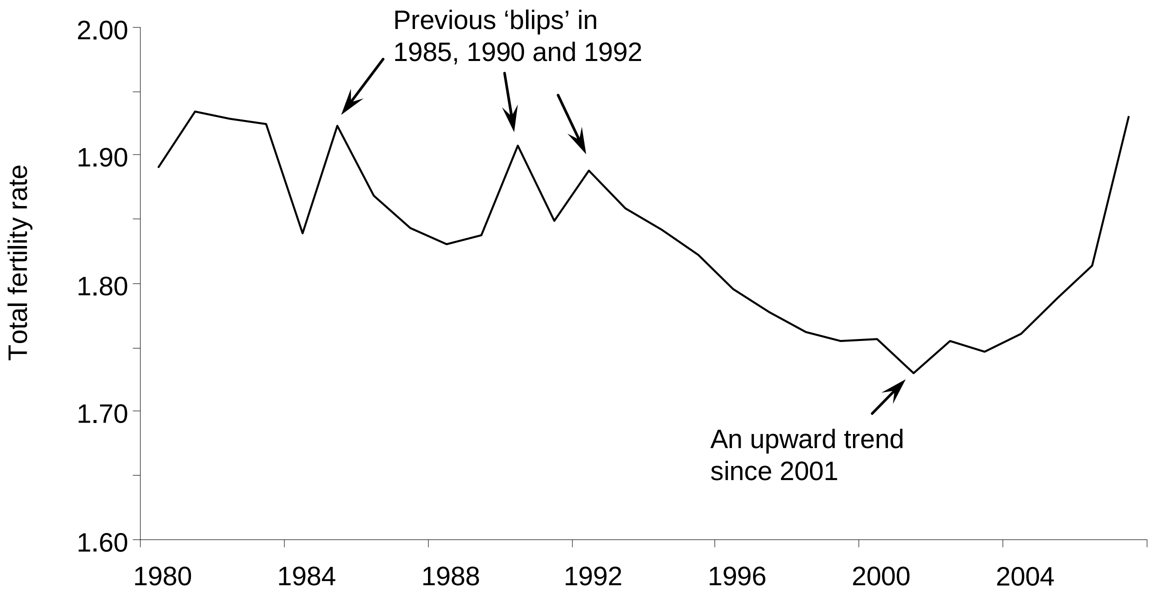
[3] In 1995, the TFR was 1.82, before dipping to as low as 1.73 in 2001.

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

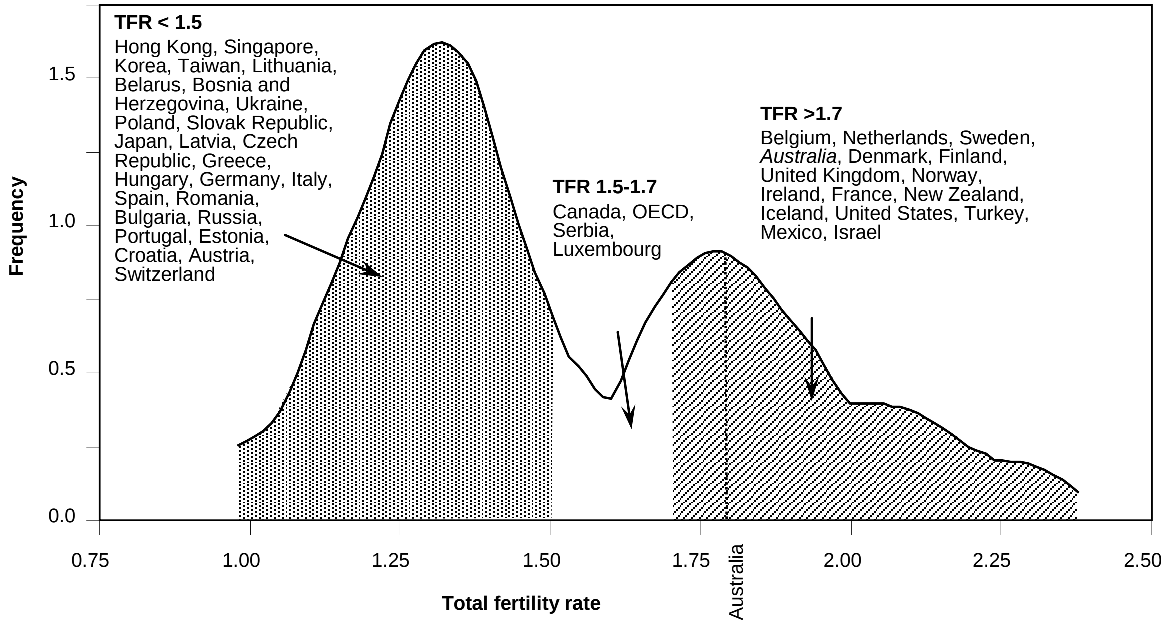
Fertility rates among developed countries tend to be above 1.7 or below 1.5, with few countries occupying the middle ground (figure 2.5). Australia sits at the higher end and, in 2005, was well above the OECD average TFR of 1.63. At that time, it was the 12th highest of the 30 OECD countries and 12th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

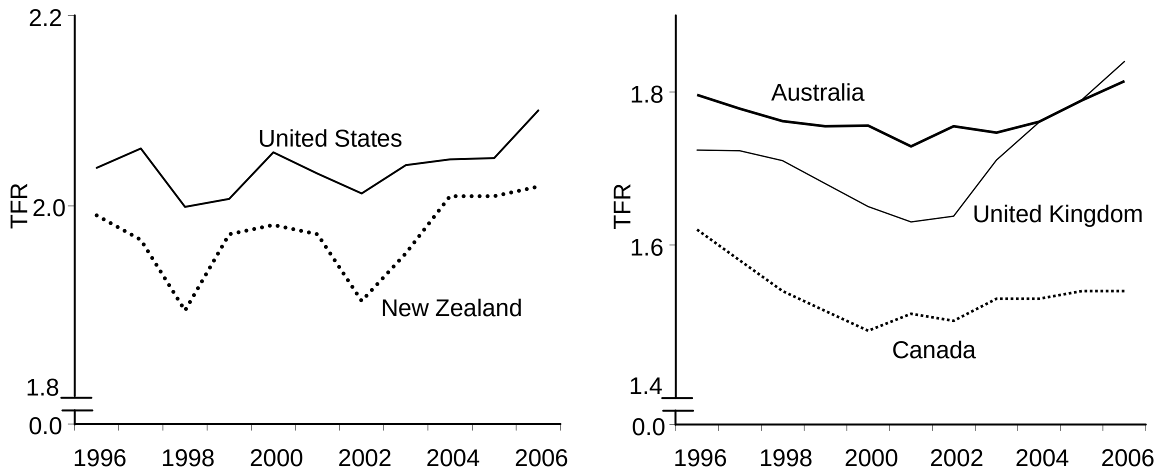
Despite the wide range of fertility rates among developed countries (and their varying economic, social and institutional circumstances), they share some historical experiences:

- 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.

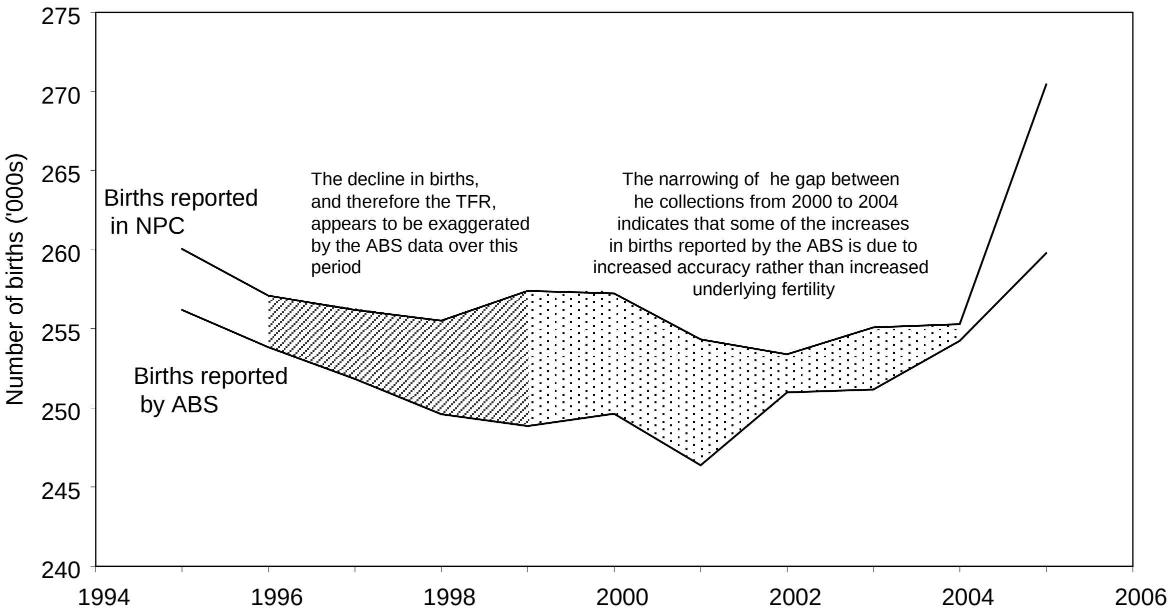
Under-registration

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 update 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]

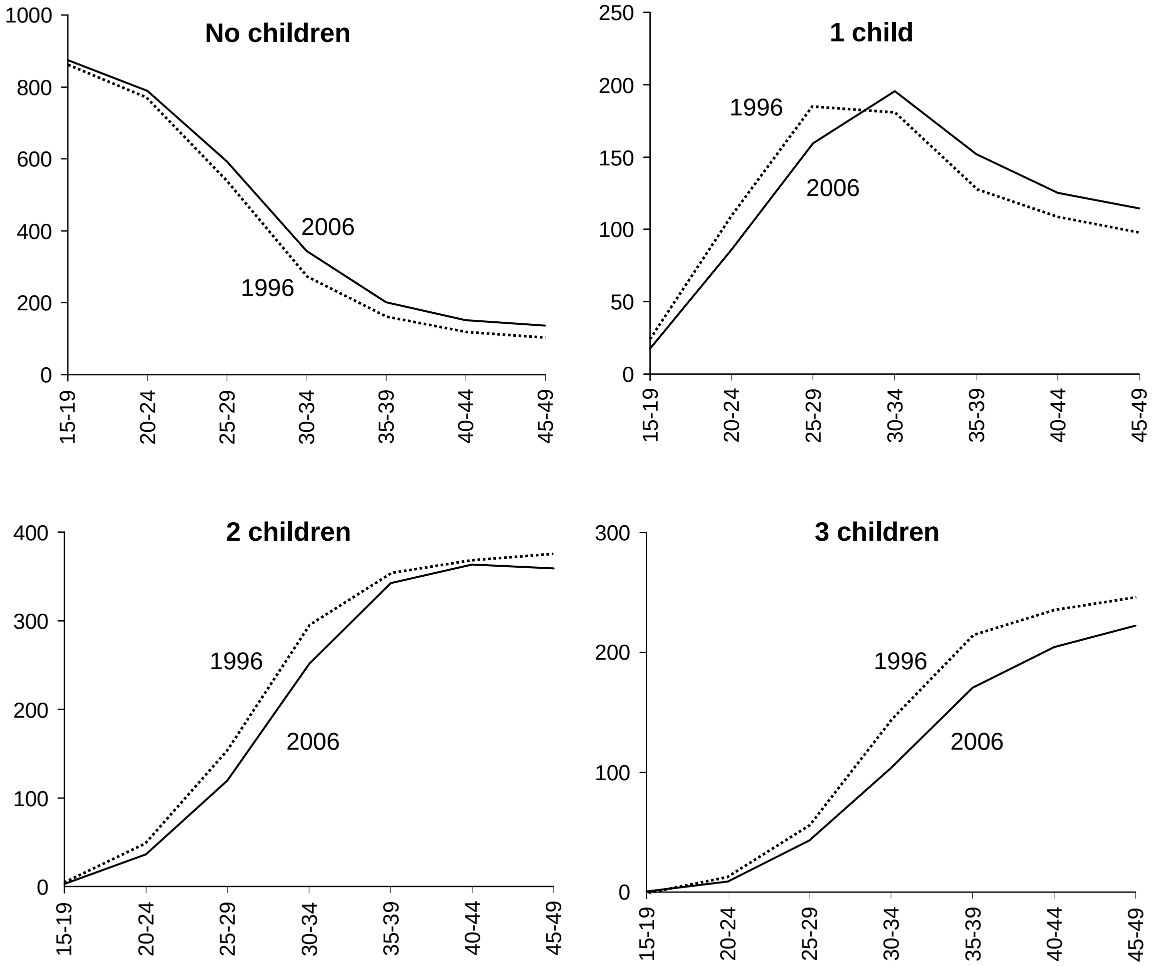
While fully consistent data needed to create Age and Parity Specific Fertility Rates (APSFRs) (and the changing transition probabilities based on these) are not available from a single source for Australia, Kippen (2003) has created a useful dataset by combining NPDC and ABS census data. She finds that 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 a 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.

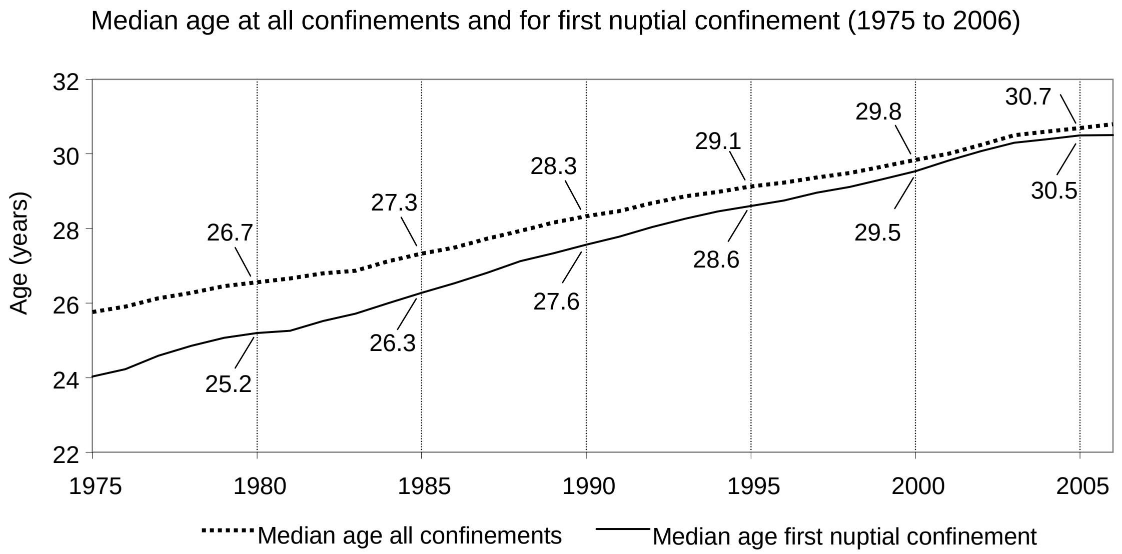
2.7 Changes to age-specific fertility rates

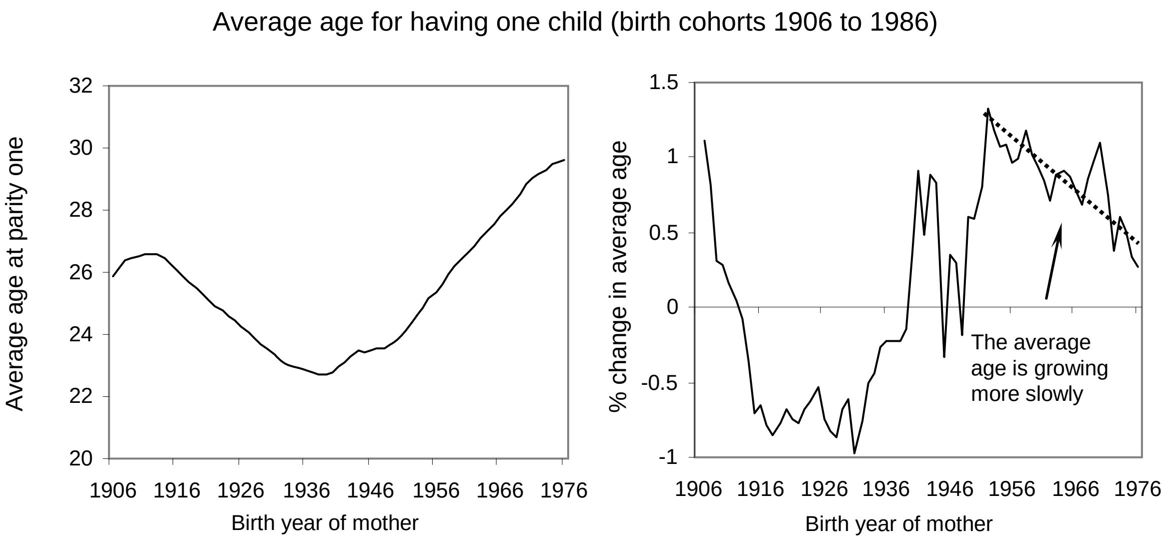
The movement of the distribution of ASFRs over time gives some indication of the changing patterns of fertility behaviour (figure 2.10). As the area under each ASFR distribution reflects the TFR in that year, the difference between the area 'lost' and the area 'gained' describes the overall change in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





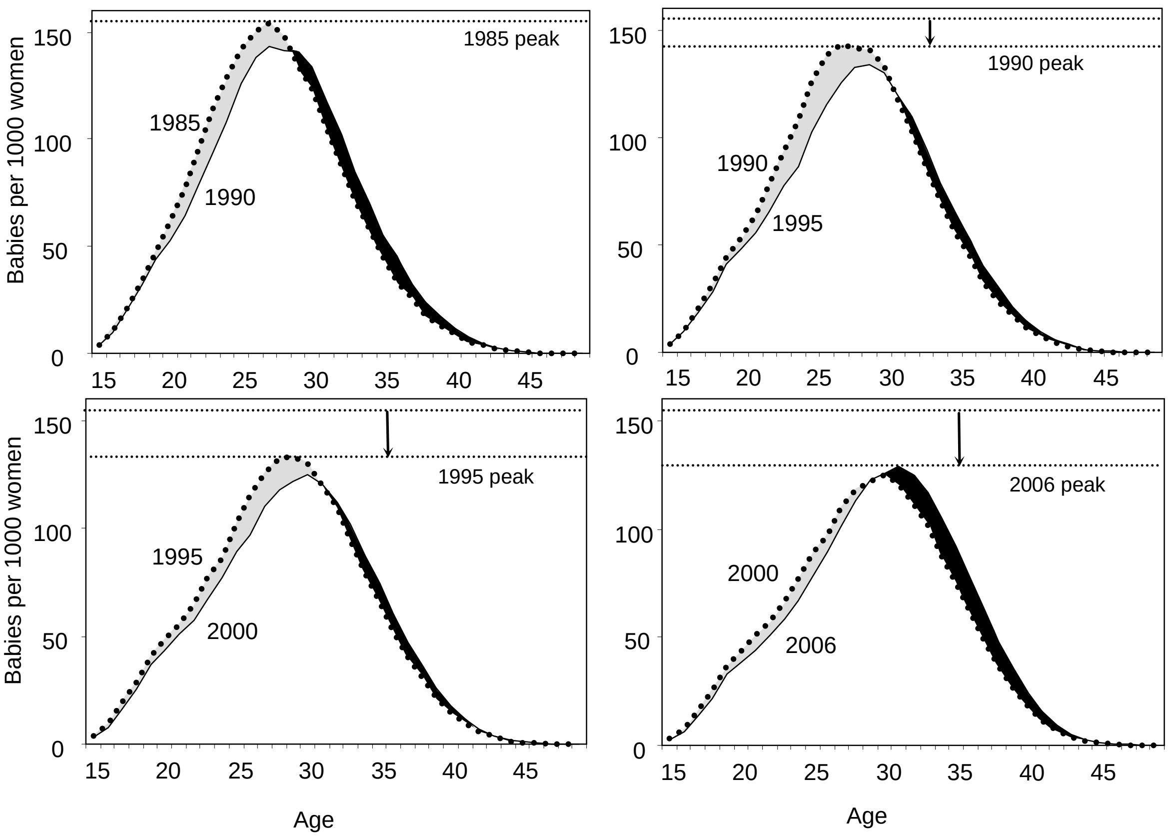
[a] Age-specific *cohort* fertility rates were derived from (period) age-specific fertility rates and used to calculate the age at which the average cumulative births of each cohort reached one.

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.

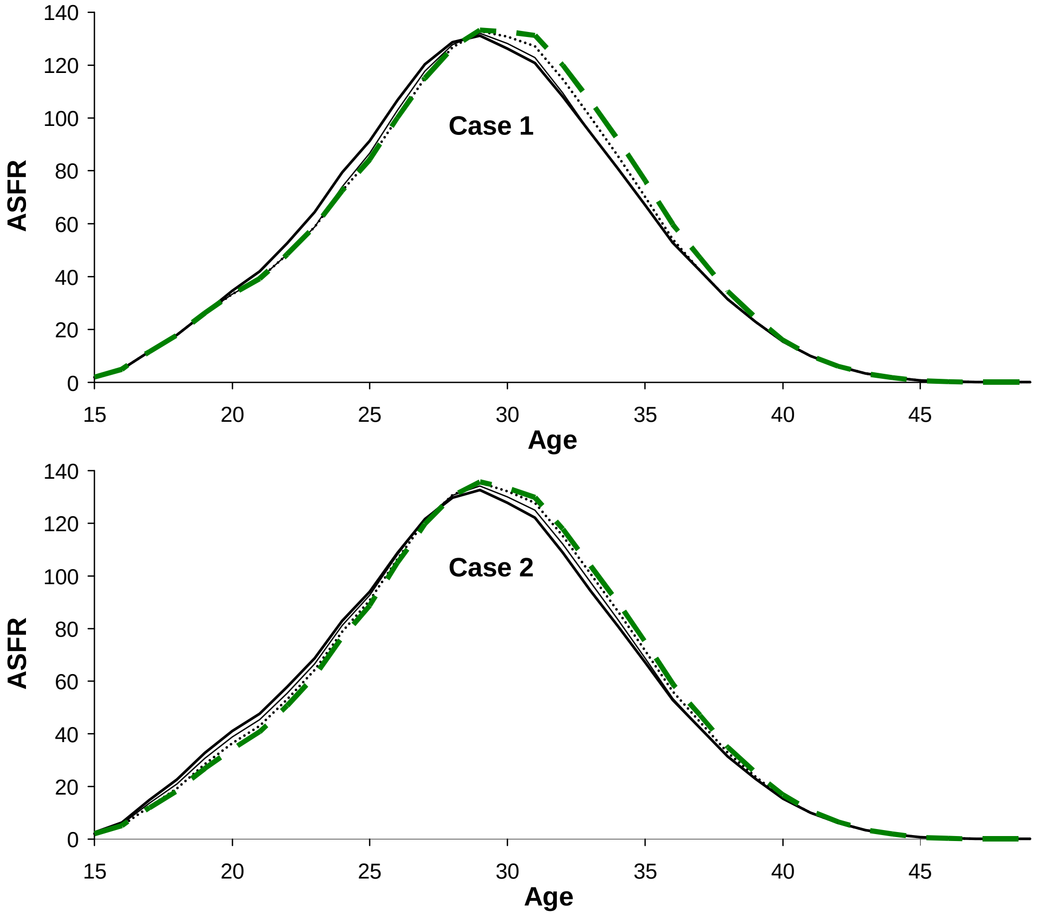
The pattern displayed in the ASFRs from 2000 to 2006 is very different. In particular, the fertility of younger women fell by less, while the fertility of older women increased by more. This, combined with an increase of age-specific fertility rates for the peak fertility ages, resulted in the increase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



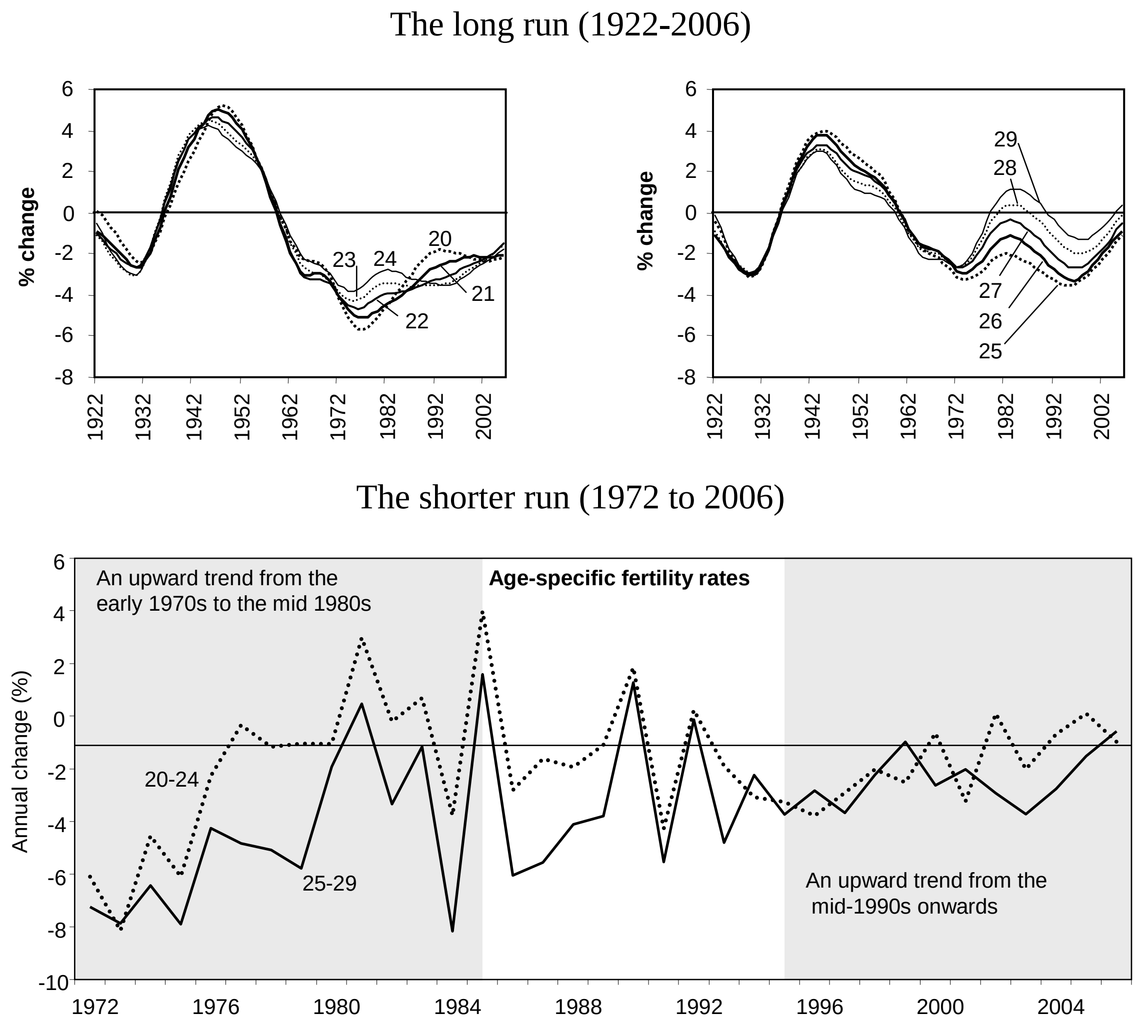
On the one hand, a quantum shock that affected all ASFRs would appear to cancel the declines in younger women's ASFRs, whilst reinforcing the increases in older women's ASFRs.

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

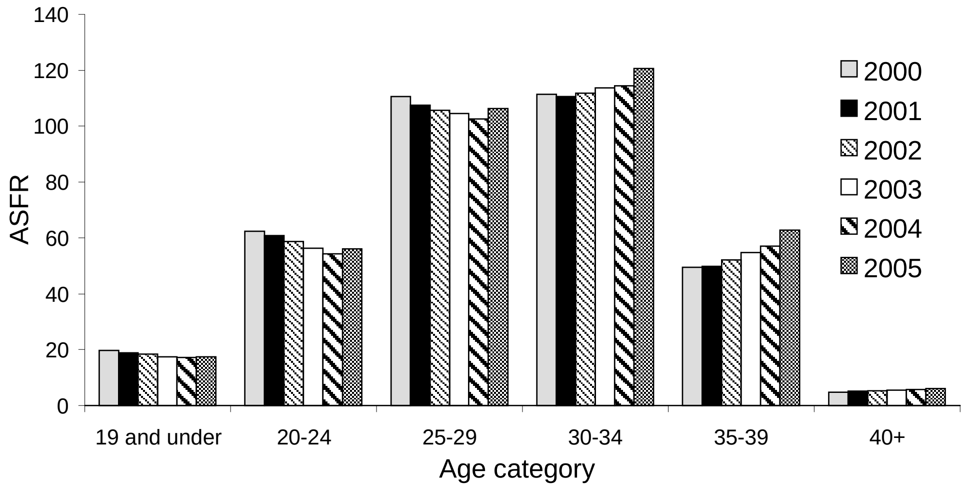
[16] ABS, *Births, Australia*, Cat. no. 3301.0.

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

[18] PC estimate based on NPDC and ABS data.

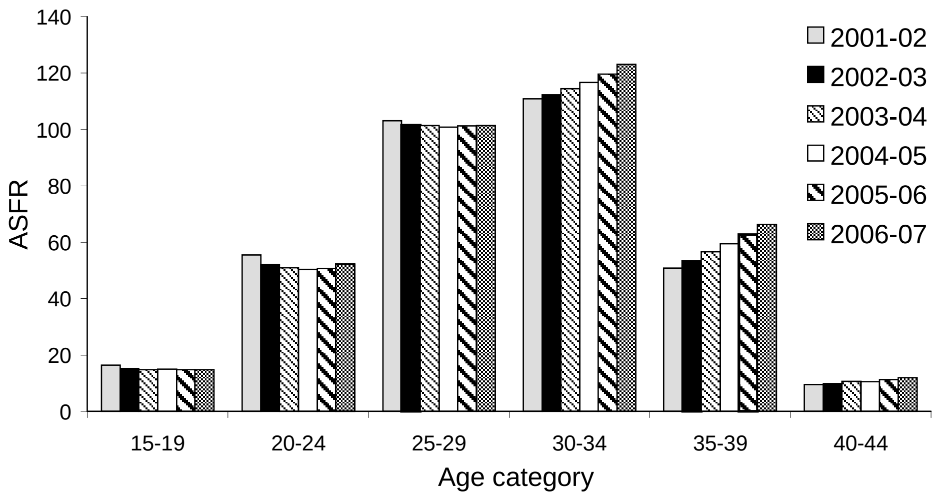
effect) and potentially a shift to earlier childbearing by new cohorts of women. However, it is too soon to tell whether the increases in the ASFR of younger women will be sustained or not.

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



[a]The 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: $S_{age,2006} = \hat{A}_{age,2006} / \sum_{\mathrm{age}=15}^{49} \hat{A}_{age,2006}$.

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:

- 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.

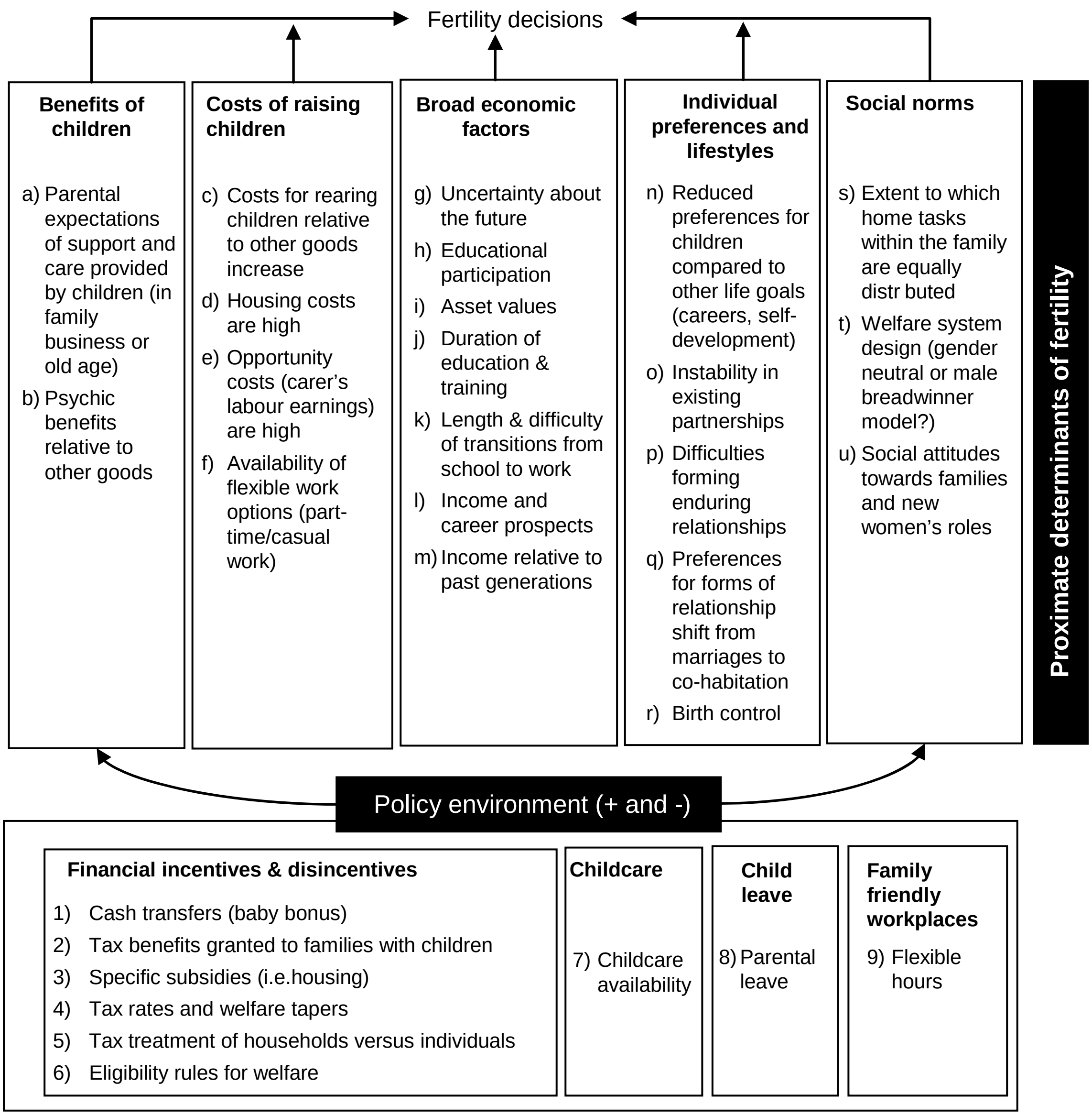
3 What has caused the increase in fertility?

Key points

- Pinpointing the determinants of fertility is difficult. As well as the observable factors considered here, community attitudes and other intangible, hard-to-measure, factors may also have played an important role in the upturn in fertility.
- House prices have probably reduced fertility below what it would otherwise have been, as has the continued rise in educational attainment by women. This implies that for the observed fertility rate to rise, other factors must have exerted a significant positive effect.
- Aside from the recuperation of previously deferred children, the major positive influence is likely to have been the recent economic environment:
  - Buoyant economic conditions and increasing access to part-time jobs have reduced financial risks associated with childbearing and lowered the costs associated with exiting and re-entering the labour market.
  - While the forgone earnings associated with caring for children have consequently grown — raising the costs of raising children — women can increasingly work while having children.
- Family policies — such as transfers and child care subsidies — are likely to have played a part. The generosity of these benefits increased significantly after the year 2000. However,
  - they have reduced the long-run costs of having children by only about 3 to 4 per cent, so that their effects on fertility are also likely to have been relatively modest.
  - since families still benefited from the additional payments even if they did not change their fertility behaviour, the average budget cost per *additional* child born will have been high. While difficult to estimate precisely, the average cost of each of these additional children may be around $300 000.
  - the Baby Bonus, while often seen as a particularly influential policy, will have played only a partial role in the increase, given that it was only one element of a package of other measures whose generosity has also increased substantially (such as Family Tax Benefit A).
- In Australia, family policies are not designed explicitly to stimulate fertility and aim to promote other social and economic goals. Given this, finding only an incidental, supportive effect is neither surprising nor problematic.

As suggested by the large international variation, fertility is sensitive to a country's environment. A host of factors are influential on both the timing and ultimate lifetime number of children — including income, general prosperity, the cost and availability of child care, female workforce participation, trends in partnering, education, and government family policies (figure 3.1). Some factors, such as community norms and changing individual preferences, are likely to be crucially important over the long run, but are less able to be quantified.

Figure 3.1 **The determinants of fertility**



Data source: This draws on Sleebos (2003), but is adapted significantly.

At any one time, fertility is the outcome of the positive and negative forces these factors exert. An increase in fertility could as much reflect the decrease in a negative factor as an increase in a positive factor, making both relevant to understanding why Australian fertility levels have risen. The cumulative effects of deposits and withdrawals from a bank account provide a simple analogy of the complexities of accounting for fertility changes. A bank account balance might increase by $20 from $100 to $120, with the following transactions: Jack withdraws $90, while Jill and Jane deposit $90 and $20 respectively. Looked at in isolation, Jane's transaction accounts for 100 per cent of the change in the balance. However, while true, this is misleading since Jack and Jill's transactions are actually more important contributors to the change. This is why it is important to consider the range of influences on fertility and to be cautious in interpreting the role of any one factor.

While it is easy to generate a rich taxonomy of influences on fertility like figure 3.1, in many cases, the quantitative magnitude (and sometimes even the direction) of their impacts has proved elusive. This is a reflection of:

- the long list of relevant factors, but also their strong interdependence and contingency. For example, a pronatalist measure that provides significant transfers may be much more successful in a country that has generally favourable social and environmental conditions for children than one in which this is not true
- the slow moving, trending nature of some explanatory variables, such as changing social attitudes, mean they are strongly correlated with each other. This makes it hard to separately assess their influence. Given that, for the periods usually subject to investigation, the TFRs have also been trending, it is easy to get a high correlation between TFRs and any trending variable, even if the two are unrelated — the so-called 'spurious regression' problem (Granger and Newbold 1974)
- the fact that their impacts may change through time, as well as affect different groups differently. For example, the correlation between fertility and female workforce participation rates was initially negative among OECD countries, but is now positive (testimony to the development of varying supportive social institutions, like child care)[1]

[1] This pattern may also reflect other aspects of the multiple and changing causal pathways between fertility and female labour force participation. On the one hand, greater labour force participation (prompted by changing social attitudes or higher real wages for women) may increase or depress fertility, depending on whether women can undertake both childrearing and work roles. This causal pathway runs from participation to fertility. On the other hand, all other things being equal, shocks that depress fertility levels allow more women to shift from unpaid child rearing to the formal labour market. In this case, the causal link is from fertility to workforce participation, not the other way round.

- a paucity of panel data. Such data overcome the main drawbacks of either cross-sectional or time series datasets by themselves, but there are significant problems in obtaining consistently defined measures of some important variables across countries and time. For example, family policies have different eligibility criteria that are hard to capture, or simply have not been adequately reported in the historical data
- the suitability of the measure of fertility usually used in empirical models — the TFR. As noted in the previous chapter, the TFR is a synthetic measure, confounded by large tempo effects. It is hard enough to surmise the likely magnitude of the quantum component of changes in the TFR, let alone try to explain the strength of an array of complex, context-dependent, influences on this barely measurable component. The better measure of fertility, the completed fertility rate, is only available when a woman reaches 49 years old. This means that to understand the impacts of policies and economic conditions on the completed fertility of all childbearing cohorts in 2007 (women aged 15 to 49 years), it would be necessary to wait until 2041. This has limited public policy usefulness.

For all these formidable constraints, at least a qualitative impression of what matters most for fertility is developing, and in some instances, a body of quantitative evidence about the rough size of the effects of some variables (Sleebos 2003 and Gauthier 2007). This can help guide an understanding of what might have stimulated Australia's recent 'mini baby boom'.

Moreover, by their nature, some factors can probably be eliminated as suspects in explaining the recent increase in fertility because they are slow moving and do not appeared to have fundamentally changed in the 2000s. For instance, female educational attainment has progressively increased, as has the decline in the marriage rate — with both factors probably providing a continuing negative pressure on fertility rates through the 2000s:

- The long-run trend towards higher educational attainment for women (and duration spent in education) has continued unabated in the 2000s. The share of the female population with a bachelor's degree or higher in the key age group 25-34 years old increased by around 9 percentage points (compared with 7 per cent for men) between 1996 and 2006. In 2006, around 45 per cent of women had such a qualification (compared with about 35 per cent of men).[2]
- Stable relationship formation, typically taking the form of marriage, is a common precursor to childbearing. Marriage rates have progressively fallen for many years and have continued to do so. Partnering rates (the sum of de facto

[2] (ABS, *2006 Census of Population and Housing*).

and marriage rates) also declined between 1986 and 2001 (Birrel, Rapson and Hourigan 2004) and have continued to fall between 2001 and 2006, albeit at a slower pace (Weston and Qu 2007).

Accordingly, these factors are unlikely to explain slowly declining fertility over the long run, and yet, without altering their long-run trajectories, explain a (relatively abrupt) rise in fertility in 2000s.

For these reasons, this report examines a selective set of factors that have been put forward by commentators as influential or/and that have varied significantly over the last decade. These are Australia's relative prosperity and buoyant labour markets in the 2000s (section 3.1), house price inflation (section 3.2), child care availability (section 3.3); and finally, family policies (section 3.4). Given the policy relevance of the latter, this chapter intensively examines the nature of the changing interventions in this area and their possible impacts on the fertility rates for women in aggregate and for those in some key sub-groups.

3.1 Prosperity and fertility

Over the 15 years from 1992, Australia experienced a remarkable period of economic growth (figure 3.2). Such a sequence of growth has not been evident since the post-war boom years.

Although this growth has not made everyone better off, many Australians have benefited substantially from increased income. Real wage growth averaged 1.5 per cent per annum for full time adults from 1992 to 2007 compared with 0.1 per cent from 1982 to 1992[3]. This economic buoyancy has been associated with stronger perceptions of financial security (figure 3.3).

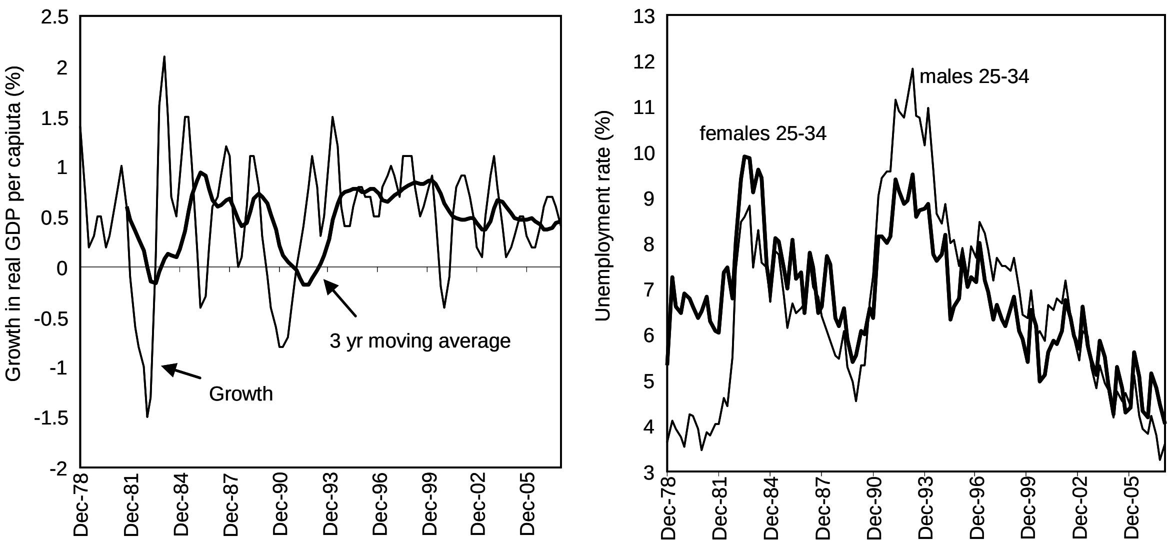
What does this prosperity imply for fertility?

The theoretical and empirical links between income and fertility have been contested for more than 200 years. Early theorists argued that there was a strictly positive relationship between fertility and income (a 'quantity' effect). This underpinned Malthus's (1798) prediction that population growth would stop per capita income from ever exceeding its 'natural level', as any rise in income would elicit a proportionate increase in fertility. This has been refuted by the strong negative correlation between fertility and GDP per capita across time and between

[3] PC calculations based on ABS, *Average Weekly Earnings, Australia,* Cat. no. 6302.0 and ABS, *Consumer Price Index, Australia,* Cat. no. 6401.0.

countries. Rich countries have significantly lower fertility rates than poorer countries, and the pathway to development is invariably associated with falling fertility rates.

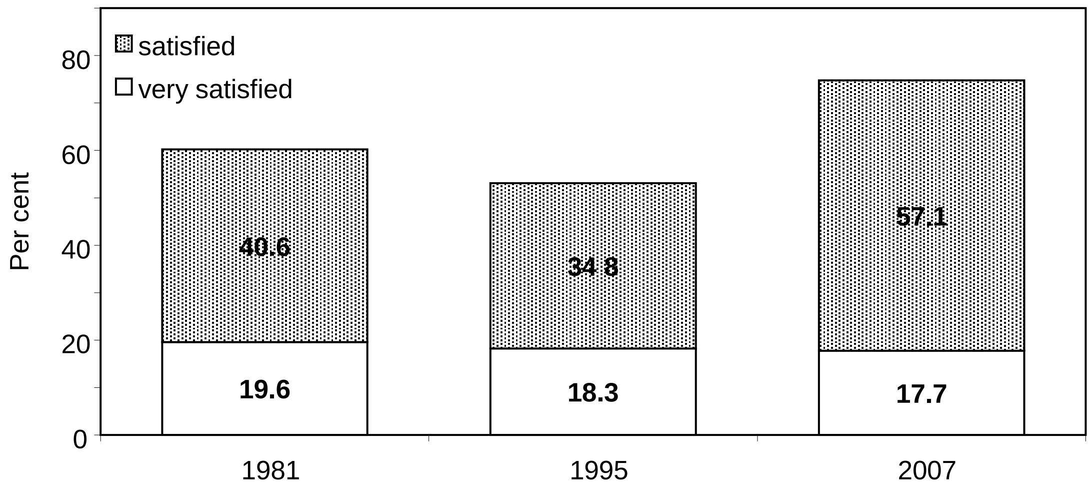
Figure 3.2 **Indicators of prosperity**
December 1978 to December 2007[a]



[a] The unemployment rates are the weighted average over the three months in each quarter. The rates for 25-34 year olds have been chosen as these are the prime childbearing years.

Data source: ABS, *Australian National Accounts: National Income, Expenditure and Product*, Cat. no. 5206.0 and ABS, *Labour Force, Australia, Detailed - Electronic Delivery*, Cat. no. 6291.0.55.001.

Figure 3.3 **Surveyed assessment of personal financial security in Australia**



Data source: Markus and Dharmalingham (2008), based on World Values Surveys; 2007 national survey.

The obsolescence of the Malthusian view posed the question of why income and fertility were *not* positively linked. After all, in most instances, higher income increases the demand for things people value highly, and children are clearly highly valued by their parents. Several rival explanations have emerged.

Quality versus quantity

The original simple characterisation of the link between income and fertility ignored the capacity for parents to invest in the quality of children as well as their number. As people's income increases, they tend to spend more on each child through material support, education, time and energy (Becker 1960). If these investments are valued highly enough, then fertility and income can be negatively related.

Relative cohort size and tolerance to income

Alternatively, Easterlin (1987a and 1987b) argues that the nature of the link between income and fertility depends on relative cohort sizes of young adults. The Easterlin model combines several inter-related conjectures.

- The age structure of the population affects the income and labour market experiences of young adults. When young workers are relatively scarce compared with older workers they command higher wages and expect faster promotions.
- Younger cohorts assess their material affluence, not in absolute terms, but in comparison with previous generations.
- People make fertility decisions based on these perceptions of material affluence and not income per se.

Consequently, the benchmark against which people assess their relative wellbeing continues to rise with economic growth. In effect, people develop 'tolerance' to a given income. They then need more to believe themselves well off enough to have children. For instance, Easterlin suggested that the baby boom was fuelled by the post-war growth in the relative income of young adults compared with their parents.[4] Notably, the share of young cohorts in the working age population is

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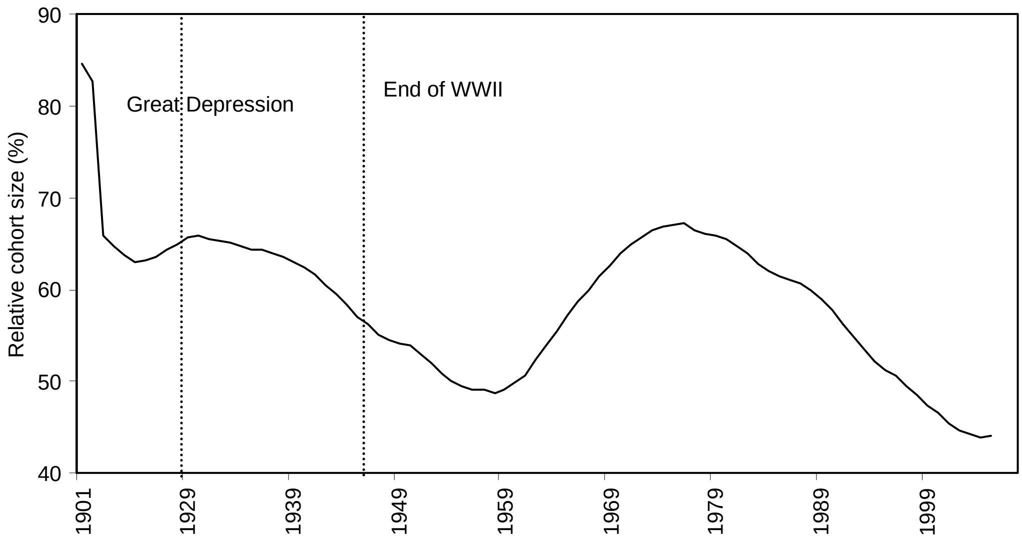
4 While the role played by perceptions about generational income may well be influential, other aspects of Easterlin's model have less clear conceptual validity. In particular, the notion that relative generational wage rates, and therefore income, are a function of relative cohort size (rather than something reflecting chance technological or other economic circumstances) entails the strong underlying assumption that the young and slightly older are not close substitutes. Moreover, gradual changes to cohort size need not have wage effects if businesses can change their capital structure and technology according to emerging shortages or surpluses of a certain type of worker. In any event, the systematic operation of the model suggested by Easterlin is only possible in the instances when cohort size dominates any number of the other factors that determine wages.

currently at its lowest levels since Federation — also consistent with an Easterlin effect on fertility (figure 3.4).

Figure 3.4 **The young are scarce**

Relative cohort size of the young 1901 to 2007[a]



a The relative cohort size is defined as the number of people aged 15-29 years divided by the population aged 30-64 years. This is the measure used by Jeon and Shields (2005) in a study confirming the importance of the Easterlin effect in OECD countries.

Data source: ABS, *Australian Historical Population Statistics*, Cat. no. 3105.0.65.001 and *Population by Age and Sex, Australian States and Territories*, Cat. no. 3201.0.

Labour market effects — children involve forgone earnings

Another aspect of economic growth even further confuses the income effects on fertility. Childbearing is usually associated with an interruption to maternal employment and earnings. Where this interruption is enduring, it can also lower skills and affect career prospects, with potentially pronounced effects on lifetime income. Accordingly, fertility choices entail forgone income now and in the future (as well as other 'opportunity costs' such as less leisure time). As real wages rise over time, so do the opportunity costs of childbearing. This effect will be stronger if female wages rise faster than males, as women tend to forgo more income than men when couples have children. This explains why, all other things being equal, falling fertility rates coincide with increases in female wages (while more often than not, male wages are positively associated with fertility — appendix C). This 'substitution' effect is also stronger if parents cannot combine work with the care of young children.

Implications

So, in the case of fertility, there are three factors that confound the usually strong positive relationship between rising income and demand: the opportunity costs of children, the demand for quality, and the relevance of relative income. The first exerts a negative influence on fertility, while the other factors will impede the usual income effects, but still could allow for a positive link. Collectively, does this imply that Australia's recent prosperity is likely to have had a depressing effect on fertility?

To the contrary, there is a reasonable case that recent prosperity has spurred rather than retarded fertility. The historical experiences in Australia provide one strand of evidence. There have been several episodes when fertility has moved in the same direction as income:

- Although fertility rates were falling prior to the Great Depression, the resultant falls in per capita income greatly increased the decline.
- Martin (2003) found that the fertility rate dropped, at least temporarily, in several periods of recession in Australia.
- In the immediate post war period,[5] rising incomes coincided with a dramatic rise in fertility. This period of prosperity appears to have induced a rise in fertility that is consistent with Easterlin's general concept that fertility is conditional on achieving or surpassing certain material aspirations.[6]

The current period of prosperity resembles that of the immediate aftermath of the Second World War, with a protracted period of economic expansion, low unemployment rates and rising wages. Interestingly, both prosperous periods contrast starkly with the decade that preceded them, which were associated with higher unemployment and relatively slow growth in wages. Almost all of the English-speaking countries with the greatest cultural and institutional similarities to Australia have experienced an era of accelerated economic growth accompanied by an upturn in fertility.

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[5] In Australia, this period can be roughly characterised as 1945-1960. There was a fertility spike immediately after the war, partly due to the recuperation of forgone childbearing. However, this cannot account for the entire rise in fertility that occurred over the entire fifteen years.

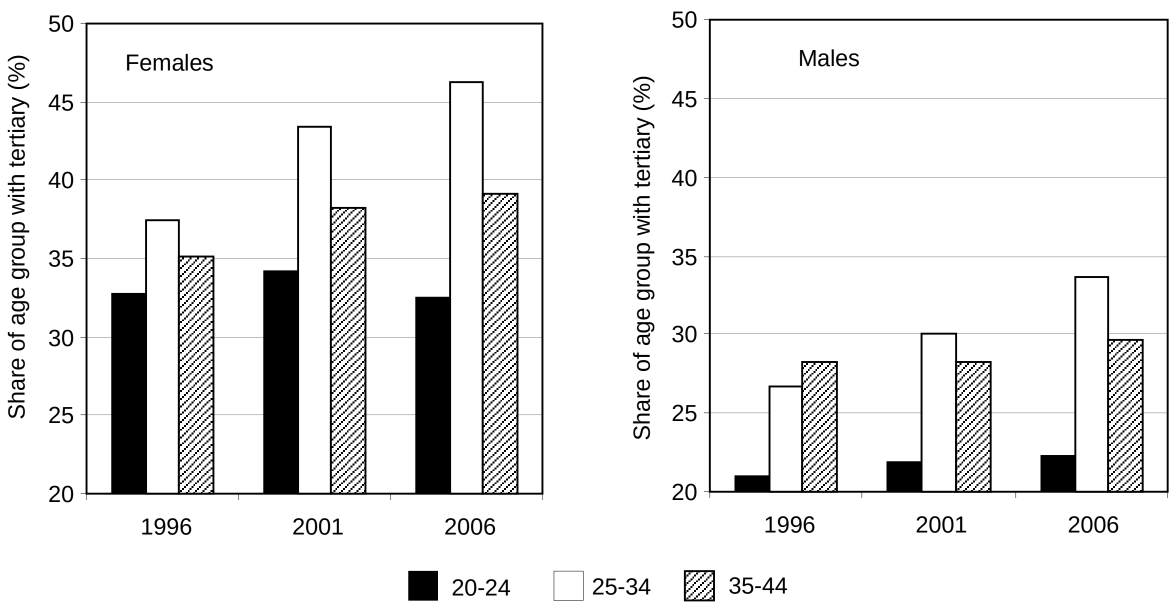
[6] Literature reviews by Pampel and Peters (1995) and Macunovich (1997) find equivocal evidence of Easterlin's explicit description of the dependence of fertility on relative cohort income. However, Maconovich finds strong evidence that changes in material aspirations affect fertility, both across populations and through time. In addition, Maconovich finds strong support for the role of rising material aspirations as a determinant of the post war baby boom and bust. A recent study that draws on the richer insights provided by panel data across OECD countries also provides support for this story (Jeon and Shields 2005).

Moreover, there are several factors associated with the recent period of prosperity that reduce the opportunity costs of childbearing:

First, the costs of leaving a job in order to have children are reduced if there are improved prospects of getting another job in the future. If jobs are plentiful, the economic future looks positive, and primary carers have higher human capital than in the past (figure 3.5), then they will be more willing to leave existing jobs because they expect easier subsequent re-entry into the labour market. Very low unemployment rates and shorter durations of unemployment (figure 3.6 and 3.7) in the mid 2000s are likely to have created these conditions. Indeed, many people currently in their prime fertile years have never experienced a recession in their working lives. The recent period of prosperity has also been characterised by very low quarterly volatility in growth, decreasing people's uncertainty about future income prospects. This reduced volatility has been empirically associated with fundamental shifts in economic institutions in Australia, for example, greater labour market flexibility (Kent et al. 2005) — which suggest that lower average volatility than in the past may persist into the future.

Figure 3.5 **Rising human capital provides insurance for families**

Share of females and males with tertiary attainment by age



Data source: ABS, *2006 Census of Population and Housing Australia*, Cat. no. 2068.0, Non-school qualification: level of education.

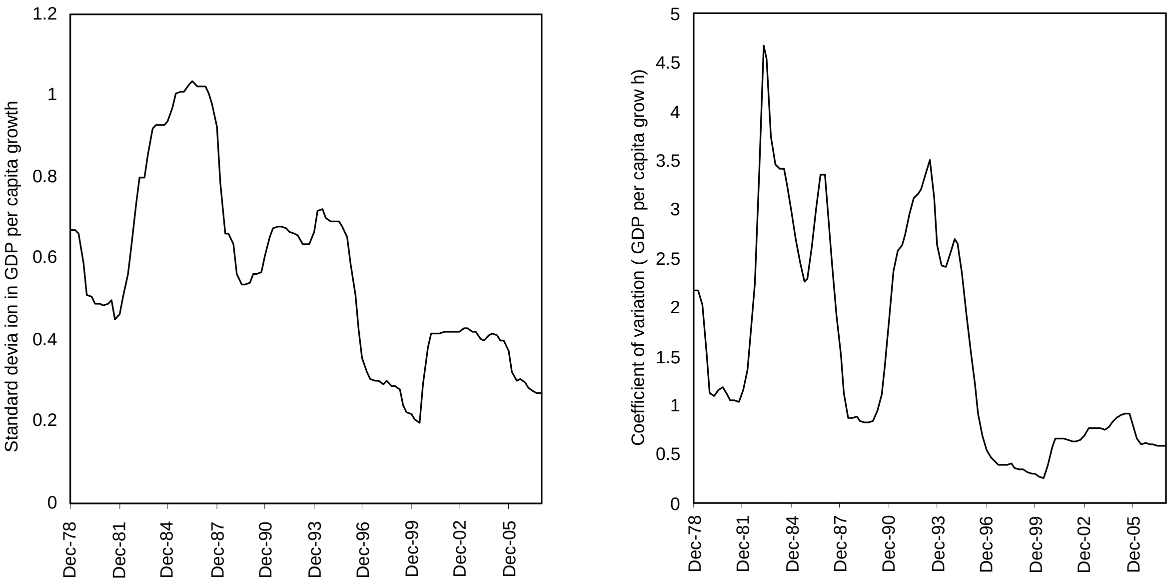
Figure 3.6 **Unemployment duration has fallen**

Share of females unemployed for more than 13 weeks[a]

[a] Data are for calendar years from 1979 to 2007. The data relate to the duration of unemployment since last full-time job.

Data source: ABS, *Labour Force, Australia, Detailed - Electronic Delivery*, Cat. no. 6291.0.55.001.

Figure 3.7 **Output volatility is at record lows[a]**



[a] The measures of volatility (the standard deviation and the coefficient of variation) are based on a five year 'window'. The coefficient of variation is the standard deviation divided by the average — this makes it possible to compare the variation of series with changing means.

Data source: ABS, *Australian National Accounts: National Income, Expenditure and Product*, Cat. no. 5206.0.

Second, family formation usually increases dependence on a single income as the primary carer reduces their employment. This reduces the scope for new families to diversify the household risk of unemployment. A strong labour market can mitigate this risk by lowering the probability of losing a given job, while increasing the probability of finding alternative employment at similar or better salary and conditions. This works to ease concerns about, and lessen the effects of, losing a particular job.

Finally, the capacity to strike a balance between work and caring responsibilities is an important factor in childbearing decisions. Enhancement of social institutions supporting families (such as access to child care) is likely to have weakened the tradeoffs between working and having children. In developed countries, the link between employment rates of women and fertility was negative in 1980, but strongly positive by 2005 (OECD 2007). In that case, the positive impacts of prosperity on female employment rates are likely to have contributed to rising fertility. A particular feature of this story may be the greater availability of part-time and casual employment, which, with easier access to, and acceptability of, formal child care, make childrearing and employment more compatible.[7] The lack of part-time and casual work opportunities is a common feature of many low fertility countries.

In summary, the prosperity of the Australian economy has probably contributed to the slowing of the decline of fertility in the late 1990s and the upturn from 2001.

In reaching this conclusion, it is important to distinguish this effect from what is likely to hold in the longer run. There can be no persistent positive or negative relationship between economic growth and fertility. If there were, continued economic growth would eventually herald vast overpopulation or universal childlessness. However, the Easterlin effect can lead to ongoing cyclical income-fertility effects, while reductions in unemployment and decreased uncertainty about future income could be expected to permanently raise fertility. Both of these facets appeared to be at work during the recent period of prosperity.

There are concerns that the Australian economy may slow down in the immediate future. If that materialises, then it will exert a transitory downward pressure on fertility rates.

[7] The ready availability of such part-time and casual work is sometimes seen as an indicator of the rationed availability of full-time jobs. Were this true, then this environment might be actually prejudicial to fertility by reducing prospective earnings. However, Abhayaratna et al. (2008) have found evidence that many people prefer part-time work and that, in part, its greater availability stems from employers trying to cater for the preferences of employees.

3.2 House prices and rents

Buying or renting a home is the major expenditure item for most households. Changes in house prices and debt servicing costs[8] have major budgetary and labour market implications, potentially deferring or reducing fertility. In this vein, Bettina Arndt (2003) has characterised mortgages as the 'new contraception'. Since the mid 1990s house prices and mortgage costs have risen substantially in real terms and relative to household income (Kryger 2006 Parliamentary library). Rents have risen more moderately than home prices, but have still increased from a median weekly cost of $159 (in 2006 dollars) in 1996 to $190 in 2006 (ABS 2007b).

As houses are both a consumption good and an asset, the increase in house prices may affect the childbearing of different groups differently. For those who have benefited from an increase in the value of their assets, the effect should be, in theory, similar to that of an increase in income. The main difference is that a rise in the value of an asset does not entail any forgone wage earnings, and so should be unambiguously positive in its impact on fertility. The size of the effect is less clear-cut. Housing equity is still relatively illiquid, many people do not know its value well and the attractiveness of realising equity through downgrading would probably be low for people intending to increase the size of their households. That said, for people who bought in the mid to late 1990s, the effect on fertility is more likely to be positive than negative. This may have contributed to the increase in fertility rates of women above thirty.

For prospective buyers, higher prices have sizeable negative implied income effects, while higher real interest rates affect owners with high mortgages relative to income. The Fertility Decision Making Project survey confirmed that the inability to buy/renovate or move house had a negative impact on fertility (but its ranking among factors was relatively low).[9]

Price changes also alter the relative costs of alternative expenditures. Whether this increases or decreases childbearing by renters or purchasers depends on whether housing and children are complements (a price-induced decrease in the demand for

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8 The effect of interest rates may have more complex effects on fertility, which we ignore here. For example, Becker (1988) has argued that altruistic parents maximise a 'dynastic' utility function, and are willing to give up consumption now to benefit their children in the future. In this model, there is a positive relationship between interest rates and fertility. The recent increase in fertility rates does in fact coincide with a period of increasing interest rates but there is little suggestion of an historical correspondence between the two. In any case, there is limited support for the underlying model that leads to such a positive correlation (Hondroyiannis and Papapetrou 1999 and Poot and Siegers 2001).

9 It was ranked 15th (males) and 17th (females) in terms of its importance for childbearing (Weston et al. 2004).

one is accompanied by a decrease in the demand for the other) or substitutes (demand for one displaces demand for the other). While in some situations, children and houses may be substitutes, at some point they must be complements because larger families demand larger dwellings. So rising house prices increases the cost of an additional child and is likely to exert a negative influence on fertility for renters and new purchasers, although the magnitude of the effect may differ across parities.

Overall, the net effect of recent trends in house prices and interest rates on observed fertility trends depends on the balance of the impacts on those making capital gains and those facing higher rents and mortgage payments. The international literature provides at least a partial guide to resolving which is more powerful, suggesting that rising house prices reduce fertility. For example, Ermisch (1988) found that a doubling of real house prices decreased fertility by around 15 per cent. Were this parameter estimate to hold for Australia, then with a rise in real house prices of around 54 per cent from 1998-99 to 2005-06 (Kryger 2006), the TFR would have fallen by around 8 per cent (or around 0.14 babies per woman). Even were fertility in Australia to be less responsive than this, it appears that some other factors must have offset the influence of house prices.

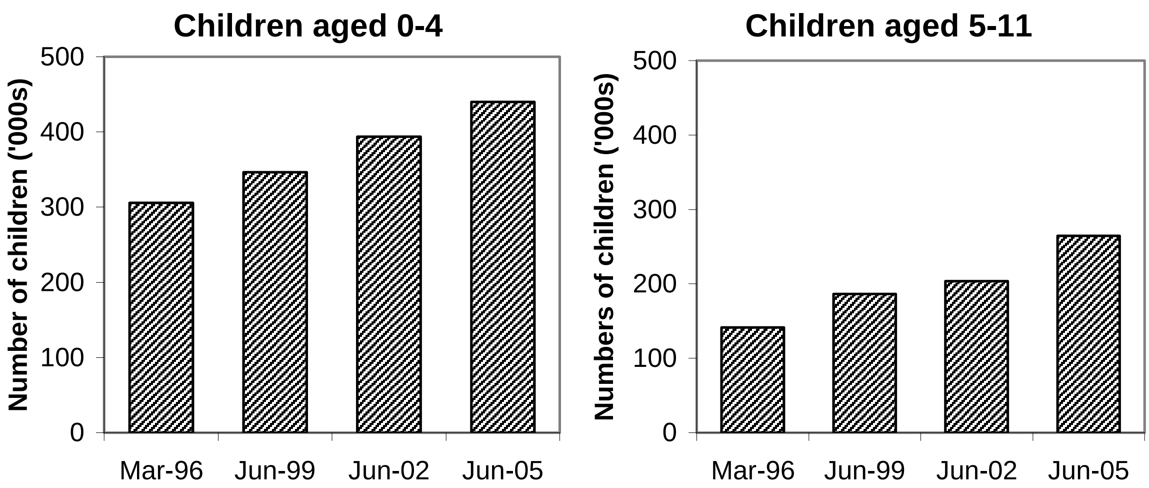
3.3 Cost and availability of child care

As apparent above, one of the key costs of raising children is forgone (maternal) earnings. The availability of affordable child care increases female employment rates, lowering the costs of raising children.

The availability of child care

In June 2005, almost half of the children aged 0-12 years were in some form of child care (ABS 2005). While some parents use informal arrangements with friends and family, many working parents rely on the formal, paid provision of child care. The strong growth in both the use of formal child care (figure 3.8), and its price, indicates a sustained increase in demand for child care. There was a marked increase in utilisation rates between 1999 and 2002 (table 3.1), which was matched by an increase in the percentage of day care facilities with no vacancies. However, between 2002 and 2004 average utilisation declined slightly, suggesting a growing capacity of the child care industry to cater for the growth in demand. The ABS measure of excess demand broadly corroborates this picture (figure 3.9).

Figure 3.8 **Number of children who used formal child care**



Data source: ABS, *Child Care, Australia, Jun 2005*, Cat. no. 4402.0.

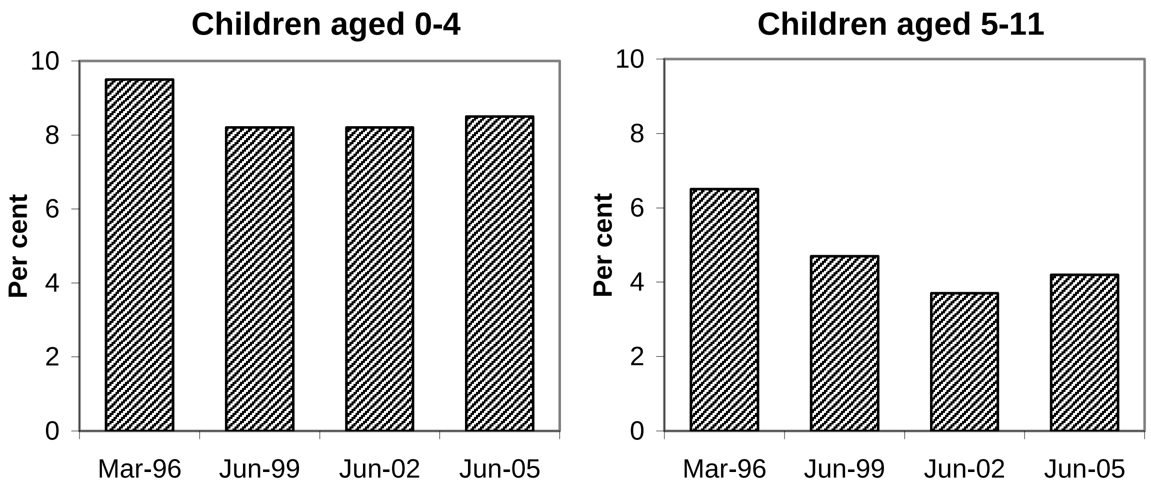
Table 3.1 **Utilisation rates of child care facilities**

	1999	*2002*	*2004*
	%	%	%
Long day care private			
Average utilisation	71	89	85
Per cent with no vacancies	9	28	na
long day care community based			
Average utilisation	75	86	84
Per cent with no vacancies	7	22	na
Family day care			
Average utilisation	70	77	68
Per cent with no vacancies	na	na	na

Source: FACSIA, *Census of Child Care Services,* 1999, 2002, 2004.

The aggregate statistics are likely to conceal some localised shortages of child care, such as in inner urban areas. In addition, the difficulty in securing certain types of child care, such as care for infants, is not well represented. Nevertheless, it does not appear that physical access to child care represents a systemic obstacle to child bearing.

Figure 3.9 **Per cent of children for whom additional formal child care was required but not available[a]**



a This is determined by asking a sample of respondents whether they required more child care than they were able to secure in the past four weeks.

Data source: ABS, *Child Care, Australia, Jun 2005*, Cat. no. 4402.0.

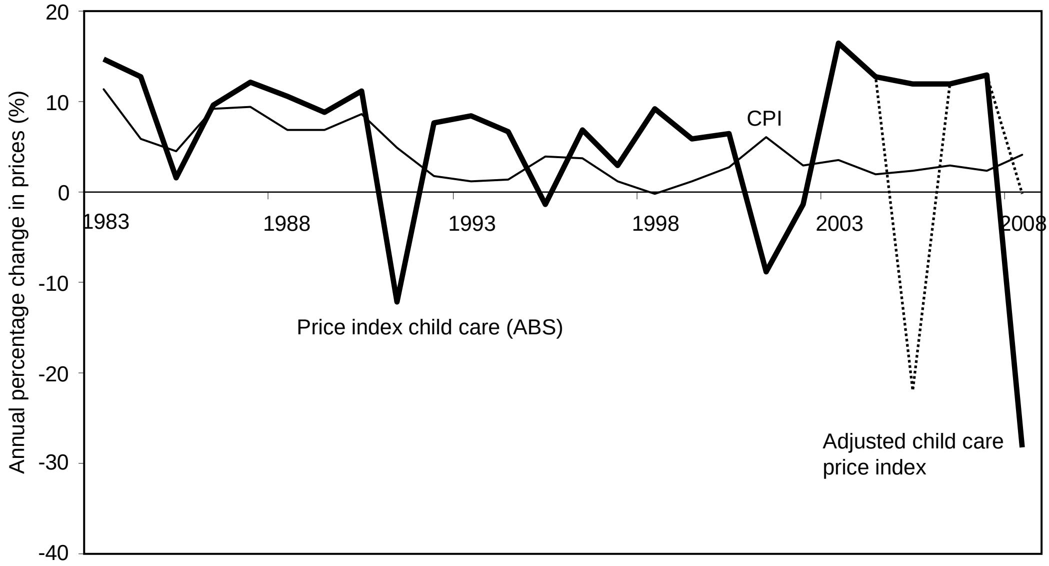
The rising cost of child care

The price of child care has grown by more than prices generally over the last twenty five years (figure 3.10). This implies that for prospective parents with anticipated child care requirements, the cost of having children has generally increased in terms of the consumption they could have enjoyed had they deferred or reduced child bearing.

Policy has been active in trying to reduce the cost to parents of child care. The introduction of the Child Care Benefit (CCB) in 2000, the Child Care Tax Rebate (CCTR) in 2004 and a change in the indexation of the CCB in September 2007 significantly reduced costs below what they would otherwise have been. As described in the note to figure 3.10, there are several complexities in estimating the impacts of these policy changes on net child care costs for families. The adjusted series in figure 3.10 probably best summarises the real outcomes. It shows downward spikes associated with the policy initiatives, surrounded by continued strong price growth.

The scope for the CCB and CCTR to reduce the cost of child care is limited by market feedbacks. As subsidies, they increase the amount of child care people would like to consume which, with only partly responsive supply, introduces a partially offsetting positive price effect. This, combined with other market forces, has generated a growth in child care prices that has exceeded 10 per cent per annum in four of the years since the introduction of CCB. Consequently, child care costs have risen by around 30 per cent from 2002 to 2008 — appreciably more than the 19 per cent rise in the prices of goods and services generally.

Figure 3.10 **Increases in the price of child care and the general price level**



a The data relate to March on March percentage changes. The price index for child care is a net cost measure based on the direct out-of-pocket costs to families. Accordingly, the ABS adjusted the market prices of child care services downwards to reflect the subsidy provided by the Child Care Benefit (CCB). The ABS made no equivalent adjustment to prices after the introduction of the Child Care Tax Rebate (CCTR) in 2004 because of the way in which the government provided the rebate to families, but did so from September 2007 following re-design of the subsidy. This explains the large reduction in prices in the last period in the ABS measure. This complex treatment of various subsidies confuses the picture of costs over time. The adjusted price measure is an experimental estimate of what the price index would have looked like had market prices been adjusted for the CCB in 2000, the CCTR in September 2004 and only for the change in indexation of the CCB in September 2007.

Data source: ABS, *Consumer Price Index, Australia*, Cat. no. 6401.0. and McIntosh (2005).

That said, many households have maintained their ability to pay for child care as wages and female participation have risen alongside costs. Despite the probable variation in individual circumstances, the share of average weekly earnings required to purchase child care has been relatively stable for most family types (Davidoff 2007, AIHW 2006).

Nevertheless, the extent to which relative cost of child care have provided a disincentive to childbearing depends on the base and end period:

- Over the long run, child care prices have outpaced consumer prices generally (280 per cent compared with 193 per cent from 1982 to 2008).
- The price rise for child care was nearly double that of consumer prices from 2002 to 2008 (33 per cent compared with 19 per cent for), but was less for the period from 2000 to 2008 (20 per cent compared with 30 per cent).

Although much of the observed increase in the cost of child care stems from market forces that are outside the control of users, part of the observed increase is likely to stem from the choices made by parents and accreditation initiatives. For example, parents may have a preference to spend more on the quality of child care as their income increases. Quality of child care may refer to qualifications of the child care staff, the staff to child ratio, the location of the child care centre or the quality of facilities offered by the centre. Alternately, there may have been a change in parent's preferences such that they desire higher quality child care regardless of their income level. This may occur as the norm for acceptable child care quality changes over time. In both cases, the changes to the cost of child care is an effect of parent's behaviour, rather than a cause. These changes would not precipitate changes in fertility behaviour.

Overall, the extent to which developments in the market for child care have exerted an influence on the fertility rate depends on the exact period chosen, reflecting the substantial volatility introduced by family policy and the responses of a (highly regulated) industry to changes in demand. In this context, it is not obvious that the relatively smooth increase in fertility in recent years can be traced to developments in child care provision and pricing.

3.4 The effect of the policy environment on fertility

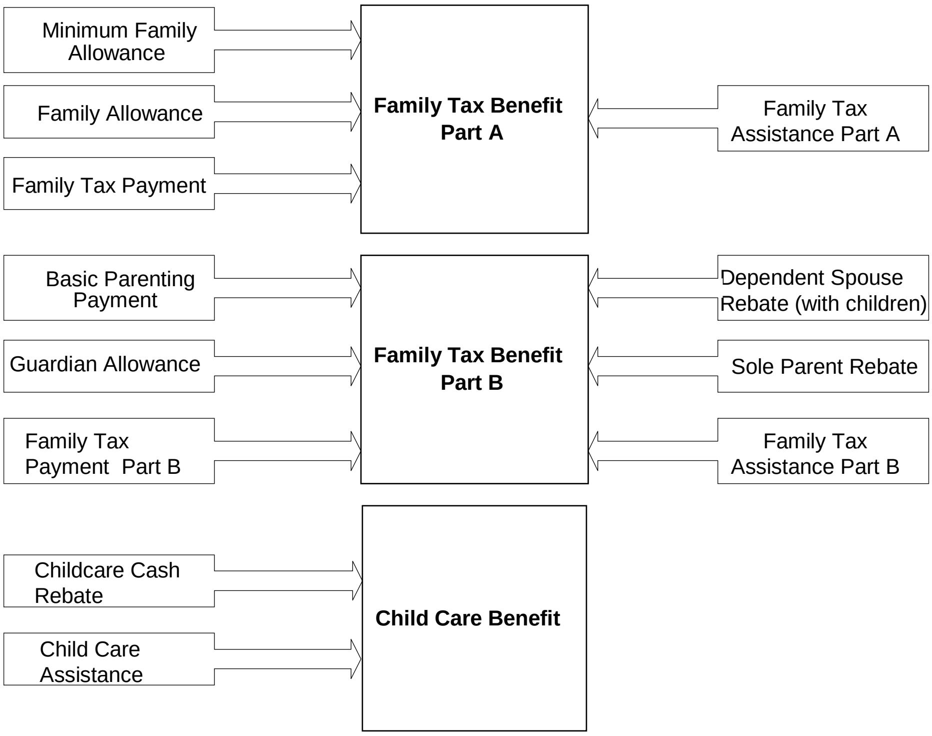
The policy environment shapes fertility choices. A wide variety of federal and state government measures are relevant to child bearing decisions — including the provision of public schools, health care and workplace legislation. While the policies relating to these areas are important, the impact is likely to be diverse, long-term and difficult to attribute. As such, this section considers a narrower suite of policies that provide direct and widespread transfers to mothers and families. Increasing fertility is not the stated objective of these policies, although it is often claimed to be a beneficial side effect.

The policies

Family Tax Benefit A and B

The Family Tax Benefit A and B were introduced on July 1st 2000 in an attempt to simplify the numerous parenting payments that existed at that time (figure 3.11).

Figure 3.11 **Twelve Family Payments simplified to three on July 1st 2000**

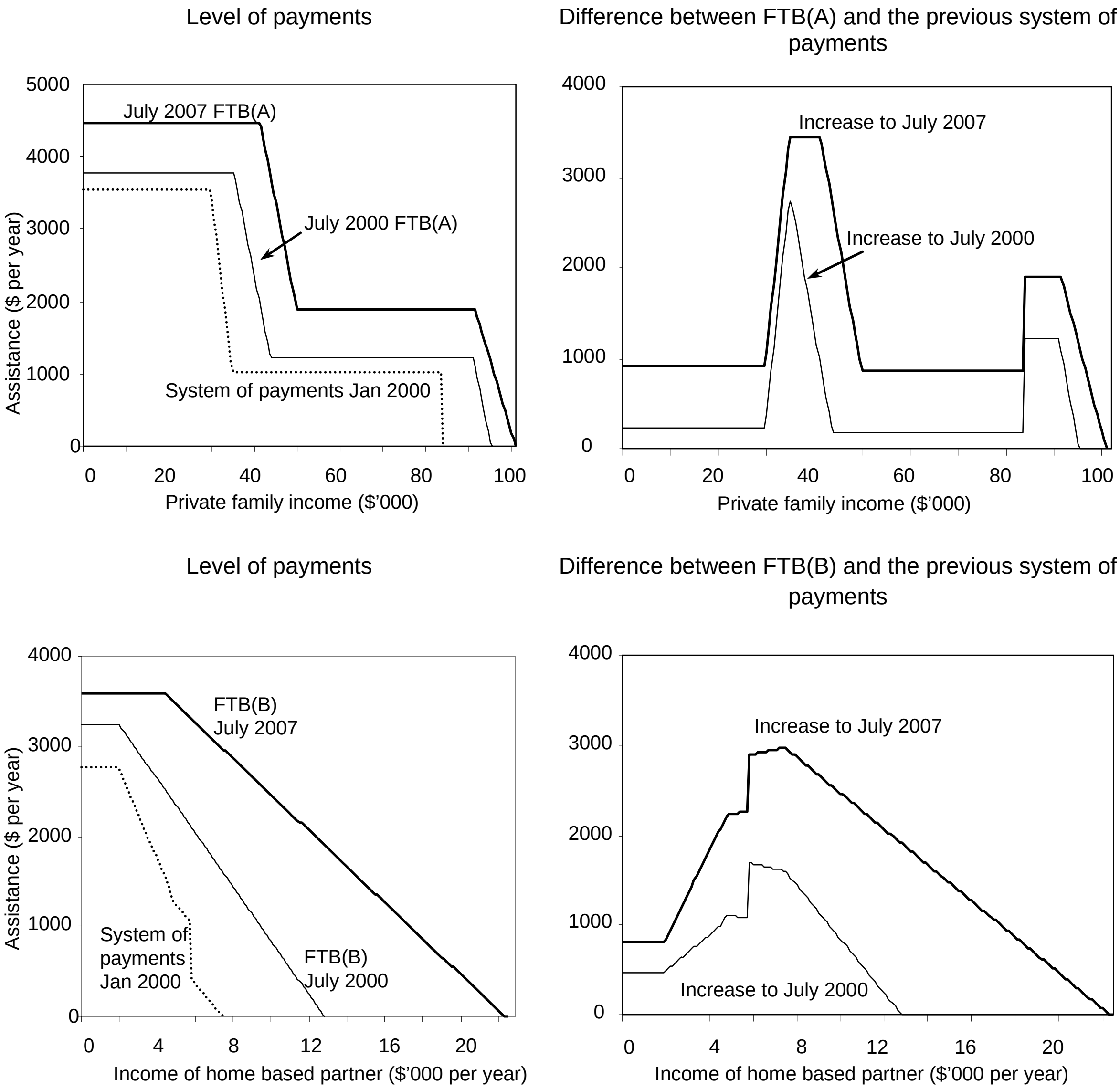


Data source: Whiteford 2000.

The stated objective of the Family Tax Benefit A (FTB(A)) is to 'assist families with the cost of raising children' (FACSIA 2007a). Families with children are entitled to a payment per child (delivered either fortnightly or as a lump sum at the end of the financial year). The maximum payment for a family with one child less than 13 years of age is currently $4460 per year and the average payment for all recipients was $5090 in 2005-2006 (FACSIA 2006b). FTB(A) has a conventionally redistributive design with an income test that progressively reduces the entitlement as family income increases. While still re-distributive, changes in the FTB(A) have particularly favoured families earning between $30 000 to $45 000 (in today's terms) (figure 3.12). These families benefited from a higher cut-out rate of the maximum payment.

Figure 3.12 **Family Tax Benefits and the preceding system of payments**

Real 2007 dollars for families with one child under 13



Data source: Assistance levels and taper rates are taken from Whiteford 2000 and Centrelink website.

The stated objective of Family Tax Benefit B (FTB(B)) is to 'provide additional assistance to families with one main earner' (FACSIA 2007a). The current maximum amount is $3584 for families where the youngest child is under five years of age. FTB(B) is subject to an income test on the secondary earner only[10] – sole parents or primary earners are not subject to an income test. The introduction of FTB(B) in July 2000 corresponded with a moderate increase over the existing system of payments, with the greatest beneficiaries being families where the

[10] Information is correct at time of writing, however FTB(B) will be subject to a means test on family income from July 1st 2008 onwards.

secondary earner earned between $6000 and $10 000 (figure 3.12). The generosity of FTB(B) was then substantially increased, so that in mid 2007 secondary earners could have an income of up to $22 000 and still receive some payment. Again families where the secondary earner made between $6000 and $10 000 have benefited the most, receiving up to $3000 dollars more than they would have under the old system of payments. The additional entitlement directed towards two person, two income families reinforces the simultaneous increase in family income thresholds applying to FTB(A).

The Baby Bonus (formerly known as the Maternity Payment)

Although the Baby Bonus[11] is the most widely publicised transfer to families, it is not new in concept or design. In fact, the Maternity Allowance, introduced in 1912 by the Fisher government, is essentially identical in nature (if not generosity) to the modern day Baby Bonus. The original Maternity Allowance of five pounds was the equivalent of over two weeks wages for an unskilled worker and like the modern day Baby Bonus, was not means-tested (Daniels 2006). The Maternity Allowance existed in various forms until its repeal in 1978. The government reinstated it as a means and asset tested payment of $840 in 1996, which remained until its ultimate cessation in 2004.

The then Australian Government introduced the Baby Bonus under its original name of the Maternity Payment in July 2004. It took the form of a one off $3000 payment following the birth or adoption of a baby. The payment was increased to $4000 in 2006 and is scheduled for a further increase to $5000 in July 2008. The Baby Bonus differs from Family Tax A and B and the Child Care Benefit in that its objective is to ‘recognise’[12] the cost of having a baby rather than assist those with actual financial need. This was most evident in the absence of any means test for the Baby Bonus until the introduction of a relatively high family income threshold in the 2008 Budget. The broader objective of the Baby Bonus means that the overall cost of this policy is greater than would be strictly required to assist the needy (although some of this loss will be recouped through the relative administrative ease of the non-means tested system). The universality and generosity of the Baby Bonus have made it a prominent feature of the fertility and population aging discourse.

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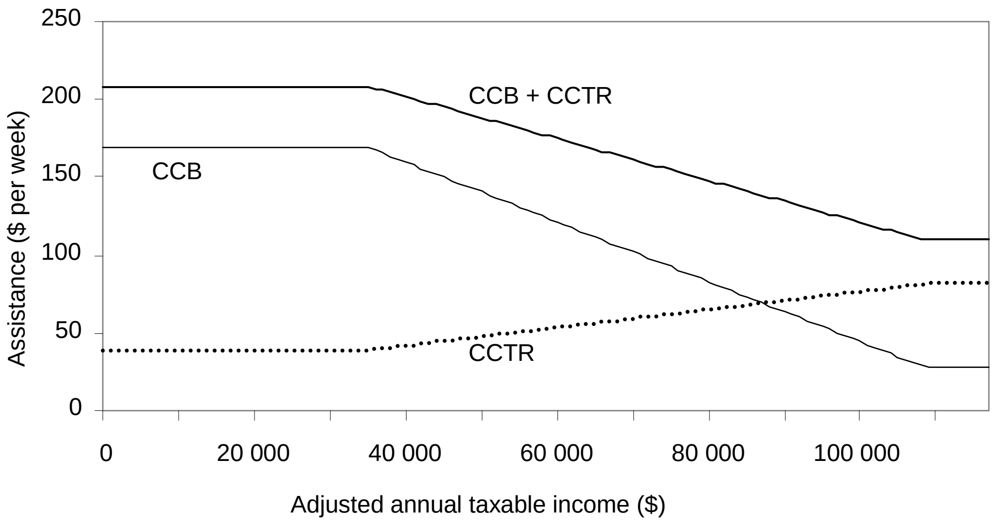
[11] Not to be confused with the original baby bonus that operated as a tax rebate from 2002 to 2005.

[12] The Family Assistance Office (2007) stated that the objective of the Baby Bonus was to ‘recognise the legal relationship between mother and child, the role of the mother in the birth of the child and the extra costs associated with the birth or adoption of the child.’

Child Care Benefit

The Australian Government introduced the Child Care Benefit (CCB) on July 1st 2000 as part of the general consolidation of family payments that occurred at that time. The CCB can be delivered as a child care fee reduction at the time of payment or as a lump sum at the end of the financial year. The current maximum payment for one non-school child in approved care is $3.37 per hour for a maximum of 50 hours week ($168.50 per week) and the payment is income tested (figure 3.13). This payment is supplemented by the Child Care Tax Rebate (CCTR), which was introduced in 2005 (McIntosh 2006). The CCTR covers 30 per cent of out-of-pocket child care expenses for children in approved child care to a maximum of $4096 for expenses incurred in 2005-2006 (ATO 2007).

Figure 3.13 **Child care benefits[a]**



[a] The figure shows the Child Care Benefit and Child Care Tax Rebate for a family with one child in the maximum 50 hours of care per week.

Data source: Assistance levels and taper rates are taken from Centrelink and Australian Tax office website.

How does family policy affect fertility decisions?

In many cases, such family polices provide financial assistance without stimulating fertility. However, they will affect the fertility behaviour of people whose financial circumstances just prevent them from having a child — 'marginal' parents.

- For some of these parents the effect is only temporary — so that they bring forward births they were going to have later in life (a tempo effect). This tempo effect may be particularly important if parents are concerned that a generous policy measure may only be in place temporarily.

- For others, the effect of policy is an increase in the completed fertility rate (a quantum effect).

Both responses will show up in contemporary fertility measures, and, to the extent that timing effects are large and sustained, both can have protracted, though not necessarily large, demographic impacts. (The dual long-run importance of tempo and quantum effects was apparent in the baby boom years — appendix H.)

Family policy provides incentives for childbearing by lowering the lifetime costs of raising children. The degree to which family policies provide a subsidy for childbearing is tempered by the fact that the recipients usually also bear some of the tax burdens that fund these measures. Low-income families are more likely to be net recipients of Australia's system of taxes and transfers, and thus receive a greater subsidy. As taxable income increases, the greater taxation burden offsets a greater proportion of the subsidy. Given people generally receive family payments over a short period, but fund the existence of such policies over their entire working lives, many families would be financially better off in the absence of even universal payments, such as the Baby Bonus.

By implication, family policies also penalise childlessness. While the net transfer is often smaller than the actual payments, the childbearing subsidy offered by existing family policies operates concurrently with a penalty for childlessness. As taxpayers must fund family policies, regardless of whether they intend to have children or not, there is a transfer from the childless to those with children. (With universal policies such as the Baby Bonus, this transfer can operate regressively — from poorer childless taxpayers — to richer families.)

Fertility policy may also have indirect effects by reinforcing social norms concerning childbearing. For example, if family policy is accompanied by an explicit and repeated message from both government and the media that emphasises the importance of having children, this may foster a more favourable community attitude to family formation. The causality is also likely to run in the opposite direction as governments design policies that respond to emerging community attitudes.

The extent to which the family policy regime affects fertility depends upon:

- the responsiveness of fertility to changes in family policy
- the changing generosity of policies.

How responsive is fertility to family policy?

Since family policies lower the costs of having children, they *must* have some impact on fertility. A vast empirical literature has attempted to establish by how much, without much consensus. This reflects the studies' variable quality, differences in methods, definitions, data sources and data period considered (appendix E). Studies differ with:

- the level of aggregation — from micro-level data, to single country macro-level data to cross-national data
- the econometric technique employed
- the characterisation of fertility
- the types of policies considered and the way policy is measured
- the influence of unobservable factors such as culture and social institutions
- whether the studies are cross-sectional, time series or panel.

Despite these difficulties, meta-surveys by Sleebos (2003) and Gauthier (2007) tentatively suggest a weak positive relationship between family policy and the total fertility rate. Both authors qualify this assessment of the evidence, citing the wide range of estimated magnitudes, as well as the many studies with insignificant, inconclusive or contradictory results. On top of these difficulties, family policies are most likely to have a bigger impact on the timing of children than their ultimate number. For instance, Ermisch (1988) and Barmby and Cigno (1990) confirm that policies encourage people to bring forward childbearing. But most studies do not address this issue because they are unable to measure the impact on completed fertility rates.

The varied and problematic nature of the empirical literature prevents ready generalisation of a 'typical' magnitude. For example, d'Addio and d'Ecole (2005) find that a 25 per cent increase in the effective child subsidy rate[13] generates an increase of 0.05 births per women (pp. 65). Blanchet and Ekert-Jaffe (1994), on the other hand, construct an index of family policy that captures both its generosity and its pronatalism. In the stated example a 140 per cent increase in the index increases the TFR by 0.17 babies per women (pp. 99). Laroque and Salanie (2004) estimate that a 50 per cent increase in total family payments, costing about 0.4 per cent of GDP, would increase the TFR by about nine per cent (p. 27). Ermisch simulates that

[13] The subsidy rate is measured as the difference between the effective tax rates of people without and with children. For a childless family, the effective tax rate is (T-v)/Y where T are taxes paid, v are the average non-family-related transfers and tax offsets, and Y is taxable income. For a family, the effective tax rate is (T-v-B)/Y where B is the family benefit transfer. So the subsidy rate is B/Y.

doubling the real value of child benefits generates a 0.17 per cent increase in average family size (pp. 57 table 4).

Overall, Sleebos (2003 p. 48) concludes that:

> The last general point is that policy-makers should probably not expect too much from pronatalist policies. … knowledge about the effects of policies is still too limited to guide the design of cost-effective interventions.

Fertility in Australia may be even less responsive to family policy than many of the countries studied in the international literature. This is partly because Australia's family policies do not explicitly aim to increase the fertility rate, as in some countries. Gauthier and Hatzius (1997) go further to suggest that, like other Anglo-Saxon countries, Australia's adherence to a 'private responsibility' model of public support (more inclined to target those in need), reduces the link between family policy measures and fertility. They find a large effect for Scandinavian countries, but no statistically significant effect for Anglo-Saxon countries (including Australia).

The changing generosity of family policy and its impact

The Australian family policy regime comprises many different policies with different target groups and eligibility conditions. Accordingly, it is not straightforward to calculate the changing generosity of this regime over time, and the associated possible impact on fertility.

The Baby Bonus

The generosity of an individual, one off, universal payment such as the Baby Bonus is easiest to appraise. Even taking into account the salience of a lump sum payment that immediately follows the birth of a child, the commitment and lifetime costs involved in the decision to have children suggest a minor role for this type of policy.

The direct lifetime costs to parents of raising a child alone have been estimated at around \$240 000 for a single child in a middle-income family (Percival et al. 2007),[14] while the indirect costs associated with forgone earnings amount to around \$310 000 for a single child (Breusch and Gray 2004).[15] However, these cost

[14] Based on the estimated average cost of raising one child over the first twenty four years shown in table 2.

[15] The original foregone earnings estimate from Breusch and Gray (2004) related to 2001 data from HILDA. The figures have been multiplied by wage price inflation from the relevant period

estimates have the same synthetic nature as the total fertility rate. They are the lifetime costs of raising children, if for every future year, families with children experienced the *currently prevailing* age-specific costs of raising children (including forgone earnings). For the purpose of comparisons with an upfront benefit, such as the baby bonus, such a measure of costs has several deficiencies. First, it does not discount future values to the present, which, all things being equal, overstates the real costs.[16] Secondly, the real costs of raising children can be expected to rise roughly in proportion to future growth in real wages. Ignoring this, understates the real costs. A back-of-the-envelope calculation suggests that the appropriate measure of the total lifetime costs of one child (until age 21 years) against which to appraise the relative generosity of the baby bonus is around $385 000 (not the $555 000 implied by adding the more simple measures above).[17]

On this basis, the Baby Bonus represents around a one per cent reduction in lifetime costs for a first child for a typical family. Furthermore, as noted above, the Baby Bonus is actually a more generous version of a pre-existing policy, the Maternity Allowance, which the Australian Government introduced almost one hundred years ago.[18] In that case, the *incremental* reduction in costs arising from the new allowance is even less than one percentage point.

The incentive effects of the bonus are greater for second and subsequent children since the marginal costs fall with additional children. The incentive effects are also greater in those families where there are no forgone wages from having children, for instance, because the prime carer does not want to, or cannot get, work. Nevertheless, the implied subsidy rates are still small. (The question of how sub-groups may respond to the Baby Bonus and other family policies is discussed later.)

in 2001 to December 2007 to put it on the same basis as the NATSEM estimates (so $247 000 x 1.26).

16 One way of looking at this is to note that the present bank balance needed to meet future costs of x dollars spread over the next two decades is much less than x because of compound interest on the initial balance.

17 The calculations take account of the age-profile of costs and of forgone wages in Percival et al. (2007) and Breusch and Gray (2004), and use a 5 discount rate and a 1.75 per cent long-run growth rate in real wages (in line with the productivity rate assumptions in the long-run models used by the PC and Treasury — such as the two Intergenerational Reports).

18 The TFR continued to fall for twenty years following the introduction of the original Maternity Allowance.

Consequently, any significant fertility effect from the Bonus would suggest the presence of short-sightedness by parents about the lifetime costs of raising children or a large price elasticity of 'demand' for children.

- Were the former true, it might explain a bigger-than-expected effect from one-off cash payments. But it would also undermine the appropriateness of the policy in the first place since it would precipitate high *unanticipated* future costs for those people responsive to the measure.
- Were the latter true, it would imply that a minor but permanent shock to any child-related costs (for example, a small increase in child care costs) whose present value was equal to the Baby Bonus would also have substantial fertility impacts. It would also imply high responsiveness to family policies in the empirical literature. Neither is evident.

Ongoing payments — Family Tax Benefits

The significance of changes to ongoing, means-tested, payments in recent years is more difficult to assess, as these payments vary:

- between individuals at a given point in time according to their income level
- with the age of children, and at older ages, with their work and dependency status
- non-linearly with the number of children
- through time as family income changes.

This precludes a categorical assessment of the magnitude of the changes to these policies. However, a case study reveals the potential magnitude of some of the policy changes. Back-of-the envelope calculations for Family Tax Benefit A (the major ongoing payments) suggest that, for a family with one child, the present value of ongoing entitlements amounted to around 3.5 per cent of the total lifetime costs of raising a child in 2000 (appendix D).[19] By 2007, they were 8 per cent — or an increase in the generosity of the payment of 4.5 percentage points.

Considering how the family tax benefits has altered people's effective tax rates provides an alternative way of looking at the relative generosity of such payments over time, while highlighting some of the complexities of interpreting the effects of changes in policy. Many families have not been eligible for family benefits at any point since its introduction — for example, a family with one young child in which the main breadwinner earns around average weekly earnings, and with a partner

[19] This is based on estimates of the wages forgone (from Breusch and Gray for a middle-income family) and children's direct costs from Natsem. Data were re-based to take account of inflation and wages growth between the relevant years.

earning half this amount (C1, W50% in figure 3.14). In contrast, low-income families have experienced substantial reductions in effective tax rates from 2000 to 2007 compared with childless families with the same family income (C2,W33% in figure 3.14). Yet some higher income families have faced bigger reductions in their effective tax rates than some lower income families — reflecting the extension of payments to higher income families over time. This shows up as ‘waves’ in figure 3.14.

The implication of these variations is that there is no single way of characterising the evolving generosity of Australia’s most important family payments. This is problematic for empirical analysis, which usually attempts to relate the total fertility rate to a single measure of transfers to a representative family. For example, a commonly cited OECD study of the determinants of fertility uses the average margin between the effective tax rate of a married couple with two children aged six and four years and that of a single person (d’Addio and d’Ercole 2005).[20]

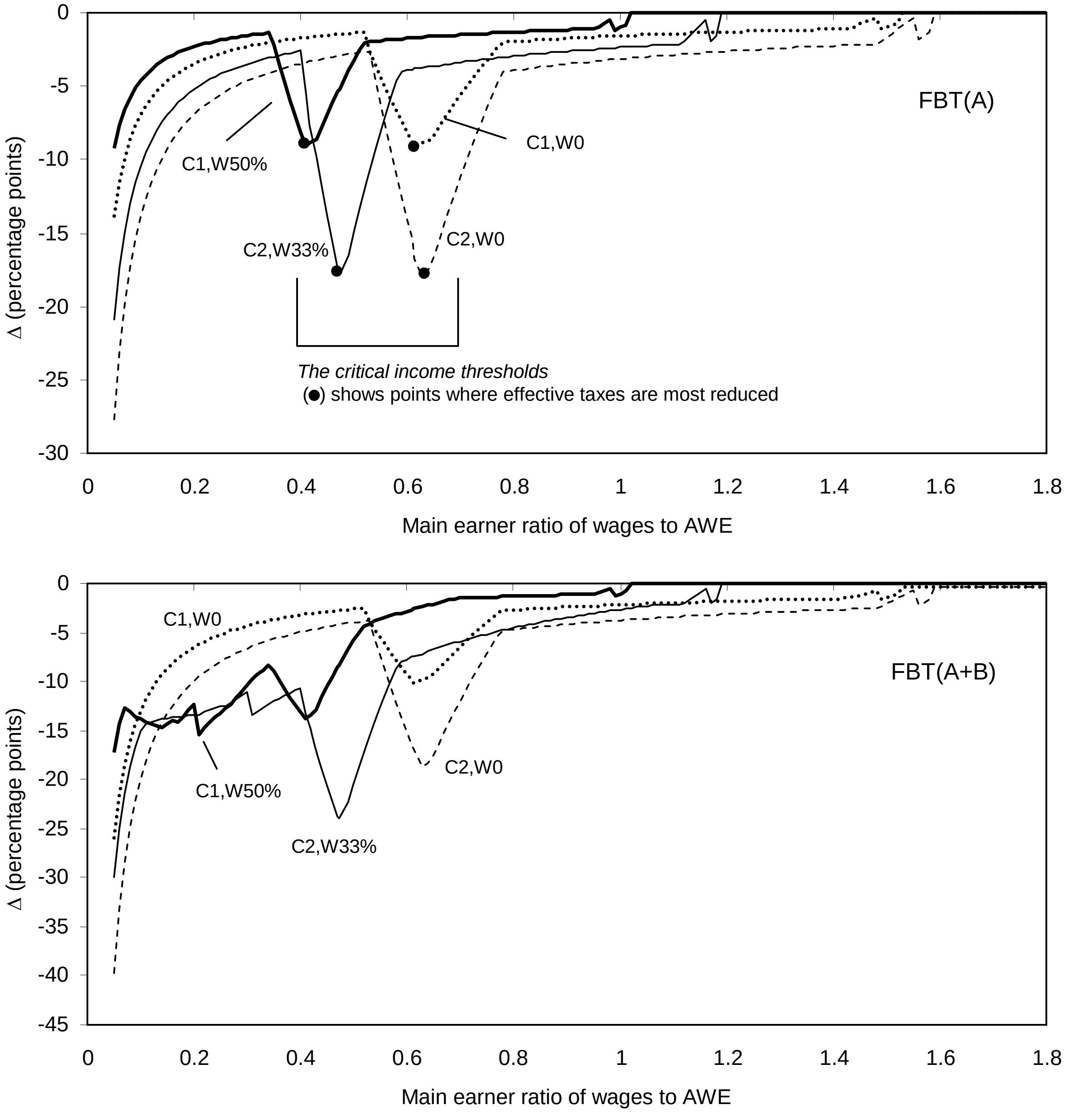
Nevertheless, given that changes in FTB(A) in the past eight years involves much greater lifetime payments to families than the baby bonus, it might be assumed to have a bigger impact on fertility. However, this assumption may not be warranted. There are several reasons to expect that the above description of the increase in payments overstates the actual increase and misrepresents how people value a future entitlement. This is because:

- For many families, household wages and hours of work tends to rise as their children age. As a result, many would receive lower family tax benefits in later years. This reduces the impact of a change in the generosity of the FTB on the lifetime costs of raising children for these families.
- Prior to the birth of a child, it is questionable how well prospective parents understand complex pre-existing FTB(A&B) entitlements, let alone the significance of any change in that entitlement.
- Future streams of family payments are not certain but often change over time. Families could be expected to rationally discount future entitlements by a greater amount to reflect this uncertainty. The fact that initial designs of the FTB resulted in significant overpayments as families’ income circumstances changed over the course of just a single year is symptomatic of the problems families face in forecasting their future eligibility. (This annual problem was resolved by holding back a proportion of the payment until family income was finalised at the end of the financial year.)

20 The measure is based on a couple where one spouse earns 100 per cent of the average production worker. It is unclear whether the parameter estimates from D’Addio and d’Ercole (2005) apply to Australia or whether the measure of policy generosity is valid in an Australian context. Were they to be, then it would imply that changes in FTB(A) would ultimately increase Australia’s TFR by around 0.05 babies per woman.

Figure 3.14 **The changing generosity of family policy depends on family type and income**

Changes in relative tax rates, couple family, FTB(A) and combined FTB(A&B), 2000 to 2007



a Effective tax rates facing otherwise identical families with and without children (and with different levels of wages relative to average weekly earnings) were calculated for the FTB(A) and FTB(A&B) in July 2007 and its equivalent in January 2000. Effective tax rates (T) were calculated as 100*(1-NY/GY) where GY is gross family income and NY is net family income, including receipt of any family benefits and payment of taxes. The term D = $\{T_{WC}(2007) - T_{NC}(2007)\} - \{T_{WC}(2000) - T_{NC}(2000)\}$ indicates the change in the relative treatment of families with children (WC) and those without (NC). The family types are (C1,W0) — a one child family with zero wages for the second partner; (C2,W0) — a two child family with zero wages for the second partner; (C2,W33%) — a two child family with the second partner earning 33 per cent of the main earner's wage; and (C1,W50%) — a one child family with the second partner earning 50 per cent of the main earner's wage

Data source: Calculations based on tax rates and family benefit schedules for January 2000 and July 2007.

Aggregate measures of generosity and their impacts

It would be desirable to repeat the calculations of the kind above for all other relevant family policies (such as various child care subsidies and other transfers) and then to pool these into a single representation of Australia's family benefits system. However, the data and conceptual complexities compound because each payment has its own specific eligibility criteria that depend on the family type and characteristics. Given these complexities, a more rough-and-ready aggregate measure of the changing importance of family policy across all payments and all families may still provide a useful indicator, while being easier to estimate.

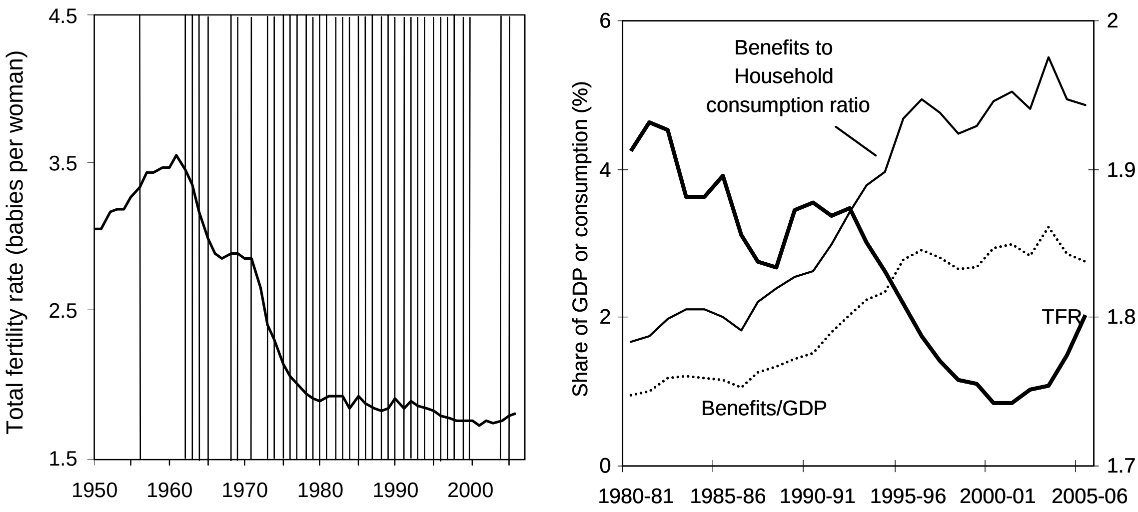
It is important to use measures of the generosity of aggregate family payments that have sensible long-run properties. Just to maintain a given incentive effect on fertility rates, the level of family payments would have to keep pace with the costs of raising children. These costs can be expected to rise over time, reflecting changing expectations about the appropriate living standards of children, the greater cost of services and the higher foregone wages of carers. In that case, family payments could only have an effect on fertility rates if their generosity was to exceed the growth in the costs of raising children. Accordingly, there can be no sensible long-run positive link between the *level* of payments and the fertility rate. Dividing government family transfers by total child costs, GDP or household consumption alleviates this problem.

The ratios of government family spending to GDP and to household consumption are easy to calculate and are likely to be reasonably correlated with total child costs. Using either metric, the recent increases in family policy spending are relatively small (figure 3.15). Family payments increased from:

- 2.65 per cent of GDP in 1998-99 to 2.75 per cent in 2005-06 — a change of 0.1 percentage points
- 4.48 per cent of household consumption in 1998-99 to 4.86 per cent in 2005-06 — a change of about 0.4 percentage points.

This indicates the correspondence of recent increases in family payments with growth in the economy.

Figure 3.15 **The unresponsiveness of TFR to family policy** [a]



a Details of policies up to the year 2000 are from the Social Market Economy Institute of Australia (2005), with subsequent developments based on annual reports by FaCS. There is a break in the series in 1998-99. The expenditure ratios from that date are derived from AIHW data, while previous ratios are drawn from the OECD Social Expenditure database. The differences between the series are small.

Data source: Social Market Economy Institute of Australia (2005), ABS (2006), OECD Social Expenditure Database.

Though difficult to estimate, conceptually, the best measure of generosity is the ratio of government family benefits to the full private lifetime costs of raising children. This can be used to identify the extent to which family benefits reduce the lifetime 'price' of children (appendix D), and therefore the possible magnitude of additional 'demand' (fertility).[21] Back-of-the-envelope calculations suggest that the Australian Government increased its contribution to the lifetime costs of raising children from 21.5 per cent in 1998-99 to 23.8 per cent in 2005-06. This implies a reduction in the average lifetime costs of around 3 per cent.

When family allowances alone are considered (FTB(A), FTB(B) and the Baby Bonus), the increasing generosity of payments decreased average lifetime costs by around 3.6 per cent over the slightly longer period from 1998-99 to 2006-07 (appendix D). Were Australian fertility to have the same sensitivity to family allowances as OECD countries as a whole, then this implies that changes in allowances over this period increased the total fertility rate by about 3.7 per cent. This equates to a budget cost of about $300 000 per additional baby (appendix D). Were fertility to have a lower sensitivity to benefits, as suggested by the nature of

[21] In contrast, other than over short periods, the *level* of government payments provides little guidance about the incentive effects of family policy. This is because the incentive effects would actually decline unless the level of payments actually kept up with costs. So growth, per se, in payments does not indicate whether policy is acting to further decrease the 'price' of children.

Australian family policy (see above), the cost per additional baby could be significantly higher.

Moreover, casual assessment suggests no obvious positive link between the myriad of family policy changes that have occurred over the past 30 years and changes in Australian fertility behaviour (figure 3.15). From 1986 to 1996, the generosity of family policy grew by much more than in contemporary times, but the fertility rate still declined significantly over that period. Econometric analysis over the period from 1980 to 2007 of the links between the total fertility rates (in levels, logs, differences) and various measures of family policy found negative, not positive, relationships, even after controlling for several other influences.[22] Of course, the true underlying relationship between fertility and family policy must be positive. The results suggest, however, that this positive impact is sufficiently small that it is hard to discern among the many other factors impinging on fertility.

The recent experiences of other Anglo-Saxon countries are also revealing. There appears to be no obvious relationship between their family policy spending to GDP and their fertility experiences. The common ingredient of their experiences has been the coincidence of rising fertility levels and a period of economic prosperity.

The fertility behaviour of different socio-economic groups also suggests relatively modest effects of family policy in Australia. The various family benefits introduced since 2000 have tended to favour lower income families, as is apparent from the payment schedules in figures 3.12 to 3.14. This is further reinforced by the fact that the private costs of raising children in families with younger or low-skill females tend to be lower since their forgone earnings are also lower. This means higher effective subsidy rates for such families. Yet, in recent times, the fertility rates of people with higher socio-economic status appear to have grown more rapidly than others:

- ABS regional analysis — while only partial evidence on this score — shows greater rises in rich areas than poor ones (as discussed later in this chapter).
- The Australian Capital Territory, which has a significant over-representation of better off families, has shown a large percentage increase in its fertility rate since 2001.

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22 Such as unemployment rates, inflation rates, housing affordability, relative female to male wages and a time trend to capture slow moving social phenomena, such as changes to attitudes to women working. No acceptable model was found using this time series approach, with all showing signs of misspecification. That does not rule out the possibility that a more sophisticated approach might yield different answers. Possible extensions could involve the use of stochastic trends, additional relevant variables (for example, divorce rates), and techniques, such as instrumental variables, that deal with the potential endogeneity of family policy.

This suggests that factors other than the income effects of family policy have prompted their behaviour.[23] Nevertheless, the changing generosity of family benefits in Australia has probably contributed modestly to the recent rise in aggregate fertility — albeit at a high cost.

Have sub-groups been affected?

As noted above, some family policies provide greater financial incentives for childbearing for younger, poorer and disadvantaged parents. If such groups are less likely to foresee the full long-run costs of raising children, they will be even more responsive to any upfront financial incentives. Affecting such sub-groups is unlikely to make much difference to aggregate Australian fertility, but it does raise several policy tradeoffs:

- While the absolute value of earnings forgone is less among lower educated women, the costs of raising children represent a bigger proportional reduction in their lifetime income than more educated women. For example, Breusch and Gray (2004) found that a university-educated woman with two children forgoes around 40 per cent of her lifetime earnings (compared with childlessness), while a woman with incomplete high school education forgoes around 60 per cent of her lifetime earnings.
- The incidence of low birth weights (a major indicator of subsequent problems) is greater among young mothers and even greater among disadvantaged mothers.
- Early children have a greater impact on lifetime earnings than later children and can displace education and training, potentially locking in disadvantage.

Various commentators have pointed to perverse incentives arising from the Baby Bonus, because its large upfront, lump-sum nature has greater potential to affect the behaviour of the disadvantaged than others. While anecdotal, the concern is that liquidity-constrained mothers were using the bonus for non-child-related expenditures and in some cases, getting pregnant in anticipation of a future lump sum payout. For example, it was claimed that some Indigenous people in the Katherine region of the Northern Territory had used the bonus to finance substance abuse, rather than child-related expenses, and that the bonus would

[23] Tempo effects may, in part, explain this pattern. The past deferral of children is more likely to have affected educated, higher socio-economic groups of women who wish to progress their careers before partnering and childbearing. Consequently, recuperation will affect higher socio-economic areas by more. But the evidence on age-specific fertility rates shows that fertility rates among younger women have also started to rise significantly in recent years in places like the ACT. So neither family policy nor recuperation provides a full explanation for the pattern observed for different socio-economic groups.

(problematically) stimulate pregnancies.[24] Skelton (2008) reported intimidation by partners of Indigenous women to obtain the bonus. The Northern Territory Chief Minister has also expressed concern about the social impacts of the bonus in some communities,[25] as have some MPs in other States.[26]

A social worker made the following observation:

> … as a long standing worker in child protection, I am also concerned about the social costs. Not many people have more babies because of the Bonus, except those who are least able to parent. The Bonus actually is a real incentive for dysfunctional families to produce more babies and so to increase the proportion of disadvantaged babies being born. $4000 is a lot of money for people living on Social Security or a 16 year old. I cannot tell you how many of my child protection clients talk of having another baby to get what seems to them to be a fortune. We are also aware of many cases where unscrupulous 'partners' leave as soon as the money comes through and they purloin it.[27]

Unfortunately, the data to test the strength of these incentive effects are not available. However, some indicators suggest that the effects on teenage pregnancies have probably not been large across Australia, with the possible exception of the Northern Territory:

- The rate of teenage pregnancy in Australia, already low when compared with other English speaking countries such as the US, UK or New Zealand, has been declining since the 1970s and has (generally) continued to fall since the introduction of the current family policy regime.
- Similarly, there is little evidence that lower income groups have been more responsive to family policy than the general population. The Socio-Economic Indexes for Areas (SEIFA) estimates the level of advantage experienced by a geographical area according to the proportion of inhabitants on low or high incomes, in low or high skilled occupations and so on. These data show that the biggest increase in fertility rates occurred for older mothers in the most advantaged areas (ABS 2007c and figure 3.16).[28] That said, the data show that,

24 Comments ascribed to Michael Berto, chairman of ATSIC's Garruk-Jarru Council in the Katherine region of the Northern Territory (AAP June 2005).

25 ABC News 2004, 'Fears baby bonus being used to buy alcohol', 27 June.

26 For example, Barry Haase in Kalgoorlie (Schubert, M. 2006, 'Increase scrutiny to stop baby bonus abuse: MP', *The Age*, October 18) and Far north Queensland MP, Jason O'Brien (ABC website, 2008, 'Baby bonus causing Indigenous population explosion: MP', 10 January).

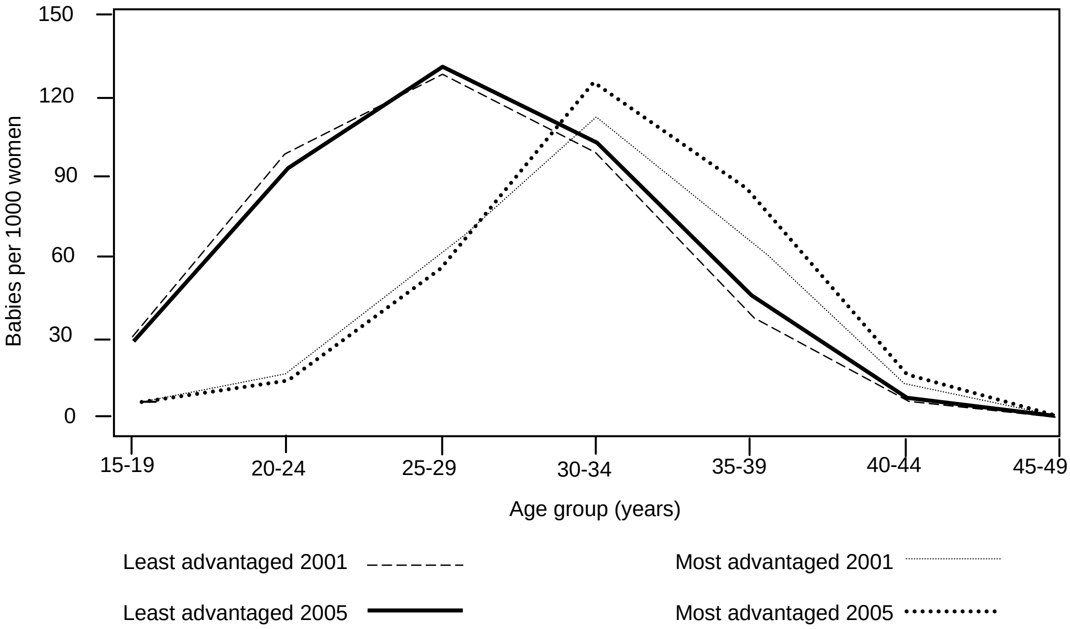
27 Comment made by participant, 14 March 2008 in Core Economics, commentary on economics, strategy and more, at http://economics.com.au.

28 As noted in figure 3.11, this evidence is not decisive because migration between areas or other confounding factors may distort the picture. Moreover, it does not control for other factors that

between 2001 and 2005, the fertility rates rose (slightly) among young mothers in the most disadvantaged areas, while over the same period they fell for young mothers in the most advantaged areas.

- A statistical measure based on age-specific fertility data also shows no evidence of a distinctive surge in teenage births relative to other age groups (appendix F) for all jurisdictions, bar the Northern Territory. While this approach has the advantage that it controls (partly) for any general factors that act to depress or increase births across mothers generally, its statistical power is probably low.

Figure 3.16 **Fertility has risen most in socially advantaged areas**



[a] It is important to note that these data do not provide the average fertility rates for rich and poor families, but averages for *geographic areas* that are in the highest and lowest quintiles of income. This could confound the true extent of fertility change by degree of socio-economic disadvantage (through the so-called ecological fallacy). As a hypothetical illustration, it could be that people with parental intentions move out of poorer areas to wealthier areas to gain access to greater security and better educational facilities, while those without parenting intentions stay. This could depress the subsequent fertility rate of the poorer area, even if the poor themselves have more children, while it would raise the fertility of the richer areas.

Data source: ABS, *Australian Social Trends*, 2007, Cat. no. 4102.0.

However, by its nature, finding effects on narrow sub-groups is hard without detailed unit record data. The anecdotal material alone suggests that this form of family payment has probably created adverse outcomes for some people. (Reflecting concerns of this nature, in 2007, the Australian Government re-designed the Baby Bonus to provide payments in instalments for women aged less than 18

have been changing between 2001 and 2005 and that may have affected poorer and richer people differently (for example, the design of welfare schemes).

years. This has been extended to all recipients following the 2008 Australian Government Budget.)

The Baby Bonus also appears to have had unanticipated effects on the timing decisions of women whose birth was to occur immediately before its introduction on July 1st 2004. As giving birth before this date meant foregoing the entire payment, women who could reschedule to a later time had a strong incentive to do so. Gans and Leigh (2006 and 2007) estimates that over 1000 births were postponed in order to qualify for the Baby Bonus and around 300 of these were postponed for more than 2 weeks.

This is likely to have placed some temporary strains on hospital resources, but beyond that, it is uncertain whether this has had adverse effects on the wellbeing of the babies concerned. Parents typically place great weight on the welfare of their children and there is medical supervision of birth timing. Nevertheless, some doctors have raised concerns about the risks of delayed childbirth (Price 2006a Price 2006b, ABC 2006). In addition, as Gans and Leigh observe, Apgar scores (a simple diagnostic tool for initial baby health) are lower for babies born late or overweight and low scores have been shown to be associated with higher health risks later in life. However, no assessment by physicians or medical researchers has been made of the health effects associated with delayed childbearing due to the baby bonus.

3.5 Summary of the likely causes of the upturn in fertility

The upturn in fertility observed in Australia has occurred in the presence of several factors that are likely to have exerted a negative influence, such as the rising cost of housing. Furthermore, the economic and social incentives that precipitated the movement by women out of the household and into higher education and the workforce have not been diluted. The forces underlying the upturn in fertility have been sufficiently strong to counteract these influences.

While much of the change may reflect a purely temporal effect (the recuperation of fertility for older women discussed in chapter 2), the stability and overall performance of the Australian economy over the last fifteen years is likely to have provided an environment conducive to such recuperation, as well as a likely quantum effect. In particular, consistently low unemployment rates, more flexible labour markets, low output volatility and strong labour demand promote family formation by reducing the financial risks associated with childbearing and reducing the cost related to exiting and re-entering the workforce. The only recent precedent for the strength and duration of the economic expansion currently occurring in Australia is the post-war boom years in the 1950s and 1960s. The very different social institutions of that time allowed for a much greater impact on fertility than is currently being observed today.

There is also some support for a positive link between family policy and fertility in the international literature, and it is likely to have played a partial, though not decisive, role in the recent increase of Australian fertility rates. In saying this, however, it is important to emphasise that such family policies are not designed explicitly to stimulate fertility and aim to promote other social and economic goals. Given this, identifying only an incidental, supportive effect is neither surprising nor problematic.

4 Do we need to be worried by Australian fertility levels?

Key points

- People often advocate policies to stimulate fertility. This reflects concerns about sustaining a viable population, the future care for the old, the demographic effects of population ageing (including on workforce participation and economic growth) and the implications for Australian society.
- However, Australia's fertility has increased in the last six years and is not low compared with other developed economies. It is far in excess of the low rates observed in Southern Europe, the former Eastern bloc economies and the advanced economies of Asia.
- Moreover, many of the concerns about the economic effects of Australia's current level of fertility are not well-founded:
  - At current levels of fertility and net overseas migration, Australia's population will continue to grow strongly. Indeed, with current fertility rates, Australia's population is projected to grow at the third highest rate among developed countries to 2051.
  - Feasible increases in fertility would make little difference to population ageing and, perversely, would depress labour supply per capita over the next 50 years — precisely the period when the baby boom generation are withdrawing from the labour market.
  - Higher fertility would actually aggravate the fiscal pressures of an ageing population since the costs associated with extra children occur upfront, whereas the fiscal benefits are deferred for a long period.
  - An increase in fertility would be a blunt way of dealing with the intergenerational implications of the pressures on government budgets resulting from ageing.
- Concerns about the social implications of very low fertility (a total fertility rate below 1.4 babies per woman) have more validity. Such low fertility rates could alter the nature of society, as it would entail an older age distribution; a much lower visibility of children; and, to make up the numbers, a significantly bigger proportionate representation of migrants in the Australian population.
  - However, Australia does not have current or likely impending fertility levels that should prompt these concerns.
- The gap between desired and expected fertility of people may be a symptom of failures in institutions supporting families, but equally at least some of that gap will reflect the inevitable tradeoffs that people make when weighing up having children with their other aspirations.
- Overall, Australia is in a 'safe zone' of fertility, with little grounds for current policy concern.

Like other factors that affect the demographic structure of a population, most governments see fertility levels as a potentially important policy concern. If they are high, as is sometimes the case in developing countries, then they can inhibit development, spread investments in human capital too thinly and place strains on finite resources, such as land and water. However, for Australia and more particularly, many European and developed Asian countries, the concern is that fertility levels may be too low or that long-term trends will lead to excessively low rates. (All OECD countries except the United States, Turkey and Mexico have fertility rates below replacement levels so that, absent sufficient net immigration, their population levels would begin to decline).

Many such countries have devised pro-natalist policies to promote rising, or at least to maintain, fertility rates. In addition to the common use of social welfare incentives, countries have, at various times applied novel measures. Singapore has used subsidies to encourage childbearing for educated women and sterilisation of poorly educated women (Yap 2002). More recently, it has introduced a baby bonus for all women, which escalates with three or more children (Loke and Sherraden 2007). Russia has considered re-introducing a tax on childless people that was previously used in the Stalinist era (Pletneva 2006). France supports families with a plethora of conventional measures (childcare, maternity leave, family allowances and tax deductions), but also still awards the 'Medal of the French Family', a gold medal in honour of women who have eight or more children.[1]

While Australian governments have usually avoided an explicitly pro-natalist policy stance, recently fertility levels have been seen as too low and as an appropriate target of policy. For example, in 2007, the United Nations (2008) characterised government policy this way,[2] while Heard (2006) also claims that support for pro-natalist policy has more generally increased in policy circles in Australia.

Against this background and the current (and impending) levels of fertility in Australia, this chapter considers whether fertility levels are worryingly low, and, therefore, the urgency of any policy intervention.

Generally, views about the appropriateness of fertility rates involve two interlinked stages. The first is an (objective) assessment of the long-run demographic, economic and social implications of different fertility scenarios. The second is a judgment about the desirability of such impacts. This chapter concentrates on the first stage, but also explores some aspects of the second.

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1 *The Economist*, 19-25th April 2008, p. 61.

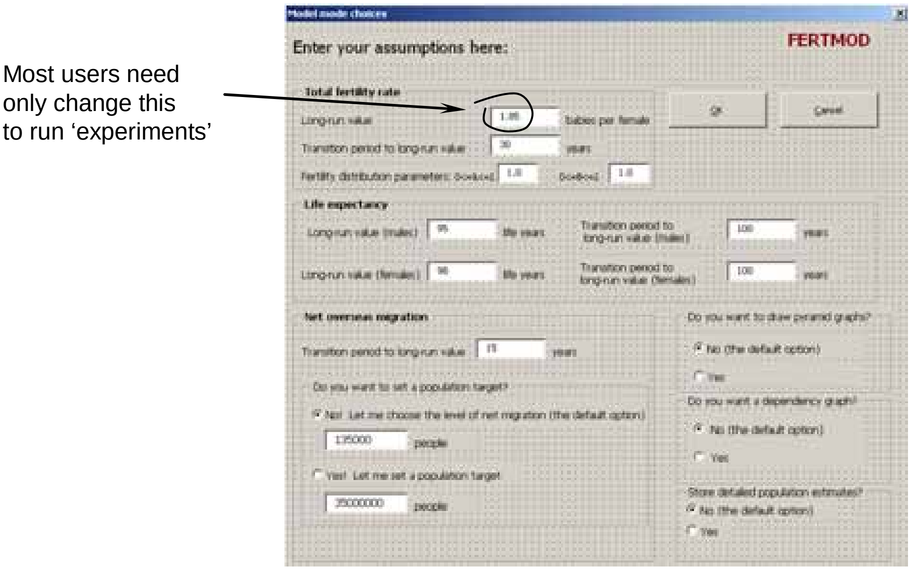
2 In previous years — 1976, 1986 and 1996 — in which the UN has canvassed government views, fertility was seen as 'satisfactory' with no required policy response.

4.1 Demographic impacts

The demographic impacts of fertility rates are straightforward because the outcomes are deterministic for given assumptions about future fertility, mortality and net migration (PC 2005c) (box 4.1). For given mortality and migration patterns, lower fertility rates result in lower long-run populations, increased population ageing and mixed effects for young and aged dependency ratios. However, there are subtleties in these effects that belie conventional wisdom.

Box 4.1 **A model for analysing fertility**

An Excel-based demographic model was developed for this study, taking account of ABS data released up to the end of 2007. Readers of this report can easily model different scenarios from those considered here by nominating different fertility or other demographic assumptions using a simple model interface:



The model and its documentation is available for free use on the Commission's website.

First, while reduced fertility rates are associated with decreased population growth (table 4.1), long-run populations stabilise even when fertility rates are well below replacement levels (so long as there is some net migration). As an extreme example, with a 30 year transition to a zero total fertility rate and annual net migration of 135 000 people (less than current levels), Australia's population would stabilise at around 9.3 million around 2150.[3] That may well be undesirable, but it does not represent extinction.

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[3] With a long-run life expectancy for females and males of 98 and 95 years respectively — similar to those used by Kippen and McDonald (2004). We assume a 100 year transition to this state —

Table 4.1 **Demographic impacts of different fertility rates**[a]

2007-2251

	2007	*2051*	*2151*	*2251*
TFR=2.1				
Population (million)	21.0	33.8	64.3	95.8
65+ (%)	13.1	24.9	29.8	30.6
0-14 (%)	19.4	17.8	16.7	16.4
Working age to dependent population ratio[b]	2.08	1.34	1.15	1.13
TFR=1.85 (base case)				
Population (million)	21.0	32.4	49.2	59.5
65+ (%)	13.1	26.0	32.8	33.5
0-14 (%)	19.4	16.1	14.5	14.3
Working age to dependent population ratio	2.08	1.38	1.11	1.09
TFR=1.73				
Population (million)	21.0	31.7	43.3	48.1
65+ (%)	13.1	26.5	34.3	34.8
0-14 (%)	19.4	15.2	13.5	13.4
Working age to dependent population ratio	2.08	1.39	1.09	1.08
TFR=1.4				
Population (million)	21.0	29.9	30.7	28.9
65+ (%)	13.1	28.1	38.2	37.7
0-14 (%)	19.4	12.9	10.9	11.1
Working age to dependent population ratio	2.08	1.44	1.03	1.05
TFR=1.0				
Population (million)	21.0	27.8	20.6	18.2
65+ (%)	13.1	30.3	42.4	40.3
0-14 (%)	19.4	9.9	8.1	8.5
Working age to dependent population ratio	2.08	1.49	0.98	1.05

a Under the base assumptions, it is assumed that there is a 30 year smooth transition from the present TFR to the long-run TFR, and a 15 year smooth transition from the present net migration level to long-run net migration of 135 000 people. It is also assumed that there is a 100 year transition to a life expectancy of 95 and 98 years for males and females respectively. The gain in life expectancy is 0.153 and 0.145 years per year for males and females respectively, which is within historical bounds. The life expectancy for males is slightly less than in Kippen and MacDonald (2004). Both male and female life expectancies are greater than those in the 2006 ABS series A projections. **b** The working age to dependent population ratio is the ratio of people aged 15 to 64 to those 'dependents' aged 0 to 14 and 65+ years. This is the inverse of the total dependency ratio.

Data source: FERTMOD (PC fertility model 2007 to 2251).

again roughly in line with Kippen and McDonald. This implies average life expectancies of around 87.8 and 91.5 by 2051 for males and females respectively. The latest ABS projections assume rather less significant increases to 84.9 and 88 years respectively.

Second, while changes in fertility levels can accentuate or impede long-run population ageing,[4] it would take significant changes in the TFR to alter the proportions of young people relative to aged cohorts:

- With a long-run TFR of 1.73 (the value in 2001 and the lowest in Australia's history), the share of the population aged 65+ would increase from 13.1 per cent in 2007 to 34.8 per cent of the population by 2151 (an increase of 21.7 percentage points).[5]
- With a TFR of 1.85 (roughly the TFR expected in 2007), the long-run share of the old would increase by 20.4 percentage points to 33.5 per cent of the population by 2151. This increase would only be a little less than if the TFR were to remain at 1.73.
- It would require a TFR of around 3.8 in order to maintain the current share of the old in the population — completely outside realistic expectations and Australia's demographic history, and involving an unsustainable population burden (with a population of more than 430 million by 2151). Even TFRs as high as 2.4 (last experienced in 1973) would not prevent the doubling of the long-run share of people aged 65 years or over (and around a six fold increase in the share of people aged 85 years or more).
- However, were the TFR to fall as low as 1.0, the share of the old rises by nearly 30 percentage points to around 40 per cent by 2151 — revealing the large structural ageing effects of profound reductions in fertility.

Third, the ratio of the potential workforce to young and old 'dependents' move in contrary directions. Lower fertility rates presage fewer potential workers[6] for every person aged 65 or more years, but more potential workers for every person aged less than 15 years. Since the fiscal implications of young dependents are about the same as old dependents (PC 2005b, p. 318), the most important measure is the ratio of potential workers to the young and the old combined (the 'support' ratio shown in figure 4.1). The support ratio can be interpreted in several ways. It gives an indicator of:

- the relative availability of people for work, and for fixed labour-capital ratios, the level of per capita GDP for future generations (the babies being born now)
- the extent of tax burdens borne by the next generation of main taxpayer groups aged between 25 and 65 years (again the babies being born now).

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4 This does not hold in the long run if fertility levels are below replacement and there is no net migration. In that instance, any variations in fertility rates make no long-term difference, as the population will slowly head to extinction.

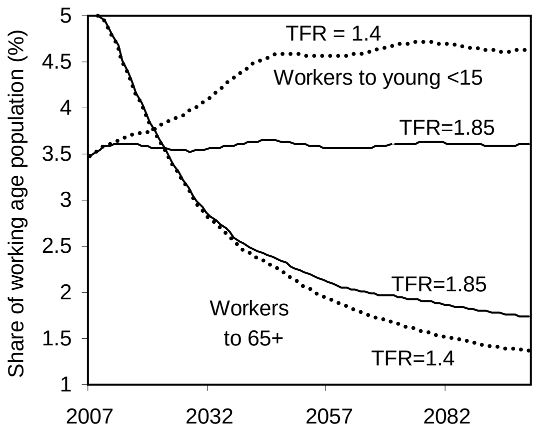
5 With annual net migration of 135 000 and the mortality assumption described in table 4.1.

6 Those aged 15 to 64 years.

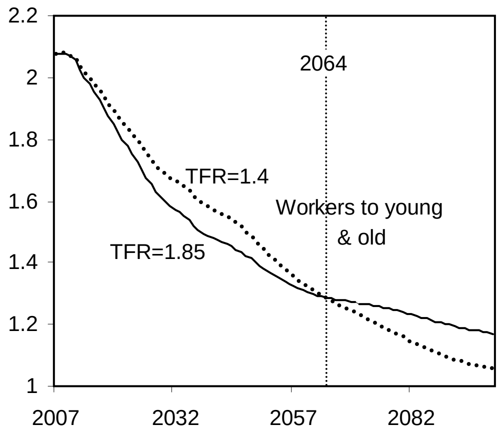
Figure 4.1 **Low fertility has countervailing effect on support ratios**

2007 to 2100[a]

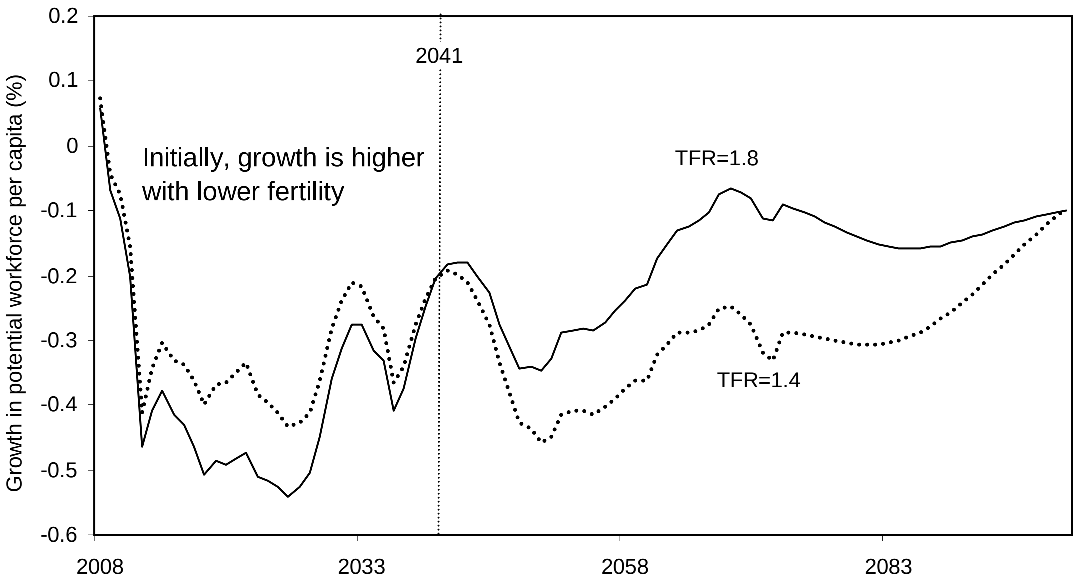
Support ratios for the young and old



The total support ratio



Potential workforce per capita growth is initially higher with lower fertility[b]



[a] There is a 15 year transition to the long-run TFR (1.85 or 1.4) from 2007. [b] The potential workforce (W) is those aged 15 to 64 years. The measure shown for each TFR is: LFGROW=$\{(W_t/POP_t)/ (W_{t-1}/POP_{t-1}) -1\}*100$ where POP is the total population. It is important to note that at a given time, the low fertility support ratio can *exceed* that for high fertility, but at the same time, the percentage growth rate in the support ratio (and the potential workforce per capita) associated with low fertility can be *less* than that for high fertility. This explains why labour force per capita growth rates are higher for low versus high fertility only until around 2041 compared with 2064 for the *level* in the support ratio. The implication is that GDP per capita would be likely to be greater with low than high fertility until 2064, but that the gap begins to close around 20 years earlier.

Data source: FERTMOD.

Initially, the support ratio falls less rapidly with lower fertility rates. Associated with this is a higher growth rate in the potential workforce per capita (the bottom panel of figure 4.1).[7]

These patterns reflect the fact that fewer babies reduce population growth, while not affecting the population of workforce age. Figure 4.1 does not take into account the fact that women with children work fewer hours in formal labour markets. This would magnify the initial negative effects of higher fertility on labour inputs per capita. Collectively, the evidence implies that, all things being equal, per capita income would grow more rapidly with lower fertility until around 2040.

This pattern then reverses, with lower implied labour resources per capita when fertility rates are low, implying a protracted period of relative stagnation in the level and growth of per capita output after the middle of the 21st century. Over the very long run,[8] changes in fertility rates have little effect on the total support ratio or labour inputs per capita.

Fertility and migration interact

The above scenarios are associated with very different population outcomes — some of which involve potentially unrealistic population sizes (table 4.1). For example, with the TFR set at the replacement rate of 2.1 (and net migration of 135 000), the Australian population reaches about 95 million by 2251.

In contrast, a TFR of 1.4 is associated with populations for the same years of around 30 million for both years. In this context, an alternative way of analysing Australia's demographic future (Kippen and McDonald 2004) is to consider the various combinations of fertility and net migration levels that lead to long-run population stability (for given mortality rates). A population target of, say, 40 million people can be achieved with low fertility rates and high net migration levels, or vice versa.

In these circumstances, falling fertility rates have weaker impacts on population ageing (table 4.2 compared with table 4.1) while their impacts on the long-run total dependency ratio are negligible. For example, were the population impacts of a fall in the TFR from 2.1 to 1.4 to be offset by increases in migrant intakes, then the ratio of the working age population to dependents would fall from 1.09 to 1.06. Indeed, there would be a small *increase* in the share of prime age workers, which would

7 The growth rate in the potential workforce per capita is not equal to the growth rate in the support ratio, though the two are related. If g is the percentage growth rate in the support ratio (S_t) then LFGROW ≈ $g/(1+S_{t-1})$.

8 Not shown in figure 4.1.

raise the available labour resources per capita (and economic output) (table 4.2). With the exception of a TFR of 1.2, the changes in migrant intakes needed to achieve these outcomes are within historical norms.

Table 4.2 **Fertility changes matter less with a fixed target population**[a]
Target population is 40 million by 2251

Demographic outcome	*TFR (number of babies per woman)*				
	2.1	*1.85*	*1.6*	*1.4*	*1.2*
Net migration level (number)	17 640	76 538	139 679	192 508	246 641
Working age to dependent population ratio	1.09	1.07	1.06	1.06	1.06
Share of population aged 65+ years (%)	31.8	34.0	36.0	37.4	38.8
Share of population aged 25-55 years (%)	32.3	32.4	32.6	32.8	33.0
Share of population born overseas (%)	3.0	13.2	24.0	33.1	42.4

a The other demographic assumptions are as described in table 4.1.

Source: FERTMOD.

The key policy implication is that analysis of demographic outcomes associated with different fertility levels needs to take account of the ultimate limits to population growth in Australia and the capacity of policy to vary net migration levels. These factors mitigate the ageing effects of lower fertility (and the population effects of higher fertility). However, there may be social issues associated with using migration as a compensating policy tool in the event of profoundly low fertility — an issue considered later.

4.2 The social impacts of low fertility

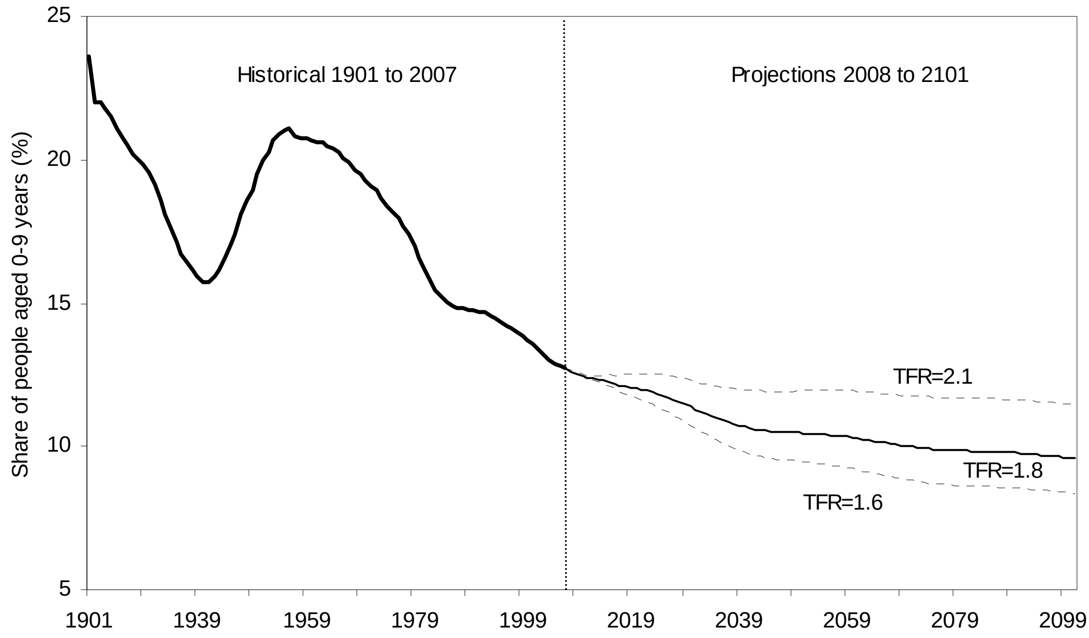
Population ageing will reduce the presence of children (and young people generally) in our society, perhaps to society's detriment.

A significant reduction in the presence of young children has already occurred (figure 4.2). For realistic fertility futures, that trend will continue. With a total fertility rate of 1.85, the number of young children (aged under 10 years) would fall from around one in eight to one in eleven, and the number of young people generally (aged under 25 years) would fall from around one in three to one in four. It is hard to judge how Australian society would change over the next 100 years because of this. However, several features of this impending change should be noted.

First, the change will occur very gradually, which increases our social capacity to manage it.

Figure 4.2 **The diminishing role of the young**

Children aged under 10 years old (share of population) 1901 to 2101



Data sources: The historical data are from ABS *Australian Historical Population Statistics*, (Cat. no. 3105.0.65.001) and *Population by Age and Sex, Australian States and Territories* (Cat. no. 3201.0), while projections are from FERTMOD.

Second, the projected change over the next 100 years is much less than the historical transformation that occurred from the peak of the baby boom years to the present.

Third, the issue for policy is not the decline in the presence of children (and other young people) per se, since some decline is probably inevitable. (The total fertility rate would have to rise to around 2.4 babies per woman to maintain the current share of young children, and to about 3.5 babies per woman to re-create the relative abundance of young children evident during the peak of the baby boom years.[9]) The issue is the extent to which policy could realistically *alter* the future relative presence of children. Table 4.3 illustrates the impacts of various scenarios. It reveals that the difference in the relative presence of young children from a change in the long-run TFR from 1.85 (roughly Australia's current fertility level) to 2.1 is about one child per 100 people (table 4.3). This is not trivial, but it is only about one third of the projected reduction in the relative presence of children were the fertility rate of 1.8 babies per woman to be sustained.

[9] This was 1956, when children under 10 years of age comprised 21.1 per cent of the population.

Table 4.3 **The reduced presence of children**[a]

	Children per 100 people		
TFR	*2007*	*2051*	*2151*
	%	%	%
2.1	12.7	11.9	11.2
1.85	12.7	10.7	9.6
1.6	12.7	9.5	8.2
1.4	12.7	8.5	7.1
1.2	12.7	7.4	6.1
1.0	12.7	6.4	5.2

a This is for children aged under 10 years. The other demographic assumptions are as described in table 4.1.

Source: FERTMOD.

Finally, a simple population share may not be an adequate measure of the *social* presence of particular age groups. A better measure might weight population numbers by the degree and diversity of social interactions (for example, between different aged people, in groups, at work, and so on). The reduction in the apparent 'visibility' of the young is not due to falling numbers, but to the greater growth in numbers of older people, and particularly the very old. The share of those 80 years and over grows from under 4 per cent to about 17 per cent by 2151 under the base assumptions (with around one million people aged 100 or more years in the same year). There is evidence that the very old have less diverse social interactions than other age groups (though this may change in the future). They currently engage in significantly fewer group social activities than younger people,[10] are less physically mobile and usually do not work.[11] A relatively large number are in aged care institutions. Accordingly, the rising share of the very old may somewhat overstate their social visibility, and because of this, understate the inherent social visibility of the young.

Profoundly low fertility rates could have adverse social consequences

While it is hard to diagnose the social consequences of the diminishing share of the young associated with *likely* fertility scenarios, the consequences may well be

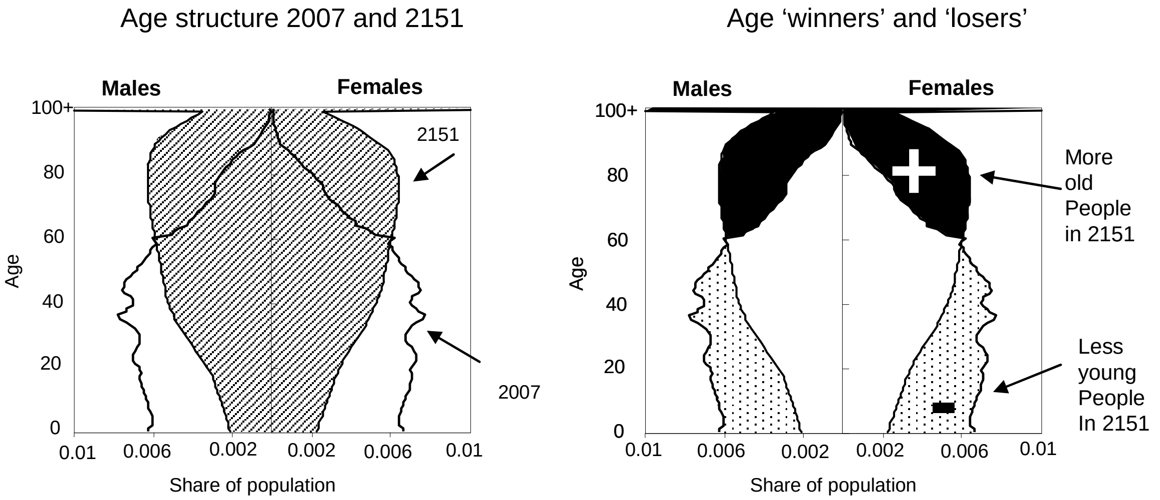
[10] AIHW (2007, p. 91).

[11] The ABS *General Social Survey 2006* (2007, pp. 22-23, Cat. no. 4519.0) reveals much lower labour force participation and capacity for physical mobility than the average population. However, people aged 65 years or more had only a slightly smaller likelihood of meeting a friend or family face-to-face daily in the past week than other age groups, but this excludes the (significant) institutionalised population. Likewise, it does not weight social interactions by the number of group members in any interaction, or include interactions with work colleagues or customers.

significant were there to be large reductions in fertility rates. Profoundly low fertility rates would have large impacts on the age structure of the Australian population (table 4.3 and figure 4.3). With a long-run TFR of 1.0, for example, the conventional diagram of the age structure of the population would begin to resemble a balloon or mushroom cloud — a thin bottom base and a thick top — almost the opposite pattern to that observed now. Were the TFR to drop to 1.0, then in the long run only around one in 20 Australians would be young children — a much lower presence of children in our society (table 4.3).

Figure 4.3 **The impacts of profound fertility reductions on Australia's age structures**

Long-run TFR of 1.0[a]



[a] With a 30 year smooth transition from the present TFR to the long-run TFR.

Source: FERTMOD.

Changes of this magnitude are likely to have significant social impacts. On the positive side, the prevalence of poverty among families may fall with diminishing average family sizes (Keilman 2003). Society would gravitate more towards the old and their needs. That may not be bad, but it would be different. Average family sizes would fall and with them, the extended networks that they foster — both at any one time and over the generations. Peter McDonald has identified this as the 'low fertility trap':

> Sustained very low fertility will change cultures. In particular, the place of children in the culture will be minimised and social institutions will adapt to the relative absence of children. A subsequent reversal of the trend would be difficult and slow. (McDonald 1998)

People generally may regret the diminishing presence of children in society. Many see children as having a value in society beyond that expressed by their parents alone. Grandparents often derive substantial pleasure from their grandchildren (Relationships Australia 2001). It is likely that this would extend outside immediate family members.[12] A recent Australian survey found that around three quarters of childless people were willing to support provision of maternity leave — close to the share of people with children (Perry 2008). Survey evidence from comparable overseas countries also corroborates the 'public' value of children. For example, a UK study of childless women found that, despite their own choices, they were broadly favourable to supporting children through taxes (McAllister & Clarke 1998). A more general Connecticut (US) survey of public attitudes to children found that people were willing to pay more taxes or support other measures for children, revealing a high value for children in society (Cunningham 1995). This value was as high for non-parents as parents.

On the other hand, a few commentators acknowledge significant social change associated with low fertility, but disagree that it will be bad:

> … what is happening in Australia is part of a worldwide tendency which is actually desirable, though it creates policy challenges and will lead to a society that may seem strange to many of us, since traditional assumptions about the centrality of children to people's lives will be weakened, with pervasive social consequences (Blackford 2003).

Remarkably little analysis has been undertaken of the likely social impacts of lower fertility on which to reach a clear judgment about its desirability. However, while there is a gap in the available information about the broader social value of children, it is likely that many people would perceive the relative scarcity of children associated with profoundly low fertility levels as adverse to a society's identity and functioning. It is notable that those countries experiencing low fertility generally perceive it as a serious social issue.

The significance of migrants to Australia

An associated social dimension of lower fertility is its implications for the migrant structure of the population and national identity. Currently, about one in four Australians were born overseas. Were fertility levels to fall significantly, and net overseas migration to be commensurately increased, then the share of overseas-born would rise appreciably. For example, with a TFR of 1.2 and net migration intakes of around 180 000 (which is sufficient to achieve a steady state population of around 30 million), over 40 per cent of the population would have been born overseas by

[12] It is hard to obtain empirical evidence on Western attitudes about the value and role of children Most attitude surveys in countries focus on parents' own children or on children that they may have in the future.

2251.[13] Moreover, the cultural heterogeneity of migration intakes might increase as the traditional sources of migrants expand to a broader group of countries (reflecting, if nothing else, the greater competition for migrants as developed countries collectively seek younger labour forces). Both of these factors would likely have cultural and social implications for Australia. Those implications may be desirable or not, but regardless it is at least appropriate for governments to take account of them when devising fertility policy.

Of course, the existing Australian prognosis is for continued relatively high fertility levels — so the above social risks of profoundly low fertility outcomes are currently small.

The gap between fertility goals and achievement

A commonly cited social concern is the mismatch between people's fertility goals and their achievement. Three differences between various measures of fertility outcomes are usually used to assess such gaps:

- the personally *ideal* number of children (what, in ideal circumstances, a parent would like)
- the realistically *expected* number of children (what, given the nature of social constraints, individual circumstances and tradeoffs, a person expects to achieve)
- the *achieved* fertility level (the completed fertility level of a woman).

The gap between expected and achieved fertility

It is difficult to establish the gap between expected and actually realised fertility because objective measures can only be produced after the childbearing years of a woman have been completed. In the absence of sufficient longitudinal evidence, it is therefore only possible to make conjectures based on projecting aggregate demographic data about the possible average gap between expected and achieved fertility.

Were a TFR of around 1.8 to persist — for example, as projected by Hugo (2007) and the United Nations (2007) — it also implies a completed fertility rate for currently young women of 1.8. This would be below their expected fertility levels (as discussed later and in appendix G). Evidence from other countries also suggests

[13] Were the TFR to be 1.85 and average annual net migration set at levels to achieve the same population by 2251 (around 45 000 annually), the share of those born overseas would be around 10 per cent, revealing the large compositional impacts of different fertility/migration scenarios.

that where women expect to have more children, they overestimate the number who will actually be born.[14]

To the extent there is such a gap, it suggests a systematic bias in people's formation of expectations, which may be policy relevant.[15] Expectations are unlikely to be fully 'rational' or informed, so that the expected number of births is unrealistic. For example, some people may not be aware of their current subfecundity (Preston and Sten 2007, p. 4) or take insufficient account of their future reduction in fecundity, thus delaying childbearing too long to achieve their fertility expectations. Other groups may underestimate future partnership difficulties (Fisher 2002) or the effects of future economic shocks. (These negative biases may be partly countered by unanticipated conception.) The mismatch between achieved and expected fertility outcomes may be resolved naturally through learning by subsequent generations, by encouraging a debate on these issues, or through policies that aim to better inform people. But, the bias in expectations is not, prima facie, a strong argument for policy measures aimed at stimulating fertility per se.

The gap between ideal and expected fertility

Surveys can easily elicit measures of the ideal and expected fertility levels for individuals and various groups since these are subjective, forward-looking measures.

Most couples consider two or three children as personally 'ideal' (so that the average ideal number of children per family is around 2.5 — Weston et al. 2004, p. xvi and Gray et al. 2008, p. 18). While most couples also expect to achieve this ideal, there are still significant numbers of people who expect to achieve less than their personal ideal, usually because of delayed childbearing and an awareness of the various monetary and non-monetary costs of children. Consequently, on average, there is a gap between the ideal and expected fertility outcomes. For example, while women aged 20-24 years old reported an average lifetime ideal number of children of around 2.5, the average expected was about 2.1. This gap tends to be higher for men without post-school qualifications (ibid p. 119) and for women in full-time jobs. Data from the HILDA survey also corroborates the

[14] For example, Noack and Østby, 2000 for Norway; Smallwood and Jefferies 2003 for England and Wales; Toulemon and Testa 2006 for France; Morgan 2003 and Morgan and Hagewin 2005 for the United States.

[15] Individual errors between expected and achieved fertility outcomes cannot, by themselves, provide a useful indicator of any problems in the formation of expectations. It is inevitable that even perfectly rational people will make negative and positive forecasting errors — as they do for any other future event. The most interesting question is whether there is still a significant bias when errors are averaged across individuals or groups of individuals.

existence of a gap (for example, appendix G and Fisher and Charnock 2003, p. 4), while older survey data suggest that the gap has been persistent (Bracher and Santow 1991).

A common perspective is that this gap is problematic and that it should elicit policy measures to help people to achieve their personally ideal number of children. However, the apparent gap is marred by conceptual and measurement problems that constrain its usefulness for policy purposes.

One difficulty is that the gap between the personally ideal number of children and the expected number may be poorly measured:

- The surveys that elicit information on ideals and expectations may well suffer from respondent biases. For example, a woman may exaggerate her ideal fertility, as people often perceive childlessness adversely. Or a woman's 'ideal' number of children' may be itself be influenced by what she expects to get.
- Non-respondent bias may affect the survey results (in either direction).
- The concepts being measured may be ambiguous. The conceptual distinction between the *personally* ideal number of children (the measure sought by the surveys) and *community norms* about the ideal number of children is significant, yet survey respondents may confuse the two. The differences between the *Fertility Decision Making Project* and *Negotiating the Life Course* surveys (box 4.2) illustrate some of the difficulties (as do differences in surveys in the United States — Peterson 1995).

Even if the gap is measured accurately, another issue is its interpretation for policy purposes. In particular, any policy implications depend on the underlying nature of, and reasons for, any gaps. Biological and time constraints, such as subfecundity, infertility and age, create a gap between ideal and expected future births that is largely unresponsive to policy. (It is notable that for a given desire for future children, older women have lower expectations that those desires will be realised — appendix G). In addition, men have a lower ideal number of children than their female partners, which must create a gap between female ideals and expectations that again cannot clearly be bridged by policy.

More critically, interpreting the gap between ideal and expected children should take account of the tradeoffs between life choices. Other than unplanned pregnancies, people balance their choices to have children with other goals (demanding careers, income security, personal freedom, seeking ideal partners). Once there are tradeoffs of this kind, people will often choose to give up their ideal family size for some other goal and we would expect 'mismatch' to occur. Such tradeoffs are common in all aspects of people's lives (for example, more work or less leisure; a nice car or a down payment on a flat; consumption now or later). People resolve these tradeoffs by choosing the one that they value the most. They may regret the forgone option — but recognise that their budgets, time, or some resource constraint prevent them from having both.

Box 4.2 Mismatch between ideal and expected fertility for educated women

A key question for some commentators has been whether mismatch is larger for more versus less educated women, since this may reflect the influence of HECS debts or failings in institutions for managing work-family obligations for successful women.

Evidence based on the HILDA survey and the *Fertility Decision Making Project* survey suggests that women with higher educational qualifications have lower than average expected fertility levels (Weston et al. 2004, p. 88, Yu 2006; Yu et al. 2007, p. 87). Weston et al. (2004, pp. 62-63, p. 110) also find that educated women have lower than average ideal fertility goals, so that the gap between ideal and expected fertility is not particularly pronounced for this group.

In contrast, the longitudinal *Negotiating the Life Course* Survey, Franklin and Tueno (2004) and McDonald (1998) found that more educated women had higher expected family sizes (2.55 children) than women with no post-school qualifications (2.4 children). This survey also suggested that expectations declined much more rapidly with age for educated women, suggesting that various unanticipated obstacles to fertility had frustrated their original aspirations. Franklin and Tueno (2004) argue that this is an ‘unhappy’ outcome, arising circumstantially, rather than through choice. They argue for targeted child-bearing subsidies for this group (such as HECS debts cancellation for childbearing).

There are several concerns about this. First, the extent of mismatch by educational attainment is unclear given the contrast between the findings about expected fertility of the *Negotiating the Life Course* survey and the other data sources. Second, Yu et al. (2007) found no credible evidence of a link between HECS debts and fertility, suggesting HECS subsidies would not be effective at achieving higher fertility levels for this group of women. Finally, even were the fertility expectations of educated women to decline with age, this is necessarily an unhappy outcome, but could reflect changing aspirations and tradeoffs as their life circumstances change over time.

The varying survey findings and policy inferences drawn from them is a good example of some of the difficulties in using appropriate evidence-based approaches to fertility policies.

Of course, as many people advocate, government can ease these resource constraints through various policy measures, such as monetary transfers or regulations relating to work/family issues. Nevertheless, by definition, it can only do that for some people, since transfers to some have to be financed from taxes paid by others. That then limits their capacity to achieve their aspirations in areas other than fertility (for example, entering the housing market, upgrading skills through further education and retiring earlier). And, governments cannot resolve some tradeoffs at all — such as those between people's goals of personal freedom and the commitment required for the care of young children.

Accordingly, government policy cannot close the gap between ideal and expected outcomes in all aspects of people's lives. As a result, the basis for government action to close any particular gap — including that between ideal and expected fertility — has to rely on rationales other than its mere presence.

There may be several such rationales, stemming from failures in social institutions or from externalities:

- Individual choices might be problematic for society more generally (see above).
- People's choices are conditioned by economic, personal and social factors, some of which may inappropriately distort the tradeoffs people make. For example, governments and society may construct, support or perpetuate social institutions and norms — child care provisions (or their absence), regulatory environments; maternity arrangements; role models for men and women — that might not sufficiently reflect the preferences of the contemporary community, and yet that are influential for fertility decisions. Peter McDonald (2002), for example, emphasises the role of unsupportive social arrangements in frustrating women's fertility preferences (such as in Italy):

  > More broadly, where women are treated as autonomous individuals in the education system and in the labour market, but as inferior beings in other social institutions founded on a male-dominated family system, some women will opt to be less family-oriented than they otherwise would have been. It is in these circumstances that we can predict very low fertility as the outcome.

Once it is recognised that such failings can exist, it is also important to take account of problems that could lead to too many children for some groups or to delayed or premature childbearing. While tax and welfare systems can inadvertently create marginal disincentives to have children (Ehrlich and Kim 2007), they can also provide potentially problematic incentives to have children for specific groups. Similarly, some groups of individuals may make ill-informed trade-offs between very early child bearing and future education and career prospects, while others may not realise the potentially adverse maternal and child health impacts of delayed childbearing.

This study does not attempt to judge the severity of the above problems for Australia, but notes that, in theory, they give rise to concerns about whether fertility levels and timing decisions are right for at least some groups of Australians.

However, it should not be assumed that the 'right' level implied by the above concerns is always more children.

4.3 Impacts on the economy

Low (or high) fertility levels raise legitimate social issues. But do changes in fertility raise equally important economic issues?

Extremes in population age structures impede economic growth. Populations with very young or very old population age structures face reduced per capita economic growth because people of these ages have lower labour market participation rates and a preference for lower hours worked (box 4.3; PC 2005b; the Australian Government 2002 and 2007 Intergenerational Reports).

Consequently, it appears that demography is 'economic destiny' and that the government could use changes to fertility or migration policies as instruments to allay population ageing and enhance the long-run economic welfare of its citizens. A representative view is that of McDonald and Kippen (1999), who argue that fertility policy is important because it can help avoid a steep reduction in people of working age and, thereby, adverse effects on economic output per capita.

However, the extent to which fertility can be used effectively as a means of dealing with the emerging economic effects of an ageing Australia is limited. While higher fertility would eventually increase per capita income and growth (box 4.3), as noted above, this is only after a prolonged period. As suggested by the results in figure 4.1, prior to this time, higher sustained fertility would be likely associated with significantly lower economic output per capita — actually exacerbating the negative labour force impacts associated with the retirement of the baby boomer generation.

Moreover, while governments can use policies to address the lower labour participation rates of the old, no such policy options are available for the young. Older people currently have relatively low participation rates and, reflecting their capacity to defer their retirement, are quite sensitive to superannuation and other retirement policies. In contrast, Australians younger than 15 years old clearly do not work at all in formal labour markets. Even those people aged 15-19 years are often in education and the scope for increasing their labour force participation by much more is limited. (While policy directed at better education would probably increase their participation and productivity when older, these benefits would be significantly deferred. And, increasing their participation while *in* education may actually worsen their educational outcomes and subsequent labour force success (Abhayaratna et al. 2008).)

Box 4.3 **The 3Ps and economic growth**

Economic output is a simple function of population, participation and productivity (the 3Ps):

$$GDP_t \equiv POP_t \times \frac{CPOP15_t^+}{POP_t} \times \frac{LF_t}{CPOP15_t^+} \times \frac{EMP_t}{LF_t} \times \frac{HOURS_t}{EMP_t} \times \frac{GDP_t}{HOURS_t} \Rightarrow$$

$$g_t = w_t \times pr_t \times e_t \times h_t \times y_t \Rightarrow$$

$$\Delta \ln g_t = \Delta \ln w_t + \Delta \ln pr_t + \Delta \ln e_t + \Delta \ln h_t + \Delta \ln y_t$$

where GDP is gross domestic product, POP is population, $CPOP15^+$ is the civilian population aged 15 years and over, LF is the labour force, EMP is total employment, HOURS are total hours, *g* is GDP per capita, *w* is the proportion of the population of working age, *pr* is the participation rate, *e* is the employment ratio, h is average hours worked, and *y* is productivity.

An increase in the share of those aged 65 years or more (at the expense of a decline in the prime-aged workforce aged 25-55 years) decreases output per capita. This is principally because labour participation rates for the old are relatively low. This is compounded by lower average hours worked for this group, testimony to a greater propensity for older people to work part time. Clearly if *pr* and *h* fall, so too must *g*.

An increase in the young prompted by fertility increases has a larger (initial) negative impact on economic growth. This is because the proportion of the population of working age must fall immediately. Moreover *h* is also likely to decrease (because the average hours worked by women falls with greater fertility) while *pr* may fall or rise slightly, depending on the policy tool used to induce greater fertility. All other variables stay much the same. Even after the young have reached the age at which they are counted in the labour force, their participation rates are lower than average. So, it takes many decades after a sustained increase in fertility before output *per capita* rises above its counterfactual level.

The relative labour force potential of the two age groups is already evident in the recent past. The labour force participation rate of those over 65 years has risen by 43 per cent from 2000 to 2007. In contrast, over the same period, the participation rate of people aged 15-19 rose by only 0.3 per cent and that by people aged 20-24 years by -0.5 per cent.

Consequently, the economic dividends from increased fertility are inevitably delayed. This implies that increased fertility cannot realistically deal with the rapidly emerging impacts of population ageing, though it will ultimately stimulate growth.

Snapshots of Gross Domestic Product are misleading

A more fundamental concern is the interpretation of falling economic growth rates. Gross Domestic Product (GDP) is often a very useful period measure of how an economy is functioning. However, projections of annual GDP per capita can be misleading measures of the impacts of demography on people's economic wellbeing.

First, a population at any one time comprises many overlapping generations. Averaging over these generations in a series of yearly snapshots provides a distorted picture of the actual experiences of any given cohort over their whole lifetimes. The problem would be analogous to considering average births per woman in a given period as a good measure of her lifetime fertility. It is ironic that the problems in a synthetic measure like the TFR are often well understood in debates about Australia's future demographic prospects, but that GDP, which shares the same problems in that debate, are not.

The *aggregate* slowdown in growth projected from demographic change (such as that calculated by the intergenerational reports) reflects the fact that there are more people in the stages of life when they work less, not that Australians as individuals are experiencing reduced income growth over their lifetimes (box 4.4). Indeed, the intergenerational reports anticipate that more recent cohorts' annual incomes will grow at a faster rate than past ones, reflecting their better labour market prospects (through higher labour force participation rates at any given age). In other words, although future GDP per capita growth rates are projected to fall, the underlying growth rates in income relevant to people's wellbeing are projected to rise. Accordingly, while it is useful to know the consequences of demographic change for measured economic growth, it is important to differentiate the aggregate cross-sectional economic impacts from the actual effects on the welfare of individuals.

Second, people care about their consumption levels and not GDP. As Guest and McDonald (2002) show, this alone invalidates some of the claims about the adverse effects of lower fertility. In addition, people can choose *when* to take any income increase as consumption by borrowing and saving. This reduces the contemporaneous link between output and the relevant measure of welfare.

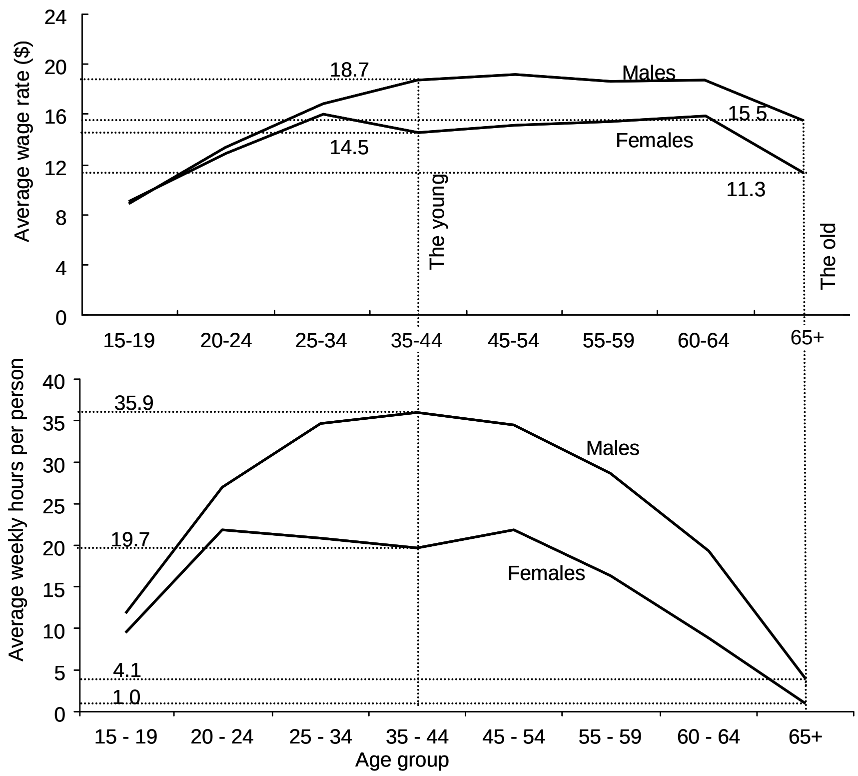
Box 4.4 **Comparing incomes of the 'old' and the 'young'**

Suppose that, at birth, people have the same future lifetime incomes, consumption levels and the same life expectancy and so are, by definition, equally well off when looked at over the long run. Consider two groups of individuals at a particular time — one 'old' (older than 65 years) and the other young (aged between 35 and 44 years).

Older people's have lower labour force participation rates, employment rates and average hours worked per employee than the young (figure below). As a result, using current data, the average hours by the young would be about 11 times those of the old In addition, those people still employed at older ages tend to earn lower hourly wages than the young (figure below). This implies that the young would have 13 times greater average *labour* income than the old. (This does not mean that the old have similarly lower total income or consumption since they can derive capital income from past savings or run down such savings.)

A snapshot of an economy with a greater proportion of old people will therefore tend to show lower incomes per capita. However, this difference in average incomes is merely an artefact of *when* income is counted rather than an indicator of the economic wellbeing of people, since in this example, by construction, all individuals have the same lifetime incomes.

This simple example illustrates that once people's economic activity varies over people's lives, demographic change will inevitably affect aggregate economic output, but without that (necessarily) being problematic.



Sources: Gruen and Garbutt (2003, figure 7) and ABS 2008, *Labour Force, Australia*, Detailed - Electronic Delivery, Cat. no. 6291.0.55.001, 17 April. Data for average weekly hours per capita are based on the 12 months preceding March 2008.

Thirdly, GDP fails to capture some important intangible outputs. There are finite endowments of beaches, areas of natural beauty and minerals. To that extent, any policy encouraging population growth may spread these finite resources more thinly or introduce congestion, lowering the average experienced welfare of a given cohort.[16]

The role played by externalities

While the above concerns invalidate simple inferences from snapshot data about the adverse economic impacts of lower fertility, that still leaves the possibility that demographic change can affect economic outcomes unfavourably through other avenues. For this to be the case, the demographic decisions of one group would have to have effects on others. Such ‘economic externalities’ could arise from greater fertility and reduced ageing in several ways.

Innovation ‘spillovers’

A younger society may be more innovative — with everyone benefitting from that innovation. For example, society as a whole benefits from the creative ideas of individuals through so-called innovation spillovers (PC 2007). In many emerging fields, the young tend to be the more active generators of new ideas. A society with fewer young may generate lower ‘externalities’ from innovation. There is little empirical evidence that this effect is policy relevant at realistically foreseeable Australian fertility levels.[17] Moreover, such technological externalities are now increasingly seen as global, so that the relevant population is the number of young in technologically advanced countries, not the very small number in Australia alone.

[16] This third factor involves more complex questions than the previous two. Parents (and societies as a whole) clearly value the future wellbeing of their children. Accordingly, it is not clear that the welfare impacts of spreading resources more thinly among a bigger population stemming from rising fertility is adverse.

[17] The evidence on the connection between *aggregate* demographic change and *individual* productivity achievement is weak. This potential link between productivity and fertility should be distinguished from the link that may arise from aggregating over people of different age-productivity combinations. There is some evidence that there is an inverted u shape for productivity over people’s lifetimes (PC 2005a, p. 110ff). By altering the age structure of an economy, policies that affect fertility can affect aggregate productivity change in given years. But as in the case of box 4.1, there is no welfare implications from this aggregation effect since lifetime incomes are unaffected.

Scale economies

It is also possible that a more rapidly growing aggregate economy associated with population growth might stimulate economies of scale and greater technological progress (Martin 2002), if nothing else because a greater share of the capital stock would be of a recent vintage and thus embody new technologies (the Salter effect). However,

- to the extent that there are such scale economies, immigration as much as fertility could be used to realise them
- any scale effects are partly countered by congestion externalities and the possibility that firms invest more in labour-saving technology when aggregate labour force growth is low (Guest 2007, Gruen and Garbett 2003 and Romer 1987). That would imply the potential for greater technical change with lower fertility
- economic outcomes for children from smaller families appear to be superior (educational attainment, savings and income) (Parr 2004). This is consistent with the view that some of the fertility decline reflects parents' decisions to choose quality rather than quantity, with potential benefits for human capital accumulation and subsequent productivity.

Intergenerational issues

Changes in fertility alter the relative sizes of successive generations. If public social expenditures (on aged care, pensions and health) are financed out of current taxation revenue rather than accumulated reserves, then tax rates are higher if a small working age generation must pay for a larger dependent population. Higher fertility rates now would create a larger working age population later, reducing the tax burden on the average member of that generation. This may be more equitable and reduce some of the costly distortions posed by higher tax rates.

However, there are several important qualifications to this view:

- The Australian fiscal burdens associated with an ageing population appear to be exacerbated (at least until 2050) by increases in fertility (PC 2005b, p. 318). This is because the early accumulation of government expenditures associated with functions such as childcare and education outweigh the later gains from more tax revenue (from a bigger workforce) able to meet the needs of the old.
- Australia does not have a pension crisis, unlike many other ageing societies.
- Older people will be richer in the future than the current old and will often pay income tax themselves (with far fewer entirely dependent on the Age Pension).

- Future generations will have considerably higher lifetime incomes than the generations whose aged needs they may need to partly fund. This reflects the compounding benefits of productivity growth. The principle of taxation progressivity suggests that it would be equitable to recover some of the costs of ageing from younger richer cohorts.
- Changes in fertility are an unusual and poorly targeted way of dealing with intertemporal financing problems compared with tax and expenditure policy. It would also potentially raise moral issues if the motivation for bringing additional human beings into the world were to finance the retirement of others.

Another perceived intergenerational issue is the provision of services for the old. If there are fewer young people, who will care for the old and provide a host of other important services? This is analogous to the issue, analysed previously (section 4.1), of the effects of lower or higher fertility on the support ratio and labour supply. Since higher (feasible) fertility rates do not influence the long-run support ratio by much, it cannot resolve any labour supply shortages for services for the old.

In any case, paid care arrangements draw on employees who are older than the average (Healy and Moskos 2005) and informal care arrangements for the old draw principally on older people (Carers Australia 2004, p. 5 and AIHW 2007, pp. 97ff). In addition, most care for the old is informal.

Moreover, accompanying increased life expectancy, the health of the 'younger' old may improve over time, reducing their dependence on care services.

In summary

In the Australian context, the economic grounds for policy interventions to raise fertility are presumptive rather evidence-based. This analysis is set against a situation in which Australia's fertility levels have been both relatively high and growing by global standards, Australia has been able to attract many skilled migrants and population growth has been strong.

This diagnosis might be different were Australia to head down the path of those European and Asian countries experiencing the 'lowest low' levels of fertility. If their low fertility levels persist, then it will take those countries into uncharted economic waters. In that case, they will provide an early natural experiment of the economic effects of very low fertility, which can better inform policy analysis. But, as in the case of the social issues raised by fertility, Australia is not in their position, nor looks likely to head there soon.

4.4 Putting Australia's demographic future into a global context

There are varying views among the governments of developed countries about the adequacy of fertility levels and appropriate population policies (figure 4.4).

Figure 4.4 **Are governments worried by fertility levels?**
2007[a]

Policy approach

Diagnosis of fertility	No intervention or maintain	Lower	Raise
Satisfactory	Belgium, Denmark, Netherlands, Sweden, UK, US, Finland, Iceland, Ireland, Luxembourg, New Zealand, Norway, Turkey (1.87)	Mexico (2.2)	France (1.94)
Too low	Switzerland (1.42)		Australia, Austria, Canada, Czech Republic, Germany, Greece, Hungary, Italy, Japan, S. Korea, Poland, Portugal, Slovak Republic, Spain (1.35)

[a] The number in brackets is the average total fertility rate in 2005 for each of the categories.

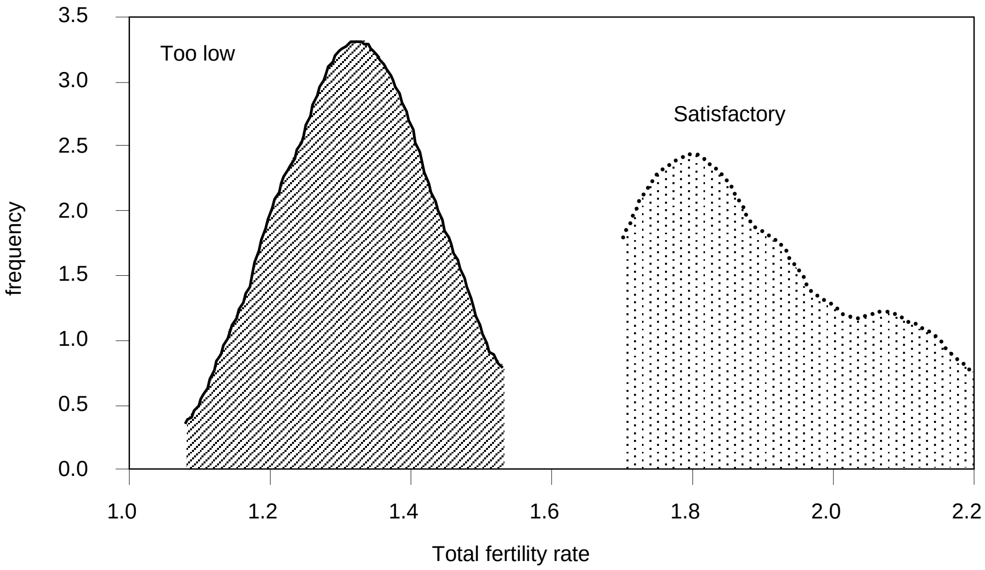
Data source: United Nations (2008).

Not surprisingly, governments generally base their perspectives on their country's fertility experiences. Just two factors — the levels of the fertility rate and the growth in the fertility rate from 1998 to 2005 — are able to accurately predict whether a country is concerned about fertility or not.[18] It appears therefore that most governments use a common, objectively based, threshold for determining the extent of their concern about fertility. For example, governments of the former Eastern bloc countries invariably perceive their fertility rates as low *because* they have very low fertility rates and low growth in fertility over time. Excluding Australia, the range of fertility rates of countries with a 'too low' diagnosis do not overlap with the range of fertility rates of countries with a 'satisfactory' diagnosis (figure 4.5).

[18] This was tested by estimating a logit model with the dependent variable being whether or not a country diagnosed its fertility as too low or not, and with explanators being the TFR level in 2005, and the growth rate in the TFR from 1998 to 2005 (with data from OECD 2007, *Health at a glance 2007* and UN 2008). With Australia excluded, the model was able to predict with complete accuracy the diagnosis of each country's government.

Figure 4.5 **Distributions of total fertility rates**

Governments perceiving fertility as 'too low' or 'satisfactory', 2007[a]



[a] Densities estimated using an Epanechnikov distribution. Based on 29 OECD and developed economies (excluding Australia). Were Australia to be included, the densities would overlap.

Data source: United Nations (2008).

However, among the 30 OECD and developed countries considered, Australia stands out with a diagnosis of fertility at odds with the thresholds for alarm used by others.[19] Australia's fertility level, while diagnosed as 'too low', lies within the range of fertility rates of countries recording satisfactory levels of fertility. Australia has fertility levels *higher* than some countries that perceive no problem (for example, Luxembourg, Netherlands, Sweden and Belgium). In addition, Australia has by far the highest fertility rate of countries that perceive their fertility as too low (with a fertility rate more than two standard deviations away from the average fertility level for these countries). If Australia were using the norm applied by other developed countries, then it would diagnose its fertility levels as satisfactory.[20]

This provides further grounds to be cautious about seeing Australia's present aggregate fertility levels as a problem requiring policy correction.

[19] The French and Mexican Governments stand out on another basis, in that they aim to raise and lower (respectively) their fertility levels, while nevertheless claiming their fertility levels are satisfactory.

[20] This is further supported by the fact that when the parameters from the logit model (described in the above footnote) are applied to the Australian data on the TFR and its growth, it predicts that Australia's diagnosis should have been 'satisfactory' levels of fertility.

Moreover, the combined effects of Australia's relatively high fertility levels and its significant migrant intakes mean that the United Nations projects Australia's population to rise by the fourth fastest rate among 45 OECD and other developed economies (table 4.4). Were the Commission's base case projections to be used, Australia's population growth would be 52 per cent from 2005 to 2051 — increasing its ranking to the third fastest growing population among OECD and developed economies.[21]

Table 4.4 **Australia's population is rapidly growing**

Population growth 2005-2050 projected by the United Nations

Country	*Rank*	*Growth*	*Country*	*Rank*	*Growth*	*Country*	*Rank*	*Growth*
		%			%			%
Luxembourg	1	58.0	Switzerland	16	13.6	Czech Rep.	31	-13.4
Israel	2	57.3	France	17	11.9	Slovak Rep.	32	-13.4
Ireland	3	49.1	Spain	18	6.9	Estonia	33	-16.1
Australia	4	38.1	Netherlands	19	5.6	Hungary	34	-16.1
Turkey	5	35.6	Austria	20	2.5	Croatia	35	-18.9
US	6	34.2	Belgium	21	2.4	Bosnia/Herz[a]	36	-19.3
Canada	7	32.5	Finland	22	2.2	Japan	37	-19.8
Hong Kong	8	27.2	Denmark	23	2.0	Poland	38	-20.8
New Zealand	9	27.1	Taiwan	24	1.4	Lithuania	39	-22.5
Mexico	10	26.9	Serbia	25	-2.3	Latvia	40	-23.2
Norway	11	23.6	Greece	26	-2.6	Russia	41	-25.1
Iceland	12	19.9	Portugal	27	-5.2	Romania	42	-26.4
Singapore	13	16.2	Italy	28	-6.9	Belarus	43	-28.9
Sweden	14	16.0	Germany	29	-10.4	Ukraine	44	-34.1
UK	15	14.1	S. Korea	30	-11.6	Bulgaria	45	-36.1

[a] Bosnia/Herz is Bosnia and Herzegovina.

Source: United Nations (2007) and CIA Handbook.

4.5 Conclusion

Australia's current levels of fertility do not presage declining economic prosperity for Australians. Indeed, all other things being equal, higher fertility would retard labour force per capita growth over the next 30 years and aggravate fiscal pressures. Moreover, in the Australian context, attainable increases from present fertility levels are ineffectual antidotes for population ageing — which is the major demographic transition facing Australia over the next century. Even were it possible to return to the levels of completed fertility of the baby boom (around 3.1 babies per women over her lifetime), then even with zero net overseas migration, Australia's

[21] With Australia's population increasing from 20.4 million in 2005 to about 32.0 million in 2050.

population would grow to arguably unsustainable levels and significant, if muted, population ageing would still occur. And, given the relative unresponsiveness of fertility to budget measures (chapter 3), the achievement of large increases in fertility would require large subsidies and therefore sizeable costs for taxpayers.

That said, were there to be profound reductions in fertility in the future — such as already experienced in some European countries — population ageing would be substantially reinforced. Sustained very low fertility rates would create the 'mushroom cloud'-shaped age structure shown in figure 4.3 and take Australia outside the bounds of its historical experiences. Children would become a much less noticeable presence in the Australian population. This would have uncertain effects on society. Potentially, it would have adverse social impacts for Australians generally since children are valued by people other than their parents and other relatives. There are grounds, therefore, for avoiding very low fertility (just as there are grounds for avoiding very high fertility rates).

However, this is not the position that Australia finds itself in now (nor a few years ago when fertility was lower). Australia's current fertility rate has recovered modestly from lower rates experienced in the early 2000s. It is relatively high compared with other developed countries. The present indications (Kippen and McDonald 2006) are that, apart from cycles associated with any economic downturns, these fertility rates will be sustained. There is, accordingly, no current or immediately impending fertility crisis in Australia — Australia's present fertility level is likely to be roughly at levels that avoid the problems of excess or insufficient fertility (figure 4.6). Problems would only be entailed were Australia to move too far outside the safe zone shown.

In saying this, it is important to acknowledge the role of uncertainty in these forecasts. Views about Australia's future fertility have changed as new evidence has become available. The fertility assumptions in successive ABS population projections have varied significantly over relatively short periods, as have those of the Treasury's Intergenerational report and some of Australia's leading demographers (figure 4.7).[22] New data, improved forecasting methods or simply new demographic developments may ultimately undermine the current 'optimistic' perspectives on Australian fertility. (More data on aspects of registration and parity would help improve the precision of forecasts.)

22 For example, only a few years ago, one demographer (Kippen 2003) was concerned that Australian fertility levels could readily decline to between 1.52 and 1.65 by 2015. This was a reasonable prospect with the data available at that time, but looks less likely now.

Figure 4.6 **Australia is probably in the ‘safe’ fertility zone**

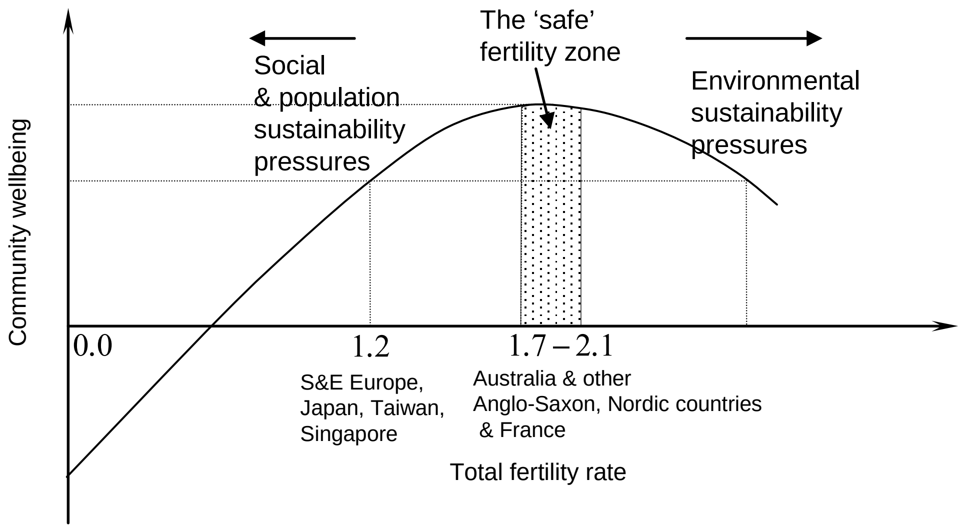
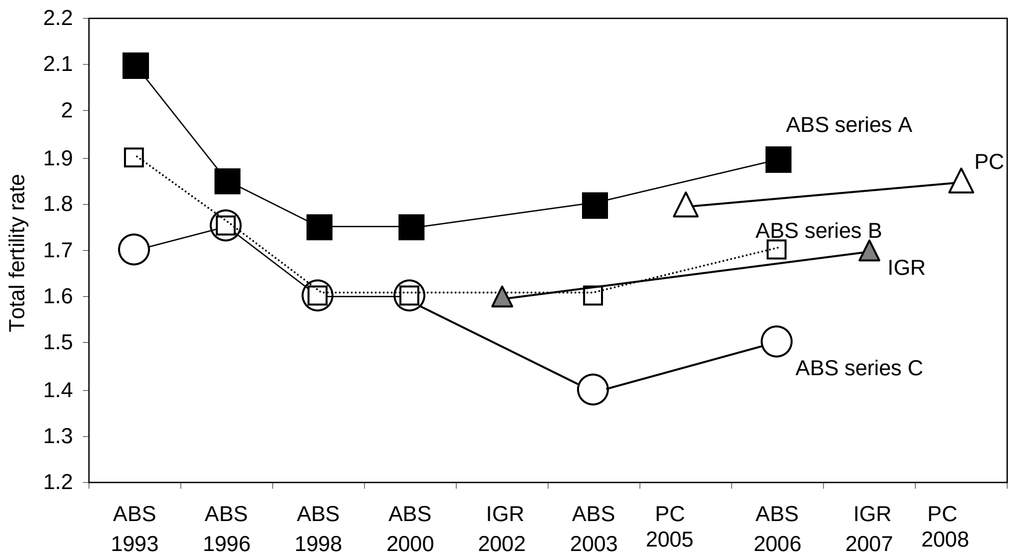


Figure 4.7 **Fertility projections have varied significantly**

Long-run estimates, 1993 to 2007[a]



[a] The estimates are the long-run fertility assumptions (five or more decades in the future) associated with various population projections made by the ABS in successive demographic projections, by the Intergenerational Report (IGR) and the Productivity Commission (PC).

Data sources: Australian Government (2002 and 2007); ABS (various issues), and PC (2005b).

The judgment that Australia has, and will continue to experience, a relatively high fertility level does not mean that there are no grounds for fertility policy. First, Australia’s current fertility levels are, in part, an outcome of social institutions and policies that lower the costs of children and that reduce the tradeoffs between careers and bearing children. While there are legitimate questions about the impacts and design of some of these policies, a wholesale retreat from such policies would risk a long-run shift to much lower fertility levels.

Second, there is an apparent gap between people's fertility goals and their achievement. While this 'baby gap' may simply reflect the inevitable tradeoffs people have to make between competing goals, it is also possible that there are systemic social problems that frustrate people's fertility aspirations. Equally, there are other factors — such as welfare design — that may create artificial positive incentives for bearing children. Problems in social institutions, therefore, can frustrate or excessively encourage fertility, depending on the groups concerned.

Finally, there are a wide range of family policies that may incidentally affect fertility, but that are premised largely on improving parental and child welfare, encouraging gender equity, achieving social justice and encouraging workforce participation, rather than more babies per se. Such policies may still have sound foundations, regardless of any diagnosis about the adequacy of a country's fertility levels. The Commission's current inquiry into the design and impacts of paid parental leave in Australia is assessing a range of issues in one such area of public policy.

APPENDIXES

A Linear interpolation method

There are two traditional ways of calculating the contribution of a factor to the growth of a multiplied quantity. However, these methods suffer from the disadvantage that the sum of the individual factor contributions do not add to the growth in the total. A 'linear interpolation contribution to growth' can be defined that overcomes this disadvantage.

Contributions to growth in a multiplied quantity (for example, $t = xyz$) can be calculated by finding the growth in **t** that would occur if only one factor were to be increased — ie $\Delta t_x = (\Delta x).y.z$. An alternative method is to calculate:

- the change in t were all factors to be increased
- the change were all factors excepting one to be increased
- then subtract one from the other so that:

$$\Delta t_x = (x+\Delta x).(y+\Delta y).(z+\Delta z) - x.(y+\Delta y).(z+\Delta z).$$

One difficulty with these approaches is that the contributions to growth of the various factors (Δt_x, Δt_y, Δt_z) will only add to the overall growth in t in the limiting case where the growth in t is infinitesimally small. This is because of the presence of cross-terms ($\Delta x.\Delta y$, $\Delta x.\Delta z$, $\Delta y.\Delta z$ and $\Delta x.\Delta y.\Delta z$, etc). Consider the example where $x_1 = 10$, $y_1 = 10$ and $z_1 = 100$. If each factor grew by the same proportion, say 10 per cent (so that $\Delta x = 1$, $\Delta y = 1$, $\Delta z = 10$), then the growth in the total (Δt) would be 3310 or 33.1 per cent. In contrast, using the first method above would give $\Delta t = (\Delta x).y.z+(\Delta y).x.z+(\Delta z).x.z = 3000$.

A more sophisticated approach is to define a 'linear interpolation contribution to growth' (*CLI*) for each factor, with the property that the sum of individual linear interpolation contributions is identical to the total growth in *t*. This linear interpolation contribution is defined as the integral of a factor's partial contributions to growth[1] calculated at every point along a straight line interval of growth in *t*.

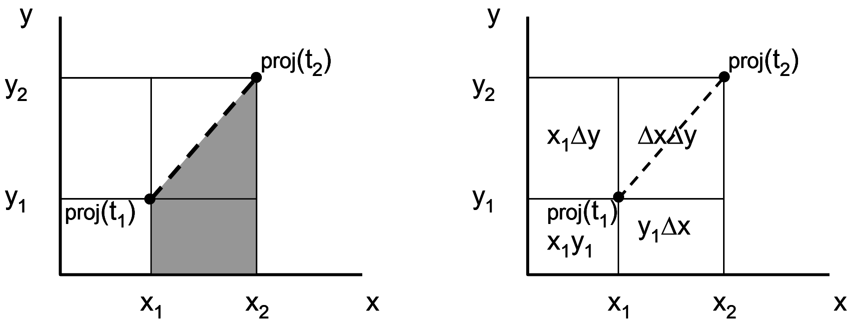
[1] A partial change is the change in the total that would occur were one factor to increase by a very small amount with all other factors remaining unchanged.

A particular *CLI* can be approximated by:

- dividing an actual growth in t between two points into a very large number of small steps along a straight line
- finding a particular factor's partial contribution after each of these small steps
- summing the partial contributions.

In the two factor case, the line along which the integral is taken is the line formed by the projection of the $t = xy$ line (which is a line in three dimensions) on the *xy* plane. The first panel in figure A.1 below shows a graphical example.

Figure A.1 **Linear interpolation contribution of the growth in *x* to the growth in *t* = *xy***



Contributions to growth over a curved growth path can also be approximated by dividing the path into a number of linear segments, then summing *CLI*'s calculated for each segment.

Deriving the linear interpolation contribution algebraically

The linear interpolation contribution can be calculated using areas as shown in the second panel of figure A.1.[2] For example, in the two factor case the calculation is as follows:

$$(t+\Delta t) = (x+\Delta x)(y+\Delta y)$$

$$(t+\Delta t) = xy + y.\Delta x + x.\Delta y + \Delta x.\Delta y$$

$$\Delta t = y.\Delta x + x.\Delta y + \Delta x.\Delta y$$

The linear interpolation contribution of *x* is then $y.\Delta x + ½.\Delta x.\Delta y$

[2] The linear interpolation was originally derived using limits (see PC 2005, Technical Paper 6)

For the three factor case the calculation is $(t+\Delta t) = (x+\Delta x).(y+\Delta y).(z+\Delta z)$. So, after removing $t = xyz$:

$\Delta t = yz.\Delta x + xz.\Delta y + xy.\Delta z + z.\Delta x.\Delta y + y.\Delta x.\Delta z + x.\Delta y.\Delta z + \Delta x.\Delta y.\Delta z$

Now, since the three linear interpolation contributions share mixed partial product terms equally, this implies that the linear interpolation contribution of factor *x* to the growth in t is $\Delta t_{(cli)x} = yz.\Delta x + ½.z.\Delta x.\Delta y + ½.y.\Delta x.\Delta z + ⅓.\Delta x.\Delta y.\Delta z$.

(Below we prove that this formula is the correct one for three factors without relying on the assertion that the mixed factor terms are shared equally.)

To continue with the above example (where $x_1 = 10$, $y_1 = 10$, $z_1 = 100$, $\Delta x = 1$, $\Delta y = 1$ and $\Delta z = 10$), then the linear interpolation contributions of each factor will be $\Delta t_{(cli)x} = \Delta t_{(cli)y} = \Delta t_{(cli)z} = 1103.3333$, which sum to the total growth in *t*.

Proving the linear interpolation formula for three factors holds using integration

The formula for the linear interpolation contribution can also be derived using area, volume and higher dimensional integrals. This is useful because it is a reasonably simple way of showing the *CLI* formula holds when there are more than two factors.

With two factors, the function $t = xy$ measures the size of an area. The change in the amount of this area (Δt) is given by $x_2y_2 - x_1y_1$ (a larger rectangle less a smaller rectangle). So the *CLI* of *x* is the area between the projection of the $t = xy$ line on the *xy* plane and the *x* axis (this is the shaded area shown in the first panel of figure A.1 above), while the CLI of y is the area between the projection of the $t = xy$ line on the *xy* plane and the *y* axis.

With three factors the function $t = xyz$ measures the size of a volume. Here the Δt volume is equivalent to a larger rectangular box with a smaller rectangular box removed ($x_2y_2z_2 - x_1y_1z_1$). The linear interpolation contributions of changes in *x*, *y* and *z* are then three volumes that add to the this total volume. The *CLI* of *x* is the volume found by integrating in the *z*, then *y* and then *x* directions[3] or in the *y* then *z* then *x* directions. Similarly, The *CLI* of *y* is the volume found by integrating in the *y* direction last and the *CLI* of *z* is the volume found by integrating in the *z* direction last.

[3] That is integrating in the *z* direction between the $z = 0$ and the $z = f_1(x)$ planes, then integrating in the *y* direction the between $y = 0$ and $y = f_2(x)$ lines and then integrating in the *x* direction between the x_1 and x_2 points.

It is also possible to find the equivalent of the *CLI* except now for a curve rather than a straight line. That is the integral of the partial changes in t for changes in x over a curved line segment divided into an infinite number of increments (i_n). This can be designated by:

$$\int_i \frac{\partial t}{\partial x}$$

The curved line formed from the various points (x_1,y_1,z_1), (x_2,y_2,z_2), (x_3,y_3,z_3) etc. can be used to calculate the various CLI integrals (where t_n measures the volume of a box that has the points (0,0,0) and (x_n,y_n,z_n) as two of its vertices and has as three of its sides parts of the xy, xz and yz planes). The projection of this curved line on the xz plane is the curved line $z = f_1(x)$ and its projection on the xy plane is the curved line $y = f_2(x)$.

So with three factors: $\int_i \frac{\partial t}{\partial x} = \int_{x1}^{x2}\int_0^{f2(x)}\int_0^{f1(x)} 1 \; dz \; dy \; dx = \int_{x1}^{x2} f_1(x).f_2(x) \; dx$

In the linear case[4] we substitute $z = f_1(x)$ and $y = f_2(x)$ with $z = \alpha_1 x$ and $y = \alpha_2 x$, so:

$$\Delta t_{(cli)x} = \int_i \frac{\partial t}{\partial x} \text{ (linear)} = \int_{x1}^{x2} \alpha_1\alpha_2 x^2 \; dx \quad \therefore \Delta t_{(cli)x} = ⅓\alpha_1\alpha_2(x_2^3 - x_1^3)$$

It can be shown that this is equivalent to $yz.\Delta x + ½.z.\Delta x.\Delta y + ½.y.\Delta x.\Delta z + ⅓.\Delta x.\Delta y.\Delta z$ where:

$z = \alpha_1 x_1$, $y = \alpha_2 x_1$, $\Delta x = x_2 - x_1$, $\Delta y = \alpha_2(x_2 - x_1)$ and $\Delta z = \alpha_1(x_2 - x_1)$

After substituting it can be seen that $yz.\Delta x + ½.z.\Delta x.\Delta y + ½.y.\Delta x.\Delta z + ⅓.\Delta x.\Delta y.\Delta z$

$= \alpha_1\alpha_2 x_1^2(x_2 - x_1) + ½\alpha_1\alpha_2 x_1(x_2 - x_1)^2 + ½\alpha_1\alpha_2 x_1(x_2 - x_1)^2 + ⅓\alpha_1\alpha_2(x_2 - x_1)^3$

$= \alpha_1\alpha_2(x_1^2 x_2 - x_1^3) + \alpha_1\alpha_2 x_1(x_2^2 - 2x_1x_2 + x_1^2) + ⅓\alpha_1\alpha_2(x_2^3 - 3x_1x_2^2 + 3x_1^2x_2 - x_1^3)$

$= \alpha_1\alpha_2(x_1^2x_2 - x_1^3 + x_1x_2^2 - 2x_1^2x_2 + x_1^3 + ⅓x_2^3 - x_1x_2^2 + x_1^2x_2 - ⅓x_1^3)$

$= \alpha_1\alpha_2(x_1^3 - x_1^3 + x_1^2x_2 + x_1^2x_2 - 2x_1^2x_2 + x_1x_2^2 - x_1x_2^2 + ⅓x_2^3 - ⅓x_1^3)$

$= ⅓\alpha_1\alpha_2(x_2^3 - x_1^3)$

4 The alphas are simply constants. They can be calculated using values of x, y and z. For example $\alpha_1 = (z_2-z_1)/(x_2-x_1)$.

Summary

The linear interpolation contribution to growth (for a total that is the product of a number of factors) is the *integral of the partial changes in the total ascribed to a particular factor*, evaluated over a linear segment of growth in the total.

In order to derive the formula for the linear interpolation contribution it is useful to think of the two factor case in terms of areas and the three factor case in terms of volumes.

In the two factor case, the linear interpolation contribution change in **t** for a change in a particular factor is the area between the axis of the factor in question and the projection of the line $t = xy$ on the xy plane evaluated over an interval.

$$\Delta t_{(cli)x} = \int_i \frac{\partial t}{\partial x}\,(\text{linear}) = \int_{x_1}^{x_2}\int_0^{\alpha_1 x} 1 \; dy \; dx = \tfrac{1}{2}\alpha_1(x_2^2 - x_1^2) = y.\Delta x + \tfrac{1}{2}.\Delta x.\Delta y$$

And the two linear interpolation contributions add to the total change:

$$\Delta t_{(\text{linear})} = \Delta t_{(cli)x} + \Delta t_{(cli)y}$$

In the three factor case, the linear interpolation contribution change in t for a change in **x** is equivalent to the volume found using the triple integral:

$$\Delta t_{(cli)x} = \int_i \frac{\partial t}{\partial x}\,(\text{linear}) = \int_{x_1}^{x_2}\int_0^{\alpha_2 x}\int_0^{\alpha_1 x} 1 \; dz \; dy \; dx = \tfrac{1}{3}\alpha_1\alpha_2(x_2^3 - x_1^3)$$

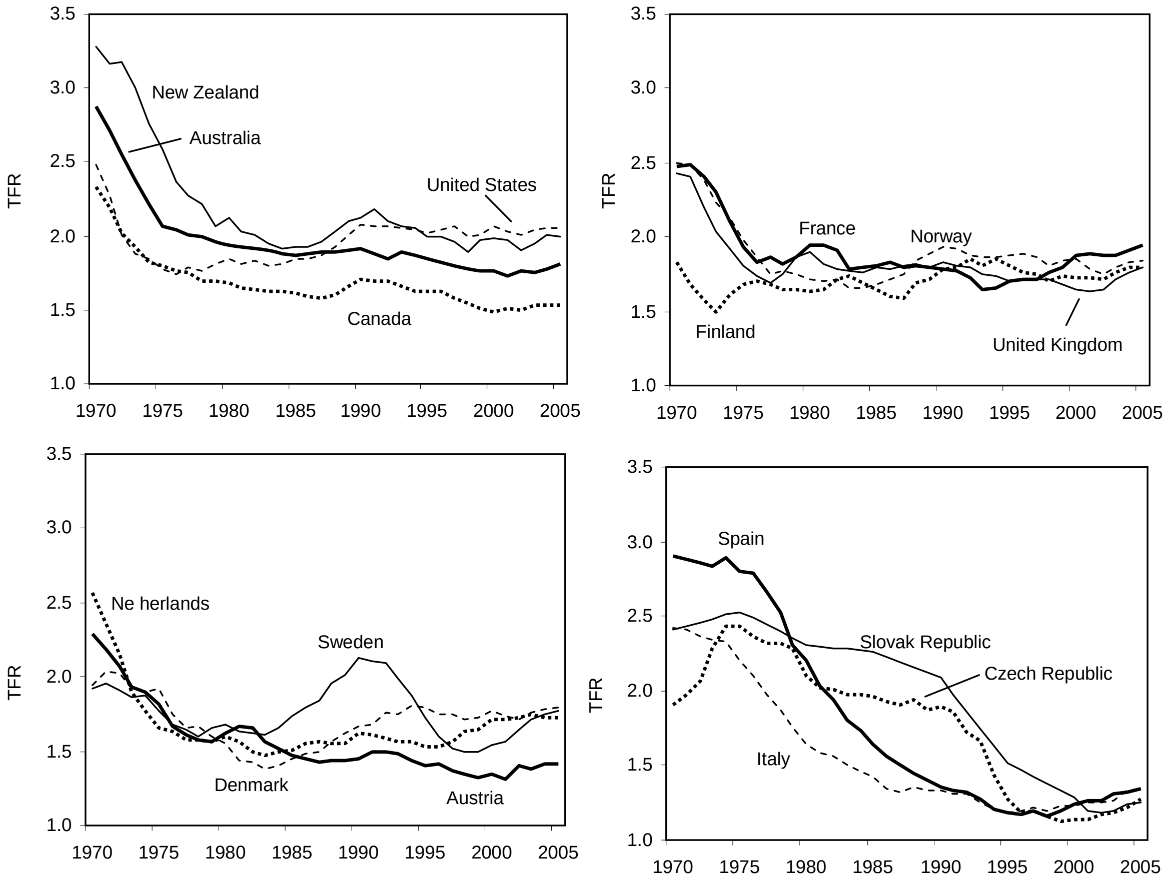
$$= yz.\Delta x + \tfrac{1}{2}.z.\Delta x.\Delta y + \tfrac{1}{2}.y.\Delta x.\Delta z + \tfrac{1}{3}.\Delta x.\Delta y.\Delta z$$

And the three linear interpolation contributions add to the total change:

$$\Delta t_{(\text{linear})} = \Delta t_{(cli)x} + \Delta t_{(cli)y} + \Delta t_{(cli)z}$$

B International Fertility Trends

Figure B.1 **Total fertility rate for selected OECD countries**



Data source: OECD 2008*, Factbook 2008: Economic, Environmental and Social Statistic*s, Paris.

C The impact of income on fertility

This appendix considers a sample of the empirical results on the effect of male and female wages and income on fertility. Many of the studies surveyed here include government policy variables and are discussed in greater detail in appendix E. However, two general points about the literature should be noted:

- The underlying models of fertility behaviour are subject to almost all of the uncertainties and inherent methodological difficulties described in appendix E.
- One mitigating factor is that income is easier to measure than government policy, and is measured more consistently between studies. This allows for greater comparability of results.

The literature on wages and fertility contains a number of common features:

- Women's wages are generally found to be negative and significant. A one per cent increase in women's wages is usually found to decrease fertility by between one and three per cent.[1]
- Men's wages/income is generally positive and significant. A one per cent increase in men's wages/income generally increases fertility by between 0.5 and 2.0 per cent.
- When men's and women's wages are included in the same model, the estimated coefficient on women's wages is usually larger (in absolute value) than the coefficient on men's wages.
- Several studies find that relative earnings are important. That is, fertility tends to fall when women's wages rise relative to men's.

However, there are discrepancies and confounding results in some studies:

- Many studies fail to find a significant effect of men's and women's wages on fertility, or find a significant effect but an unexpected sign (Gauthier and Hatzius 1997, Tasiran 1996, Zhang, Quan and Meerbergen 1994, Del Boca 2002).
- Results often differ by parity. For example, Ronsen (2004) finds a negative effect of women's wages on the probability of having a first and second child, but finds no effect on having a third.

[1] 'Fertility' here usually refers to the TFR. In some studies, it refers to completed fertility.

- Results differ by country. Using Swedish data, Heckman and Walker (1990) find a negative effect of women's wages on fertility. Tasiran (1996), following Heckman and Walkers methodology but using U.S. data, finds that women's wages have a positive and significant effect on fertility.

A sample of literature is presented in table C.1

Table C.1 **Econometric estimates of the effect of wages and income on fertility**

Authors	*Data and Methods*	*Variables included*	*Findings*
Gauthier and Hatzius (1997)	International A fixed effect panel estimator was used on aggregate data from 22 OECD countries for the period 1970–1990.	The dependent variable was the TFR. The independent variables were men's and women's wages, changes in the unemployment rate, maternity leave entitlements and the ratio of family payments to average weekly earnings. Time dummies were used to exclude missing time-varying variables.	A one per cent increase in women's average wages was found to increase the total fertility rate by 0.22 per cent in the short run. In the long run, a one per cent increase in women's average wages was found to increase the total fertility rate by around 1.7 per cent (PC calculation based on table 2). Men's wages were found to be insignificant.
Ehrlich and Kim (2007)	International A fixed effect panel estimator was used on aggregate data from 57 countries.	The dependent variable was the TFR. The independent variables were GDP per capita, social security benefits as a share of GDP, the marriage rate, government spending as a share of GDP, the probability of surviving until the age of 24, the female labour force participation rate, and ratio of average schooling years of females to males.	A one per cent increase in GDP per capita was found to decrease the total fertility rate by between 0.17 and 0.31 per cent.
d'Addio and d'Ercole (2005)	International Aggregate panel data from 16 OECD countries was used. The preferred model (out of the three presented) used a pooled mean group (PMG) estimator. (The two other models used a generalised method of moments and a pooled OLS estimator).	The dependent variable was the TFR. The independent variables were lagged TFR, female employment rate, ratio of women's to men's wages, share of female workers in part-time employment, unemployment rate, length of parental leave, parental leave benefits, and public spending on leave benefits and the difference in effective tax rates for families with and without children.	Increasing women's wages relative to men's was found to have a negative and significant effect in the preferred model (the effect was insignificant in the other models presented).

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Heckman and Walker (1990)	Sweden A hazard model of life-cycle fertility was used on individual level data from the 1981 Swedish Fertility Survey. This model essentially estimates how transitional probabilities (that is, progressing from parity 1 to parity 2) changes through time and according to various characteristics. The authors estimated 148 different specifications to find the best fitting model and to test for robustness.	The dependent variable was the transition from one parity to another. As individual wage data were not collected in the Swedish Fertility Survey, summary tax return statistics were used to calculate average wages by sex and age. Other independent variables included: employment, education, marital status, cohabitation status and social background.	Female wages were consistently found to be a significant and negative determinant of fertility across the various specifications. Likewise male wages were consistently found to be positive and significant. In the preferred model: • A one per cent increase in female wages decreases the predicted number of children a women will have by the age of 40 by 0.55%. • A one per cent increase in male wages, increases the predicted number of children his spouse will have by the age of 40 by 0.21%.
Merrigan and St.-Pierre (1998)	Canada The methodology followed Heckman and Walken (see above).	The dependent variable was the transition from one parity to another. The independent variables included: female wage and male income, religion, region, cohort and education.	A 12.5 per cent increase in women's wages was found to decrease the predicted number of children at age 40 by between 6.5 and 15.6 per cent. A 12.5 per cent increase in men's wages was found to increase the predicted number children at age 40 by between 0.12 and 1.8 per cent.
Tasiran	Sweden and the U.S.A. The methodology followed Heckman and Walken (see above).	The dependent variable was the transition from one parity to another. The independent variables included, age, education, male and female wages, benefits.	The effect of wages differed between parities and between countries. Parameter values were not reported. In Sweden: • Increasing women's wages was found to have a positive effect on the first birth, an insignificant effect on the second birth and a negative effect on the third birth. • Increasing wages was found to have a positive effect on first and second birth but an insignificant effect on third births. In the USA • Increasing women's wages was found to have a positive effect on first second and third births • Increasing men's income was found to have a negative effect on first, second and third births.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Butz and Ward (1979)	U.S.A. An OLS estimator was used on aggregate data. Regressions were run on the different ages groups separately, as well as all age groups together.	The dependent variables were the age specific fertility rates and the TFR. The independent variables were: female hourly earnings, male annual earnings, cohort and the fraction of families with employed wives.	A one per cent increase in women's hourly earnings was found to decrease the TFR by between 1.59 and 1.85 per cent (depending on the cohort). A one per cent increase in men's annual earnings was found to increase the TFR by around 1.3 per cent (table 2, page 322).
Jackson (1995)	Australia An OLS estimator was used on aggregate data.	The dependent variable was the TFR. The independent variables were the ratio of the number of women to men in the workforce, the male annual income and female hourly wages.	In the preferred model, a one per cent increase in women's hourly wage was found to decrease the TFR by 1.45 per cent. A one per cent increase in men's annual wages increased the TFR by 1.27 per cent.
Hyatt and Milne (1991)	Canada An OLS estimator was used on aggregate time series data from 1948-1986.	The dependent variable was the TFR. The independent variables were male income and female wage rates, the proportion of households in which the wife is employed and variables relating to family payments and maternity benefits.	In the preferred model (model 2, pp. 83) a one per cent increase in female wages was found to decrease the TFR by 1.1 per cent. A one per cent increase in male wages was found to increase the TFR by 0.5 per cent.
Zhang, Quan and Meerbergen (1994)	Canada An OLS estimator was used on aggregate time series data from 1921-1983.	The dependent variable was the TFR. The independent variables were: female wage and male income, family payments, tax deductions for dependent children, maternity leave, the immigration rate, the unemployment rate, infant mortality, female education and dummy variables for World War 2 and the introduction the contraceptive pill.	Female wages and male income were both found to be insignificant in this model.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Ermisch 1998	UK The study used a 'two-step' error correction model on aggregate time series data (at the cohort and parity level) from 1952 to 1983. The study determined that the dependent fertility variable and the independent variables were non-stationary and co-integrated	The dependent variable was the logit of the conditional birth rate for a particular cohort of women by age group and parity. Independent variables included: relative cohort size, ratio of men and women's wages, men's real after tax earnings, the male unemployment rate, the inflation rate, the parity-specific child allowance, real house prices, and a constructed 'permanent lifetime employment propensity' variable.	Increasing women's wages relative to men's was found to have a large effect on fertility. A 35 per cent increase in this ratio was simulated, which yielded a decline in average family size of 0.3 children. Increasing both women's and men's wages simultaneously was found to have only a small effect. A 45 per cent increase in men's earnings (holding the ratio of men and women's earnings constant) was found to decrease the average family size by 0.05 children.
McNown and Ridao and Cristobal (2004)	Canada An OLS estimator was used on aggregate data for the period 1947–1999. A co-integrating relationship was found and the estimation was done in levels, which yields long-run estimates.	The dependent variable was the TFR. The independent variables were: women's wages, male incomes, labour force participation, female education, child benefits, and dummy variables controlling for the availability of the birth control pill and the provision of publicly-funded maternity benefits.	Increasing women's wages by one per cent was found to decrease the total fertility rate by 2.7 per cent. Increasing men's income by one per cent was found to increase the TFR by 3.7 per cent.
Milligan 2004	Canada A probit estimator was used on individual level data.	The dependent variable was whether a birth had occurred. In some specifications over 20 control variables were included. These variables related to education, family income, ethnicity, age and the macro-economic environment.	An increase in family income of $10 000 was found to increase the probability of having a child by 1.75 percentage points.
Blacklow (2006)	Australia OLS, poisson, multinomial logit and sequential logit estimators were used on individual level data.	The dependent variable was the number of children ever had and expected to have. A large number of independent variables were used including: male and female wages; health; education; work force attachment; country of origin; sector; and work force experience.	Women's wages were generally found to have a significant and negative effect on fertility.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Barmby and Cigno (1990)	UK A maximum likelihood estimator was used on a large random sample of British women aged between 16 and 59, undertaken in 1980. Only women who were married for ten years were included in the analysis.	The dependent variable was 'completed' fertility (births after ten years of marriage). The independent variables were: the ratio of female to male wages, the age of the mother, the year the mother was born, the year the mother was married, years of post-compulsory education, years of work experience, and an index of child benefits.	The study found that increasing women's earnings relative to men's had a negative impact on fertility
Del Boca (2002)	Italy A fixed effect logit estimator was used on individual level panel data collected between 1991 and 1995.	The dependent variable was whether a birth had occurred in the last 2 years. The independent variables were: the proportion of children aged 1–3 in childcare for each of the Italian regions; the proportion of women in part-time work for each of the Italian regions;, mother's age at first birth; household income; family transfers (from relatives); schooling; and whether grandparents were still alive.	Family income was found to be insignificant in both models
Ronsen (2004)	Norway and Finland A maximum likelihood estimator was used on individual level data. Each parity was estimated separately.	The dependent variable was whether a birth occurs (for a woman of a given parity). There were a large number of independent variables relating to birth cohort; social background; marital status; education; wage; and experience.	Women's wages was found to have a negative and significant effect on the probability of having a baby for women of parity zero and one (but not two).
Risse (2006)	Australia. A probit estimator was used on individual level data. The modelling technique also corrected for potential sample selection biases.	The dependent variable was whether the respondent had fallen pregnant in the last year. A large number of independent variables were used including: personal weekly gross wage; workforce attachment; industry of employment; education; age; region; and remoteness.	Women's wages were found to have a negative and significant effect on the probability of having fallen pregnant in the last year.

D The generosity of family policy

The size of family payments relative to the private lifetime costs of children is likely to affect ‘marginal’ incentives to have a child by reducing their impacts on family budgets. As shown in the chapter 3, it is straightforward to calculate the changing incentive effects of upfront, non-means tested payments like the baby bonus. It is more difficult to estimate the effects of ongoing payments whose generosity varies with household income and with the age and number of children.

It is more difficult again to summarise the overall impact of the plethora of family payments, each with different designs and eligibility conditions.

This appendix sets out a rough method for assessing the overall impact of family payments, used as the basis for the estimates presented in chapter 3. The basic approach is to calculate the government subsidy as the ratio of all direct family payments[1] in any given year to an estimate of the total costs of children to families in that year (not their lifetime costs).

The main difficulty in doing this is the absence of yearly data on the costs of children. This appendix provides a method for estimating children’s costs in those years where data are missing from other observable features of the economy and population.

D.1 Direct costs

AMP & NATSEM (2002 and 2007) have calculated the direct costs of children (by various age groups) for families of different sizes and incomes. The costs for an average income family with one child for all ages from 0 to 24 years was estimated by fitting a cubic spline to the published age group data. The incremental costs for 2nd (C2) and 3rd (C3) children by age were then calculated as:

$$C2_a = \{(\sum_{a=0}^{24} C2_a \Big/ \sum_{a=0}^{24} C1_a) - 1\} \times C1_a \ \ and \ \ C3_a = \{(\sum_{a=0}^{24} C3_a \Big/ \sum_{a=0}^{24} C1_a) - 1\} \times C1_a$$

[1] That is, excluding services such as provision of healthcare or education.

We then approximated the average direct costs per child for each age group by weighting the costs by the rough probabilities of different parities:

$$C_a = 0.4\,C1_a + 0.4\,C2_a + 0.2\,C3_a$$

Then the economy-wide direct costs up to age 21 years (TDC)[2] were estimated as:

$$TDC = \sum_{a=0}^{21} C_a \times POP_a$$

where POP_a is the population of children of age a.

For December 2007 and March 2002, the economy-wide costs of forgone wages associated with having children were approximated using information from Breusch and Gray (2004), appropriately updated by the changes in the hourly rates of pay over the relevant intervening periods.

Using these methods, in 2007, the aggregate economy-wide costs of children ($\tilde{C}_{2007}$) were around $110 billion with an average cost per child in that year ($\tilde{C}_{2007} / POP_{2007}$) of just under $18 000.

D.2 The productivity link

In the steady state, as the economy grows, nominal per child costs can be expected to rise by real wage growth plus inflation (that is, with nominal productivity growth). Such a long-run condition is similar to other models of costs used in long-run projections (such as in the Intergenerational Reports and the Productivity Commission's ageing models). The underlying rationale is that the opportunity costs of women's labour should be proportional to wage rates, and that children's direct costs grow with economic growth as measured by output per input, reflecting the desire by parents to maintain children's relative living standards (consistent with the Becker model).

Accordingly, we assume that average children's costs are proportional to labour productivity so that $\tilde{C} / POP = \gamma GDP / Hours$ where POP is the aggregate number of children between 0 and 21 years, GDP is gross domestic product, Hours are total hours worked and γ is a constant.

2 Children over the age of 21 were ignored because many will have left home. To impute the costs experienced by those who stay at home to the whole population of people aged 22 to 24 years would exaggerate costs. The understatement of costs resulting from ignoring those who do stay offsets the overstatement of covering children of younger ages who have left.

Now $GDP_{t+1}/HOURS_{t+1} = (1+\mathrm{g})\, GDP_t/HOURS_t$ and $POP_{t+1} = POP_t\,(1+\mathrm{e})$ where e is the growth rate of the number of children and g the nominal growth rate in productivity. Accordingly:

$$\tilde{C}_{t+1}/\tilde{C}_t = \{POP_{t+1}\; GDP_{t+1}/HOURS_{t+1}\} \,/\, \{POP_t\; GDP_t/HOURS_t\}) \Rightarrow$$
$$(1+v) = (1+e)(1+g)$$

where v is the growth rate in economy-wide children's costs.

In the steady state, with zero population growth and a stable age structure, e=0 and therefore v=g, which is a sensible long-run result.

An advantage of this model is that it takes account of the growth in the population of children as well as economic growth. Were, for example, the growth in the population of children to be negative, then for given productivity, costs would fall as a share of GDP. In contrast, an estimate of the costs of children based on a fixed share of GDP ignores the population dynamics of children.

D.3 Estimating costs for the missing years

In 2007, γ can be estimated as $\gamma = \{GDP/Hours\}/\{\tilde{C}/POP\} = 280.72$ using National Accounts data on GDP and the Labour Force Survey for hours worked. A similar calculation can be made for 2002, giving an alternative value of γ=307.9. We use the 2007 value in the calculations that follow, but the difference made to the results from using the 2002-based estimate is small.

Given a value of γ, then for any given period $\tilde{C}_t = \gamma\, POP_t \times GDP_t/Hours_t$. An estimate of family policy subsidy rate (s) (as shown in table D.1) can be derived as: $s_t = GOV_t/\tilde{C}_t$ where GOV_t is aggregate nominal transfers to families and children.[3] The results suggest that the Australian Government currently meets about one quarter of the full private costs of having children.

[3] This includes payments defined by the AIHW as ‘family’ benefits, though some do not relate to the additional *direct* costs of caring for children. For example, parenting payments are akin to conventional pensions, providing income support to a group of people (largely) outside the labour force. There is justification for including these payments as an offset against the full costs of parenting because they reduce the forgone wages of carers of children when they are outside the labour force. However, GOV excludes government payments made indirectly to children, such as through provision of educational and health services. These are not included in the analysis since such payments are not transfers to parents to help defray the private costs of children.

Table D.1 **How much do governments subsidise the private costs of children?**

Experimental estimates, 1998-99 to 2005-06

	Govt nominal spending on children and families (GOV)	*Private costs of children ($\tilde{C}$)*	*Subsidy rate (s)*
	$m	$m	%
1998–99	16 088	74 766	21.5
1999–00	17 329	77 789	22.3
2000–01	20 168	83 843	24.1
2001–02	21 893	89 369	24.5
2002–03	22 195	92 835	23.9
2003–04	27 122	100 020	27.1
2004–05	25 760	103 406	24.9
2005–06	26 580	111 487	23.8

a Payments are restricted to welfare expenditure, comprising cash paid to recipients of income support and welfare services (benefits-in-kind). The spending includes that by all Australian Governments. Payments include Parenting Payments made to people caring for children, as well as the Maternity Payment (the 'baby bonus'), FTB (A&B), the Immunisation Allowance, the Large Family Supplement and various other sundry payments. It excludes the costs associated with provision of schools or other government services to children.

Source: Australian Institute of Health and Welfare 2007, *Welfare expenditure Australia, 2005–06*, Health and Welfare Expenditure Series, No. 31, AIHW cat. no. HWE 38, November, Canberra; and PC estimates.

These experimental estimates suggest that changes in family policy increased the government subsidy rate to families by 2.3 percentage points from 1998-99 to 2005-06. Denoting s_1 and s_2 as the subsidy rates for 1998-99 and 2005-06 respectively, this implies that the changing generosity of family policy between these years reduced the net costs of children to families by: $r = 100\,(s_2 - s_1)/(1 - s_1) = 3\ \textit{per cent}$. However, this result reflects the choice of 1998-99 as the base year. For all other alternative base years (except 1999-00), the subsidy rate in 2005-06 is lower.

Another, narrower, measure of the generosity of family policy provides a different perspective. The measure is based on non-hypothecated family payments that directly address the additional costs of children (table D.2). Over the period 1998-99 to 2006-07, the subsidy rate defined on this basis (k), increased by just over 3 percentage points, implying that it reduced private costs by $\hat{r} = 100\,(k_2 - k_1)/(1 - k_1) = 3.6\ \textit{per cent}$.

D.4 What does family policy imply for fertility?

While there is a large empirical literature on the impacts of family policy on fertility, much of it is flawed or does not derive conventional price elasticities (appendix E). Moreover, one of the better studies — Gauthier and Hatzius (1997) — finds no significant effect of family policy on fertility in Anglo-Saxon countries (including Australia).

Table D.2 **Government transfers targeting the direct costs of children**
1998-99 to 2006-07

	Family allowances (ALLOW)	*Share of GDP*	*Share of private costs (k)*
	$ m	%	%
1998–99	7 334	1.21	11.0
1999–00	7 314	1.13	10.6
2000–01	10 253	1.49	13.7
2001–02	11 104	1.51	14.0
2002–03	10 690	1.37	12.9
2003–04	15 316	1.82	17.2
2004–05	13 554	1.51	14.7
2005–06	14 389	1.49	14.5
2006-07	15 204	1.45	14.2

a These comprise non-hypothecated payments intended to assist parents with the direct costs of children. It includes maternity allowances (the baby bonus), family tax benefits (A and B), the one-off 'More help to families' payment and equivalent payments that were made prior to these benefits. It excludes 'in-kind' benefits, such as child care subsidies, and income replacement measures, such as parenting payments. The value of ALLOW is used in the subsequent analysis to illustrate the possible effects of family policy on fertility. This narrower definition is consistent with that used by the best quality panel studies, whose parameters we apply in the analysis below. Nevertheless, if GOV is used rather than ALLOW, the results are qualitatively similar, but with family policy having a slightly weaker impact on fertility.

Source: FACS (various issues), Annual Reports, and OECD Social Expenditure Database.

However, suppose that, in fact, Australian fertility was as responsive to family policy transfers as OECD countries in aggregate. What would this then imply for the impact of government family policy changes in the last few years? A first step in undertaking this calculation is interpreting the parameters from the empirical literature.

Interpreting parameters from panel data studies

Gauthier and Hatzius's (1997) measure of the generosity of family policy is the ratio of all family allowances for a two child family to average male wages in manufacturing (B). In their study, they found that $\ln(TFR_t) = 0.87 \ln(TFR_{t-1}) + 0.42B_t + \varphi Z_t$, where TFR is the total fertility rate and Z_t are a vector of other variables. Assuming that only B changes then in the long run (when t=T):

$$\ln(\text{TFR}_T) - \ln(\text{TFR}_0) = 0.42\Delta\text{B}_t / (1 - 0.868) = 3.19\Delta\text{B}_t ,$$

where TFR_0 is the base year TFR. For small changes, $100 \times \ln(TFR_T) - \ln(TFR_0)$ closely approximates the percentage change in the fertility rate (%TFR) so that $\%TFR \cong 3.19 \Delta B_t$.

Gauthier and Hatzius note that the average TFR in the OECD was 1.71 and that B was 0.0531. A 25 per cent increase in the generosity of family payments implies that for the OECD, $\%TFR \cong 3.19 \times 0.25 \times B_0 = 4.2$ per cent or an increase of around 0.07 babies per woman.

The difficulty in applying this approach in an Australian context is that — across all payment types — B is not directly available. However, an estimate of B can be derived as follows. By definition,

$$B = \frac{\text{(Aggregate annual benefits to 2 child families)/(Number of families with 2 children)}}{\text{Hourly wages in manufacturing} \times \text{average weekly hours} \times 52}$$

$$= \frac{q}{w.h.52}$$

Where q is the average family payment to 2-child families, w is the wage rate and h is hours. Suppose that ρ and θ are the share of families with one and two children respectively. Then the number of families with two children = $\theta \times \text{the total number of families} = \theta\ F$; the number of families with one child = ρF and the number of families with three or more children $= (1 - \rho - \theta)\, F$, where F is the total number of families.

Suppose that the average benefits per family are q/2 for a one child family and 1.7q for a three or more children family. In that case, total family benefits ($ALLOW$) are:

$$ALLOW = F\, q\, (\theta/2 + \rho + 1.7\,[1 - \rho - \theta]) \text{ so that } q = \frac{ALLOW}{F\ (\theta/2 + \rho + 1.7\,[1 - \rho - \theta])}$$

Now from ABS data, w is close to average full-time earnings per hour across the economy (v). Now aggregate family income (y) can be defined as around: $y = \mu\, F\, v\, h.52$ where μ is the number of full-time equivalent persons per family.[4] Accordingly, $F\, v\, h\, 52 = y/\mu$. Now the full costs of children ($\tilde{C}$) is some proportion of family income, so that $y = \tilde{C}/\gamma$.

Bringing these various expressions together:

4 This also takes into account the unemployed, who are assumed to be equivalent to 0.25 of a full-time worker given that they receive unemployment benefits of around 25 per cent of average weekly earnings.

$$B = \frac{q}{w.h.52} = \frac{ALLOW/\{F\ (\theta/2+\rho+1.7\,[1-\rho-\theta])\}}{v.h.52} = \frac{ALLOW}{(\theta/2+\rho+1.7\,[1-\rho-\theta])\ F\ v.h.52}$$

$$= \frac{ALLOW}{(\theta/2+\rho+1.7\,[1-\rho-\theta])\ y/\mu} = \frac{ALLOW}{\tilde{C}} \times \frac{\mu\,\gamma}{(\theta/2+\rho+1.7\,[1-\rho-\theta])}$$

$$= k \times \frac{\mu\,\gamma}{(\theta/2+\rho+1.7\,[1-\rho-\theta])}$$

This expression implies B is proportional to k (the subsidy rate derived above). The actual relationship depends on the fixed parameters shown (table D.3 and D.4). A simpler back of the envelope calculation, based on the rough assumption that $B \cong ALLOW/y = k \times \tilde{C}/y = k \times \gamma$, suggests slightly smaller values of B (table D.4), but substantiates that B is probably around 10 per cent in Australia.

Table D.3 **Key parameters for deriving the ratio of family subsidies to income (B)**

Parameter	*Description*	*Value*	*Source*
γ	Aggregate children's' cost share of family income (%)	37.2	Breusch and Gray (2004) and AMP/NATSEM (2007)
θ	Share of families with 2 children (%)	40.6	ABS Cat. No. 2068.0 - 2006 Census Tables
ρ	Share of families with 1 child	38.5	ABS Cat. No. 2068.0 - 2006 Census Tables
μ	Full time equivalent income recipients per family	1.1	ABS Labour Force Survey (ST FA2)

Source: PC calculations and sources as noted above.

Table D.4 **Estimates of B**

Experimental estimates, 1998-99 to 2005-06

	B (complex method)	*B (simple method)*
	ratio	ratio
1998–99	0.0478	0.0410
1999–00	0.0458	0.0393
2000–01	0.0595	0.0511
2001–02	0.0605	0.0519
2002–03	0.0561	0.0481
2003–04	0.0746	0.0639
2004–05	0.0638	0.0547
2005–06	0.0628	0.0539
2006-07	0.0617	0.0529

Source: PC estimates.

Implications

Given the above results, an initial TFR of 1.758 in the fiscal year 1998-99, and Gauthier and Hatzius's parameter estimate, the long-run effect of the change in B from 1998-99 to 2006-07 would be:

$$TFR_T - TFR_0 = (e^{3.19 \times (.0617 - .0478)} - 1)\, TFR_0 = 0.08 \text{ babies per woman}.$$ [5]

However, this estimate is the long-run effect, not the effect apparent to date. It also abstracts from other factors that may have influenced recent fertility. To consider this, Gauthier and Hatzius's model was used to decompose recent changes in the TFR into three factors:

- the influence of the changing generosity of family benefits (through ΔB) from 1998-99
- the impact of all other influential factors (Z) subject to change on a year by year basis after 1998-99
- the effects of pre-1998-99 influences that are captured by the lagged dependent variable in Gauthier and Hatzius's model ('history').

The simulation suggests that were Gauthier and Hatzius's parameter estimates relevant in an Australian context, the changes in family policy may have raised fertility by around 3.7 per cent (or by 0.066 babies per woman) over the period June 1999 to June 2007 (table D.5). Changes in other factors over this period raised the TFR by 0.07 babies per woman, while the influence of shocks prior to June 1999 contributed to a fall in the TFR of 0.064 babies per woman.

Notably, the apparent contribution of family policy to the change in fertility from June 2005 to June 2007 has been much smaller than the effects of other factors (Z).

5 Another back-of-the-envelope calculation based on Ermisch (1988) suggests that a doubling of child allowances increases the TFR by 8.6 per cent (or an underlying point elasticity of 0.086). Assuming a roughly constant elasticity, this implies that the 29 per cent increase in B from 1998-99 to 2006-07 would have increased the long-run TFR by around 2.5 per cent or 0.044 babies per woman. These variations highlight the uncertainty about the likely impact.

Table D.5 **A 'what if' analysis of the impact of family policy**
June 2000 to June 2007[a]

Year end June	*B*	*Z*	*History*	*Total TFR change*
	Contribution to 100×ΔlogTFR in each year (or about the % change in the TFR)			
2000	-0.08	0.48	-0.57	-0.17
2001	0.51	-0.76	-0.49	-0.74
2002	0.48	-0.08	-0.43	-0.03
2003	-0.03	0.66	-0.11	0.52
2004	1.83	-0.48	-1.17	0.17
2005	0.51	1.07	-0.39	1.19
2006	0.35	1.42	-0.29	1.48
2007	0.18	1.68	-0.18	1.68
1999 to 2006	3.74	3.98	-3.63	4.09

a The model is $LF_t = aLF_{t-1}+hB_t+Z_t$ where LF is log(TFR), B is the benefit measure and Z are all the other influences. In each year, B is subject to some shock: ε1 (for June 1999 to June 2000), ε2 (for 2000 to 2001) and so on. Similarly Z is subject to similar shocks (ζ1, ζ2 and so on). In addition, shocks prior to June 1999 continue to affect the TFR through the lagged dependent variable (the 'history' effect). The cumulative effects of B on log (TFR) from June 1999 to June 2007 is $h\varepsilon_1(1+a+a^2+a^3+..\ a^7) + h\varepsilon_2\ (1+a+a^2+..a^6) + ..\ h\varepsilon_8$. A similar measure can be derived for shocks to Z. Recall that 100×ΔlogTFR is very close to the percentage change in the TFR in each year.

Source: PC calculations.

The results above are likely to exaggerate the real impact of family policy in Australia for the reasons outlined in chapter 3. Moreover, the underlying model has some dynamic features that are unrealistic and that are likely to overstate the impacts of policy:

- The effect of any given policy shock grows continuously over time.
- Adjustment is very slow. It takes about five years after a policy shock for even half of the effect to be felt on fertility rates. While it is likely that people do not respond immediately to the changing generosity of family policy, the protracted nature of this response appears improbable.

A more credible depiction of fertility behaviour would entail:

- a small initial effect (associated with a short lag in recognition and the period of confinement)
- a bigger effect over several subsequent years
- followed by a negative effect, reflecting the fact that some of the initial response involves bringing forward children that parents were going to otherwise have later in their lives (a tempo effect).

Limits to data availability meant that Gauthier and Hatzius were obliged to use a simple dynamic specification[6] that, by its nature, ruled out the latter tempo effect — adding to the likelihood that the long-run effect of family policy is overstated.

Additionality

Even though the results in table D.5 are likely to be reflect an upper limit of sensitivity of Australian fertility to family policy, it is useful to consider their implications for the number of (long-run) additional children per dollar of public support of families. A back of the envelope calculation suggests:

$$\text{Impact} = [e^{\{3\ 19 \times (B_{2006-07} - B_{1998-09})\}} - 1] \times \mathit{Births}_{1998-99} = 11\,301\ \mathit{babies}$$

$$\text{Cost} = \text{ALLOW}_{2006\text{-}07} - k_{1998-99} \times \tilde{C}_{2006-07} = \$3.43\ \mathit{billion}$$ [7]

Accordingly, the policy effect is 0.0000033 extra babies per dollar of additional funding or just over $300 000 of public funding per baby. If — as is more likely — the real responsiveness of fertility to family policy is less than this, then clearly the amount of public funding needed to induce an additional baby rises commensurately.

[6] Only a lagged dependent variable.

[7] The estimate of the cost is the government's expenditure level in 2006-07 had the subsidy rate stayed at its 1998-99 level.

E International studies of the impacts of family policies on fertility

This appendix describes a representative sample of the econometric literature relating to fertility and family policy. The summary provided here (tables E.1 to E.4) is narrower, but more detailed, than that found in Sleebos (2003) and Gauthier's (2007) broad and useful meta-studies. Nevertheless, the evidence presented here supports Sleebos (2003) and Gauthier's (2007) qualitative assessment that while family policy is positively related to fertility, the magnitude of the effect is likely to be small and subject to a great deal of uncertainty.

It is difficult to pin down the effects of family policy due to the diversity of findings and methods employed in the literature, as well as the inherent methodological difficulties involved in modelling fertility decisions. The most obvious point of distinction is the level of aggregation. Studies range from country level (macro) to individual level (micro) data.

E.1 Macro-level studies

Macro-level studies typically model the effects of country-wide variables on a period measure of fertility — usually the TFR. While there are some time series studies for single countries (for example Gabos, Gal and Kezdi 2007), in general, panel data involving many countries and periods is preferable. This allows the estimation to exploit the variation that occurs between countries, as well as through time. The main difficulty for macro-level studies is that it is hard to measure policy in a way that is both meaningful and comparable between countries. Family policy differs not just by generosity, but also by type. Some countries have a strong redistributive element to their policy (benefits differ by the income of recipients), some favour flat payments (benefits are the same for all), and others have pronatalist elements (benefits differ by parity, bonuses to big families, etc). To overcome this problem, an index of family payments is usually constructed, based on an assumed family type. For example, d'Addio and d'Ecole (2005) use the difference, for a given level of family earnings, in effective tax rates between families with two children and childless families.

Macro-level studies consistently find a small effect of government policy on fertility. The categorisation of ‘small’ stems from the size of the change in TFR that could be expected from feasible changes in the index of family policy used. This is usually in the range of 0.02 to 0.04 children per woman.

E.2 Micro-level studies

Micro-level studies generally use discrete response models to estimate the impact of various factors on the probability of having a child over a given period. One advantage of these studies is that fertility decisions are modelled according to the mix of attributes and opportunities actually encountered by individuals (as opposed to country-wide averages). As variations in benefits usually only occur through time or regionally, the difficulty lies in identifying the effect of family policy. This problem is acute in ‘difference-in-difference’ or ‘treatment/effects’ type models. The reliability of estimates from these models depends crucially on the adequacy of the ‘control’ group (those not exposed to new or increased family policy). An ideal control group is identical in their traits to the ‘treatment’ group except that they have not received the treatment. Or, if achievement of this ideal is not feasible, the differences in the traits of the control and treatment groups should be unrelated to people’s fertility decisions.

Unfortunately, the implicit ‘control’ groups used in these studies fall short of these standards — reflecting the inherent difficulty of observing all the relevant characteristics of the control and treatment groups.

Accordingly, while these studies yield the largest policy coefficients in the literature, it is difficult to predict how much of the estimated policy effect merely reflects the influence of unobserved factors. Studies that attempt to model policy as continuous variables (such as Barmby and Cigno (1990) and Laroque and Salanie 2004) tend to find a more modest effect.

Micro-level studies tend to suggest a larger effect of family policy on fertility than macro-level studies, although there is also more variation in the findings. Studies differ not just in the estimated magnitude, but also in relation to the parities most sensitive to policy.

E.3 Common issues

Both macro-level and micro-level studies face a number of common challenges. Most of these studies are subject to a ‘tempo’ bias that overstates the impact of family policy. This occurs because the introduction of new or more generous family policy prompts some families to bring childbearing forward, but does not change their completed fertility. Typical specifications (that specify the TFR or the probability of having given birth as the dependent variable) will spuriously construe these tempo effects as an increase in lifetime fertility.

The most basic difficulty is specifying the complex and heterogeneous process that underlies fertility behaviour. While it is not obvious what a 'complete' model would even look like, ideally panel models should control for variations in individuals' traits (such as men's and women's wages, family income, and educational attainment) and economy-wide factors (such as unemployment, availability of child care and the cost of children). Lack of data frequently constrain such richly specified models. Moreover, there are several unobservable, even undefinable, factors that are likely to play a powerful role in childbearing decisions. These include a tapestry of evolving cultural norms and social institutions pertaining to the role of women, family structure, working habits, materialism and the value placed on children.

Given the profound challenges involved, the discordant approaches to (and outcomes from) modelling fertility behaviour are unsurprising. In addition to preventing easy generalisation about the results, specification issues make it difficult to assess the reliability of individual studies. It is probable that the estimated coefficient of the effect of family policy is highly sensitive to sample selection, econometric technique and the inclusion or exclusion of other variables. When multiple models are presented, the effect of family policy often appears to be unstable, with coefficients changing sign and/or losing significance.

The implication of this is that any one study result needs to be interpreted with caution. Nevertheless, the shared qualitative finding of a small, but significant, positive link between family policy and fertility is both sound and intuitively plausible.

Table E.1 **Micro-level data studies**

Authors	*Methods*	*Variables included*	*Findings*
Laroque and Salanie (2004)	France The study was based on three years of individual level data from the French labour surveys of 1997, 1998 and 1999, with a total of 23 000 observations. A Full Information Maximum Likelihood (FIML) estimator was used to examine the impact of the 1994 extension to maternity benefits. The study assumes women decide whether to have a child in the current year by incorporating expectations of next year's income. This expectation is determined by their potential wage and whether they are employed in the next year. The above approach then allows anticipated income to be controlled for when estimating the impact of additional income on fertility choices. The coefficients from the income-fertility model were then used to model the effects of increasing or decreasing maternity benefits.	The dependent variable was whether a birth had occurred or not. Explanatory variables included women's income, partner's income, non-wage income, education attainment, work experience, matrimonial status and employment status. The study also incorporated a large number of other controls (more than 70). The estimated coefficients were then used to model the removal of the *Allocation Parentale d'Education* (APE) for second children. (The APE provides around 465 euros per year for three years for a parent who stops work to care for a child. The parent must have worked in two years out of the previous five. Prior to 1994 it was only available for children of parity three or above.)	The impacts of the 1994 reform to extend the maternity benefit (APE) to second children were estimated to be: • no affect on the probability of having a first child • a 5.0 per cent increase in the probability of having a second child • a 2.1 per cent decrease in the probability of having a third child • a 1.3 per cent net increase in total births (this was around one fifth of the overall increase in fertility observed between 1995 and 2000) • the APE could reduce participation by 2.0 per cent. The study also modelled an increase in family benefits of 240 euros per month (equivalent to an approximately 50 per cent increase in family benefits) and found this would result in an 8.9 per cent increase in the TFR (see page 27).

Table E.1 continued

Authors	*Methods*	*Variables included*	*Findings*
Milligan (2004)	Canada This study used the introduction of generous maternity benefits in the province of Quebec as a natural experiment. A probit regression and a difference-in-difference estimator were used. The study measured the impact of the increase in Quebec's allowance for newborn children, which was increased in 1991 from C$375 for first and second children and C$3000 for third or later children to C$500 and C$8000.	The dependent variable was whether a birth had occurred or not. Living in Quebec during the introduction of the maternity benefit was the proxy for the effect of policy. In some specifications over 20 control variables were included. These variables related to education, income, ethnicity, age and the macro-economic environment.	The difference-in-difference estimate of the additional rise in fertility in Quebec compared with the Rest of Canada (ROC) over the study period was 5.5 per cent. The study presented two estimates of impacts. One measured the rise in TFR one year after the policy was introduced. This rise comes after only a portion of entitled benefits have been paid (since the entitled benefits were paid quarterly over five years). Because the one-year estimate measures the TFR response to only a fifth of the benefit increase, the impact of an increase in benefits by C$1000 measured after one year is equivalent to the impact from a C$5000 increase in overall benefits. The one-year estimate found an additional C$1000 (per year) was associated with an increase in the TFR of 16.9 per cent (see Milligan 2004, table 8). The other measure of impacts included the total additional family payments made over the five years from birth. This measure was considered to be the more reliable. Using the five-year estimate of maternity benefits, additional maternity payments of C$1000 were related to an increase in the TFR of 2.6 per cent.
Barmby and Cigno (1990)	UK The study used a maximum likelihood estimator. The data originated from a large random sample of British women aged between 16 and 59 years undertaken in 1980. Only women who were married for 10 years were included in the analysis.	The dependent variable was completed fertility (births after 10 years of marriage). An index of child benefits for first and second children from 1954 to 1980 was used as the policy variable (recipients' benefits differ according to the year in which they had children). Other variables include the ratio of female to male wages, the age of the mother, the year the mother was born, the year the mother was married, years of post-compulsory education, years of work experience at marriage, and annual earnings.	The study found: • increasing child benefits increased completed fertility and reduced the time to the first birth • a higher ratio of female-to-male earnings reduced fertility • older age at first birth reduced completed fertility.

Table E.2 **Multi-country studies with macro-level data**

Authors	*Methods*	*Variables included*	*Findings*
d'Addio and d'Ercole (2005)	The modelling covered 16 OECD countries. Aggregate data were used. The preferred model (out of the three presented) employed a Pooled Mean Group (PMG) estimator. This estimator assumes a common long-run effect of policy but allows different short-run coefficients for each country. The model was dynamic so it allowed for different short and long-run effects. (The two other models used a generalised method of moments and a pooled OLS estimator).	The dependent variable was the TFR (as a log). The policy variable was the difference between average effective tax rates for families with two children and singles without children. The representative married couple had two children (aged 4 to 6) and earned 100 per cent of the income of an Average Production Worker (APW). The representative single person without children also earned 100 per cent of the income of an APW. The average effective tax rate included both income taxes and social security contributions paid by households, less cash benefits received from governments. Other variables included in the models were the: lagged TFR; female employment rate; ratio of women's to men's wages; share of female workers in part-time employment; unemployment rate; length of parental leave; parental leave benefits; and public spending on leave benefits.	Using the pooled mean group dynamic model, the authors found that a 25 per cent increase in the tax rate difference would increase the TFR by 0.05 births per woman (see d'Addio and d'Ercole 2005, p. 65, footnote no. 52).
Blanchet and Ekert-Jaffe (1994)	The study examined 11 countries in Western Europe. It used aggregate data for the period 1969 to 1983. The model did not differentiate between short and long-run effects. Time dummies were used to exclude missing time-varying variables.	The dependent variable was the TFR by parity. Family policy was measured by an index (FPI) that accounted for both the generosity of family payments as well as the degree of pronatalism. Pronatalism was defined by the extent to which payments increased with parity. Women's wages were also included. These wages were converted to purchasing power parity amounts in a common currency.	A one unit increase in the FPI would generate an increase the TFR of between 0.00475 and 0.00940 (OLS regression results from table 4.5 and 4.6). As an indicative example, France and the United Kingdom were compared in 1981. At this time France had a FPI of 60 and England had a FPI of 25. France's more generous policies were estimated to have contributed between 0.17 and 0.31 births per woman.

Table E.2 continued

Authors	*Methods*	*Variables included*	*Findings*
Gauthier and Hatzius (1997)	OECD countries The study analyses 22 countries, using aggregate data for the period 1970 to 1990. The study uses a fixed-effects estimator with a lagged dependent variable (TFR). The study analysed the impact of family expenditures and maternity leave. As family payments often differ by parity, three separate regressions were run for the payments received by families with one, two or three children. Time dummies were used to try and exclude missing time-varying variables.	The dependent variable was the TFR as a log. The policy variable was the ratio of family payments to average weekly earnings for male manufacturing workers. The maternity leave variables were: 1) weeks of leave offered by country 2) maternity leave payments as a percentage of wages. Other variables included in the model were men's wages, women's wages (as logs) and the change in the unemployment rate.	Maternity leave and pay was not found to have a significant effect. A 25 per cent increase in the family payment to wages ratio for a family with two children was estimated to increase fertility by 0.07 children per woman in the long run (for a country with an average TFR of 1.71). The short-run effect was found to be smaller, being 0.01 children per woman. The effect was also found to vary across countries. • No effects were found in the English-speaking countries. • Large positive effects were found in the Scandinavian countries. • Intermediate effects were found in the continental West-European countries and in the Southern-European countries. • For the Southern-European countries only benefits for the first child were significant.

Table E.3 **Single country studies with macro-level data**

Authors	*Methods*	*Variables included*	*Findings*
Gabos, Gal and Kezdi (2007)	Hungary Found TFRs and family benefits to be non-stationary but not cointegrated. In order to overcome problems of spurious significance with non-stationary variables, the dependent variables were included in differenced form (in this case as the differences of logs).	The dependent variable was the change in the log of the TFR (which is equivalent to dependent variable being the percentage change in the TFR). The policy variables were changes in logs of: • family benefits as a percentage of GDP • pensions as a percentage of GDP. (This is equivalent to including the percentage changes in these variables as the explanatory variables.) Other variables included in the model were the participation rate, the infant mortality rate, the marriage rate and dummies to control for periods of stringent abortion policy in the early 1950s and early 1970s.	The study finds that a one per cent increase in the ratio of family benefits to GDP increased the TFR by 0.25 per cent.
Duclos, Lefebvre and Merrigan (2001)	Canada The regression was a linear probability model. The study undertook parity-specific regressions for parities of one, two and three. The data covered the period from 1982 to 1997. The study analysed the impact of policies introduced in Quebec in 1988. Only women under the age of 35 years were included in the sample.	The dependent variable was the probability of transitioning from one parity to another (for example, a women with one child giving birth to a second). The transition probabilities were compared between Quebec and Canada in 1987 to obtain an initial difference. Another difference was found by comparing between Quebec and the ROC in 1989 (1990 for third births). The difference between these (the difference-in-difference estimate) was then ascribed to the impact of the introduction of the additional family policy expenditures in Quebec. No other factors were controlled for.	The study found the additional family benefits introduced in Quebec had positive effects on the probability of first, second and third births. The initial impacts found were: • a 21 per cent increase in the transitional probability of first births • a 15 per cent increase in the transitional probability of second births • a 26 to 35 per cent increase in the transitional probability of third births.

Table E.3 continued

Authors	*Methods*	*Variables included*	*Findings*
Zhang, Quan and Meerbergen (1994)	Canada The study used an ordinary least square regression on aggregate data from 1921 to 1983.	The dependent variable was the TFR. The study examined the impacts of three family expenditure programs: the tax deduction for dependent children; the family allowance; and the child tax credit. These variables were measured as real dollar amounts and were examined individually and as combined total benefits. The study also examined the impacts of maternity leave. Other variables included in the model were the immigration rate, the unemployment rate, female wage and male income, infant mortality, female education and dummy variables for World War 2 and the introduction of the contraceptive pill.	The study found a positive and statistically significant effect of total benefits on fertility. A one per cent increase in total benefits was estimated to increase the TFR by between 0.05 to 0.11 per cent.
Hyatt and Milne (1991)	Canada 1948 to 1986 Aggregate data	The dependent variable was the log value of the TFR. The study analysed the impacts of maternity benefits (over the 1971 to 1979 period), female income and a combination of ongoing family payments and male income.	The study found weak positive effects.

Table E.3 continued

Authors	*Methods*	*Variables included*	*Findings*
Ermisch (1988)	UK The study used a 'two-step' error correction model on aggregate time series data (at the cohort and parity level) from 1952 to 1983. The study determined that the dependent fertility variable and the independent variables were non-stationary and co-integrated.	The dependent variable was the logit of the conditional birth rate for a particular cohort of women by age group and parity. Independent variables included relative cohort size, ratio of men and women's wages, men's real after-tax earnings, the male unemployment rate, the inflation rate, the parity-specific child allowance, real house prices, and a constructed "permanent lifetime employment propensity" variable. The coefficients from the logit regression were then used to simulate the explanatory variables impacts on steady state changes in family size.	The study found a positive and significant effect of child benefits on fertility. It was estimated that doubling child benefits would increase the TFR by 0.17 birth per women. Other findings were: • higher relative female to male wages decrease CFR • higher male wages increase CFR • higher house prices decrease CFR • women from larger generations tend to have lower completed fertility and to have their children later in life. The findings suggested that increases in women's pay relative to men's, increases in real house prices and changes in relative generation size were the factors primarily responsible for falls in fertility rates between 1971 and 1985.

Table E.4 **Child-care and family friendly policy studies**

Authors	*Methods*	*Variables included*	*Findings*
Lalive and Zweimuller (2005)	Austria The study examined the effect of the extensions of maternity leave from one year to two years in June 1990. Women giving birth to an additional child whilst on leave qualify for additional maternity leave — that is they avoid the requirements of having had worked 20 weeks prior to birth. Previously, few people had subsequent children within a year and so the follow-on option was rarely available. It was hypothesised that extending the maximum duration of maternity leave would provide an incentive to have children more rapidly and potentially to have more children. The study used data from the Austrian Social Security Database (ASSD), which covers all Austrian employees.	The dependent variable was whether a woman had given birth or not. The effect of policy was captured by a dummy variable indicating whether a mother gave birth before or after the introduction date. The regression controlled for age, employment prior to birth, unemployment prior to birth, occupation type (white or blue collar), region, industry and wage in previous work.	During the first 3 years the group giving birth after the reform had 15 per cent more births than the group giving birth before the reform. After 10 years the difference was around 12 per cent.
Del Boca (2002)	Italy The study used a fixed effect logit model on individual level panel data. The panel data were drawn from the Bank of Italy's Survey of Households Income and Wealth. There were three years of data collected over the 1991 to 1995 period.	The dependent variable was whether or not women gave birth in the last 2 years. Explanatory variables were: the proportion of children aged 1 to 3 years in childcare for each of the Italian regions; the proportion of women in part-time work for each of the Italian regions; the mother's age at first birth; household income; family transfers (from relatives); schooling; and whether grandparents were still alive.	The fixed effects model found that increasing the availability of childcare by 1 per cent increased the relative odds of having a child by 0.198 per cent (Del Boca 2002, p. 567). Having a greater proportion of part-time workers in a region was found to have a statistically significant impact in the pooled cross-sectional model, which had a larger sample size (but that did not remove Italy-wide fixed effects). This model also found mothers' age to have a negative effect, and additional family transfers to have a positive effect.

Table E.4 continued

Authors	*Methods*	*Variables included*	*Findings*
Hank and Kreyenfeld (2001)	West Germany Logit model 1984 to 1995.	The dependent variable was the probability of having a first child. The explanatory variables included the availability of public childcare and the availability of childcare through social networks.	The study found the availability of childcare had no effect on the decision to have a first child.
Kravdal (1996)	Norway Logistic regression. The study obtained information from Family and Occupation Surveys conducted in 1988. These were linked with migration information and with regional social science time series data. The study was also based on histories collected for 4019 women born between 1945 and 1968 and for 1543 men born in 1945 and 1960.	The dependent variable was whether or not the respondent had given birth, by parity of the child. The policy variable was the childcare supply, which was defined as the number of children aged 1 to 3 years in public or private childcare centres.	The study found a weak positive association between childcare supply and fertility. Using the most optimistic assumptions, a 20 percentage point increase in childcare coverage generated a 6 percentage point increase in the probability of progressing from parity two to parity three.

F Has the Baby Bonus changed the patterns of birth by age?

The biggest concern about the impact of the baby bonus is on teenage mothers (aged 15-19 years), since they face the greatest monetary incentives to bear children and may not take into account the full lifetime implications of children for subsequent work and education prospects. One *very* simple method would be to assess this by considering whether the fertility rates for this age group increased from 2004 to 2006 (noting that while the bonus was introduced in 2004 it cannot have had any impact in that year, since conception would have occurred at a prior time). This measure is:

$$\Delta F1 = ASFR_{15\text{-}19,2006} - ASFR_{15\text{-}19,2004}$$

where the ASFR is the age-specific fertility rate. Using this measure, there are reductions in fertility rates for Australia as a whole, but reasonably large increases in South Australia and (particularly) the Northern Territory.

However, it may be that fertility was growing before the bonus was introduced and that the apparent increase using ΔF1 is merely the continuation of historical trends. One way of dealing with this is to take the difference between pre-bonus and post-bonus growth:

$$\Delta F2 = (ASFR_{15\text{-}19,2006} - ASFR_{15\text{-}19,2004}) - (ASFR_{15\text{-}19,2004} - ASFR_{15\text{-}19,2002})$$

ΔF2 is positive for Australia as a whole and only negative for Victoria and Western Australia. It is very high for the Northern Territory.

Finally, it could be that some common factor has increased the fertility rate for all ages (such as economic prosperity) and that ΔF2 is picking up this general phenomenon rather than something that is particularly affecting young women. To control for this, the gap between ΔF2 for women aged 15–19 and 24–29 was calculated (ie the difference in the difference in the difference):

$$\Delta F2 = \{(ASFR_{15\text{-}19,2006} - ASFR_{15\text{-}19,2004}) - (ASFR_{15\text{-}19,2004} - ASFR_{15\text{-}19,2002})\} -$$

$$\{(ASFR_{24\text{-}29,2006} - ASFR_{24\text{-}29,2004}) - (ASFR_{24\text{-}29,2004} - ASFR_{24\text{-}29,2002})\}$$

This is negative for all States and Territories except the Northern Territory, which again shows a very high positive change in fertility (table F.1).

Table F.1 **Behaviour of teenage fertility**

15-19 year olds, pre and post Baby Bonus[a]

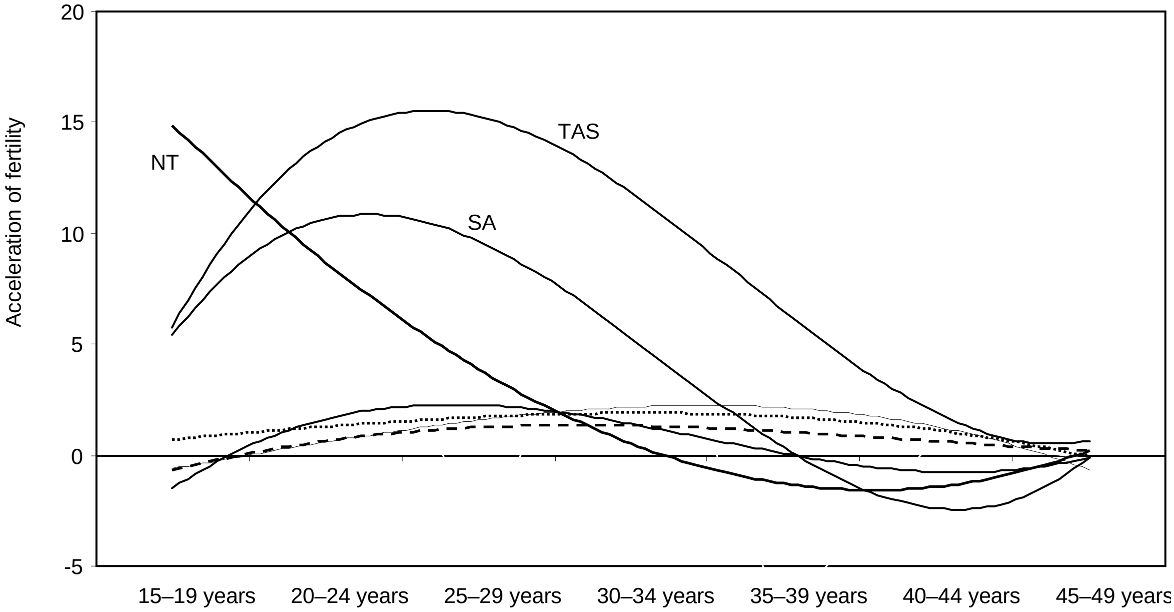
	Growth in fertility after the baby bonus	'Acceleration' in fertility growth	Difference in acceleration for 15-19 and 25-29 year olds
	ΔF1	ΔF2	ΔF3
NSW	-1.8	0.4	-0.2
VIC	-0.6	-1.2	-0.1
QLD	-1.9	5.2	-2.3
SA	3.2	5.2	-6
WA	0	-0.8	-3.5
TAS	1.7	5.1	-5.3
NT	7.2	14.2	17.8
ACT	1.3	4.6	-16.3
AUST	-0.6	0.6	-1.3

[a] See box 4.1 for the derivation and interpretation of these figures.

Data source: ABS, *Births, Australia*, (Cat. no. 3301.0).

Another (similar) way of diagnosing the possible influence of the baby bonus is to graph ΔF2 across ages (figure F.1). Since ΔF2 is subject to noise, the resulting curve for each jurisdiction is smoothed using a third order polynomial so that the underlying shape of the relationship is made clearer. In all jurisdictions, bar the Northern Territory, the resultant curve is concave — with the greatest acceleration in fertility occurring for women aged 25–39 years. This is consistent with the effects of recuperation (chapter 3). In contrast, the Northern Territory has a distinctively convex shape, suggesting that the baby bonus *may* have stimulated teenage pregnancies in that jurisdiction.

Figure F.1 **The acceleration of fertility was generally greater for prime age women, not young women after the baby bonus**[a]



a The figure shows the measure ∆F2 from box 4.1 for each of the age groups for each State and Territory. The data were smoothed across age groups to reveal the underlying relationship more clearly. The Northern Territory is the only exception to the finding that prime-aged, not young women, have experienced the greatest acceleration of fertility.

Data source: ABS, *Births, Australia*, (Cat. no. 3301.0).

G Fertility intentions

G.1 Are women revising their fertility expectations?

As discussed in chapter 2, rising fertility levels for women can reflect three factors:

- recuperation — the realisation of births that were formerly postponed as women shifted the timing of their births to older ages
- anticipation — Births brought forward in time, but with no change in the expected completed fertility rate
- quantum effects —increases in a woman's expected completed (lifetime) fertility.

It is difficult to distinguish the relative role of these three factors over just a few years, which is problematic since they have different policy implications. However, the Household, Income and Labour Dynamics in Australia (HILDA) survey provides some evidence about the role of the quantum effect, since it can be used to analyse changes in women's expectations of future births. This appendix considers the causes of the changes in fertility over the five year period from 2001 to 2006, which was a period of rising fertility at the aggregate level.

HILDA is a household-based panel study that began in 2001. It collects information about economic and subjective well-being, labour market dynamics and family dynamics, with the latter relevant to this report.

The survey asks female (and male) respondents several questions about previous and anticipated fertility:

a) the number of children ever had — 'parity' (*P*)

b) the desire for children in the future (*D*). The strength of the desire was measured on a Likert scale between 0 and 10 — with low (high) values indicating a negative (positive) attitude to having future children

c) the likelihood of having future children (*L*). The likelihood is also measured on a scale between 0 to 10, with scores of 5 or less interpreted as 'unsure or unlikely' to have a child

d) the number of additional children (*I*) a person intends to have (an estimate of the actual number of such children).

The survey can be used to derive several measures of changing fertility intentions[1] and attitudes over time:

- $\Delta(P_t+I_t)$ provides an indicator of the change over time in the expected completed fertility (*ECF*). It may be appropriate to condition the analysis on age (or cohort). However, as noted by Rebecca Kippen in commenting on a draft of this report, it is not appropriate to condition the analysis on children already had. Given postponement, that would inevitably suggest a quantum effect even when none existed.
- Changes in D and L may indicate changes in people's latent desires for children and the likelihood these will be realised.

An issue in interpreting any results is the longstanding problem of distinguishing cohort, age and period effects on expected completed fertility. This stems from the fact that the cohort at time T is defined simply as T less age, so that, in the absence of identifying restrictions, it is only possible to isolate the effects of two factors, implicitly assuming that the omitted one is irrelevant.

Cohort effects will arise if people of different generations have different inherent preferences or capacities for fertility. Period effects can arise when the economic or social environment changes over time, prompting women to revise their expected number of children. Age effects are different in character because their presence requires that younger people systematically under or overestimate their completed fertility, regardless of their cohort or of the social and economic environment. This violates the often-applied assumption in economics of 'rational expectations'.[2]

Nevertheless, applying rational expectations may be too strong an assumption. Forecast bias could arise in several ways. Women could be overly optimistic about being able to have children later, forgetting the risks of not being able to partner or of sub-fecundity. That would suggest that the *ECF* declines with age. Some

[1] It can also do so for men, but most of this appendix concentrates on women, since they have greater control over their reproductive lives.

[2] This assumption does not require that people are accurate forecasters of their future fertility and nor does it require that the variance of forecast errors is constant over time — these could be expected to fall as women age. Rather rational expectations requires that, *for any given information at hand at the time of the forecast*, the expected error is zero. Notably, a failure to account for period changes in fertility due to future unanticipated economic and social events does not violate rational expectations because women do not, by definition, know of these beforehand. But women do know they will age, so rational forecasts should (on average) factor any age-related impacts on completed fertility.

aggregate survey evidence supports this contention. The expected fertility of more recent cohorts exceeds the long-run total fertility rates used in most current Australian demographic projections. That could mean those projections will underestimate future fertility, but it is also consistent with overestimation of future fertility by women.

Alternatively, an opposing bias could arise if preferences for children, careers and lifestyles may not be stable over age, so that some younger women underestimate their higher future preferences for children and, consequently, the number they ultimately bear. Both biases could be present, but manifested at different ages.

If rational expectations is not assumed, a general model might allow for period, cohort *and* age effects. In that instance, it is much harder to attribute changes to period effects. However, box G.1 shows that in realistic circumstances a regression of expected completed fertility against a dummy variable for 2006 and women's age or cohort will produce an estimate of the period effect that is, if anything, underestimated.

Balanced and unbalanced data

Where appropriate, we show results for both 'balanced' and 'unbalanced' samples. A balanced sample is one where observations on each person are available in both 2001 and 2006. Comparing across a balanced sample means that results relate to people from the same cohorts. It does not mean an absence of cohort effects — people from different cohorts may respond differently to period effects.

Balanced data control for changes in the mix of cohorts over time, though, in the context of the purposes of this study, the weights used for unbalanced data will largely deal with this issue anyway. Unbalanced results may also be more reliable because they are based on significantly larger samples and allow greater variation in some relevant variables (such as age). The construction of the HILDA survey in different waves particularly affects the sample size of balanced datasets. In wave 1, women from 17 years up to age 54 years were asked questions about their fertility, whereas in wave 6, only women aged 17 to 44 were asked. This means that a balanced sample requires that the ages covered are from 17 to 39 years in wave 1, and from 22 to 44 in wave 6, which excludes many respondents.

The results

Descriptive data analysis suggests some changes in the pattern of expected completed fertility over time.

Box G.1 **Distinguishing period, age and cohort effects**

A general formulation of period, cohort and age effects would allow year-by-year changes in all factors, but for the sake of illustrating the issues, we assume an additive linear form for the effects:

$$C_{it} = \alpha_1 + \alpha_2 age_{it} + \alpha_3 cohort_{it} + \alpha_4 Y2006_{it} + \varepsilon_{\text{it}} \text{ where t is either 2001 or 2006} \quad \{1\}$$

where C_{it} is the expected completed fertility of an individual i at time t, cohort is the year born, Y2006 is a dummy equal to 1 in 2006 and 0 in 2001 to capture the period effect, and ε is a white noise error term. The form of {1} simplifies any actual fertility behaviour since it allows for the possibility of 'fractional' children, but it provides ease of exposition.

Consider a person aged 20 in 2001. Their predicted C is α_1+20α_2+1981.α_3. In 2006, this person is aged 25 years and their predicted C is α_1+25α_2+1981.α_3+ α_4, so that the change in C from 2001 is 5 α_2+ α_4. Without identifying restrictions, the general model cannot be estimated due to linear dependence, so that only one pair of the three possible effects can be modelled. Suppose that C was estimated as a function of cohort and Y2006, so that:

$$C_{it} = \hat{\beta}_1 + \hat{\beta}_3 cohort_{it} + \hat{\beta}_4 Y2006_{it} + \xi_{\text{it}} \quad \{2\}$$

In that case, for the identical person above, we estimate that the change is $\hat{\beta}_4$, solely a period effect, when in fact some of the change is due to the effect of the (omitted) changing average age in the sample. If α_2>0 then this means that $\hat{\beta}_4$ is biased upwards as a measure of the true period effect. If α_2<0 then this means that $\hat{\beta}_4$ is biased downwards.

If, on the contrary, suppose that C was estimated as a function of age and Y2006, so that:

$$C_{it} = \hat{\phi}_1 + \hat{\phi}_2 Age_{it} + \hat{\phi}_4 Y2006_{it} + \vartheta_{\text{it}} \quad \{3\}$$

In that case, for the identical person above, the expected change in C is $5\hat{\phi}_2$ due to an age effect and $\hat{\phi}_4$ to the period effect. It is straightforward to show that $\hat{\phi}_2 = -\hat{\beta}_3$ and $\hat{\phi}_4 = \hat{\beta}_4 + 5\hat{\beta}_3$ (so that the expected total change is $\hat{\beta}_4$ as above, but with a different attribution to age and period effects). There is a reasonable prior that the cohort effect is negative (α_3<0). In that case, if the age effect is also negative (α_2<0), then $\hat{\phi}_4$ is biased downwards.

If rational expectations hold, the best estimate of α_4 will be that based on {2}, but even if rational expectations does not hold, there is a reasonable prospect that period effects will be underestimated. There are various techniques for distinguishing period, cohort and age effects through identifying restrictions, with little consensus on the best methodology. Nevertheless, further research could usefully apply several such restrictions to examine their implications for estimates of period effects.

There is a lower likelihood of expected lifetime childlessness in 2006 than 2001, and a corresponding increase in the likelihood of having just one child (table G.1). The picture for parity 2 and above suggest only small changes of indeterminate sign. This picture is consistent with a quantum effect, but could be confounded by age and cohort effects.

Table G.1 **Distribution of expected completed fertility (ECF)**
Balanced sample[a]

	Share of women in main reproductive years by number of ECF			
Number of expected completed children	*Unweighted*		*Weighted*	
	2001	2006	2001	2006
	%	%	%	%
0[c]	14.1	11.8	15.4	14.0
1	8.6	10.4	8.5	10.6
2	41.8	42.4	42.6	42.5
3	23.5	23.8	23.1	23.1
4+	11.9	11.6	10.4	9.8
Total	100.0	100.0	100.0	100.0

a The results are based on survey responses about expected lifetime fertility from women aged 17 to 39 years in 2001 (and since it is a balanced sample, those aged 22 to 44 years old in 2006). For example, the table shows that in 2001, 14 per cent of these women expected to have no children over their a lifetime, but that five years later, the same group of women had revised this number down to 11.8 per cent. The number of observations were 4258 unweighted and 3648 weighted (with the latter based on longitudinal weights).

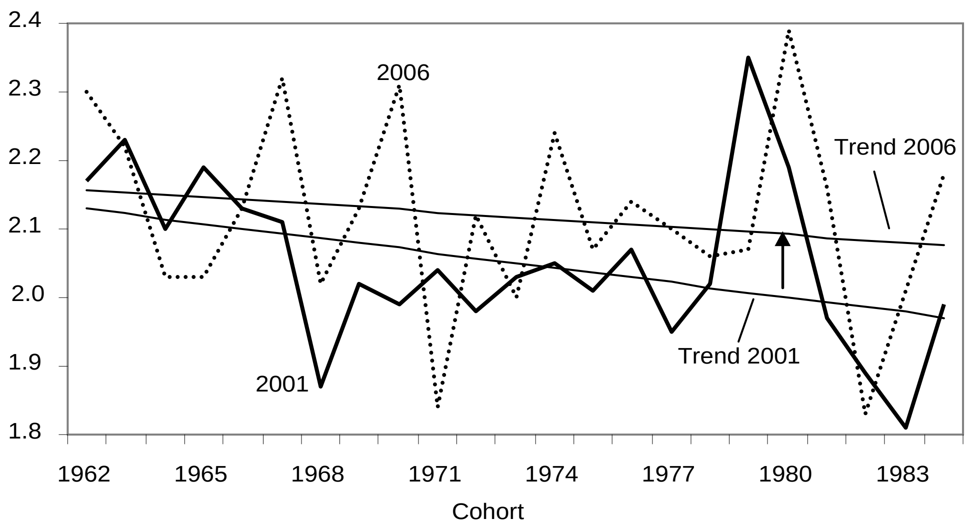
Source: HILDA database (waves 1 and 6).

The results for cohorts and age presents a more complex picture. In any given period, more recent cohorts tend to have slightly lower expected completed fertility than older cohorts. This is consistent with several hypotheses about the behaviour of women of more recent versus older generations. For example, the differences might entail a lower inherent desirability of children, differences in aspirations for careers, or greater selectivity of partners. But the differences are modest, with expected fertility still being around two for the younger and older cohorts of women in the sample — none of whom have completed their reproductive lives (figure G.1).

For any given cohort, there is a tendency for higher expected fertility in 2006 than 2001, which is evidence of a quantum effect. This shows up as the shift in the trend lines in figure G.1. There is a tendency for greater positive changes in the fertility of younger cohorts than older cohorts. A possible explanation for this is that older women have only a few years of reproductive life left and, accordingly, less opportunities than young women to take advantage of an environment more conducive to childbearing.

Figure G.2 summarises the *changes* in expected completed fertility between 2001 and 2006 as a function of cohort and age. Both show a tendency for higher fertility in 2006, with more bars above zero than below.

Figure G.1 **Expected completed fertility for different cohorts of women** [a]

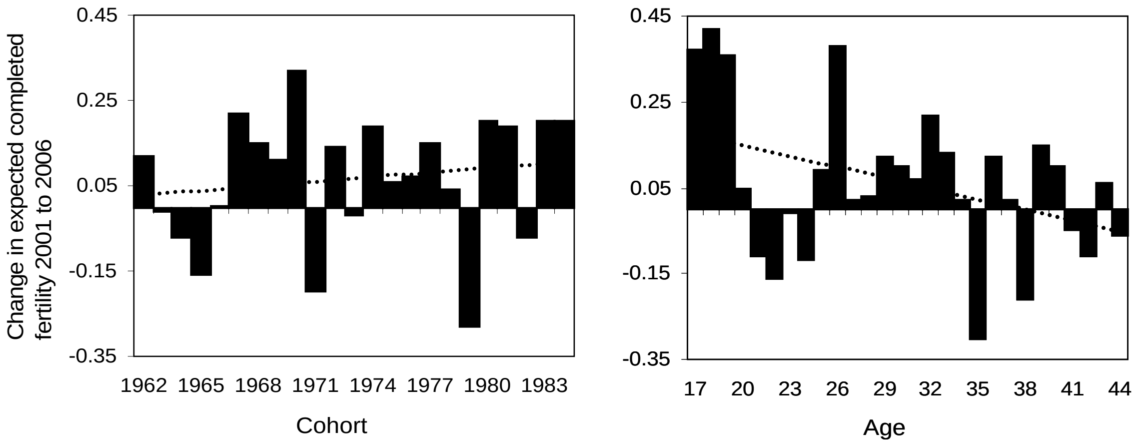


[a] Cohort is the year of birth of the woman. The results are based on unbalanced data weighted by cross-sectional weights. Balanced data using longitudinal weights produced a similar qualitative picture, except that the effects for younger cohorts were even greater relative to older cohorts.

Data source: HILDA database (waves 1 and 6).

Figure G.2 **Changes in expected completed fertility**

2001 to 2006, cohorts and ages[a]



[a] The left-hand side graph show the average change in ECF from 2001 to 2006 for cohorts born from 1962 to 1984. The other graph show this change for people of different ages. So, the average ECF of someone aged 25 in 2001 would be compared with the ECF of someone aged 25 in 2006. Note that this means the comparison is between people from different cohorts. The results shown are for weighted unbalanced data. The dotted lines show the trends in the changes by cohort and age. For instance, in the case of cohorts, there is a tendency for the change in ECF to be greater for more recent cohorts.

Data source: HILDA database (waves 1 and 6).

Some model results

A simple model of completed fertility summarises these period, cohort and age effects (table G.2), and finds statistically significant period effects.[3] The results imply that more recent cohorts (or younger people) experienced an increase in their expected completed fertility between 2001 and 2006 of up to 0.15 children per woman (table G.3). There was effectively no increase for cohorts of women born prior to the mid-1960s. As noted above, a likely explanation is that their fertility was close to completed already in 2001, with little scope for a change. Results for males echo those of females, except that males expect, on average, to have a lower lifetime number of children than women. (In part, this may explain why women's ideal number of children may not be realised).

These results are based on ordinary least squares, which are easy to interpret. However, fertility levels at the individual level must assume an integer value and predictions of negative outcomes are possible under OLS, but are clearly untenable. Nevertheless, analysis using a Poisson model found qualitatively similar effects.

An alternative approach is multinomial regression analysis, which considers the probability of varying parities in 2001 and 2006. Multinomial regression analysis confirms that, controlling for cohorts, fewer women expect to experience lifetime childlessness in 2006 than in 2001 (table G.4). There is a corresponding increase in the expectation of just having one child (and for more recent cohorts, also two and three children). There is also an increase in women's subjective view about the desirability and likelihood of future children (table G.5).

Overall, while not definitive, the HILDA results are consistent with a quantum increase in fertility from 2001 to 2006.

3 The simple model selected is conceptualised as a local approximation to Australia's recent fertility history, but linear cohort effects cannot be realistic in the long run as that would imply infinite or negative long-run expected fertility.

Table G.2 **Expected completed fertility**

Females and males, In 2001 and 2006

Models	*Females*	*Males*
		Coefficients & tests
The 'cohort' representation		
Constant	18.08 (3.3)	34.76 (8.8)
Y2006 (Dummy for 2006 wave)	-14.65 (1.9)	-17.64 (3.2)
Cohort (year of birth)	-0.00813 (2.9)	-0.0167 (8.3)
Interaction (Cohort × Y2006)	0.00746 (1.9)	0.00898 (3.2)
Significance of Y2006 variables	0.019	0.004
The 'age' representation[b]		
Constant	1.819 (20.4)	1.388 (18.4)
Y2006	0.277 (2.2)	0.293 (2.8)
Age of respondent (Age)	0.00813 (2.9)	0.0167 (8.3)
Interaction (Age × Y2006)	-0.00746 (1.9)	-0.00898 (3.2)
Significance of Y2006 variables	0.057	0.004

a Estimation is by weighted least squares of the unbalanced dataset (comprising 6930 observations). In contrast to the results above, the balanced dataset (based on significantly fewer observations) found no impact for the cohort or the interaction term, with a (statistically insignificant) small increase in expected completed fertility of 0.003 babies per woman from 2001 to 2006. There was also no significant period effect for males using the balanced dataset. **b** The 'age' representation was estimated, but given lack of identifiability its coefficients can be derived from the cohort representation. Namely, in a regression of ECF = $\alpha_1 + \alpha_2$ Cohort + α_3 Y2006 + α_4 * Cohort * Y2006 compared with ECF = $\beta_1 + \beta_2$ Age + β_3 Y2006 + β_4 * Age * Y2006, then $\beta_1 = \alpha_1 + 2001 * \alpha_2$, $\beta_2 = -\alpha_2$, $\beta_3 = \alpha_3 + 2006.\ \alpha_4 + 5.\ \alpha_2$ and $\beta_4 = -\alpha_4$. This underlines the fact that the regressions are not different ones, so the impacts of cohorts and age cannot be distinguished from each other.

Source: PC calculations based on waves 1 and 6 of HILDA.

Table G.3 **Implied quantum effects by cohort, 2001 to 2006**

Women and men

	Females			*Males*		
cohort	2001 value	2006 value	change	2001 value	2006 value	change
	Expected lifetime children per person					
1962	2.129	2.115	-0.013	1.995	1.973	-0.021
1963	2.121	2.115	-0.006	1.978	1.966	-0.012
1964	2.113	2.114	0.001	1.961	1.958	-0.003
1965	2.105	2.113	0.009	1.945	1.950	0.006
1966	2.096	2.113	0.016	1.928	1.942	0.015
1967	2.088	2.112	0.024	1.911	1.935	0.024
1968	2.080	2.111	0.031	1.894	1.927	0.033
1969	2.072	2.111	0.039	1.878	1.919	0.042
1970	2.064	2.110	0.046	1.861	1.912	0.051
1971	2.056	2.109	0.054	1.844	1.904	0.060
1972	2.048	2.109	0.061	1.828	1.896	0.069
1973	2.040	2.108	0.069	1.811	1.888	0.078
1974	2.031	2.107	0.076	1.794	1.881	0.087
1975	2.023	2.107	0.083	1.778	1.873	0.096
1976	2.015	2.106	0.091	1.761	1.865	0.104
1977	2.007	2.105	0.098	1.744	1.858	0.113
1978	1.999	2.105	0.106	1.727	1.850	0.122
1979	1.991	2.104	0.113	1.711	1.842	0.131
1980	1.983	2.103	0.121	1.694	1.834	0.140
1981	1.974	2.103	0.128	1.677	1.827	0.149
1982	1.966	2.102	0.136	1.661	1.819	0.158
1983	1.958	2.101	0.143	1.644	1.811	0.167
1984	1.950	2.101	0.151	1.627	1.804	0.176

Source: Table G.1.

Table G.4 What share of women expect to be childless or to have some children?

Results from multinomial regression analysis, 2001 and 2006 waves[a]

Women's expected completed number of children	*Balanced data*			*Unbalanced data*		
	2001	2006	Change	2001	2006	Change
	Proportion of women (%)			Proportion of women (%)		
1970 cohort						
0 children	13.7	11.5	-1.9	14.7	12.1	-2.2
1 children	8.9	10.6	2.1	9.5	10.1	0.8
2 children	41.7	42.4	0.3	40.8	41.8	0.7
3 children	23.6	23.9	0.0	22.9	24.2	1.2
4 children	8.8	8.2	-0.7	8.7	8.5	-0.2
5 or more children	3.3	3.4	0.2	3.4	3.2	-0.3
1980 cohort						
0 children	16.3	13.8	-2.5	17.6	14.5	-3.0
1 children	6.6	8.0	1.3	6.7	7.2	0.5
2 children	42.7	43.9	1.1	41.6	42.8	1.2
3 children	23.2	23.7	0.5	23.3	24.8	1.5
4 children	8.9	8.3	-0.6	8.5	8.4	-0.1
5 or more children	2.3	2.4	0.1	2.3	2.2	-0.1

[a] The table shows the predicted proportion of women having 0,1 to 5+ children over their lifetimes. Parity shares for two cohorts are compared — the group of women born in 1970 and those aged in 1980. The 2001 column shows the predictions of lifetime fertility by the two cohorts in 2001, while the 2006 column shows the revised expected lifetime fertility. For example, in 2001, 16.3 per cent of the 1980 cohort expected to be childless, while in 2006, 13.8 per cent expected to be childless. The change may be due to a period effect (or to age biases — see the main text). Results are unweighted as the multinomial logit estimation routine in the software used to calculate the estimates had no provision for weights.

Source: PC calculations based on waves 1 and 6 of HILDA.

Table G.5 **Changes to the desire for, and likelihood of, future children**
2001 and 2006[a]

Likert scale	Desire for future children		Likelihood of having future children	
	2001	2006	2001	2006
0 (Low))	42.6	33.4	45.7	36.5
1	2.6	3.3	4.3	5.0
2	3.0	3.1	3.2	3.6
3	2.0	2.1	2.2	2.5
4	1.3	1.7	1.5	2.1
5	7.1	6.6	8.0	6.9
6	2.8	3.0	2.4	2.8
7	4.2	5.3	3.9	5.6
8	6.0	8.2	6.2	8.7
9	4.5	6.6	4.5	6.4
10 (High)	23.8	26.7	18.1	19.7

a Based on the weighted unbalanced dataset (which means that the average age of the waves does not change appreciably).

Source: PC calculations based on waves 1 and 6 of HILDA.

G.2 The issue of mismatch

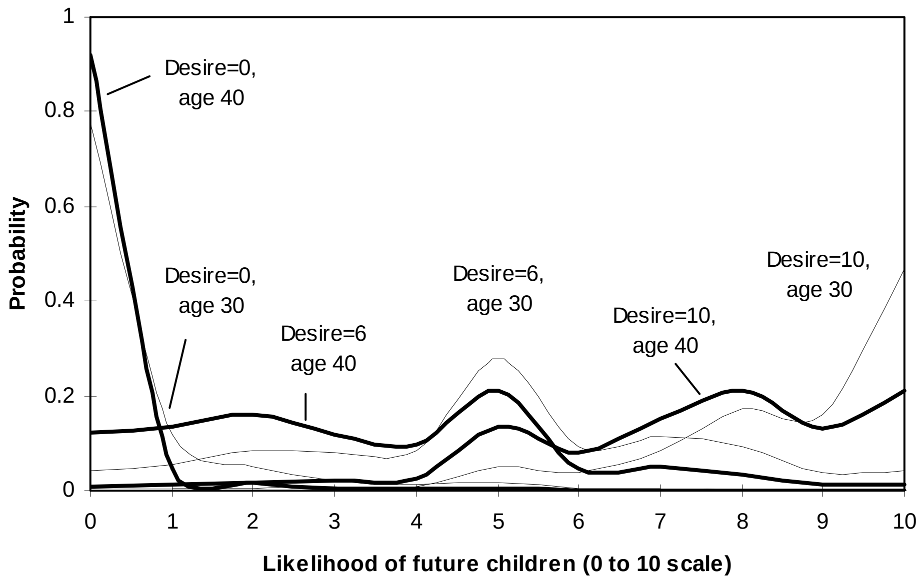
As discussed in chapter 4, many studies find a gap between the personally ideal and expected fertility of people. In HILDA, this gap can be assessed by considering the relationship between the desire for children (D) and either the mother's subjective rating of the likelihood of future children (L) or her intention to have future children (F).[4] D and L are measured using a scale from 0 to 10 (as discussed above), rather than as a number of children, but should still adequately represent the extent of the coincidence between the inherent desire for children and the likelihood that women's preferences will be realised.

The data suggest that there is a strong, but incomplete, correspondence between the desire for, the likelihood of, and intentions to have future children. Looking first at the link between desire and likelihood (figure G.3), women of all ages with a low desire to have future children uniformly say that it is unlikely they will have future children. However, the converse is not true. While women with a high desire to have future children believe that this will often be realised, the older the woman the less optimistic they are. For instance, a woman aged 40 years old with a very strong desire for future children has only a 20 per cent chance of having an equally high

4 F is an indicator variable equal to one if a woman says she intends to have one or more future children and zero otherwise (that is, F=1 if I>0, else F=0).

likelihood of having future children (that is, a score of 10 on 'desire' and 10 on 'likelihood').

Figure G.3 **Is the desire for children likely to be achieved?**



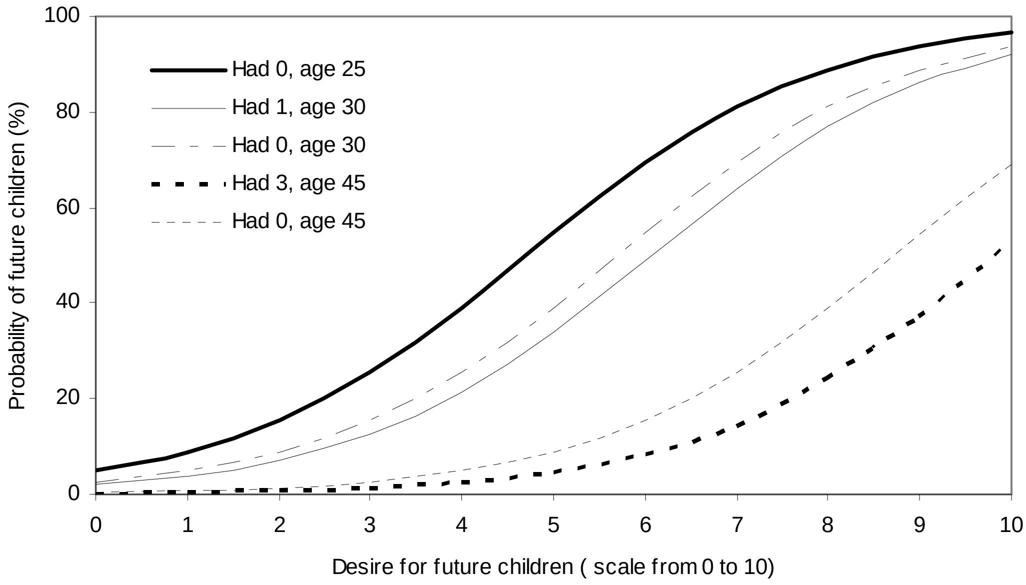
a The graph shows the relationship between the desire for future children (measured from 0 to 10) and the likelihood of actually having future children also on a 0 to 10 scale). For any particular score for desire (say D=6) there is some probability of getting a particular score in the likelihood indicator (say L=7). The graph shows these probabilities for women of different ages and with varying measures of desire for children. For example, a woman aged 30 with D=6 (ie a medium level desire for children) has around a 10 per cent chance of saying that L equals 7, but around a 30 percent chance of saying that L equals 5.

Source: PC calculations based on wave 5 of HILDA.

Similarly, the correspondence between the desire to have more children and the intention to have one or more future children (figure G.4) declines with greater age and with parity. The former may reflect the fact that fertility declines with age, affecting women's views about what they can realistically expect. The latter may reflect the costs of additional children and partners' preferences about the number of ideal children.

Figure G.4 **Fertility intentions correspond closely to fertility desires**[a]

Wave 5 of HILDA, 2005



a Based on a logit regression of intentions for more children (F) against the desire for children (D), age, children ever had and a constant. 2005 (wave 5) rather than 2006 (wave 6) of HILDA was used because of a survey complication that could affect the validity of inferences about the relationship between F and D. In 2001 and 2006 only women who gave an answer of 6 or more on the likelihood of future children were asked about their future number of intended children (presuming that a score below 6 would imply zero future intended children). In wave 5, the order of questions was different, so that all women were asked how many children they intended to have and *then* questions about the desire and likelihood of children. About five per cent of women who said they intended to have more children gave an answer of 5 or less on the likelihood of future children. By implication, some women who intended to have future children are probably omitted from the 2001 and 2006 surveys. Depending on the value of D for this omitted group, this could bias the relationship between desire for children and intentions to have one or more children. Consequently, wave 5 was used as it provides more complete data for measuring the association between F and D.

Source: PC calculations based on wave 5 of HILDA.

H Tempo effects

As this report has emphasised, changes in the total fertility rate (the snapshot measure of fertility) can reflect changes in women's lifetime fertility or timing effects. We believe that some of the recent increase in fertility reflects recuperation, some an increase in women's expected completed fertility rates and some the decisions by women to have babies earlier than they would have otherwise. Clearly, a permanent shift in the completed fertility rate of women affects long-run population levels and the age structure of the population. However, what are the demographic effects of changing the timing of childbearing without changing the lifetime number of children had by women?

It is not well understood that timing effects can also have persistent impacts on the size and age structure of a population. A good way of illustrating this is to consider the impact of the baby boom. The baby boom was characterised by two features:

- a substantial rise in completed fertility for the relevant cohorts of women
- bringing forward of births to younger ages compared with previous cohorts (a process that was subsequently reversed). Figure H.1 shows the change in the distribution for different birth cohorts of women of when they had children over their lifetimes.

What would have happened had the first effect had been present and the second had not? The answer to that question isolates the demographic effects of bringing forward children.

This question was modelled in several steps:

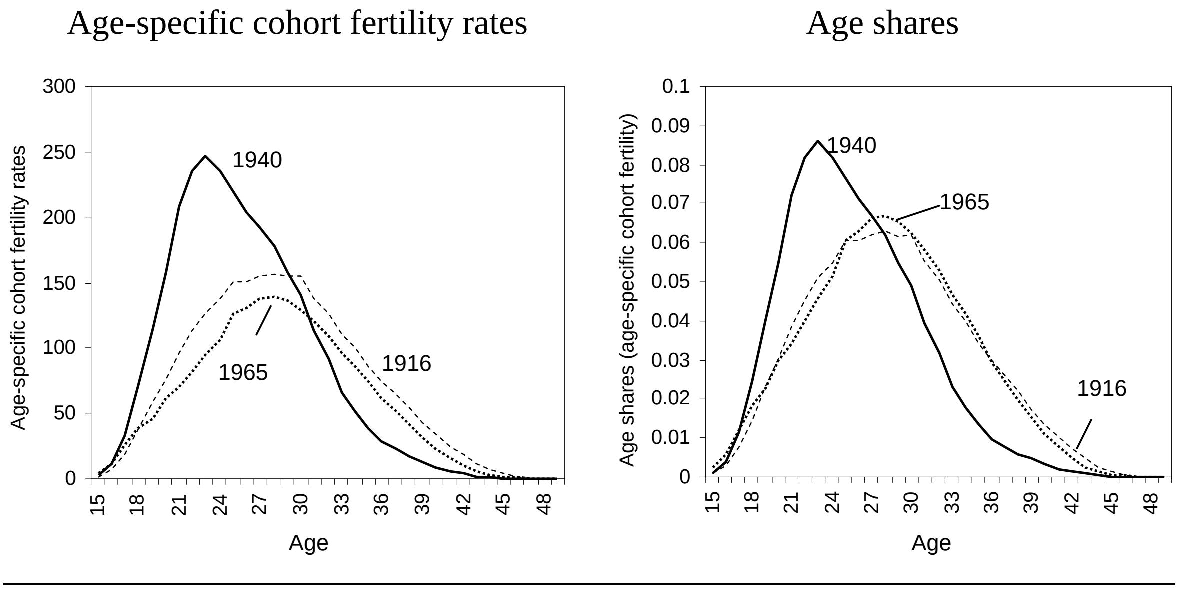
- Data on (period) age-specific fertility rates were obtained from the ABS for the period 1921 to 2006, supplemented by the 'base case' projections to 2101 used in the Commission's FERTMOD projection model of fertility.
- The average fertility rates for each year of the reproductive lives of the cohorts of women born from 1916 to 2052 were calculated.[1] These are the cohort equivalents of the period age-specific fertility rates, and provide the actual fertility rates experienced over the lifetimes of specific cohorts of women. As an illustration, figure H.1 shows the cohort-age-specific fertility rates for women

[1] Noting that data to 2101 is needed to derive the estimate of the CFR for the 2052 cohort.

born in 1916, 1940 and 1965. Summed over women's reproductive years, this gives the average completed fertility rate of the relevant cohorts.

- The shares of the completed fertility rate accounted for by each year of women's reproductive lives were calculated (with figure H.1 showing the shares for selected years, and revealing the distinctive nature of the distribution for women who gave birth during the baby boom generation).
- The cohort-age specific fertility rates applicable to all cohorts born after 1939 were calculated, with the assumption that each cohort's completed fertility rates stayed the same as before, but that the age-shares of the completed fertility rates were fixed at those applying for the 1916 birth cohort.
- The implied period age-specific fertility rates were then derived from the cohort data, as was the total fertility rate. This alternative set of data can then be used in the standard cohort-component population model to project Australia's population from 1955 to 2101. The difference between demographic outcomes from these and the original data reflect the impact of bringing forward childbearing during the baby boom (and subsequent tempo effects).

Figure H.1 **The changing picture of cohort fertility behaviour**
1916, 1940 and 1965 birth year cohorts of women



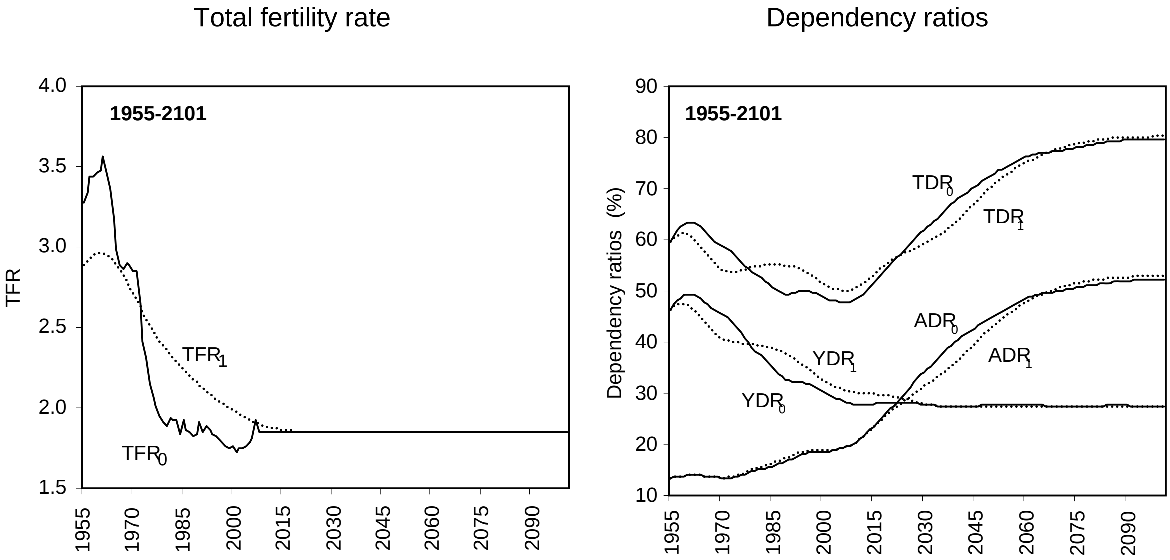
Data source: Data provided by ABS to 2006, with subsequent years derived from the 'base case' scenario of FERTMOD.

A significant part of the rise in the total fertility rate apparent during the baby boom era reflected decisions by women to bring childbearing forwards. TFR_0 in figure H.2 is much higher (initially) than the total fertility rate that would have prevailed had the baby boom occurred without any change in the timing of children (TFR_1). This tempo element of the baby boom meant that the dependency ratio rose significantly above the level that would have applied had no timing effects been apparent. As the baby boom subsided, women started to shift back to the timing pattern characterised in the earlier period (and indeed have since pushed childbearing into even older ages).

This meant that the number of children born declined compared to the situation in which timing effects were held fixed. This is why the youth and total dependency rates would have been higher in the half century from the 1980s had the timing of childbearing stayed fixed.

Figure H.2 **Demographic effects of bringing forward childbearing**

A baby boom without a change in the timing of children



a ADR is the aged dependency ratio (the number of people aged 65 years or more expressed as a percentage of the number aged 15–64 years); YDR is the youth dependency ratio (the number of people aged under 15 years expressed as a percentage of the number aged 15–64 years). The TDR — the total dependency rate — is the sum of the two. A 0 subscript denotes the base case (the dependency rates anticipated had the age-specific cohort shares of the CFR changed), and 1, the alternative (fixed age shares).

Data source: PC calculations.

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