

# Fertility assumptions for the 2006-based national population projections

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Fertility is one of the key components of the national population projections, alongside mortality and migration. For the 2006-based population projections, long-term completed family size in the UK is assumed to be 1.84 children per woman. This represents an increase of 0.10 on the assumption of 1.74 children per woman used in the 2004-based round.

Although the UK's long-term fertility assumption has been lowered several times in recent years, this is the first time it has been raised since the 1960s baby boom. This article outlines why ONS decided to raise the long-term fertility assumption for all four UK countries in the 2006-based population projections.

## Introduction

National population projections based on the mid-2006 population estimates for the UK and constituent countries were published in October 2007. Further information on these projections can be found in Bray (2008)<sup>1</sup> in this edition of *Population Trends*.

This article focuses on the fertility assumptions used in the 2006-based projections. These assumptions are made in terms of the average number of children that women are expected to have over their lifetimes (known as completed family size or CFS – see Box One). The headline assumptions refer to the ultimate level that fertility is projected to reach in the long-term, that is the average number of children that cohorts of women born in the mid-1990s and later are assumed to have. Underlying these headline assumptions are the ultimate age-specific fertility rates assumed for these cohorts and the path that these rates take from their 2006 level to their long-term projected level. However, this paper concentrates on how ONS set the headline assumptions.

Table 1 shows that the UK fertility assumption has been lowered a number of times since the 1971-based projections, where women were assumed to have an average of 2.32 children in the long-term. Assumed fertility was set below replacement level<sup>2</sup> for the first time in the 1985-based projections. By the 2000-based projections, the assumed CFS had fallen to 1.74 children per woman and was kept at this level for the 2002-based and 2004-based rounds.

During 2007 ONS undertook a full-scale review of the assumptions underlying future fertility for England, Wales, Scotland and Northern Ireland. Following consultation with key users of national population projections and advice from an expert advisory panel<sup>3</sup>, the final

**Table 1**

**Long-term completed family size assumed in UK population projections; 2006-based and selected previous projections**

Projection round	Completed family size assumption
1971-based	2.32
1983-based	2.10
1987-based	2.00
1992-based	1.90
1998-based	1.80
2000-based	1.74
2002-based	1.74
2004-based	1.74
2006-based	1.84

assumptions for the UK and constituent countries were agreed in liaison with the devolved administrations. The UK fertility assumption of 1.84 agreed for the 2006-based projection is 0.10 higher than in the previous round and represents the first rise in assumed long-term fertility for many years.

For the 2006-based projections, the long-term CFS assumptions for both England and Wales have been raised to 1.85 (Table 2). The assumed long-term CFS in Scotland has been increased to 1.65 and that for Northern Ireland increased to 1.95. Fertility assumptions for individual countries are conventionally given as multiples of 0.05. The UK assumption is derived by aggregating the four constituent country assumptions and therefore may not be a multiple of 0.05; however, this should not be taken to imply a greater degree of precision in the UK assumption. Although projections analyses are made at the individual country level, much of the discussion here focuses for conciseness on the UK as a whole.

**Table 2**

**Long-term completed family size assumed in population projections, UK and constituent countries; 2006-based and selected previous projections**

	England	Wales	Scotland	Northern Ireland	United Kingdom
2000, 2002 and 2004-based	1.75	1.75	1.60	1.80	1.74
2006-based	1.85	1.85	1.65	1.95	1.84

This article reviews the evidence used by ONS during 2007 in considering the fertility assumptions. It describes recent trends in UK fertility and some possible underlying explanations for these. It then discusses future prospects for completed family size for women born in different years and explains how and why the decision was taken to raise the assumed level of future fertility in the 2006-based population projections.

## Recent trends in period fertility

### Recent increases in the Total Fertility Rate

Setting appropriate fertility assumptions for the 2006 round of UK population projections was particularly challenging, given the climate of changing fertility trends over the past decade.

Since 2001, the Total Fertility Rate (TFR – see Box One) in the UK has been increasing steadily (Figure 1). By 2006, it reached 1.84 children per woman, its highest level since 1980. This upturn followed declining UK fertility during the 1990s, culminating in a record low TFR of 1.63 in 2001.

When ONS set the fertility assumptions for the 2004-based projections, it was considered too early to judge whether the upward rise in fertility would be sustained. Therefore the long-term assumption was kept at 1.74, as in the previous round (although fertility levels assumed in the short-term were raised slightly). However, it was noted at that time that if trends seen at the start of the decade were to continue, there would be a case for raising the long-term assumption in the 2006-based round<sup>4</sup>.

**Figure 1**

**Total Fertility Rate, United Kingdom, 1961–2006**

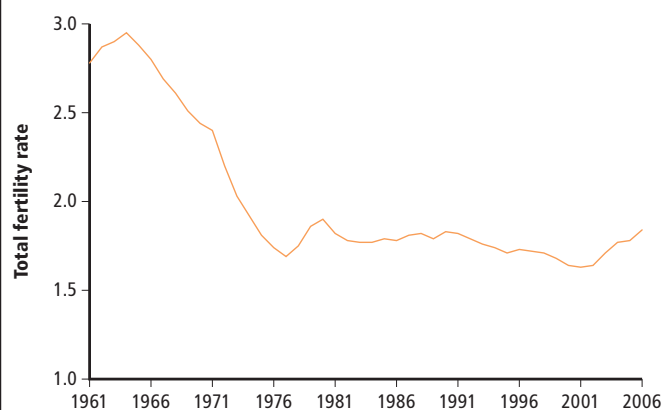
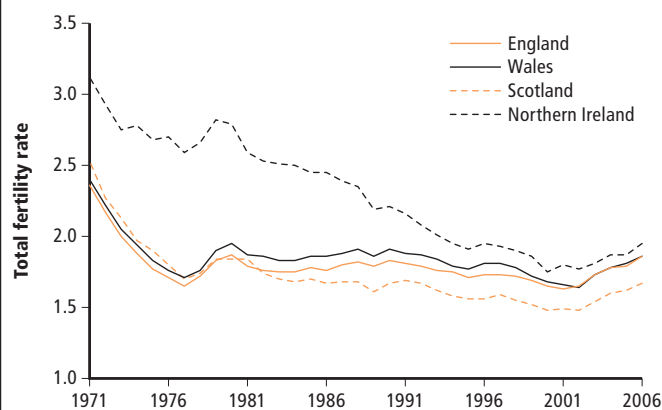


Figure 1 shows clearly that the increases in fertility since 2001 have been maintained over the five years to 2006, and provisional births data for early 2007 show no signs of this trend reversing. This made it necessary to re-examine the long-term level of fertility used in UK population projections and to consider an upward revision. Of course it does not necessarily follow that fertility will continue to increase in future – following the low fertility of 1977 the TFR increased for three years before resuming its downward course; however, the recent upturn has been more sustained than the recovery seen in the late 1970s.

All four UK countries have experienced a rising TFR in recent years (Figure 2). The TFR in England rose from a low of 1.63 in 2001 to 1.86 by 2006. This increase was mirrored in all Government Office Regions, despite continuing regional variation in the level of fertility. Similarly, the TFR in Wales rose from 1.64 in 2002 to 1.86 in 2006. Northern Ireland, which has historically had higher fertility than the rest of the UK, experienced an increase from 1.77 in 2002 to 1.94 by 2006. Scotland's TFR, which has been below the UK average over the past decade, saw an equally strong upturn from 1.48 in 2002 to 1.67 in 2006.

**Figure 2**

**Total Fertility Rates, UK countries, 1971–2006**



## Box one

### Period and cohort measures of fertility

The Total Fertility Rate (TFR) is the average number of children that a group of women would have if they experienced the age-specific fertility rates for a particular year throughout their childbearing lives. For example, a TFR of 1.84 for the UK in 2006 means that, on average, a woman would have 1.84 children during her lifetime, based solely on fertility rates at each age in 2006.

The TFR is a 'period' measure that uses data from a particular time period to provide a snapshot of the current level of fertility. It does not represent the experience of a 'real' group of women. Changes in the timing of childbearing may influence the TFR; for example if women are delaying childbearing to older ages, the TFR may underestimate average family size. Conversely, if women are having children at younger ages than previous generations, the TFR will overestimate average family size. For this reason the TFR is more volatile year-on-year than the completed family size of cohorts.

Completed Family Size (CFS) is the average number of children that women born in a particular year have had by the end of their childbearing years. For example, UK women born in 1961 had a CFS of 1.96; just below two children on average.

The CFS is a cohort measure of childbearing and represents the fertility experience of real generations of women. Since it is based on women who have reached the end of their childbearing years, the CFS does not provide a timely measure of family size. However, it is possible to analyse the fertility experience of women who have not yet completed childbearing on a cohort basis by comparing the average number of children achieved by particular ages.

The recent rise in UK fertility has been somewhat unexpected given the climate of low and declining fertility in much of Europe during the 1990s. However, several other developed countries, including France, Sweden, Denmark, Finland and Australia, have experienced similar increases in their TFR over the past five years. Although the UK had the fifth highest TFR in the European Union in 2006, its fertility is not exceptional among developed countries, for example France and the USA saw TFRs of 2.0 and 2.1 respectively in 2006<sup>5</sup>.

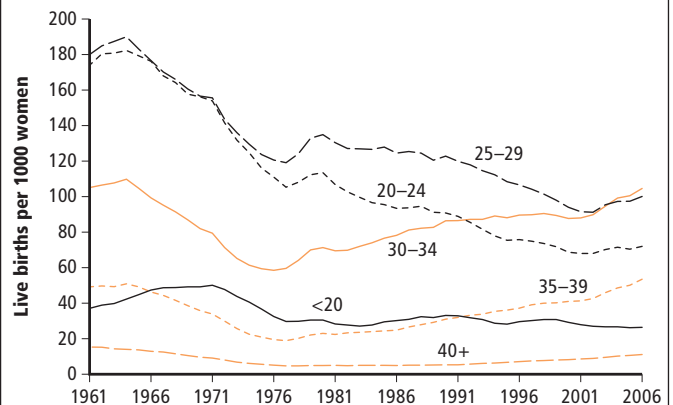
### Age and parity

Since future fertility is projected by age and parity (that is, the number of children a woman has had), an understanding of the age and parity composition of recent fertility trends is essential for making plausible projections.

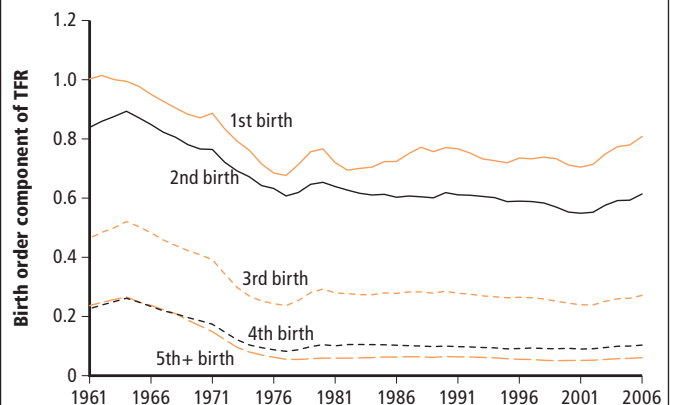
The recent increase in the TFR in the UK has been driven mainly by faster increases in fertility rates for women in their thirties and forties, continuing the long-term trend that started in the late 1970s (Figure 3). By 2006, women aged 30 and above were contributing 46 per cent of overall fertility, compared with 42 per cent in 2001 and only 26 per cent in 1980 when the TFR was last higher than in 2006. The fertility rate at age 30–34 exceeded the rate at age 25–29 for the first time in 2004, making the early thirties now the most fertile age group.

In addition to the continuing increases in fertility among older women, the UK has also witnessed a reversal in fertility trends for younger women in very recent years. During the 1980s and 1990s fertility rates for women aged 20–24 and 25–29 fell consistently, as women postponed their childbearing to later ages. However, since 2001 there have been increases in fertility rates among the 25–29 age group and to a lesser extent for those aged 20–24. Only the 'under-20' age group has not experienced rising fertility during this period.

**Figure 3** Age-specific fertility rates, United Kingdom, 1961–2006



**Figure 4** Trends in birth order components of the Total Fertility Rate, England and Wales, 1961 to 2006



Note: Figure 4 shows the contribution that first births, second births and so on make to the TFR. The birth order components for each year sum to the total fertility rate for that year<sup>6</sup>.

Figure 4 shows that the increase in the TFR since 2001 has resulted from increases in fertility at all parities. The strongest rise has been in first births. Compared with 1980 (when the TFR was last higher than in 2006), first births made a larger contribution and higher order births a slightly smaller contribution to the TFR in 2006 than in 1980.

Figures 3 and 4 underline the fact that the recent increases in UK fertility have been almost universal and not confined to specific age groups or parities.

### Why has period fertility increased since 2001?

There is no single explanation for the recent increase in the UK TFR, which is likely to have resulted from a combination of complex factors. Three possible influences are discussed briefly below, but this list is not intended to be exhaustive. The likely impacts of these factors in the near future are also outlined.

#### Timing of births and the TFR

In most developed countries, women have been increasingly delaying both partnership formation and childbearing to later in life. In the UK this is clearly evident from the increasingly high fertility of women in their

thirties and forties and the rising mean age at first birth (from 25.2 years in 1986 to 27.4 by 2006 in England and Wales<sup>7</sup>). Explanations for this postponement of childbearing have been widely documented and include delayed marriage and partnership formation, widening participation in higher education and increasing female participation in the labour force<sup>8</sup>. Delayed fertility is often associated with longer-term reductions in completed family size, since intentions to have children later in life may not be fully realised for a variety of reasons.

Postponement of childbearing has generally led to short-term reductions in period fertility in developed countries. When women in their twenties start to delay childbearing, fertility rates at these ages fall and, other things being equal, the TFR is reduced by this timing change. This postponement contributed to the low TFR seen in the UK during the 1980s and 1990s. Once fertility rates at older ages rise and a pattern of later childbearing is fully established, the TFR would be expected to recover. In the current UK context, while such a 'recovery' may explain some of the recent rise in the TFR, it is clearly not the whole explanation. As well as continuing increases in the fertility of older women, the fertility of women in their twenties is also rising. This could suggest that women currently in their twenties are delaying their fertility to a lesser extent than women of that age in previous years. It is the combination of fertility trends in these two age groups that has led to the recent increases in the UK TFR.

The degree to which women currently in their twenties delay their childbearing to older ages will impact on period fertility over the next few years. Although rising fertility rates in this age group could indicate a lower degree of postponement in future, the signs are mixed. One could speculate that women now in their twenties could postpone their fertility to a lesser extent than those now in the older childbearing ages, if for example full-time employment or lack of a stable partnership became less of a barrier to childbearing in future<sup>9</sup>. However, if the proportion of women participating in higher education carries on rising and younger women continue to delay marriage and partnership formation, further delay in parenthood is to be expected.

### International migration

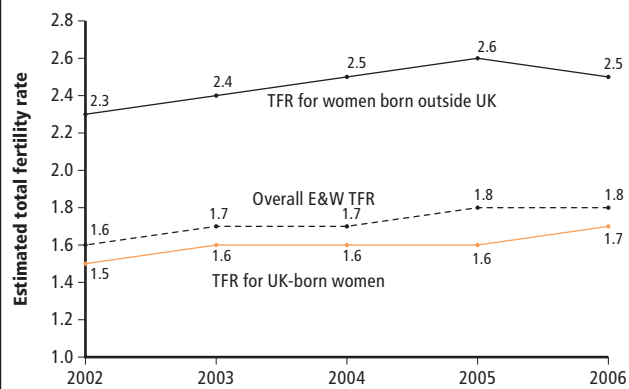
Quantifying the contribution of international migration to the recent increases in fertility rates is far from straightforward. For example, no information is available on the past or future fertility of women who emigrate from the UK and therefore how out-migration affects the UK fertility rate.

However, it is known that female in-migrants born in certain countries<sup>10</sup> have higher period fertility rates than others. For example, in 2001, women born in Pakistan and living in England and Wales had a TFR of 4.7 compared with an average 1.6 for UK born women<sup>11</sup>. Between 2002 and 2006 the TFR increased among both UK born and non-UK born women (Figure 5), although the TFR remained higher for the non-UK born (2.5 in 2006 compared with 1.7 for UK born women).

Considering age-specific fertility, both UK born and non-UK born women in their late twenties, thirties and forties have experienced increasing rates since 2002<sup>13</sup>. But the increases in fertility at ages 20–24 appear to have been driven solely by women born in the UK. Therefore, although in-migrants may be contributing to rising period fertility, migration is certainly not the only underlying cause.

The contribution of foreign-born women to the overall UK TFR might be expected to increase slightly in future, purely due to their making up an increasing proportion of the population of childbearing age. Net in-migration is projected to remain at high levels and migrants already resident in the UK (if they remain) will be moving through the peak childbearing ages for some time to come<sup>14</sup>. However, any impact on the

**Figure 5** Estimated total fertility rates for UK born women and non-UK born women, England and Wales, 2002 to 2006



Note: estimates based on births by mother's country of birth from birth registrations and female populations by country of birth from the Labour Force Survey<sup>12</sup>.

TFR could be dampened if fertility within key migrant-sending countries fell or the proportion of in-migrants to the UK originating from lower-fertility countries (such as EU countries) increased. Any convergence in fertility between recent in-migrants, the second generation and indigenous UK born women will also reduce the impact of in-migration on UK fertility in future.

Although both UK born women and those born outside the UK have contributed to recent increases in period fertility, it is important to note that the higher TFR estimated for non-UK born women does not necessarily imply higher completed family sizes in this group. Some of the differentials in period fertility may simply result from timing effects associated with international migration. For example, there may be some acceleration of childbearing after migration, pushing period fertility upwards in the short-term<sup>15</sup>. Having said that, evidence suggests that intended family sizes are higher among certain groups of women born outside the UK than among the UK born<sup>16</sup>.

### Changes in support for childbearing

Over the past decade the UK has seen a wide range of policy changes with financial implications for pregnant women, parents and families. In 1999 the government introduced a set of reforms to benefits for low-income families with children, including the Working Families Tax Credit (WFTC). Shortly afterwards, other changes benefiting all families with children were brought in, including the Child Tax Credit and increases in child benefit for first children. Adam and Brewer (2004)<sup>17</sup> have estimated that state financial support for children in the UK grew 52 per cent in real terms between 1999 and 2003.

Other recent changes may have made it easier to combine employment with parenthood. The Employment Act 2002<sup>18</sup> increased the length of paid maternity leave from 18 to 26 weeks, improved rates of maternity pay and gave women the option of a further 26 weeks of unpaid maternity leave. Two weeks of paid paternity leave also became available to fathers. Both parents of children under five gained entitlement to 13 weeks of unpaid parental leave for childcare purposes. From April 2003, employees with children aged below six have also had the right to request flexible working to help combine employment and family responsibilities.

In 2004 the government set out plans for further changes to give parents more choices in balancing their work and family responsibilities<sup>19</sup>. The Work and Families Act 2006 increased the length of paid maternity leave from 26 to 39 weeks<sup>20</sup>. The intention is to extend paid maternity leave

further to 52 weeks by the end of this Parliament and to enable mothers to transfer part of their maternity leave and pay to fathers<sup>21</sup>. The 2006 Act was implemented for women giving birth from April 2007, so any impact on fertility would not yet be apparent.

There is much debate over whether government policy can influence women's completed family sizes, rather than simply change the timing of births<sup>22</sup>. None of the policies above were put in place with explicit pro-natalist intentions. Instead, the drivers were varied and included reducing child poverty, encouraging lone parents into employment and improving gender equality. However, it is not inconceivable that these policies, rather than directly 'causing' fertility change, could be having an impact on fertility by creating an environment where women can more easily combine work with having a family. For example, Brewer, Ratcliffe and Smith (2007)<sup>23</sup> concluded that the Working Families Tax Credit had some positive impact on the fertility of women in couples, increasing the probability of a birth by 10 per cent. Although this finding is consistent with the increase in period fertility, it remains to be seen whether it also implies higher completed family sizes for these women or not.

## Summary

The difficulties in determining and quantifying the causes of fertility trends should not be underestimated. Childbearing decisions made by men and women, as individuals and couples, are based on a wide range of personal, social and economic factors, some of which can be measured at the aggregate level, while others cannot. A full discussion of these is outside the scope of this paper but it seems likely that the three factors outlined above (changes in the timing of births, international migration and changes in support for childbearing) could all be contributing to some extent to recent rises in period fertility in the UK.

## Recent trends in cohort fertility

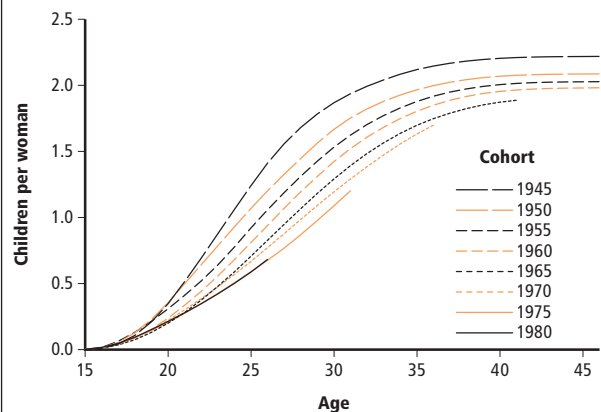
The previous section noted that, although the TFR gives the most up-to-date summary measure of fertility, it is affected by changes in the timing of births within women's lives. Therefore the assumptions used for population projections are formulated in terms of the completed family sizes of cohorts of women, since this measure is more stable.

Completed family size has fallen steadily among UK women born between 1940 and 1960. Women born in 1940 had on average 2.39 children by age 45. Fertility fell below replacement level in the 1951 cohort and has remained below replacement level since then. Women born in 1961, the most recent cohort to have reached age 45, had 1.96 children on average by the end of their childbearing years<sup>24</sup>.

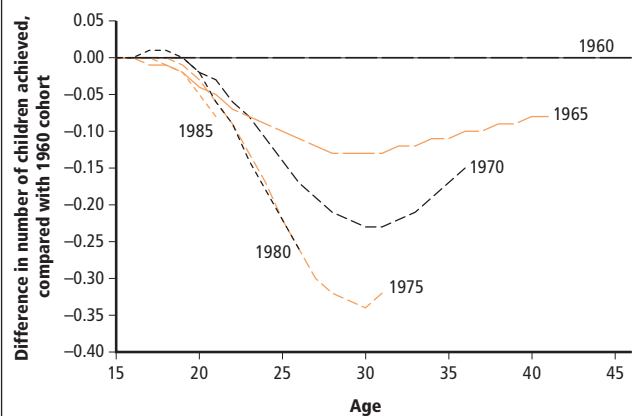
For the purposes of setting future fertility assumptions, the fertility of women born since 1961, who have not yet completed their childbearing, is of much more interest. Figure 6 shows clearly that the 1965, 1970 and 1975 cohorts have had fewer children by ages 25, 30 and 35 than earlier cohorts. At first sight these figures do not appear to support raising the fertility assumption.

However, cohort data do show strong recuperation at older ages for women born between 1961 and 1975 (aged in their thirties and forties in 2006). These cohorts who delayed their fertility at younger ages have been experiencing relatively high rates at older ages compared with earlier cohorts. For example, women born in 1970 had 0.47 children between ages 30 and 35 compared with 0.44 children for women born ten years earlier. Similarly, women born in 1965 had 0.22 children on average between ages 35 and 40, compared with only 0.16 for the 1955 cohort. Thus their completed family sizes will not be as low as they would have been had their fertility at older ages stayed at levels experienced by earlier cohorts.

**Figure 6** Average achieved family size by age, women born 1945 to 1980, United Kingdom



**Figure 7** Comparison of achieved fertility by age for 1965 to 1985 cohorts with 1960 cohort, United Kingdom.



This recuperation at later ages is illustrated further in Figure 7, which compares the achieved fertility of recent cohorts with that for women born in 1960. Although the 1965, 1970 and 1975 cohorts fell increasingly behind the 1960 cohort during their twenties, the curves for these cohorts after age 30 lead increasingly steeply upwards towards the 1960 level.

Turning to women born in the early 1980s (in their twenties in 2006), Figure 6 shows that the 1980 cohort had achieved the same family size by age 26 as the 1975 cohort (an average of 0.68 children). This represents a marked difference from the earlier pattern where successive cohorts achieved slightly lower fertility at each age than their predecessors, and suggests that falls in cohort fertility could be bottoming out. However in the 1980 cohort this is partly due to slightly higher teenage fertility.

The 1985 cohort has experienced lower levels of teenage fertility than the 1980 cohort but since they had only reached age 21 by 2006, it is impossible to speculate on their future fertility with any certainty. However, if this cohort were to experience 2006 period fertility rates at ages 22 to 26, they would also achieve 0.68 children by age 26, the same as the 1975 and 1980 cohorts.

In summary, recent rises in period fertility at all ages are starting to have some impact on the family sizes already achieved at different ages by cohorts who have not yet completed their fertility. Possible future paths of fertility for these cohorts are discussed next.



## Future prospects for UK fertility

The previous sections have described strong increases in period fertility in the UK at most ages and outlined some possible explanations for these. However, the impact of rising period fertility on the future completed family sizes of more recent cohorts is less clear. This is because period measures of fertility are affected by the timing of childbearing within women's lives<sup>25</sup>. For example, if policy changes are having any upward impact on period fertility rates, the question is whether this simply represents women having births earlier rather than later (a timing change), or whether women now in their twenties and thirties will actually go on to have more children in total as a result. Similarly, for some groups of in-migrants it is not yet clear whether their higher period fertility relative to the UK born is due to acceleration of fertility post-migration, or whether they will go on to have larger families. More work is needed to disentangle these timing effects from real changes in completed family size.

Clearly there is uncertainty inherent in making assumptions about future fertility<sup>26</sup>. When assumption-setting, it is essential to consider plausible trends for different age groups (from a period perspective) and for women born in different years (from a cohort perspective). These trends for age groups and cohorts can then be combined numerically to reach a credible assumption for the overall level of fertility. For simplicity, the discussion below considers two groups of women separately: those currently aged 30 or over and those currently aged below 30.

### Women aged 30+ in 2006

Cohorts of women born during the late 1960s and early 1970s, aged in their thirties in 2006, have already experienced a good part of their childbearing lifespan, so only future trends in fertility at older ages need to be considered in making assumptions about their completed family sizes. From a period perspective, fertility rates for women in their thirties and forties have been increasing steadily since the early 1980s (Figure 3) and the expert advisory panel agreed that there is potential for fertility rates in these age groups to rise further, given biomedical advances and the increasing social acceptability of childbearing at older ages. Bearing this in mind, alongside the possible impacts of international migration and improvements in financial support for families on period fertility at all ages, it is difficult to find any clear arguments that would point to a decrease in fertility rates at ages over 30 in the immediate future.

From a cohort perspective, although women born during the late 1960s and early 1970s have had lower fertility in their twenties than women born a decade earlier, it seems likely that they will catch up to a certain extent at older ages (indeed those born in the late 1960s have already had higher fertility in their early thirties than those born 10 years earlier). These cohorts may recuperate more than expected if the factors discussed above exert a strong upward influence on fertility rates at older ages.

### Women aged below 30 in 2006

For women born in the late 1970s and early 1980s, who were in their twenties in 2006, completed family size is much harder to project, as these women are only a short way through their childbearing lifespan. Future fertility becomes even more speculative for those born in the late 1980s (teenagers in 2006) and those born after 1991 (who have not yet reached childbearing age). Projecting completed family size for these groups involves not only projecting the path of fertility rates for women aged below 30 in the immediate future, but also making assumptions about fertility rates at older ages for these cohorts compared with their predecessors.

Until recently it was assumed that fertility rates for women in their twenties would continue to decline, as seen during the 1980s and 1990s, but recent trends have shown that this is not necessarily the case (Figure 3). Although it is by no means certain that the upwards trends in fertility

at these ages will continue, it is certainly possible, given recent policy changes supporting maternity and childbearing alongside the ongoing contribution of women born outside the UK, to increases in fertility at ages 25–29.

Although it is easy to overlook the importance of teenage fertility, the completed family size of different cohorts is partly determined by their teenage fertility and teenagers currently contribute more than twice as much to the TFR as women aged 40 and over. Fertility rates for women under 20 have been on a gradual downward trajectory since 2000. Although this trend cannot continue indefinitely, if it continues in the short run, it could have a slight dampening effect on the completed family size of the most recently born cohorts of women under consideration here.

For cohorts born from the late 1970s onwards, projections must take into account any dependencies between fertility rates experienced at younger ages and the fertility of the same cohorts of women at older ages, rather than considering future trends in fertility for different age groups independently. If present trends continued indefinitely, then women currently in their teenage years or early twenties would have more children by age 30 than comparable cohorts born five or ten years earlier. They would also have relatively high fertility in their thirties and forties like previous cohorts, resulting in higher completed family sizes. However, an alternative scenario is that women in their twenties with higher fertility at younger ages could have fewer births at older ages and thus reach their mid-forties with a similar number of children to their predecessors. This would effectively represent the converse of postponement with women bringing forward childbearing to younger ages and having lower fertility at older ages as a consequence.

In summary, there were three key considerations in setting the principal fertility assumption for the 2006-based projection round. These were:

- the extent to which fertility rates at older ages are likely to continue to increase
- the likely future course of fertility rates for women in their twenties
- for women born after the mid-1970s, the likely impact of fertility trajectories up to age 30 on fertility after age 30

The next section discusses how final decisions about assumed future fertility were made, after exploring various options for the above.

## Finalising the fertility assumptions

### The UK assumption

In order to reach a plausible long-term fertility assumption for the UK, a variety of factors were considered, in particular the completed family sizes calculated to result from a range of scenarios relating to possible trends in fertility at different ages. Other factors taken into account included the views of the expert advisory panel, the latest available provisional births data and the UK assumptions used in UN and Eurostat projections<sup>27</sup>.

The recent increase in UK period fertility and the impact this has already had on achieved family sizes clearly supported raising the long-term fertility assumptions for the 2006-based population projections. An increase would mitigate the risk of 'assumption drag' noted by Shaw (2007)<sup>28</sup>, whereby assumptions lag behind actual events. In the current situation of increasing fertility, this 'drag' would lead to under-projection of births in the short-term. Of course, the opposite risk of overreacting to new trends and making changes that subsequently need to be reversed must also be considered.

The key judgement was by how much to raise the UK fertility assumption. The decision over whether to raise the UK assumption by

0.10 (to 1.84) or even 0.15 (to 1.89), or whether to take a more cautious approach of raising it by 0.05 (to 1.79) was not straightforward.

When asked their views on the likely level of the UK TFR in 2030, three out of six members of the expert panel estimated a future value between 1.75 and 1.85, while two estimated a higher and one a lower value. The mean value given was 1.78, or 1.83 excluding the particularly low outlier. On balance the responses supported increasing the long-term assumption from 1.74 but did not provide a clear steer on the most appropriate level.

In Spring 2007 detailed work was carried out within ONS to project the long-term completed family size in the UK and constituent countries resulting from various scenarios for future fertility<sup>29</sup>. Scenarios that assumed fertility would increase at all ages until 2008 but then fall back below 2006 levels gave ultimate completed family sizes for the UK of between 1.70 and 1.80.

Under the cautious scenario that fertility rates for older women continued to increase for several years but those for younger women resumed their long-term downward trend, completed family size would ultimately stabilise at around 1.80. If instead, fertility rates for younger women were held constant into the future, completed family size would be higher at around 1.90. These figures show that, even if they rose no further, the impact of the higher fertility rates already experienced at younger ages on plausible trajectories of future fertility for women born between 1962 and 1990 is consistent with raising the UK fertility assumption by 0.10 rather than 0.05.

If fertility rates for women aged 20–29 as well as those for older women were projected to increase in the short-term, the ultimate CFS could even exceed two children. Under this scenario cohorts with higher fertility in their twenties will also experience increasingly high fertility rates in their thirties and forties and thus have much higher completed fertility than their predecessors. A CFS of over two may appear surprisingly high, but this is in line with the fertility intentions reported by women now in their twenties<sup>30</sup>.

However, a more plausible scenario was thought to be one where fertility rates at all ages above 20 continued to increase in the short-term, but that cohorts of women currently in their twenties could experience slightly lower fertility in their thirties than the cohorts immediately preceding them, to compensate for relatively higher fertility earlier on in their lives. Under this scenario long-term fertility was estimated to stabilise just below 1.90.

The wide range of completed family sizes resulting from these scenarios emphasises the difficulty of making long-term fertility assumptions at this time. But overall they do tend to support a significant increase from their previous long-term assumption of 1.74. Considering this work, the views of the expert advisory panel and other evidence, and following consultation with key users of projections, the decision was taken to raise the UK assumption by 0.10, to give a UK long-term CFS of 1.84 for the 2006-based projection round.

This increase in the fertility assumption should not be taken as implying a rising CFS in future, but simply a slower fall in the CFS than assumed in the previous projection round.

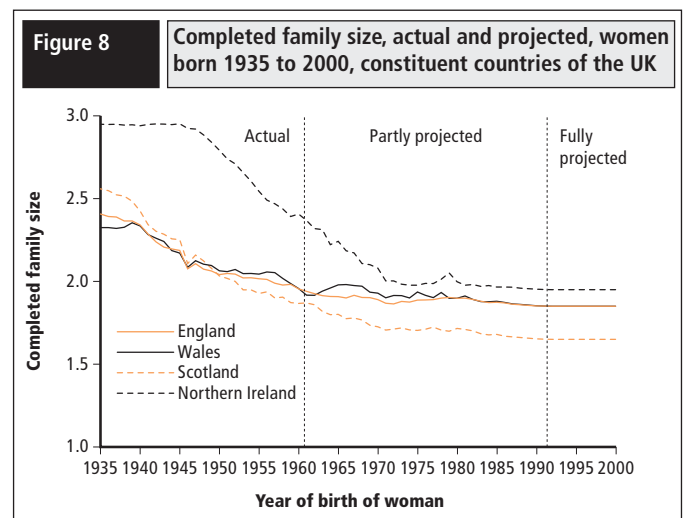
### Assumptions for the individual UK countries

The work reported above for the UK was first carried out at individual country level. In England and Wales, where a long time series of true birth order estimates is available, detailed age-specific fertility rates were projected forwards by parity, as detailed in Smallwood (2003)<sup>31</sup>. Although the age pattern of fertility differs slightly in the two countries, the overall level of fertility has been very similar over the past five years. For the 2006-based projections, the long-term CFS assumptions for both England and Wales have been raised from 1.75 to 1.85.

Scotland's long-term CFS assumption has been increased by 0.05 to 1.65, while assumed long-term fertility in Northern Ireland has been raised by a larger amount, from 1.80 to 1.95 children per woman. The new long-term fertility assumptions are close to current period fertility levels in all four countries, thus maintaining current differentials. Recent trends do not provide any strong evidence that fertility in Scotland or Northern Ireland is converging towards the levels seen in England and Wales.

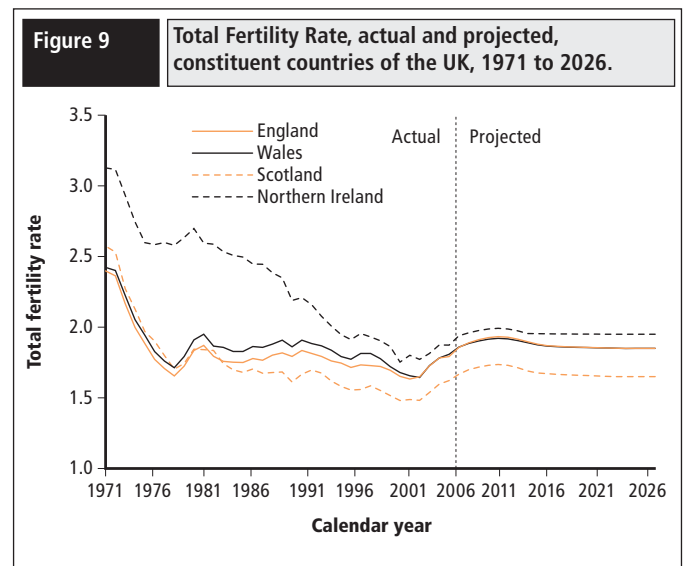
### Outcomes

Figure 8 shows the projected path of completed family size in the four countries. The fall in the CFS is not entirely steady for women born during the 1970s and 1980s, with fluctuations reflecting real cohort variations in achieved fertility to date. For the UK as a whole the ultimate CFS is reached by women born in 1994 and later.



As noted previously, recent increases in period fertility in the UK have led to the TFR reaching 1.84 in 2006, for the first time in a quarter of a century. The 2006-based projections assume further short-term increases in period fertility until 2010, with the TFR going above 1.90 before falling back to the assumed long-term level of 1.84. This represents a key difference from the 2004-based projections, where the TFR was assumed to decrease immediately after the base year.

Figure 9 shows the projected TFR in each of the UK countries, highlighting the projected short-term increases in period fertility.



This paper has focused on setting the principal fertility assumptions. However, high and low variants have also been produced to illustrate the range of outcomes that could occur due to the inherent uncertainty of demographic behaviour. As in previous years, these have been set 0.2 higher and lower than the principal assumption, giving high and low fertility variants of 2.04 and 1.64 respectively for the UK. These assumptions are used in variant population projections including the single component 'high fertility' and 'low fertility' variants and the combination 'high population' and 'low population' variants.

More detailed information on projected fertility and births and the future population (principal and variant projections) is available online<sup>32</sup>.

## Conclusions

Period fertility in the UK has been increasing over the past five years, due to continued and more rapid increases in the fertility of women over 30 among cohorts who have delayed their childbearing to older ages, alongside smaller increases in fertility rates for women currently in their twenties. Although increases in fertility for older women represent the continuation of a long-term trend, the strength of these increases and the change in fertility trends for younger women may have been influenced by a combination of factors, such as the impact of international migrants and policies that help women to combine childbearing with employment.

However, from a cohort perspective, completed family size in the UK has continued to fall slowly in recent years to just below two children per woman for those currently reaching their mid-forties. This gradual decline is expected to continue, although recent increases in period fertility have the potential to slow down the speed of change if they prove to affect completed family size and not just the timing of fertility within women's lives.

This paper has demonstrated that the UK long-term fertility assumption of 1.74 used in the 2004-based population projections now appears too low in the current fertility climate. For the 2006-based projections, a higher assumption of 1.84 has been used for the UK. Current fertility differentials between UK countries have been projected to continue, with Northern Ireland's long-term assumption being raised to 1.95 and Scotland's to 1.65, in comparison with 1.85 assumed for both England and Wales. These increases have, in combination with changes in the assumptions made about mortality and migration, contributed to significant increases in the projected populations of the UK and constituent countries<sup>33</sup>.

Further work is still needed to understand better the underlying causes of recent changes in UK period fertility. Time will tell what the longer-term effects of these will be on the family sizes to be achieved by women born since the mid-1960s and, therefore, how closely the 2006-based fertility assumptions will mirror actual future fertility.

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- the assistance of Eva Natamba and Helen Bray in preparing data and charts for the projections work
- the useful comments from ONS colleagues and anonymous referees on this paper

## Key findings

- The UK long-term fertility assumption for the 2006-based population projections is that completed family size will stabilise at an average of 1.84 children for women born in the early 1990s onwards
- The UK assumption of 1.84 represents an increase of 0.10 in assumed fertility compared with the 2004-based projections. The long-term fertility assumption for national projections has been lowered on a number of occasions since the 1960s baby boom, but this is the first time it has been increased since then
- Women born in 1961 (the most recent cohort to complete their childbearing) had on average 1.96 children per woman. Therefore the 2006-based projections assume that completed family size continues to fall
- For the 2006-based projections, the long-term completed family size assumptions have been raised to 1.85 for both England and Wales, 1.65 for Scotland and 1.95 for Northern Ireland
- These changes reflect strong increases over the past five years in the fertility of women aged 30 and above, alongside a small upturn in the fertility of women in their twenties
- In the immediate short-term fertility rates are projected to continue increasing for all age groups except teenagers

## Notes and references

- 1 Bray H (2008) 2006-based national population projections for the UK and constituent countries. *Population Trends* 131.
- 2 In developed countries such as the UK, a fertility rate of 2.1 is usually taken as the approximate number of children per woman needed for the population to replace itself (2.075 is used as a more exact estimate for the UK in this context). For a more detailed discussion of replacement fertility, see Smallwood S and Chamberlain J (2005) Replacement fertility, what has it been and what does it mean? *Population Trends* 119, 16–27.
- 3 The National Population Projections Expert Panel met in an advisory capacity in March 2007; details of panel membership and minutes of this meeting and can be found at: [www.gad.gov.uk/Demography\\_Data/Population/2006/methodology/expert1.asp](http://www.gad.gov.uk/Demography_Data/Population/2006/methodology/expert1.asp)
- 4 Office for National Statistics/ Government Actuary's Department (2006) *National population projections, 2004-based*. Series PP2 no. 25. Chapter 6.
- 5 Eurostat New Cronos database (December 2007): [http://epp.eurostat.ec.europa.eu/Provisional 2006 TFR for USA: \(www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56\\_07.pdf\)](http://epp.eurostat.ec.europa.eu/Provisional%202006%20TFR%20for%20USA%20%28www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_07.pdf%29)
- 6 Birth order estimates used in Figure 4 refer to 'true birth order': the number assigned to a birth based on the number of previous live births to that mother, counting all births inside and outside marriage. Complete information on birth order for all live births is not collected at registration in England and Wales. The partial information on birth order from registration data is supplemented with data from the General Household Survey (GHS) to provide estimates of true birth order for all live births. For Figure 4, birth order components are calculated as follows: for example the first birth component in a particular year is the sum of first birth rates at each age (number of first births at age x divided by total population of women aged x).
- 7 Mean ages given here are standardised to take into account changes in the age structure of the female population.
- 8 For a discussion of higher education and childbearing see, for example, Rendall M and Smallwood S (2003) Higher qualifications,



- first-birth timing, and further childbearing in England and Wales. *Population Trends* 111, 18–26. For a discussion of trends in marriage and cohabitation, see McConnell H and Wilson B (2007) Families – Chapter 1 of Focus on Families, ONS. The impact of partnership status on fertility postponement is discussed in Berrington A (2004) Perpetual postponers? Women's, men's and couple's fertility intentions and subsequent fertility behaviour. *Population Trends* 117, 9–19.
- 9 For example, Smith and Ratcliffe (2006) found that in more recent cohorts, the proportion of women with children who work full-time has been rising: Smith S and Ratcliffe A (2006) *Fertility and women's education: A cohort analysis*. Working paper 06/165, Centre for Market and Public Organisation.
  - 10 Country of birth of mother is used for this analysis since this information is collected at birth registration, unlike ethnicity or migration history. Care is needed in interpretation as country of birth cannot be used as a proxy for these variables. For example not all women born outside the UK will be recent in-migrants. Similarly the UK born group will include the children of earlier in-migrants to the UK (the second and third generation).
  - 11 See Table 9.5 in the FM1 series Birth Statistics; TFRs obtained from birth registration data and 2001 Census data on population by country of birth.
  - 12 Estimated populations by country of birth are only available from survey data. The Labour Force Survey may undercount the numbers of people who were born overseas because :-
    - the survey excludes certain people who have been resident in the UK for less than six months;
    - it excludes students in halls of residence who do not have a UK resident parent;
    - it excludes people in most other types of communal establishment (e.g. hotels, boarding houses, hostels, mobile home sites etc);
    - it is weighted to population estimates which exclude migrants staying for less than 12 months;
    - the LFS microdata are weighted to population estimates consistent with those published in spring 2003, which are significantly lower than the latest population estimates.
 Because the LFS has not yet been reweighted at the time of writing, the overall TFRs for England and Wales estimated using this method (in Figure 5) do not exactly match published figures.
  - 13 Dunnell K (2007) The Changing Demographic Picture of the UK – National Statistician's Annual Article on the Population. *Population Trends* 130, 9–21.
  - 14 Data used in population estimation show female in-migrants of childbearing age in 2005–06 to have a younger age structure than the total female population of childbearing age in England and Wales, with the proportions in age groups 20–24 and 25–29 being much larger among in-migrants. However, the age structure of different migrant groups varies considerably, as shown in the 2001 Census (see for example chapter 2 of ONS *Focus on Ethnicity and Religion*, 2006 edition: [www.statistics.gov.uk/StatBase/Product.asp?vlnk=14629](http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14629).)
  - 15 See for example Toulemon L (2004) Fertility among immigrant women: new data, a new approach. *Population & Societies* 400.
  - 16 See reference 13 – Dunnell.
  - 17 Adam S and Brewer M (2004) *The Financial Costs and Benefits of Children since 1975*. Bristol, The Polity Press.
  - 18 The Employment Act 2002 was implemented for women expecting to give birth in April 2003 or later.
  - 19 Choice for parents, the best start for children: a ten year strategy for childcare (2004): [www.hm-treasury.gov.uk/pre\\_budget\\_report/prebud\\_pbr04/assoc\\_docs/prebud\\_pbr04\\_adchildcare.cfm](http://www.hm-treasury.gov.uk/pre_budget_report/prebud_pbr04/assoc_docs/prebud_pbr04_adchildcare.cfm)
  - 20 For a guide to maternity benefits, see [www.dwp.gov.uk/advisers/ni17a/](http://www.dwp.gov.uk/advisers/ni17a/). For more information on the Work and Families Act 2006, see [www.berr.gov.uk/employment/employment-legislation/workandfamiliesact/index.html](http://www.berr.gov.uk/employment/employment-legislation/workandfamiliesact/index.html).
  - 21 [www.hmrc.gov.uk/statutory-notice/paternity-leave-pay.htm](http://www.hmrc.gov.uk/statutory-notice/paternity-leave-pay.htm)
  - 22 For example see Bjorklund A (2006) Does a family friendly policy raise fertility levels? *Journal of Population Economics* 19, no.1.
  - 23 Brewer M, Ratcliffe A and Smith S (2007) *Does Welfare Reform Affect Fertility? Evidence from the UK*. Working Paper 07/177, Centre for Market and Public Organisation.
  - 24 For the purposes of cohort analysis, women are assumed to have completed their fertility by age 45. These figures take into account the fact that some women remain childless; hence the average completed family size of women who do have children will be higher than the figures given here.
  - 25 Smallwood S (2002) The effect of changes in timing of childbearing on measuring fertility in England and Wales. *Population Trends* 109, 36–45.
  - 26 Shaw C (2007) Fifty Years of United Kingdom national population projections: how accurate have they been? *Population Trends* 128, 8–23.
  - 27 United Nations – World Population Prospects: the 2006 Revision: <http://esa.un.org/unpp/index.asp?panel=4>. Eurostat population projections: [http://epp.eurostat.ec.europa.eu/portal/page?\\_pageid=1996,45323734&\\_dad=portal&\\_schema=PORTAL&screen=welcomeref&open=/&product=Yearlies\\_new\\_population&depth=3](http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/&product=Yearlies_new_population&depth=3)
  - 28 See reference 26 – Shaw.
  - 29 This work was carried out prior to the publication of 2006 population estimates for the UK and therefore is based on fertility rates up to 2005. Incorporating 2006 data would increase the resulting completed family sizes slightly. 'Long-term' outcomes presented refer to the CFS for women born in 1990 (who have just started childbearing).
  - 30 Based on fertility intentions data from General Household Survey, 2003–5.
  - 31 Smallwood S (2003) Fertility assumptions for the 2002-based national population projections. *Population Trends* 114, 8–18.
  - 32 See ONS website at [www.statistics.gov.uk/StatBase/Product.asp?vlnk=8519&Pos=&ColRank=1&Rank=422](http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=8519&Pos=&ColRank=1&Rank=422) and GAD website at [www.gad.gov.uk/Demography%5FData/](http://www.gad.gov.uk/Demography%5FData/).
  - 33 See reference 1 – Bray.