

Compendium

Fertility, 2014-based national population projections reference volume

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1 . Introduction

For the UK as a whole, the main measure used in setting the fertility assumptions in the national projections is average completed family size; the average number of live-born children per woman which a group of women born in the same year have had by the end of their childbearing years. This has been falling from a peak of nearly 2.5 children per woman for women born in the mid-1930s and the projections assume that this will level off at 1.89 children per woman for women born in 2015 and later. This long-term assumption is unchanged from the 2012-based projections at the UK level.

The assumptions made about completed family size, which underlie this projection round, are based on an analysis of recent trends in fertility and an assessment of their implications for future completed family sizes, together with other relevant information such as the views of the expert advisory panel. These assumptions about future levels of fertility are set for each of the UK's constituent countries separately and then combined to obtain the assumption for the UK as a whole.

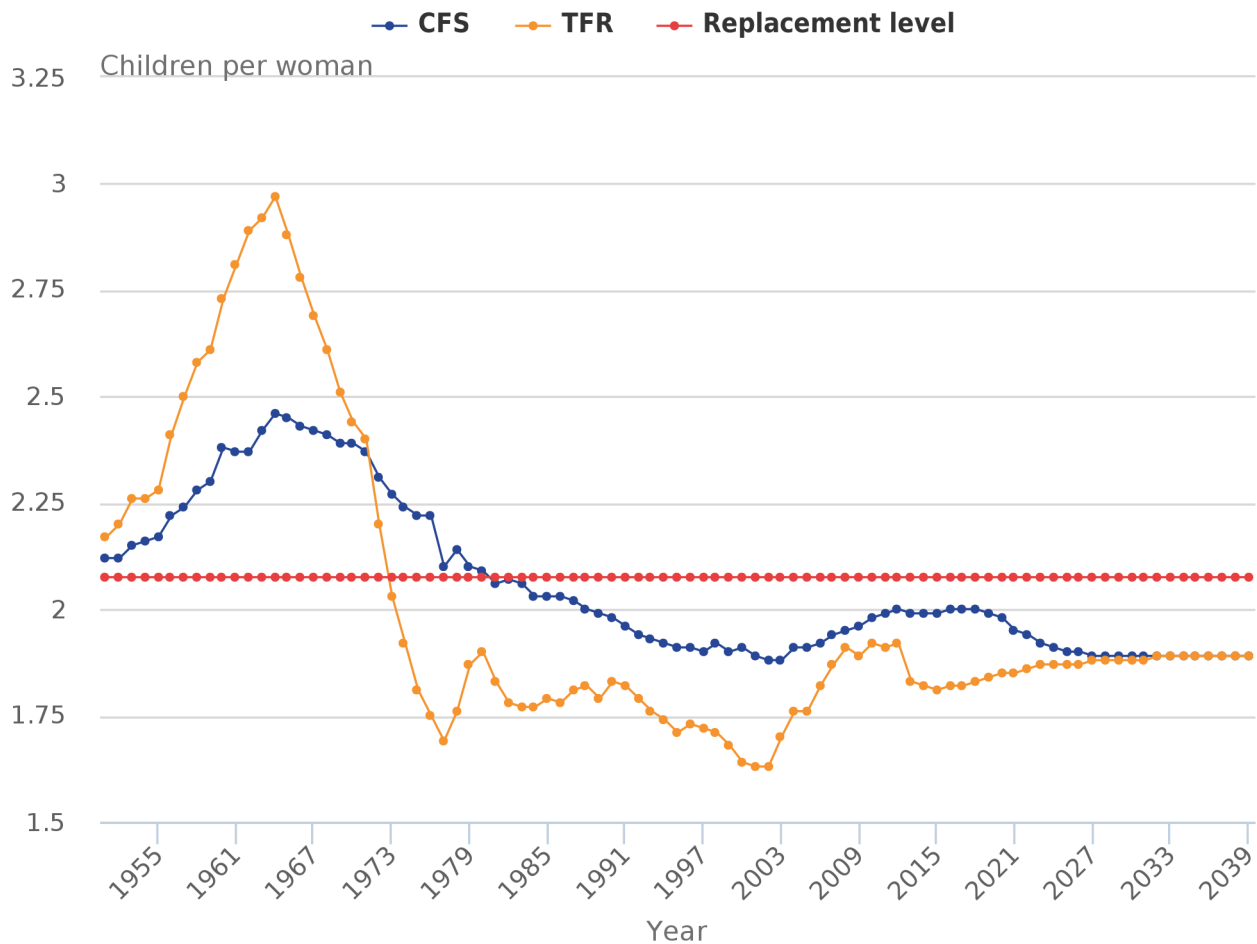
This chapter discusses past trends in fertility and summarises the resulting assumptions adopted for the 2014-based projections.

2 . Recent trends in fertility

Fertility assumptions are formulated in terms of completed family size. As Figure 3.1 shows, the cohort measure of fertility is more stable than the total fertility rate (TFR), which is based on the calendar year (period measure). This is because the completed family size is affected only by changes in the total number of children women have and not by the timing of births within women's lives. The TFR, in contrast, may rise or fall if births are brought forward or delayed for any reason¹. The TFR measures the average number of children that a group of women would have if they were to experience the age-specific fertility rates of the year in question throughout their childbearing lives.

The completed family size is plotted against the year in which women were, or will be, aged 30 (the approximate mid-point of childbearing ages). Average completed family size reached around 2.45 children per woman among those born in the mid-1930s, who would have been in their peak childbearing ages in the early to mid-1960s. Since then, the completed family size in the UK has fallen steadily, with women born in 1969 – the most recent cohort for whom there are data up to exact age 45 – having an average of 1.90 children.

Figure 3.1: Estimated and assumed total fertility rate (TFR) and average completed family size (CFS), UK, 1951 to 2039



Source: Office for National Statistics

Notes:

1. Completed family size relates to cohort born 30 years earlier – 30 years being the approximate mid-point of the childbearing ages. Projected completed family size is given for cohorts who have not yet completed childbearing
2. All fertility data are displayed on a calendar year basis
3. Replacement fertility is the level of fertility required for the population to replace itself in size in the long-term. In the UK, women would need to have, on average, 2.075 children to ensure long-term "natural" replacement of the population

Fertility rates in the UK fell sharply from the “baby boom” peak in the TFR of just under 3 children per woman in 1964 to a trough of 1.69 in 1977. During the 1980s, the TFR stayed relatively stable at around 1.80 children and then fell to around 1.70 in the second half of the 1990s. In recent years the UK has generally seen increases in the TFR, from 1.63, the lowest point ever recorded in 2001, to 1.92 in 2010 and 2012, the highest since 1974. However, in 2013 there was a substantial drop in the UK TFR from 1.92 to 1.83 (the largest single year change since 1975).

Fertility rates among women in their 30s and 40s in the UK have continued to rise at a fast pace since the turn of the century, reaching levels last seen during the 1960s “baby boom”. This increasing fertility among older women continued until 2012 despite the TFR drop in 2009. Since 2002, there have also been smaller increases in fertility among women in their late 20s and stabilisation among women in their early 20s, following declining fertility in this age group during the 1990s. Fertility rates for women aged under 20 have been declining since their peak in the late 1960s. The combination of trends in these age groups has led to the rise in overall fertility over the decade, as well as further small increases in the average age at childbirth. The drop in fertility in 2013 was experienced by all age groups with the exception of women aged 40 and over, who experienced a small increase in fertility compared with 2012.

Apart from the recuperation in fertility at older ages by women born in the late 1960s and 1970s, other factors that could be associated with recent increases in period fertility include the increasing proportion of women of childbearing age born outside the UK (who have above UK-born average fertility) and the possible role of changes relating to support for families (such as tax credits or maternity and paternity leave) – see references 2,3,4,5,6,7 for further discussion of these factors.

The 1965, 1970 and 1975 cohorts have had steadily fewer children by the ages of 25 and 30 than earlier cohorts and this trend continues with the data now available for the 1980 and 1985 cohorts. The exception is a rise in the average achieved family size, at the age of 30, between the 1975 and 1980 cohorts (Table 3.1). This is due to a growth in the number of children achieved between the exact ages of 25 and 30. The 1975 cohort achieved 0.47 children, whereas the 1980 cohort achieved 0.50 children. This reflects the increases in the period fertility of 25 to 29 year olds from 2002 to 2008.

Table 3.2 shows women have been increasingly “catching up” in their 30s. For example, women born in 1980, on average, achieved 0.56 children between their 30th and 35th birthdays compared with 0.47 for women born 10 years earlier.

Table 3.1: Average achieved family size by age (exact years) and year of birth woman, UK, women born 1950 to 1995

Cohort born	Age						Final
	20	25	30	35	40	45	
1950	0.23	0.93	1.56	1.93	2.06	2.09	2.09
1955	0.22	0.78	1.43	1.84	2.00	2.03	2.03
1960	0.16	0.68	1.31	1.75	1.94	1.98	1.98
1965	0.13	0.59	1.18	1.64	1.85	1.91	1.91
1970	0.15	0.57	1.09	1.56	1.83	1.90	1.91
1975	0.15	0.51	0.98	1.51	1.83	...	...
1980	0.15	0.50	1.00	1.55	...	...	...
1985	0.14	0.49	1.01	...	...	...	...
1990	0.13	0.47	...	...	...	...	...
1995	0.09	...	...	...	...	...	...

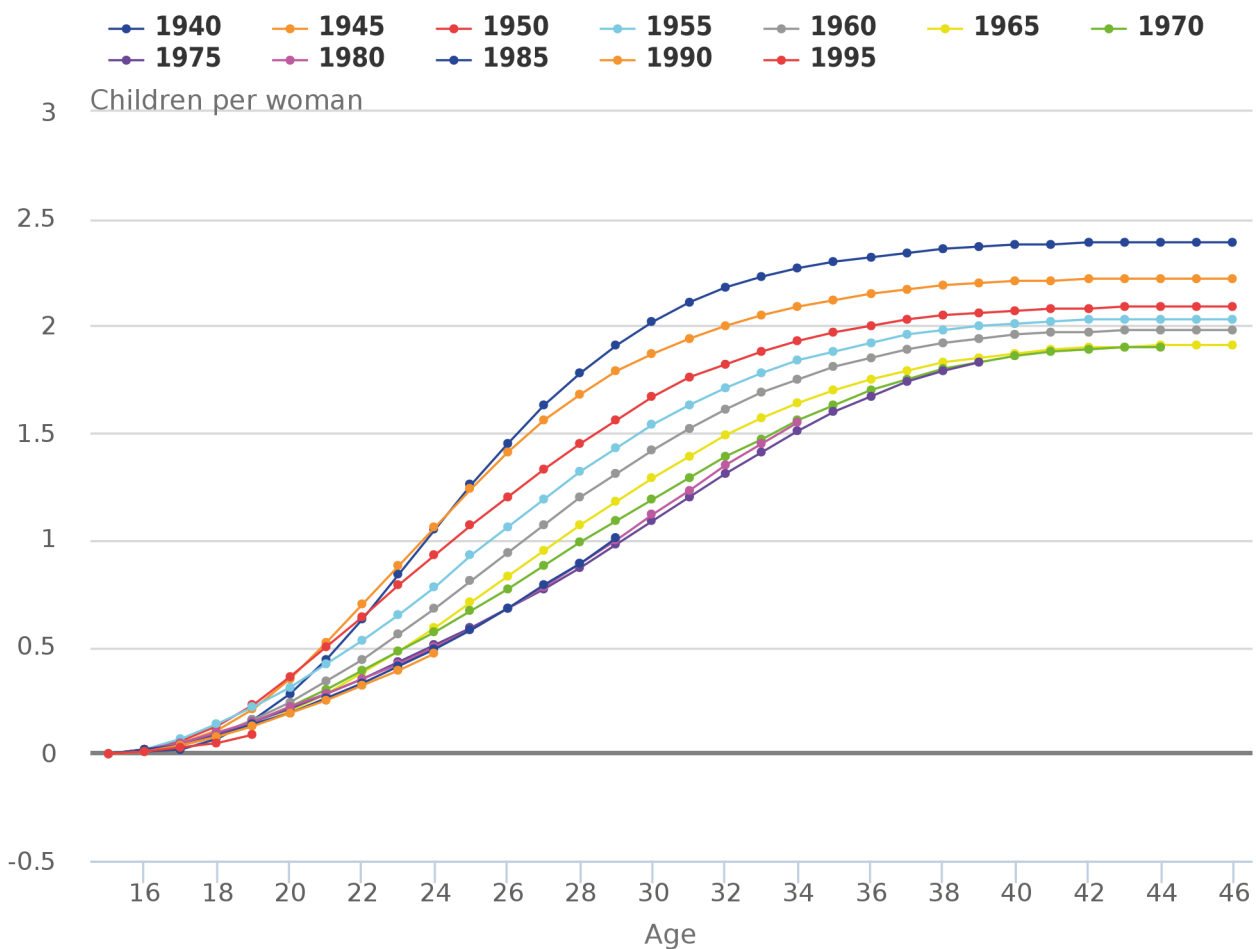
Source: Office for National Statistics

3 . Fertility assumptions for the UK

In the 2014-based projections, the long-term completed family size is assumed to be 1.89 children per woman. This is the same as the level assumed in the 2012-based projections, but is below the “replacement level”. The “replacement level” family size of 2.075 represents the approximate number of children per woman needed for the population to replace itself in the long-term (in the absence of migration)⁸. The total fertility rate (TFR) in the UK has been below replacement level since the early 1970s and the completed family size assumed for the long-term falls around 9% below replacement level.

Table 3.1 and Figure 3.2 show the achieved family sizes of selected cohorts at successive ages. From 1950, for those aged 25, 40 and 45, each subsequent cohort has had fewer children by each age than earlier cohorts. For those in their 30s, the most recent data show a slight increase on previous cohorts. Over time there have been some fluctuations in the achieved family size for those aged 20 but a downwards trend for successive cohorts born since 1980.

Figure 3.2: Average achieved family size by age and year of birth of woman, UK, women born 1940 to 1995



Source: Office for National Statistics

There is also evidence of strong recuperation at older ages for women born between 1960 and 1970. These cohorts delayed their fertility at younger ages but have been experiencing relatively high rates at older ages compared with earlier cohorts. For example, Table 3.2 shows that women born in 1965 had, on average, 0.22 children between the ages 35 to 39, compared with 0.16 children for the 1955 cohort for this age group. Thus, the completed family sizes of more recent cohorts will not be as low as they would have been had their fertility at older ages stayed at levels experienced by earlier cohorts.

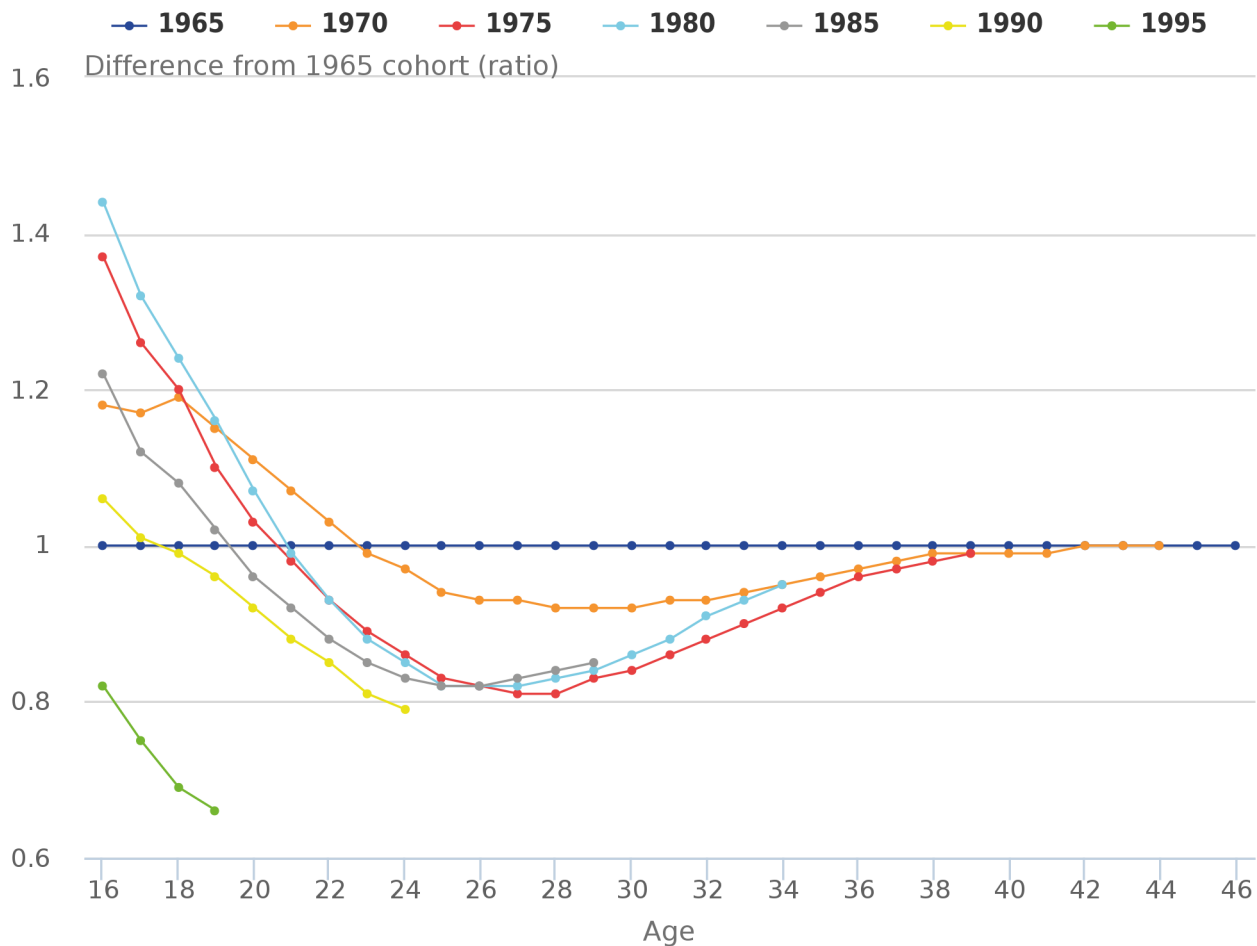
Table 3.2: Average number of children between given ages by year of birth of woman, UK, women born 1950 to 1995

Cohort born	Age						
	Under 20	20–24	25–29	30–34	35–39	40–44	45 and over
1950	0.23	0.70	0.63	0.36	0.13	0.03	0.00
1955	0.22	0.56	0.65	0.40	0.16	0.03	0.00
1960	0.16	0.53	0.63	0.44	0.19	0.04	0.00
1965	0.13	0.46	0.59	0.45	0.22	0.05	0.00
1970	0.15	0.42	0.52	0.47	0.28	0.07	...
1975	0.15	0.36	0.47	0.53	0.32	...	...
1980	0.15	0.35	0.50	0.56	...	...	...
1985	0.14	0.36	0.51	...	...	...	...
1990	0.13	0.34	...	...	...	...	...
1995	0.09	...	...	...	...	...	...

Source: Office for National Statistics

Figure 3.3 also shows this recuperation in terms of differences in selected cohorts relative to the 1965 cohort, who completed their fertility with an average of 1.91 children per woman. Although the 1970, 1975 and 1980 cohorts fell increasingly behind the 1965 cohort during their 20s, the curves for these cohorts after around age 28 rose steeply towards the 1965 level due to higher fertility at older ages, with the 1970s cohorts set to catch up with the completed family size of the 1965 cohort.

Figure 3.3: Difference between average achieved family size by age and year of birth of woman, UK, 1965 cohort compared with women born 1970 to 1995



Source: Office for National Statistics

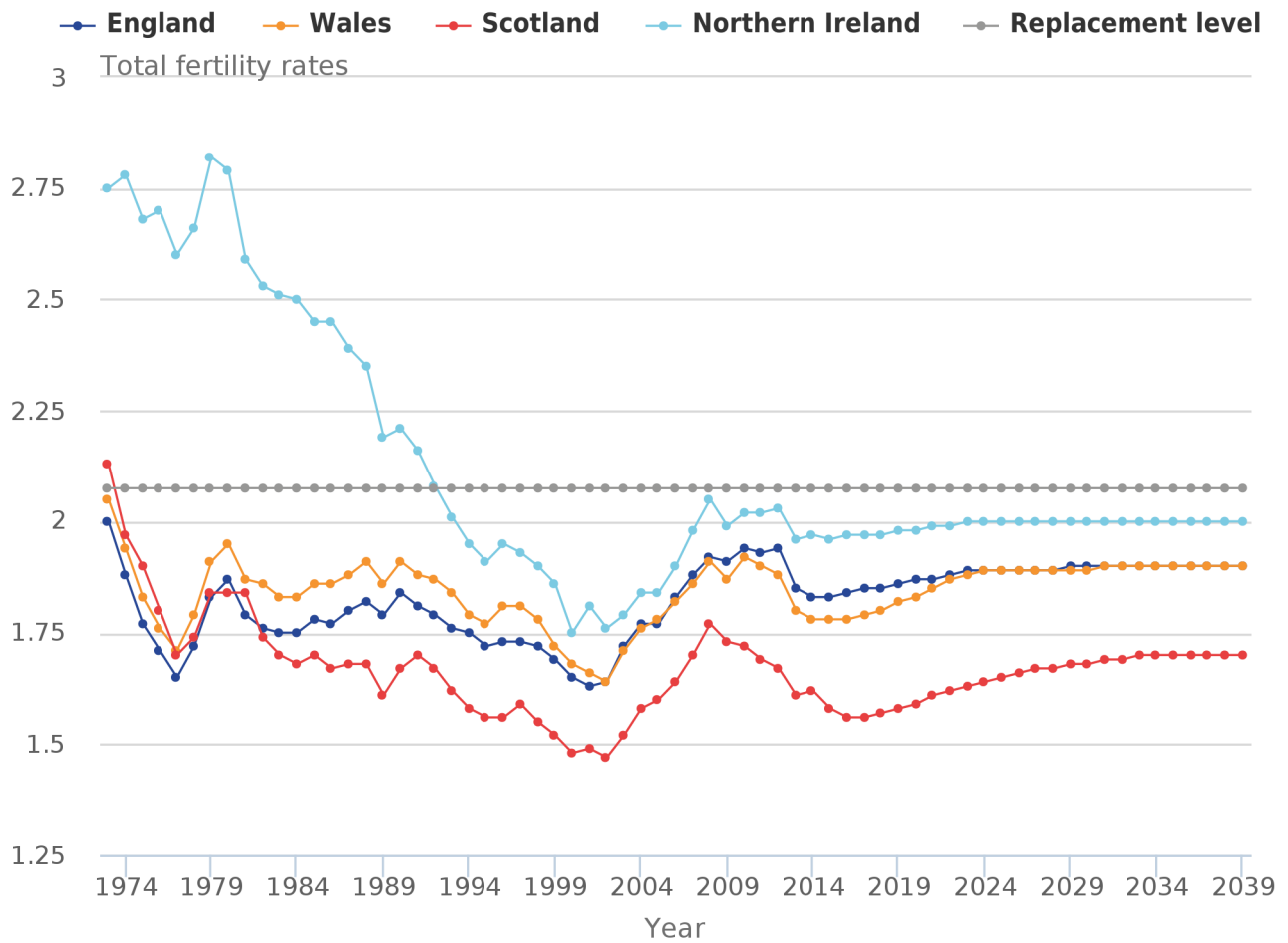
Women born in 1980 have followed a very similar fertility trajectory to the 1975 cohort up to age 25, but are showing higher fertility from age 27 onwards. This represents a marked difference from the previous pattern where successive cohorts born between the 1940s and the 1960s achieved lower fertility by each age than their predecessors, and suggests that falls in cohort fertility are bottoming out. However, women born in the late 1980s onwards have experienced slightly lower teenage fertility than those born in the 1970s and early 1980s, so they will have further to catch up at older ages if they are to match the achieved family sizes of their predecessors.

4 . Fertility assumptions for the constituent countries

Figure 3.4 and Figure 3.5 show the estimated and assumed trends in the total fertility rate (TFR) and completed family size for the constituent countries of the UK. All 4 countries show a similar trajectory over time, though Scotland's TFR declined from 2008 onwards compared with the roughly stable TFRs that England, Wales and Northern Ireland had between 2008 and 2012. In 2013, the TFR fell in all 4 countries of the UK (Figure 3.4). In 2014, the TFRs for England and Wales were 1.83 and 1.78 children per woman, respectively. Northern Ireland has historically had higher fertility than the rest of the UK and in 2014 its TFR was 1.97. Scotland has had lower fertility than England since the early 1980s and in 2014 its TFR was 1.62.

Recent trends do not provide any strong evidence of convergence in the overall levels of fertility between the individual countries, so current differentials are reflected in the completed family sizes assumed for the long-term (Figure 3.5).

Figure 3.4: Estimated and assumed total fertility rates, constituent countries of the UK, 1973 to 2039

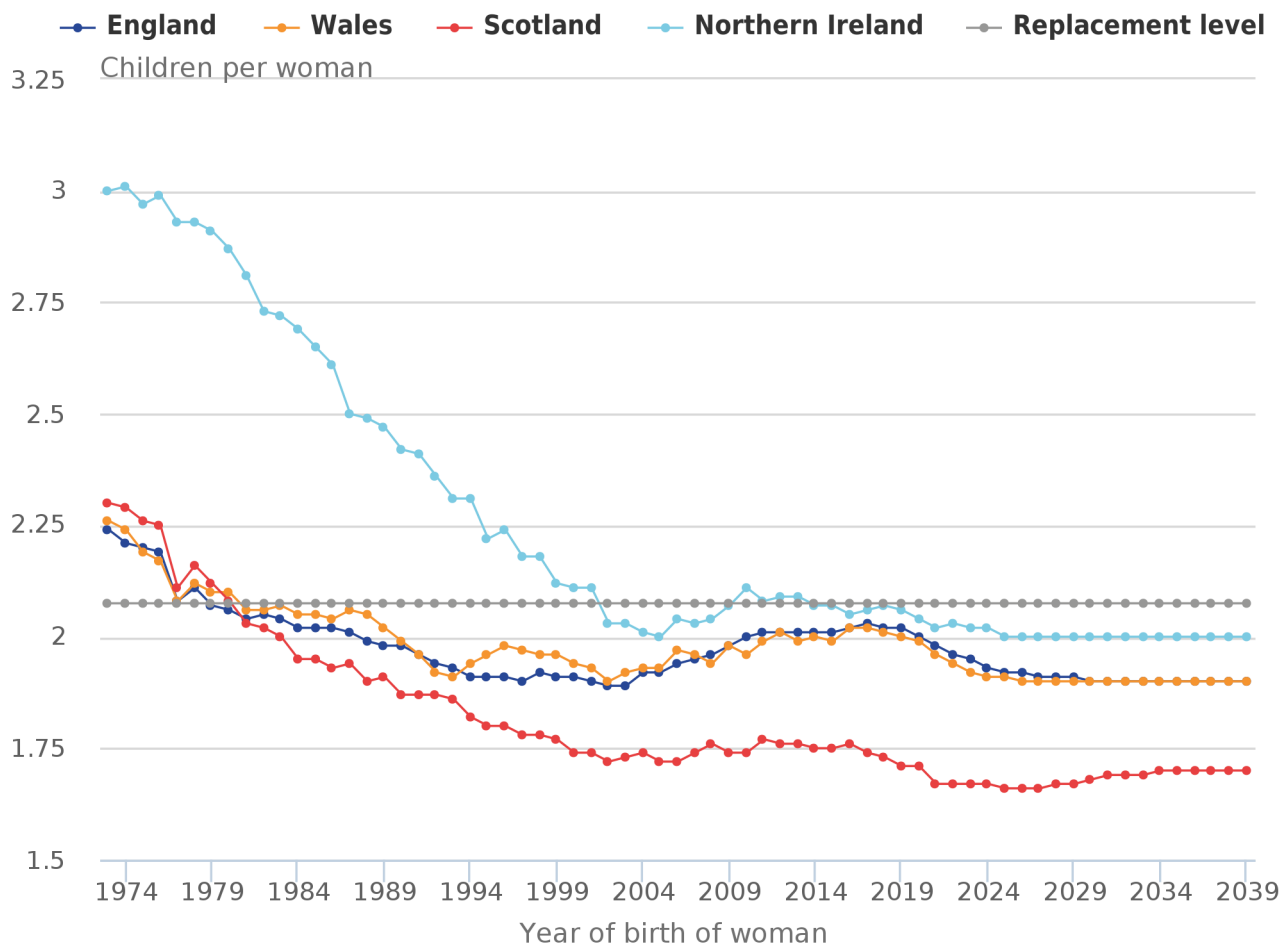


Source: Office for National Statistics, NRS, NISRA

Notes:

1. All fertility data are displayed on a calendar year basis
2. Replacement fertility is the level of fertility required for the population to replace itself in size in the long-term. In the UK, women would need to have, on average, 2.075 children to ensure long-term "natural" replacement of the population

Figure 3.5: Estimated and assumed completed family size, constituent countries of the UK, women born 1943 to 2009



Source: Office for National Statistics, NRS, NISRA

Notes:

1. All fertility data are displayed on a calendar year basis
2. Replacement fertility is the level of fertility required for the population to replace itself in size in the long-term. In the UK, women would need to have, on average, 2.075 children to ensure long-term "natural" replacement of the population

The achieved family sizes to date for the individual countries of the UK for selected cohorts are shown in Table 3.3. For the 1964 and 1969 cohorts – who can now be effectively regarded as having completed their childbearing – average family sizes were lowest in Scotland and highest in Northern Ireland. In the 1964 cohort, Wales had a larger completed family size than England and this pattern continues to the 1969 cohort; the most recent cohort to complete childbearing. While the 1964 and 1969 completed family size (CFS) for England are similar, there were declines for UK, Scotland and Northern Ireland, and an increase for Wales between these cohorts. The relative achieved family sizes across the countries of the UK for the 1974 and 1979 cohorts are similar to the 1969 cohort. For younger cohorts, the achieved family size for Northern Ireland is lower than for England and Wales and, for the 1994 cohort, is lower than England, Wales and Scotland. This reflects the older age pattern of child bearing in Northern Ireland.

For the 2014-based projections, the long-term fertility assumptions for England, Wales, Northern Ireland and Scotland have been slightly raised when compared with the 2010-based projections. The assumptions for England, Wales and Northern Ireland are the same as the 2012-based projections whereas the long-term assumption for Scotland has been set slightly lower. The assumed long-term completed family size is 1.90 children per woman for England and for Wales, 2.00 for Northern Ireland and 1.70 in Scotland. Table 3.4 illustrates, for each constituent country of the UK, the assumed progression in completed family size from cohorts who have recently finished childbearing to those who have not yet started. The CFS is assumed to rise slightly for the cohorts between 1975 and 1985, before declining back down to the long-term trend.

Table 3.3: Achieved family size attained by 2014 for the constituent countries of the UK, women born 1954 to 1994

Cohort born	Achieved to age	UK	England	Wales	Scotland	Northern Ireland
1954	Complete	2.03	2.02	2.05	1.95	2.69
1959	Complete	1.99	1.98	2.02	1.91	2.47
1964	Complete	1.92	1.91	1.94	1.82	2.31
1969	Complete	1.90	1.91	1.96	1.77	2.12
1974	Age 40	1.86	1.86	1.89	1.70	1.97
1979	Age 35	1.63	1.64	1.70	1.48	1.75
1984	Age 30	1.12	1.13	1.23	1.00	1.13
1989	Age 25	0.59	0.59	0.66	0.53	0.53
1994	Age 20	0.19	0.19	0.22	0.18	0.17

Source: Office for National Statistics

Table 3.4: Estimated and assumed average completed family size for the constituent countries of the UK, women born 1950 to 2010

Cohort born	UK	England	Wales	Scotland	Northern Ireland
1950	2.09	2.06	2.10	2.08	2.87
1955	2.03	2.02	2.05	1.95	2.65
1960	1.98	1.98	1.99	1.87	2.42
1965	1.91	1.91	1.96	1.80	2.22
1970	1.91	1.91	1.94	1.74	2.11
1975	1.91	1.92	1.93	1.72	2.00
1980	1.98	2.00	1.96	1.74	2.11
1985	1.99	2.01	1.99	1.75	2.07
1990	1.98	2.00	1.99	1.71	2.04
1995	1.90	1.92	1.91	1.66	2.00
2000	1.89	1.90	1.90	1.68	2.00
2005	1.89	1.90	1.90	1.70	2.00
2010 and later	1.89	1.90	1.90	1.70	2.00

Source: Office for National Statistics

Notes:

1. For cohorts born in 1970 and onwards figures are partly projected

Between 2002 and 2008, total fertility rates increased in all constituent countries of the UK, followed by a dip in 2009. All countries except Scotland then showed a recovery in 2010, followed by a fluctuating pattern in TFR in the short-term. This is reflected in the latest projections, as the total fertility rate for the UK also fluctuates in the short-term and levels off at the long-term assumption of 1.89 by 2032.

5 . Fertility assumptions age and sex distribution

Assumed age pattern of fertility

Table 3.5 summarises assumed fertility rates for the UK by 5 year age groups. The age pattern is projected to change slightly over the projection period, with fertility rates for women aged 40 and over increasing and rates for women aged under 20 decreasing slightly. Fertility rates for women in their 20s are also assumed to decrease slightly and this is offset by slight increases for women in their 30s.

The mean age at motherhood for the UK is assumed to rise gradually from 28.4 years for the 1965 cohort to its long-term level of 30.6 years for those born from 2005 onwards. Among the constituent countries of the UK, the mean age at motherhood assumed for the long-term varies from 29.9 years in Wales to 30.3 years in Scotland, 30.6 in England and 30.4 years in Northern Ireland.

Table 3.5: Estimated and assumed births per 1,000 women by age and year of birth of woman, UK, women born 1950 to 2010

Cohort born	Age						Average completed family size (number of children)	Mean age at motherhood (years)
	Under 20	20–24	25–29	30–34	35–39	40 and over		
1950	231	699	634	365	132	28	2.09	26.4
1955	221	561	650	403	163	36	2.03	27.1
1960	156	527	630	438	190	43	1.98	27.8
1965	133	457	594	454	216	57	1.91	28.4
1970	152	418	522	466	276	71 †	1.91 †	28.9 †
1975	147	361	469	533	316	80 †	1.91 †	29.5 †
1980	154	346	498	556	338 †	88 †	1.98 †	29.7 †
1985	135	357	513	549 †	348 †	90 †	1.99 †	29.7 †
1990	127	338	504 †	564 †	354 †	91 †	1.98 †	29.9 †
1995	88	284 †	507 †	572 †	360 †	91 †	1.90 †	30.4 †
2000	73 †	283 †	508 †	574 †	361 †	92 †	1.89 †	30.5 †
2005	72 †	281 †	509 †	574 †	361 †	92 †	1.89 †	30.6 †
2010 and later	71 †	281 †	509 †	575 †	361 †	92 †	1.89 †	30.6 †

Source: Office for National Statistics

Notes:

1. † Figures are partly or wholly projected

Assumed sex ratio at birth

It is assumed that there will be 105 boys for every 100 girls. This is in line with the estimated sex ratios recorded in the UK since the 1987-based projections. The UK sex ratio fluctuates each year with no clear trend over time and these annual fluctuations are relatively larger in Wales, Scotland and Northern Ireland compared with England; therefore it was decided during the 2004-based round not to use different sex ratios for the 4 countries of the UK.

6 . Distribution of completed family size

The assumptions for these projections have been informed by the use of a birth order probability model for England and Wales as a whole, maintained by the Office for National Statistics (ONS)^{9,10,11}. This model also provides details of a distribution of women by number of children that is consistent with the fertility assumptions used for the 2014-based projections.

Table 3.6 shows that the proportion of women who remain childless by age 45, in England and Wales as a whole, has been increasing in recent years, from an estimated 14% of the 1950 cohort to 20% of women born in 1965. The rise in childlessness was the main factor in the reduction in completed family size for cohorts born in the 1950s through to the early 1960s, since the average number of children for women who were not childless remained fairly stable for these cohorts at around 2.4.

In the long-term, for cohorts born from the mid-1990s, it is assumed that 18% of women will remain childless. The fall in completed family size, from 1.98 for the 1960 cohort to the 1.90 assumed for those born from the mid-2000s onwards, is consistent with a decrease in the average complete family size of women who have children from 2.45 to 2.33. The family size distribution consistent with the 2014-based projections is similar to the distribution produced alongside the 2012-based projections.

Table 3.6: Estimated and assumed distribution of women by number of children and year of birth of woman. England and Wales, women born 1950 to 2010

Cohort born	Average family size	Average family size of women who have children	Number of children (percentages)				
			0	1	2	3	4 or more
1950	2.07	2.39	14	13	44	20	10
1955	2.02	2.41	16	13	41	19	11
1960	1.98	2.45	19	12	38	20	11
1965	1.91	2.39	20	13	38	19	10
1970	1.91	2.31	17	18	37	17	10
1975	1.92	2.35	18	17	37	17	11
1980	2.00	2.37	16	17	38	18	11
1985	2.01	2.40	16	16	37	19	12
1990	2.00	2.41	17	16	37	18	12
1995	1.92	2.34	18	17	37	17	11
2000	1.91	2.33	18	18	37	17	10
2005	1.90	2.33	18	18	37	17	10
2010 & later	1.90	2.33	18	18	37	17	10

Source: Office for National Statistics

Notes:

1. Figures for 1950 to 1965 (incl) are estimated, 2000 onwards are wholly assumed and between 1970 and 1995 (incl) are based on partly estimated and partly assumed data
2. Comparable figures for Scotland and Northern Ireland are not available

7 . Future fertility levels

For the 2006-based projections, the fertility assumptions were raised for the first time since the 1960s, with the long-term level of completed family size for the UK increasing from 1.74 to 1.84 children per woman. For the 2008-based projections, the long-term assumptions remained unchanged following a review of the available evidence, except in Scotland where the assumption was raised slightly. In 2010, the assumptions were maintained at the 2008-based levels. In 2012, the long-term fertility assumptions in the individual countries were increased from the 2006, 2008 and 2010 based rounds.

Our review prior to the 2014-based projections proposed maintaining the assumptions in line with the following arguments:

- the expert panel cautioned against frequent changes of long-term assumption, stating that stability is desired by users
- four (of nine) of the expert panel predicted a long-term total fertility rate (TFR) of between 1.90 and 1.93.
- both Eurostat and the UN assume higher TFRs for the UK than the Office for National Statistics (ONS); decreasing the assumption will increase this gap
- the current achieved family sizes for the 1970 to 1985 cohorts suggests that they are catching up with the achieved family sizes of the 1968 cohorts and may exceed the completed fertility of the 1968 cohort by the time they have finished childbearing, if the projected rises in older age fertility rates occur; the completed family size (CFS) for the 1968 cohort was 1.91, near to the 2012-based long-term projected TFR, so this supports maintaining the assumption
- net migration levels remain high despite political will to decrease them, and women born outside the UK tend to have higher fertility levels than UK-born women

8. References

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9. Smallwood S (2002). New estimates of trends in births by birth order in England and Wales. Population Trends 108. Available at: <http://webarchive.nationalarchives.gov.uk/20150904113534/http://ons.gov.uk/ons/rel/population-trends-rd/population-trends/no--108--summer-2002/index.html>

10. For application in population projections, see also Smallwood S (2003). Fertility assumptions for the 2002-based national population projections. Population Trends 114. Available at: <http://webarchive.nationalarchives.gov.uk/20150904113534/http://ons.gov.uk/ons/rel/population-trends-rd/population-trends/no--114--winter-2003/index.html>
11. Since May 2012, information on previous children has been collected from all women at birth registration, so from 2013 onwards, birth order is no longer estimated from the General Lifestyle Survey for births outside marriage.

9. Background notes

1. The [2014-based Population Projections for the UK and constituent countries](#) were published 29 October 2015 (main release) and the [extra variants](#) were published 26 November 2015.
2. These [National Statistics](#) are produced to high professional standards and released according to the arrangements approved by the [UK Statistics Authority](#).