

Fertility assumptions for the 2002-based national population projections

Steve Smallwood
*Population and Demography
Division. Office for National
Statistics*

One of the key components of national population projections is the assumed level of fertility, which determines the number of future births in the projections. Assumptions are made in terms of the average number of children women will have over their lifetime. For the 2002-based projections this average is assumed to ultimately be 1.75 for England and for Wales, 1.60 for Scotland, and 1.80 for Northern Ireland, leading to a United Kingdom assumption of 1.74.

This article explains how these overall assumptions, which are the same as assumed in the 2000-based and interim 2001-based projections, are derived. It also explains why these levels are higher than current 'period' indicators of fertility. Finally, information on more detailed age specific fertility rates, and implications for family size distributions, is given.

BACKGROUND

The Government Actuary's Department (GAD) produces national population projections regularly, usually every second year. After each full set of projections GAD publishes a reference volume¹ which contains explanations of the assumptions behind the projections, including fertility. The 2000-based set of projections saw a change in the fertility assumptions from the 1998-based round with a reduction in the assumed average number of children per woman from 1.80 to 1.74 at the United Kingdom level. The figures for individual countries are shown in Table 1. The assumptions were unchanged for the interim 2001-based national population projections (these projections were produced to take immediate account of the 2001 Census results and only the migration assumptions were revisited).

Since the 2000-based set of projections were produced the lowest ever fertility rates have been recorded for England (1.64 in 2001) and Wales (1.63 in 2002), following on from record lows in 2000 for Scotland (1.48) and Northern Ireland (1.75). However, there is also evidence of a recent upturn in births in 2003. Compared to the first half of 2002, births in the first half of 2003 are over 3½ per cent up in England and in Wales, 2½ per cent up in Scotland and about 1 per cent up in Northern Ireland.

Further, three new pieces of information have become available. Firstly, results of the 2001 Census have been released.² As usual after a census, population estimates have been rebased to the new census³ and this has meant revisions to population estimates for the 1980s and 1990s, although for females of fertile age (for analytical purposes assumed to be ages 14 to 46) the population was unchanged for the 1980s. Secondly, for England and Wales combined, new estimates have been made of births by true birth order (that is whether a birth is a first birth, second birth, and so on).⁴ Birth order data can be used to model progression by birth

order (the probability having a first birth, second birth, and so on) both to give a better understanding of fertility trends and to produce plausible age specific fertility rates. Thirdly, birth expectations data collected in the General Household Survey have been examined.⁵ This article reviews the evidence used in the determination of fertility assumptions and shows that the completed family sizes assumed for 2000-based projections are still the most plausible assumptions for the 2002-based projections (Table 1).

DATA

For the discussion in this article of the overall assumption of family size mainly United Kingdom or England and Wales data are used. Births are recorded by the civil registration systems for England and Wales, Scotland and Northern Ireland. Births can either be counted at the time they were registered or at the time the birth actually occurred. In England, Wales and Northern Ireland a birth must be registered within 42 days of occurrence while for Scotland, the limit is 21 days.⁶ Births data used here are at the time of occurrence for England and Wales and at the time of registration for Scotland and Northern Ireland. The analyses in this article take account of the revised population estimates for 2001 and the new estimates for 2002 issued on the 26 September 2003. Data for previous years consistent with the revision to 2001 were not available until towards the end of the preparation this article and have therefore not been included in most of the analysis, however their impact would be minimal as there was little change to the female population aged 14–46. They have, however, been included in the section on age-specific fertility rates and family size distribution. This work does not take account of the revisions to population estimates for 2001 and 2002 published on 4 November 2003.

REBASED POPULATION

As mentioned previously, one major change since the 2000-based set of projections is the rebasing of population data to the 2001 Census. In fact the fertile-age female populations of the constituent countries of the United Kingdom changed remarkably little, as can be seen from the comparison of fertility rates for 2001 from before and after the rebasing of population shown in Figure 1 and Table 2 (the pre-2001 Census figures for 2001 are calculated using the 2000-based projected population of mid-2001). Thus the levels of age-specific fertility that were used in formulating the 2000-based set of projections are little changed. The changing shape of the fertility curve, with the slope of the curve becoming less steep between ages 20 and 30 is therefore confirmed as a real phenomenon and not a result of cumulating errors in the rolled forward population estimates. The resulting Total Fertility Rates (TFRs) (Table 2), therefore, also change little as a result of the 2001 Census. The biggest change was for Wales where the change in population reduced the TFR by just over one per cent. For the other three countries and the United Kingdom as a whole the changes were within ± 0.5 per cent.

FERTILITY TRENDS

Fertility measures can be presented in two dimensions. The first is the 'period' dimension. That is, the measure relating to the fertility that occurred in a particular period, normally a year, say 2002. The fertility in a particular period is made up of the experiences of women in their childbearing years (assumed to be ages 14–46 in these analyses). Thus any measure of period fertility contains the fertility of women born across a span of over 30 years. Age-specific fertility rates in a period are summed to obtain the TFR. Alternatively, fertility can be looked at in the cohort dimension and it is cohort analysis that is used in setting fertility assumptions. Cohort fertility analysis looks at the fertility experience of a group of women born around the same time, for example, in the year 1960. Cohort fertility is more stable than period fertility as measures of total cohort fertility are affected only by changes in the number of children women eventually have. Period fertility rates are affected both

Table 1

Average number of children per woman assumed for, 2002-based and previous projections

United Kingdom and the constituent countries

	1998-based	2000-based	2002-based
England	1.80	1.75	1.75
Wales	1.80	1.75	1.75
Scotland	1.75	1.60	1.60
Northern Ireland	1.85	1.80	1.80
United Kingdom	1.80	1.74	1.74

Table 2

Difference in Total Fertility Rate values using pre and post census populations as denominators, 2001

United Kingdom and the constituent countries

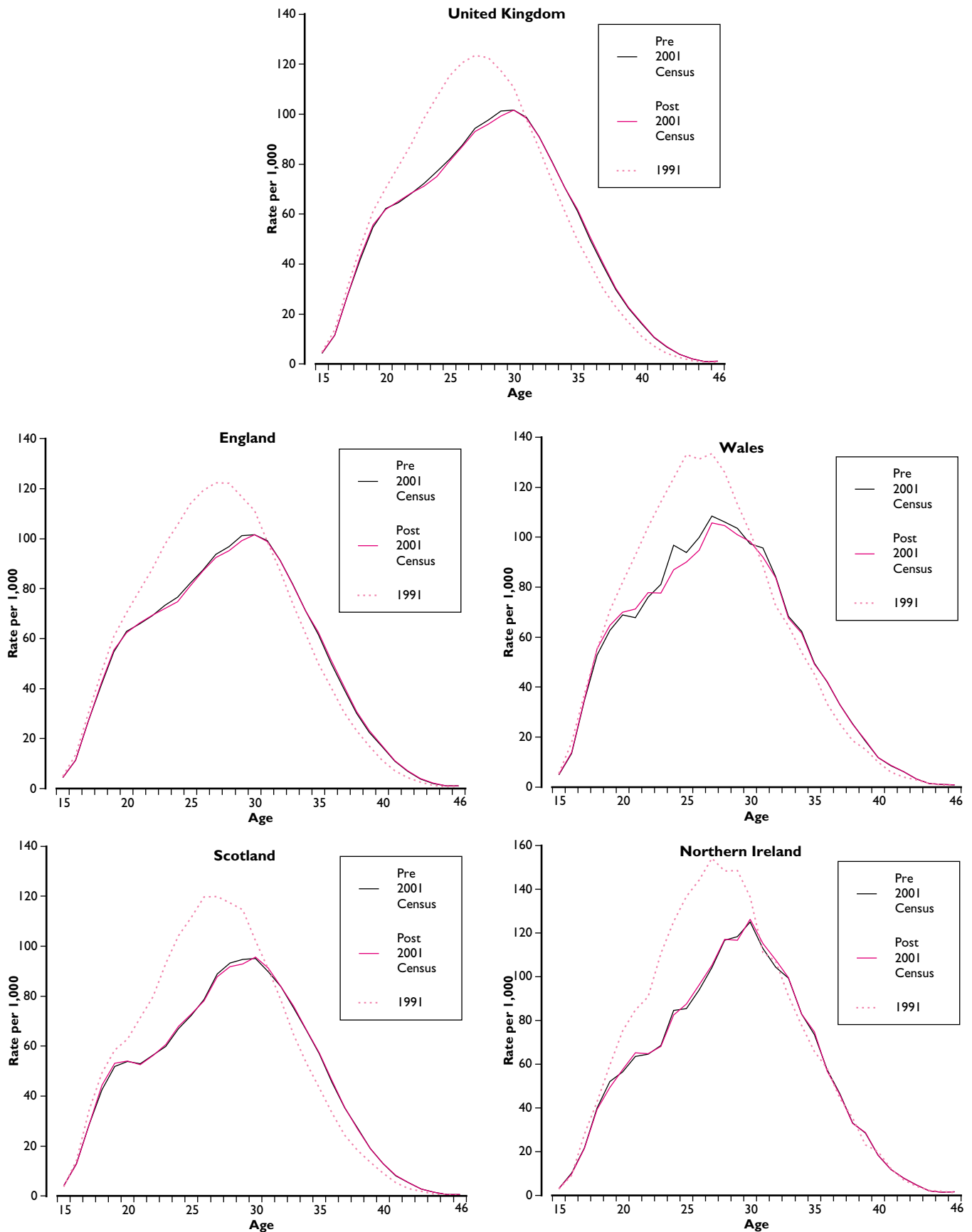
	Pre-census	Post census	% difference
England	1.641	1.639	-0.12%
Wales	1.680	1.661	-1.13%
Scotland	1.484	1.488	0.25%
Northern Ireland	1.793	1.801	0.43%
United Kingdom	1.633	1.631	-0.12%

by changes in the number of children women have and by changes in the timing of when women have children.⁷ Cohort fertility rates therefore give a true measure of the number of children women have without the distortion caused by changes in timing of births. Of course, overall levels of cohort fertility may be affected by timing as delaying fertility narrows the period of time over which women bear children, conversely earlier fertility may increase the possibility of women having further children. But the cohort measure itself is unaffected by timing changes.

Two presentations of trends in cohort fertility for the United Kingdom are shown in Figure 2 and illustrate that there have been changes in timing of births between cohorts. Figure 2(a) shows average achieved family size by age for a selection of cohorts. By age 30 it can be seen that the 1972 cohort have on average 0.15 children fewer than the 1967 cohort. However, some of this decrease is very likely to be offset by increasing fertility at older ages, as has happened with earlier cohorts. For example, the chart shows that the 1957 cohort was 0.12 behind the 1952 cohort at age 30, yet their final completed family size was only 0.05 lower. Figure 2(b) demonstrates this falling behind and catching up (recuperation) more clearly. Representing the same data used in Figure 2(a) it shows the difference between the 1957 cohort and the other cohorts. The 1957 cohort have completed their childbearing at an average of just over 2 children per woman (2.02). The chart demonstrates that the cohorts shown born before 1957 had *higher* fertility at younger ages than the 1957 cohort did, but that the difference diminished at older ages. The cohorts born after 1957 are a mirror image. At young ages fertility has been *lower* than the 1957 cohort. The difference has been particularly marked at younger ages for cohorts born in the late 1960s and early 1970s. For cohorts born in the early 1970s the greater difference at young ages has persisted into older ages than for earlier cohorts. However, there is evidence of these cohorts beginning to recover some of the difference as they get older. To help put the relationship between the trends and the 2002-based projection assumption in context both charts show the assumed ultimate level of completed family size for the projection at age 46. One of the consequences of the effects of delaying fertility is that period measure of fertility the TFR may remain below the ultimate average number of children women have, and this effect may persist for some years. Box 1 gives further explanation of why this is so.

Figure 1 2001 age-specific fertility rates calculated using pre and post 2001 Census population data, and comparison with 1991

United Kingdom and constituent countries



LIKELY COMPLETED FAMILY SIZE OF OLDER COHORTS (I.E. THOSE AGED OVER 30 IN 2002)

Cohorts of women who are now aged in their thirties have experienced at least half of their fertile life span. To make assumptions about their completed childbearing trends the only consideration is what is likely to happen to age-specific fertility rates at older ages. The following analysis compares assumptions from the previous (2000-based projections) with recent trends in age-specific fertility rates at ages above 30.

United Kingdom

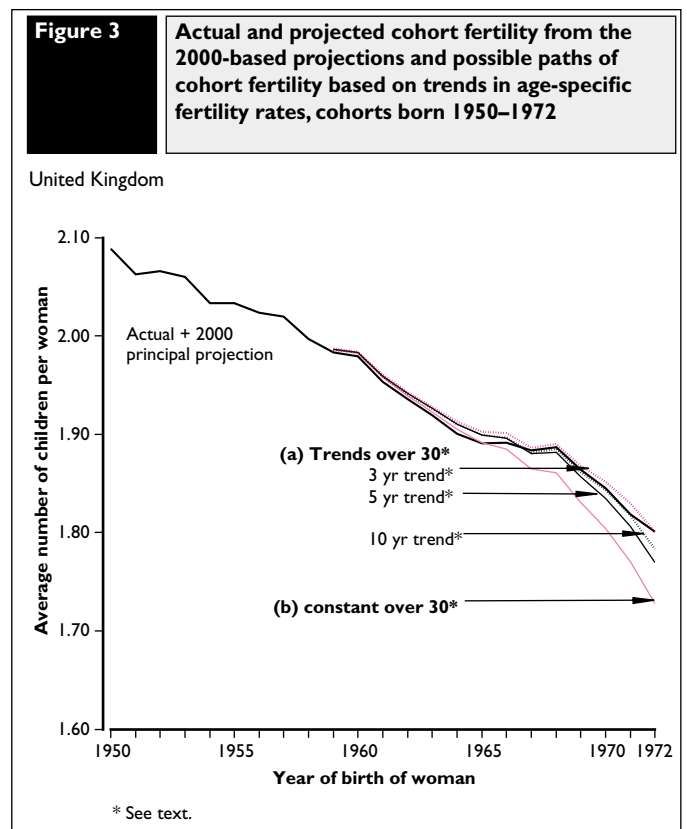
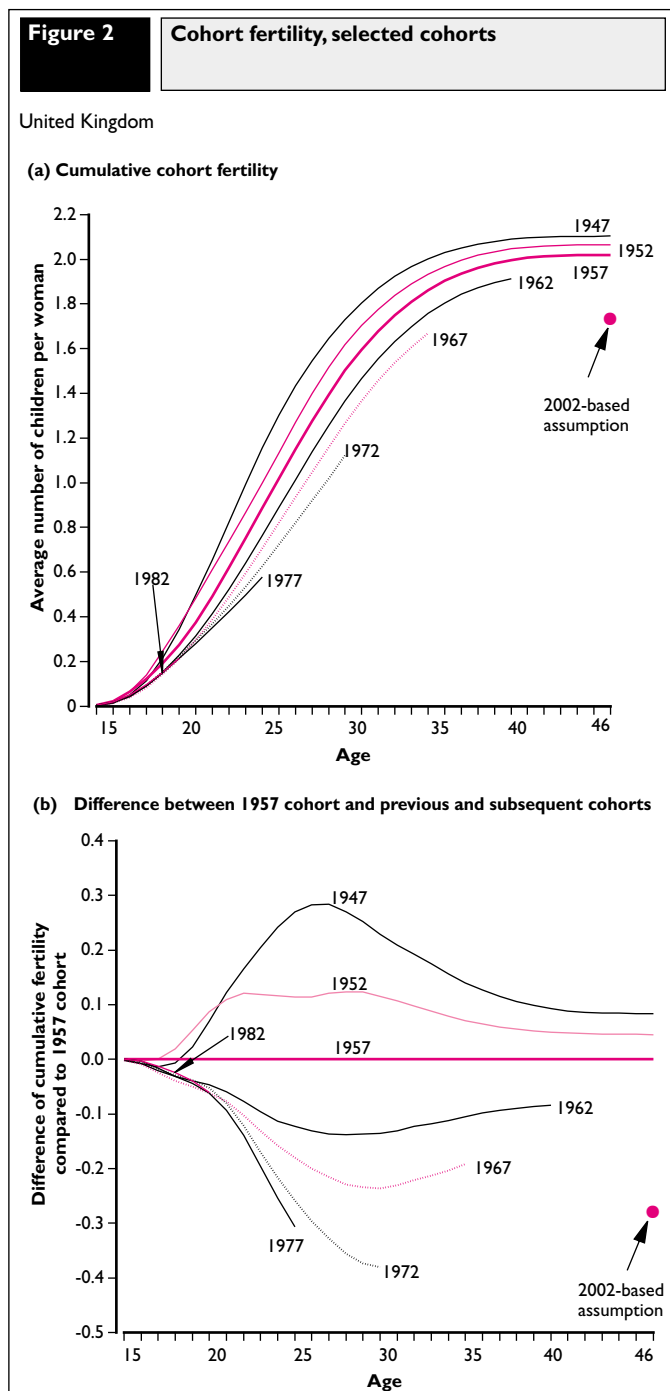
Figure 3 shows a simple comparison of the previous 2000-based assumptions for cohort fertility for cohorts aged older than 30 in 2002, with possible paths of their completed family size. The paths are based on the assumption that (a) fertility rates above age 30 change linearly based on trends in the previous three years, five years and ten years and

(b) no further change occurs in age-specific fertility rates above age 30. The projected final family size from the 2000-based projections for the United Kingdom for cohorts born prior to 1967 actually lies slightly below all of the lines. For cohorts born 1967 to 1972 the 2000-projection lies above the no further change and paths based on 5- and 10-year trends but slightly below the path based on three-year trends. None of these paths are limits – fertility rates at older ages could fall, conversely they could increase more rapidly than current linear trends suggest. However, they provide a plausible range for the path of these cohorts. The 2000-based projections assumed that the 1972 cohort would have on average 1.79 children per woman, a fall from an average of just over 2 children for women born in the 1950s. If there were no further changes to fertility rates above age 30 then this cohort would achieve only 1.73 children. However, assuming continued rises at the pace of the last 10 years produces an average of 1.78, 5 years produces an average of 1.77 and of the last 3 years produces an average of 1.80. It is interesting to note that trend in the years 2000 to 2002 produces the highest average completed family size for the 1972 cohort despite fertility levels in those years, as measured by the TFR, being three of the lowest ever recorded.

The conclusion from this analysis is that if fertility at older ages continues to rise at current trends the assumed levels for fertility for women born before 1973 in the previous set of projections are still plausible.

Constituent countries of the United Kingdom

The projection assumptions for the United Kingdom are actually the combination of the assumptions for each of the constituent countries. Therefore Figure 4 shows similar charts to Figure 3 for each of the four countries of the United Kingdom (to simplify the graphs only the three year and ten year trends are shown). Comparisons of the previous 2000-based projections with current trends in age-specific fertility rates show broadly the same patterns for England, Wales and Scotland. In each case the 2000-based assumption follows the path of assumed continued increases in fertility rates at older ages. The exception is Northern Ireland. Here, trends in the last 5 and 10 years produce a pattern very



Box one

WHY THE TOTAL FERTILITY RATE IS NOT NECESSARILY A GOOD INDICATOR OF COHORT FERTILITY

The most commonly used measure of fertility is the Total Fertility Rate (TFR). It is constructed from births by age of mother and female population by age in a particular period of time, normally a year. This gives a measure of the average number of children than a group of women would have if they experienced the fertility rates of that period. Of course each age-specific fertility rate comes from women born in different years, at different ages of their life course. So, for example, the 2002 TFR includes the age-specific fertility rate at age 15 who are women born around 1987 and the age-specific fertility rate at age 45 who are women born around 1957. The TFR is, therefore, a synthetic measure; it is not a measure of a single 'real' group of women. It is, however, a very useful measure in that it allows comparison of fertility across time and geography, as it controls for differences in population size. Perhaps because the measure is given as the average number of children per woman, it is often inferred wrongly that the level indicates the average number of children 'real' women will have over their lifetime.

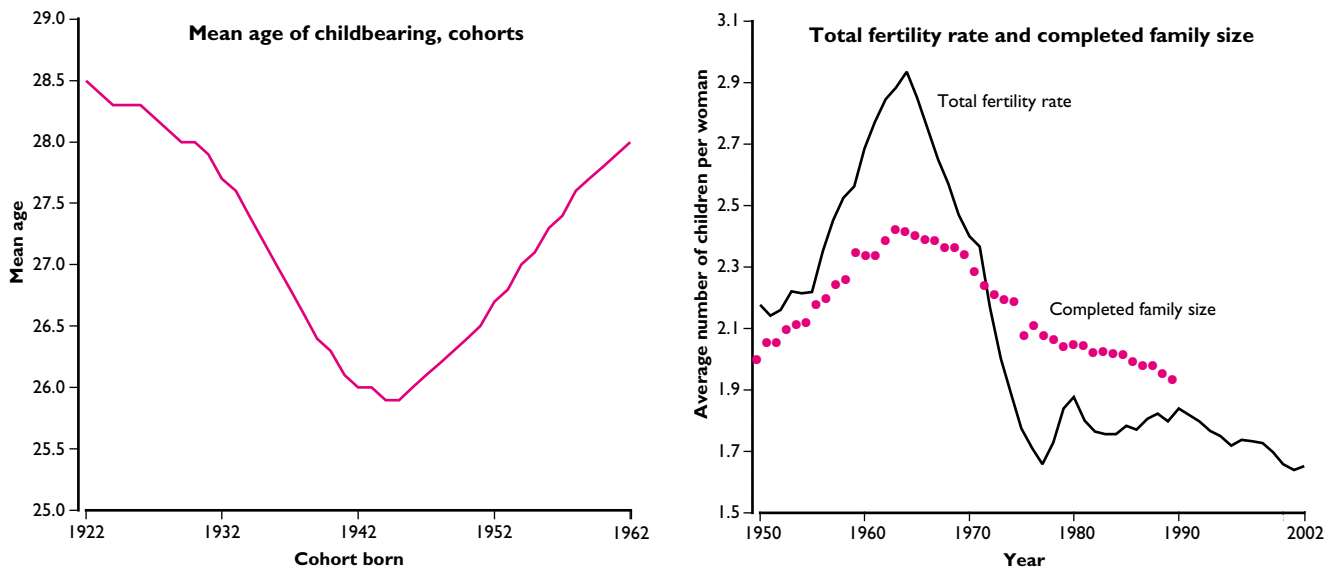
Only if all cohorts had the same age pattern of fertility and the level of cohort fertility did not change, would the TFR accurately reflect the cohort fertility. If successive cohorts still have the same average number of children per woman but delay their childbearing their births are spread out over a longer period of time. This would result in a reduction in period fertility. The converse effect would be seen if cohorts advanced their births, period fertility would be inflated compared to cohort fertility.⁸ This can be seen when comparing the total fertility rate with the completed family size of cohorts plotted in the year of their mean age of childbearing in the chart below. Cohorts of women

born in the 1930s and 40s were bringing forward their births in the 1960s and consequently the completed family size is above the TFR. Conversely cohorts born in the 1950s and 60s have been delaying childbearing, with the TFR being below the completed family size of these cohorts. Changes in timing of childbearing by cohorts therefore 'distort' the TFR making it less representative of cohort fertility levels. Dependent on how many successive cohorts delay (or advance) fertility this timing distortion can last for many years. If 20 successive cohorts delayed their childbearing the TFR would, other things being equal, be reduced below the level of cohort fertility for up to 50 years (20 years plus the three decade span of childbearing). Postponement of births by successive cohorts cannot continue indefinitely. Once the mean age of childbearing stabilises the disappearance of the timing effect will put upward pressure on the TFR. In fact even a slowdown in the pace of postponement of childbearing would, if cohort fertility itself is not falling, produce a rise in the TFR.⁹

The graph below shows that the cohort mean age of childbearing fell to around 26 years for the cohorts born in the mid 1940s cohort but has been rising since. It is therefore likely that in the United Kingdom the current TFR is understating the level of cohort fertility as successive cohorts are having births later. The TFR would also be reduced, however, by a reduction in the level of fertility of cohorts. Trends also show that cohort fertility is reducing. The projection assumptions reflect this with a fall in cohort family size in the United Kingdom from 2.02 for the cohort that have just completed their childbearing (born in 1957) to 1.74 for cohorts born from the 1980s onwards. But because of changes in the timing of women having births the likely effect is that cohort fertility will still be higher than the record low levels of the TFR seen in the last few years.

Figure A1 Mean age of childbearing and completed family size for cohorts born 1922–1962 and total fertility rates 1950–2002

England and Wales



Note cohorts 1958 to 1962 include a small element of projection.

* Completed family size is plotted at the year of birth of the cohort + the mean age at birth, for example, the peak completed family size is the 1934 cohort which is plotted at 1961.4 (1934+ the mean age of 27.4).

similar to the current rates, and the 2000-based assumption follows this path. Trends based on the last three years produce a slightly higher path. If these very recent trends continue the final family size for cohorts born in the late 1960s and early 1970s could be a little higher than estimated in the 2000-based projection.

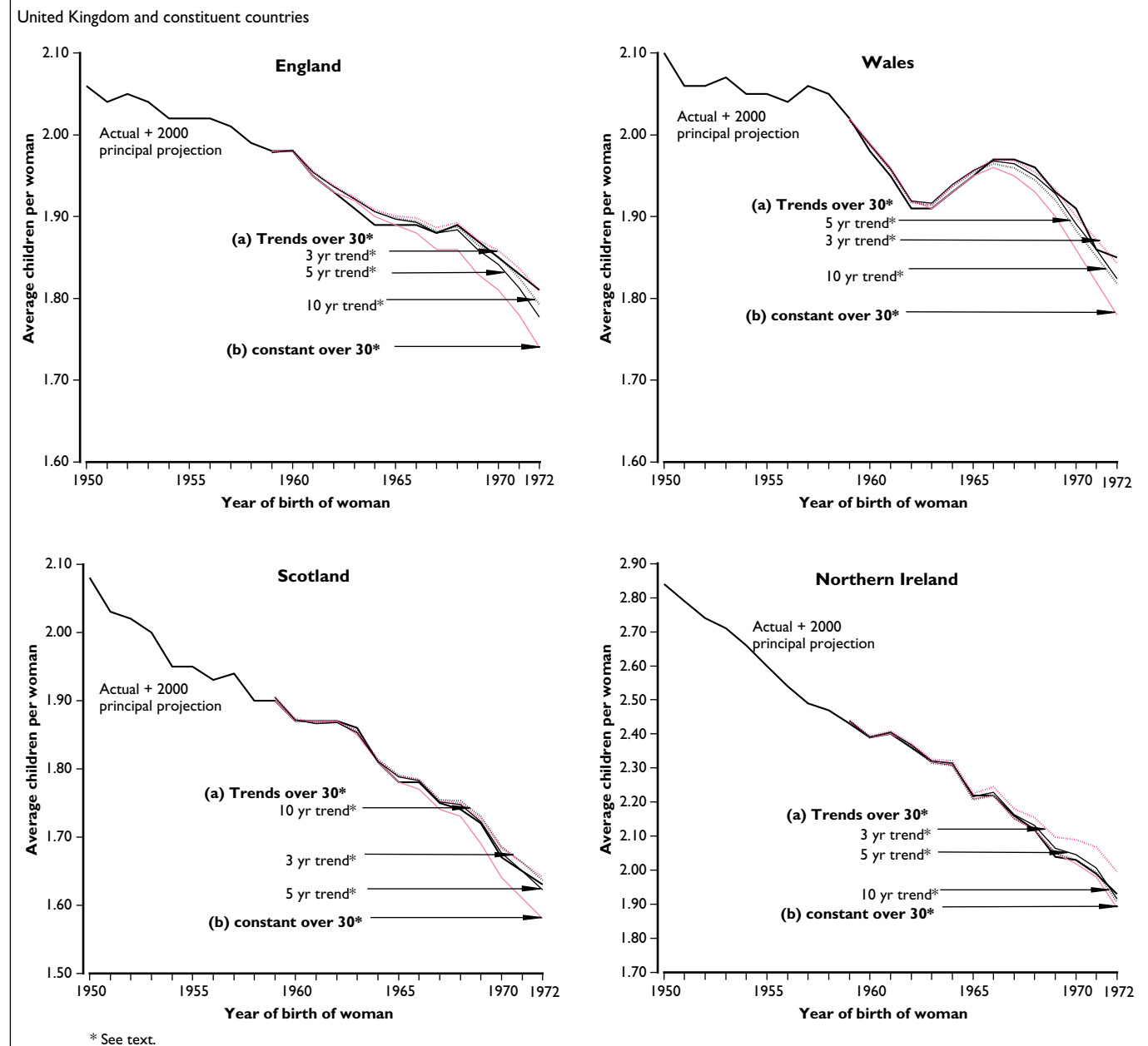
TRENDS IN YOUNGER COHORTS (I.E. THOSE AGED UNDER 30 IN 2002)

United Kingdom

For cohorts born since 1972 the completed cohort size becomes successively more conjectural. However, some evidence for possible levels of fertility can be gained from Figure 2(b) and Table 3. Table 3 shows the possible impact of recuperation on completed fertility for the 1977 cohort. The 1977 cohort is already 0.05 of a child behind the 1972 cohort by completed age 25. Assuming fertility rates at ages 26 to 30 remain constant, by completed age 30 the 1977 cohort will have around

0.07 children fewer than the 1972 cohort. (Table 3 row ii) However fertility rates at ages 26–30 have been falling in the last few years and if these falls continue the difference will be around 0.11 (row iv). As figure 2(b) demonstrates, there is likely to be some recuperation of fertility at older ages. For example, at completed age 30 the 1962 cohort was 0.14 of a child lower than the 1957 cohort. By completed age 40 for both cohorts the difference had become 0.08. Thus just under 40 per cent of the difference between the cohorts at completed age 30 had been recovered between age 30 and 40 (row vii). If the 1977 cohort experienced a similar proportionate recuperation, it is likely to be only around 0.04 to 0.07 below the final completed family size of the 1972 cohort (row viii). This would suggest that for the 1977 a completed family size in the range 1.72 to 1.75 would be plausible (row viii) The actual level of recuperation may be lower or higher than shown by previous cohorts so the likely range is, of course, somewhat wider. The 2000-based assumption for this cohort was 1.76 and the range is consistent with the long-term assumption of 1.74. There is no evidence that for younger cohorts fertility is falling further (row ix).

Figure 4 Actual and projected cohort fertility from the 2000-based projections and possible paths of cohort fertility based on trends in age-specific fertility rates, cohorts born 1950–1972



The conclusion, therefore, is that the overall long-term assumption for the United Kingdom of 1.74, assumed for the previous projections is still credible for the 2002-based projections.

Constituent countries of the United Kingdom

For each of the Constituent countries a similar analysis to that carried out above for the United Kingdom shows that the previously assumed levels of ultimate cohort fertility are still plausible (see Table 3). Assumptions for the constituent countries are rounded to the nearest 0.05. As noted previously the United Kingdom figures will be the result of the addition of the projections of the constituent countries of the United Kingdom. The fact that the United Kingdom figure will not be rounded to the nearest 0.05 should not be taken as any indication of greater accuracy. For England and Wales the rounded assumption lies within the range shown in Table 2. For Scotland, the rounded figure lies only slightly above the range. Fertility in Northern Ireland has fallen further and faster than in the other countries of the United Kingdom and has appeared to be on a course to converge with fertility levels in England and Wales. The slight rises in fertility rates at older ages in the last three years have been taken as evidence for support in maintaining a distinctive level of fertility for Northern Ireland, but insufficient to consider raising the projection assumption in this projection round.

FACTORS AFFECTING THE NUMBER OF CHILDREN WOMEN HAVE

Cohorts that have recently completed their childbearing have done so at an average of just over 2 children per woman (For the United Kingdom 2.02 for the 1957 cohort). The projections assume that ultimately completed family sizes will be lower than this at 1.74.

There are many factors that account for the new patterns of family formation seen in the last twenty years. Lesthaeghe⁹ identified the following set of factors affecting childbearing behaviour in developed societies:

- increased female education and female economic autonomy;
- rising and high consumption aspirations that created a need for a second income in households and equally fostered female labour force participation;
- increased investments in career developments of both sexes, in tandem with increased competition in the workplace;
- rising 'post-materialist' traits such as self actualisation, ethical autonomy, freedom of choice and tolerance for the non-conventional;
- a greater stress on the quality of life with a rising taste for leisure as well;
- a retreat from irreversible commitments and a desire for maintaining an 'open future'; and
- rising probabilities of separation and divorce, and hence a more cautious 'investment in identity.'

In addition he points to country specific effects including costs and availability of housing, the flexibility of the labour market.

Bongaarts⁸ notes that there is no agreement on which of these potential explanatory factors are most important in determining fertility trends; they will vary between countries and between different strata of society within countries. However, on balance, for each of the above the effects on fertility are likely to be twofold. Firstly they will tend, on average, to lower the number of children that women have. However, they are also likely to lead to a postponement of births.

Recent work by Rendall and Smallwood¹⁰ has shown that women born in 1954–1958 resident in England and Wales who had a higher educational qualifications had births on average 5 years later than those without, and that they were also more likely to be childless. Figure 5 shows for women aged 20–24 the percentage of women in education and for women aged 25 and over the percentage who have a higher educational qualification.

Table 3

Analysis of the cohorts born in 1977 in the constituent countries of the United Kingdom

	Average number of children per woman				
	England	Wales	Scotland	Northern Ireland	United Kingdom
(i) Achieved family size at completed age 30 assuming ASFRs at ages 26–30 remain constant at 2002 levels	1.06	1.17	0.96	1.10	1.05
(ii) Therefore probable minimum fall in achieved family size at age 30 relative to the 1972 cohort	0.06	0.09	0.08	0.10	0.07
(iii) Achieved family size at completed age 30 assuming continued falls in ASFRs at ages 26–30	1.01	1.13	0.92	1.07	1.01
(iv) Therefore probable fall in achieved family size at age 30 relative to the 1972 cohort	0.11	0.13	0.11	0.12	0.11
(v) 2000-based assumption for 1972 cohort	1.81	1.85	1.63	1.92	1.79
(vi) Range for 1977 cohort assuming no recuperation (v)-(vi) to (v)-(ii)	1.70–1.75	1.72–1.76	1.52–1.55	1.80–1.83	1.68–1.72
(vii) Percentage recuperation based on 1957 to 1962 cohorts between ages 30 and 40	39%	14%	49%	16%	38%
(viii) Revised range assuming recuperation (v)-[(iv) × 1-(vii)/100] to (v)-[(ii) × 1-(vii)/100]	1.75–1.77	1.74–1.77	1.57–1.59	1.82–1.84	1.72–1.75
(ix) Difference in fertility at completed age 20 comparing the 1977 and the 1982 cohort	+0.00	+0.01	+0.00	–0.00	+0.00
(x) Final Assumption (rounded to nearest 0.05)	1.75	1.75	1.60	1.80	1.74

The 1990s have seen acceleration in the proportion of young women in education and in the second half of the 1990s a corresponding acceleration has been seen in proportions of those aged 25–29 with a higher educational qualification. Assuming younger cohorts exhibit similar fertility behaviour to the 1954–1958, cohorts postponement of fertility is likely to continue. Similarly there has been a rise in the proportion of women in full-time employment in the labour force (Figure 6). Employment is a less clear indicator of fertility trends, as the relationship is harder to quantify, for example, Italy has fairly low levels of female employment by European standards but also low fertility.¹¹ Also many women combine being economically active with having children, in the latest GHS over half (54 per cent) of women who had a child under 5 were also in employment. The effect of employment is complex and is likely to be intertwined with types of employment, the flexibility it affords and availability of child care support.¹²

A precursor to the postponement of the majority of fertility has been the postponement of marriage. The mean age of first marriage for women has risen from 23.1 years in 1981 to 28.4 years in 2001 (England and Wales). The majority of births still occur within marriage and therefore postponement of marriage will in turn lead to later fertility. However a large minority of births, 40.6 per cent in England and Wales in 2002, take place outside marriage. Of these births the majority, 64 per cent, are registered to a mother and father living at the same address. The only available evidence on starting age of cohabitation relates to median age of cohabitation prior to first marriage, Haskey¹³ has shown that this has risen steadily from around 21 years in the early 1980s to around 23 years towards the end of the 1990s. If the starting age of cohabitation is also rising this is also likely to lead to a postponement of births.

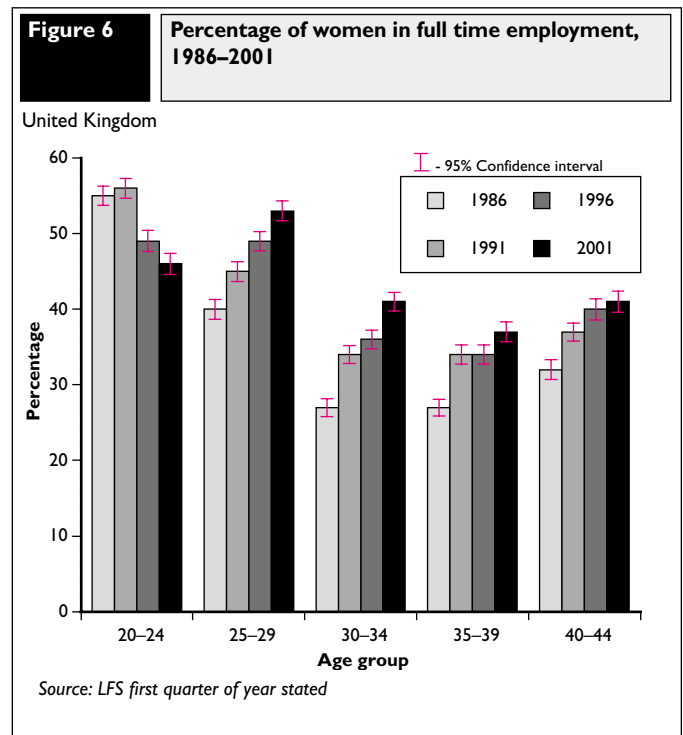
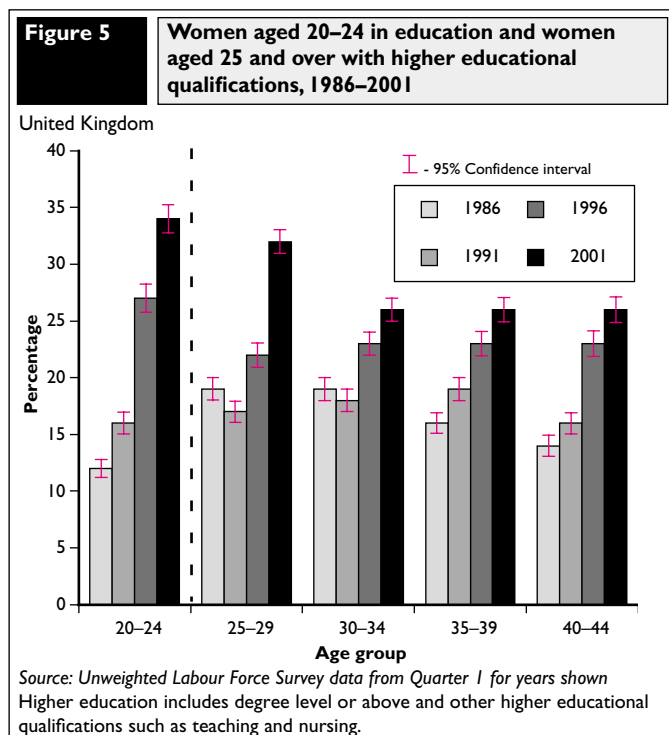
Evidence on women’s fertility intentions is collected in the General Household Survey (GHS). Information from the 1979 to 2001 Surveys for England and Wales has recently been analysed.⁵ The results showed that there had been a reduction in the average number of children intended by younger women of around 0.1 to 0.2 of a child over the two decades but overall average intended family size is around, or a little above, two children. Some caution in interpreting the levels and trends given by the data is needed as the analysis also showed that intentions of

young women in the 1980s appear to have been poor predictors both in terms of levels and trends of fertility.

Nevertheless the GHS data do clearly show evidence for postponement. They show that, where women think they will have a further birth, more recent surveys show that those births are expected to happen further into the future. For example, for 21- to 23-year-olds interviewed in the 1979–1981 GHS who said they were going to have a further birth, 31 per cent said it would be within 3 years and 71 per cent within five years. For 21- to 23-year-olds in 1988–1990 GHS the corresponding percentages had fallen to 21 per cent and 56 per cent, and for the 1998, 2000 and 2001 surveys (unweighted) the figures are 12 per cent and 39 per cent.

The further ahead women think they will have their first/next birth the greater the uncertainty over the birth occurring (although there is always the chance that the next birth may happen earlier). Some of the uncertainty will come from the possibilities of life events and changing preferences. There is some evidence of postponement at older ages. For women aged 27–29 at the start of the 1980s 95 per cent of those intending to have a further birth intended it to be within the next 5 years. This had fallen to 79 per cent for 27- to 29-year-olds asked between 1998 and 2001. Some uncertainty at older ages will come from simple biology. While successful older motherhood is possible, the fecundity of women drops rapidly once a women enters her late 30s.¹⁴ Although there were 19.2 thousand births to women aged 40 and over in the United Kingdom in 2002, that represented only three per cent of all births.

Recently Voas¹⁵ has highlighted the possibility that fertility outcomes might be lower (or higher) than given in data on fertility intentions because of the interactions of the intentions of partners; it is the couple’s joint preferences and how they are worked out that are important. Even if, on average, men desired the same number of children as women if there is a mismatch at the individual level of fertility intention or desire outcomes will be affected by how those mismatches are resolved. If there is a tendency for the lower preference in a partnership to prevail then actual fertility will be lower than expressed. As yet no data has been analysed to shed light on the interactions of men’s and women’s preferences in Britain although data collected in the British Household Panel Study in the 1990s may be able to be used.



ASSUMED AGE-SPECIFIC FERTILITY RATES

The assumed ultimate age specific fertility rates for the constituent countries of the United Kingdom are shown in Figure 7, and would apply to cohorts born from around 1990 onwards. For Scotland and Northern Ireland a smooth set of ultimate rates was produced using fitting of a mixture model Hadwiger curve¹⁶ to actual data and then adjusting the parameters of the curve. For England and Wales parity progression ratios derived from the female population and the estimated births by birth order have been used. Parity progression ratios give the probability by age of having a first birth, a second birth a third birth or a fourth birth. Wales figures have been calculated using current differences in the pattern of age-specific fertility rates between Wales and England. England figures have then been derived such that the England and Wales combined figures are reproduced. All four curves are a continuation of the formation of what appears to be a new pattern of fertility that has emerged in the last decade. There has been a deceleration of the increases in rates by age at ages in the early to mid 20s, leading to the appearance of a bulge in the curves at ages in the early 20s.

This ultimate assumed age specific fertility rates for the United Kingdom give a mean age of childbearing of 29.2 years, one half a year higher than the 28.7 years of current age specific fertility rates. Figure 8 shows the cohort data shown in figure 2 completed with the projected age-specific fertility rates. Figure 8 (b) shows further reductions in fertility at younger ages for cohorts born in the 1970s and 1980s but with some recuperation at older ages.

ASSUMED FERTILITY BY BIRTH ORDER, ENGLAND AND WALES

The work in producing age-specific fertility rates for England and Wales above also produces details about the distributions of completed family size by number of children women have already had (parity). Different family size distributions could have been used to produce the overall level of fertility assumed in the projections so distributions here

should not be regarded as part of the projections. They are rather a set of distributions resulting from the birth order modelling to produce the age-specific fertility rates that are consistent with the overall fertility assumption for England and Wales. Completed parity distributions from the birth order model are shown in Table 4. The projection assumptions for England and Wales are consistent with a rise in the proportion of childlessness women from 19 per cent for the 1960 cohort to around 22 per cent, and a slight rise in the number of women with one child. Conversely the modelling shows continued slight falls in the proportions of women having three or more children.

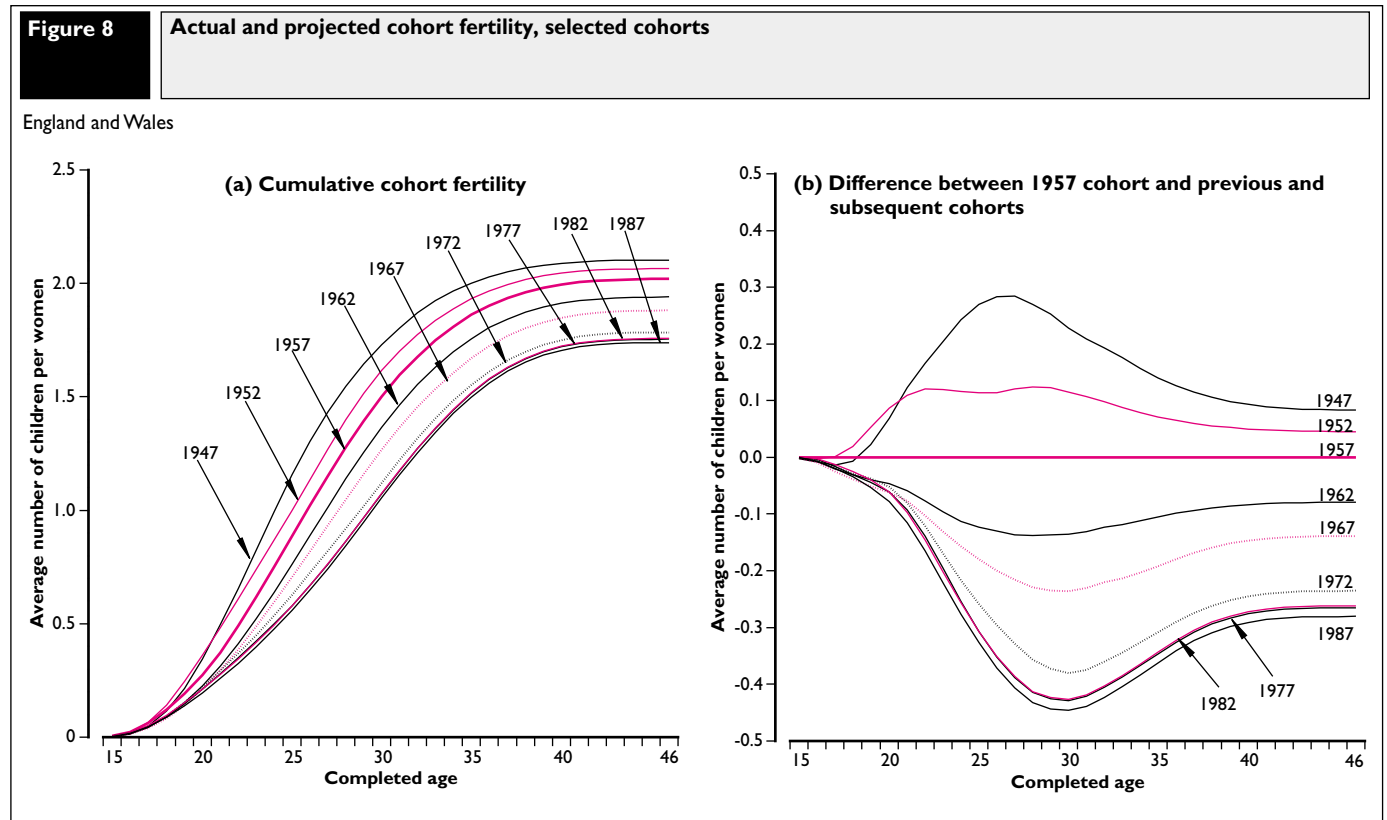
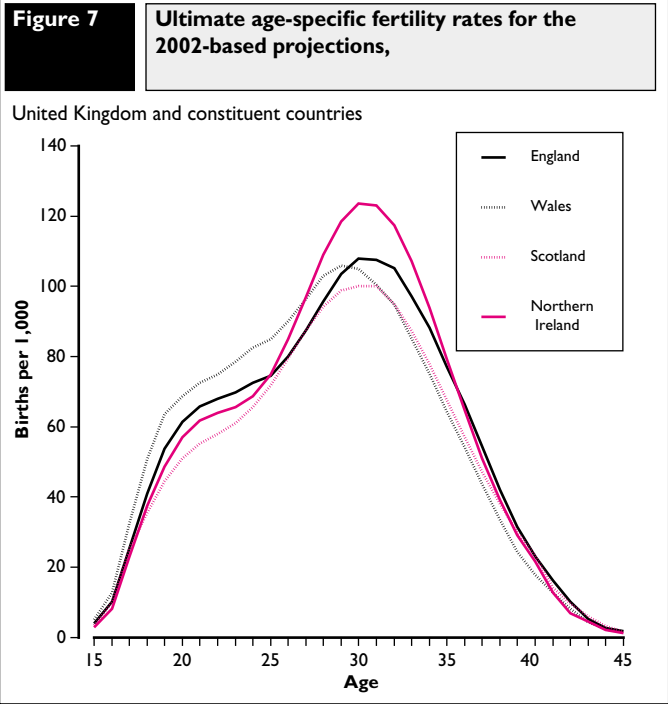


Table 4

Actual and assumed distribution of women by number of children, consistent with 2002-based projections, selected cohorts

England and Wales

Cohort born	Average family size all women	Average family size of women who have children	Number of children (percentages)				
			0	1	2	3	4 or more
1945	2.19	2.42	9	14	43	21	12
1950	2.07	2.39	14	13	44	20	11
1955	2.02	2.39	15	13	41	20	10
1960	1.98	2.43	19	12	40	20	10
1965	1.90	2.37	20	13	39	18	10
1970	1.87	2.33	20	14	40	17	9
1975	1.80	2.28	21	15	39	16	8
1980	1.78	2.27	22	15	40	16	8
1985	1.76	2.25	22	15	40	16	7
1990 and later	1.75	2.24	22	15	40	16	7

The table also shows the average number of children for women who have children. As with the average for all women this measure is also falling. For cohorts born up to the first half of the 1960s the falls in cohort fertility were largely driven by increasing childlessness, women who had children were having on average around 2.4 children. Since then the fall in overall family size is a product both of increasing childlessness and smaller average family sizes for those women that have children.

PROJECTION RESULTS

The full results of the 2002-based national population projections will be published on the 18 December 2003. An article will also appear in the next edition of *Population Trends*. The resulting number of births from the assumptions here will depend on the size and age distribution of the female population of fertile age. Therefore previous birth cohort sizes and the assumptions for migration will play a part in determining the number of births. Mortality also plays a part but is so low for females at fertile ages that it will have little effect on trends in birth numbers.

VARIANT FERTILITY ASSUMPTIONS

The principal population projections provide a consistent starting point for all government planning which is affected by the numbers in the population. However, due to the inherent uncertainty of demographic behaviour, any set of projections will inevitably be proved wrong, to a greater or lesser extent, as a forecast of future demographic events or population structure. To give users of the projections an indication of this uncertainty, a number of variant population projections, based on alternative assumptions of future fertility, mortality and migration are also been produced. These variant assumptions are intended as plausible alternatives to the principal assumptions and not to represent upper or lower limits for future demographic behaviour. For fertility the variant assumptions will assume a difference of +/- 0.2 of the principal assumption for each of the constituent countries of the United Kingdom.

CONCLUSION

The rebasing of the population estimates to the 2001 Census and the updating of the estimates of births by true birth order made very little difference to fertility trends and therefore support previous analysis of trends in overall fertility used to set the assumptions in the 2000-based projections. Although the last three years have seen the lowest ever recorded levels of fertility in the United Kingdom, these recent data do not provide a strong case for reducing the fertility assumptions. Underlying these low levels of fertility have been continued increases in fertility at older ages with falls in fertility at younger ages. These patterns are consistent with postponement of fertility. Cohort analysis of fertility rates suggests that the overall levels of completed family size assumed

for the 2000-based projections for each of the constituent countries of the United Kingdom need not be changed. Fertility intentions data, although weak evidence, suggest women still expect to have on average around 2.0 children and only show slight falls through time. The same data show that women are postponing intended births.

More detailed analysis of age-specific fertility rates suggests that the pattern of falling fertility rates for women aged in their twenties and rising fertility rates for women aged in their thirties will continue. This leads to a distinctive pattern of age-specific fertility. More work is required to understand and interpret the social and demographic factors that are producing this pattern.

Key findings

- The United Kingdom fertility assumptions for the 2002-based projections are an assumed fall in completed family size from just over two children per woman for cohorts who have just completed their childbearing to an average of 1.74 children per woman.
- The United Kingdom figure is a result of the combination of the assumptions for the constituent countries of the United Kingdom with assumed completed family sizes of 1.75 children per woman in England and Wales, 1.60 in Scotland and 1.80 in Northern Ireland.
- The overall assumptions for the 2002-based projections are the same as assumed in the 2000-based national population projections
- Underlying the low fertility of the last three years has been a continued move towards women having children at older ages, with a rise in standardised mean age by 0.2 years to 28.7 in the United Kingdom in 2002. The projection assumptions assume trends towards childbearing at older ages will continue to rise to an assumed standardised mean age of 29.2.
- The projection assumptions are consistent with a continued rise in the proportion of women who remain childless, from 19 per cent for cohorts born around 1960 to 22 per cent for cohorts born around 1980. They are also consistent with falls in the proportion of women who have three or more children, from 30 per cent for cohorts born around 1960 to 24 per cent for cohorts born around 1980.

The author acknowledges the assistance of colleagues at the Government Actuary's Department both in the setting of the fertility assumptions and the production of this article.

REFERENCES

1. Government Actuary's Department/Office for National Statistics, *2000-based National population projections* PP2 no. 23, latest volume. TSO: London.
2. <http://www.statistics.gov.uk/census2001>
3. Duncan C, Chappell R, Smith J, Clark L and Ambrose F (2002) Rebasing the annual mid-year population estimates for England and Wales. *Population Trends* **109**, pp 9–14.
4. Smallwood S (2002) New estimates of trends in births by birth order in England and Wales. *Population Trends* **108**, pp 32–48.
5. Smallwood S and Jefferies J (2002) Family building intentions in England and Wales: trends outcomes and interpretations. *Population Trends* **112**, pp 15–28.
6. Devis T (2000) Recording of births and deaths in the countries of the United Kingdom. *Health Statistics Quarterly* **06**, pp 32–39.
7. Cooper J and Shaw C (1993) Fertility assumptions for the 1991-based national population projections. *Population Trends* **71**, pp 43–49.
8. Bongaarts J. The end of fertility transition in the developed world. *Population and Development Review* **28(3)**, pp 419–443.
9. Lesthaeghe, R (2001) *Postponement and recuperation: Recent fertility trends and forecasts in six Western European countries*, paper presented at the IUSSP Seminar on 'International perspectives on low fertility: Trends, theories, and policies', Tokyo, 21–23 March.
10. Rendall R and Smallwood S (2002) Higher Qualifications, first birth timing and further childbearing in England and Wales. *Population Trends* **111**, pp 18–26.
11. Del Boca D, Pasqua S and Pronzato C (2003) *Analyzing Women's Employment and Fertility Rates in Europe: differences and similarities in Northern and Southern Europe*, <http://iserwww.essex.ac.uk/epunet-2003/docs/pdf/papers/pronzato.pdf>
12. McDonald P (2002) *Low fertility: unifying the theory and the demograph*. Paper prepared for Session 73 Future Fertility of Low Fertility Countries, 2002 Meeting of the Population Association of America, Atlanta 9- 11 May 2002, http://demography.anu.edu.au/Publications/PAA_Paper_2002.doc
13. Haskey J (2001) Cohabitation in Great Britain: past, present and future trends and attitudes. *Population Trends* **103**, pp 4–25.
14. Gosden R and Rutherford A (1995) Delayed childbearing. *BMJ* **311**, pp 1585–86.
15. Voas D (forthcoming December 2003) Competing preferences: A reason fertility tends to be too high or too low? *Population and Development Review* **29(4)**.
16. Chandola T, Coleman D A and Hoirns R W (2002) Distinctive features of age-specific fertility profiles in the English speaking world: Common patterns in Australia Canada, New Zealand and the United States, 1970–98. *Population Studies* **56**, pp 181–200.