Office for National Statistics

National Population Projections

2006-based

Population projections by age and sex for the United Kingdom, Great Britain and constituent countries

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1 Executive summary

Introduction

This publication presents the results of new (2006-based) projections of the population of the United Kingdom and its constituent countries. Comparisons in this summary are with the previous 2004-based projections.

Key results

- The population of the United Kingdom is projected to increase from an estimated 60.6 million in 2006, passing 65 million in 2016 and 70 million in 2028, to reach 71.1 million by 2031. This is equivalent to an annual rate of growth of 0.64 per cent over the twenty-five year period. Longer-term projections suggest the population will continue to rise beyond 2031 although at a lower rate of growth.
- The projected total population of the United Kingdom at 2031 is 4.1 million (6.1 per cent) higher than in the 2004-based projections. This is due to a combination of higher assumed levels of net migration, higher fertility assumptions and slightly higher life expectancy assumptions.
- Some 47 per cent of the projected 10.5 million increase in the population between 2006 and 2031 is directly attributable to the assumed level of net inward migration. The remainder is attributable to natural increase (an excess of births over deaths). However, projected births and deaths are partly dependent on the assumed level of net migration. Allowing for the additional impact of migration on natural change, it is estimated that some 69 per cent of projected population growth in the period to 2031 is attributable, directly or indirectly, to migration.

The change in the age distribution between 2006 and 2031 is shown by **Figure 1.1**. The projection has the following features:

- The number of older people will significantly increase relative to the number of younger people, with the mean age of the population expected to rise from 39.6 years in 2006 to 42.6 years by 2031.
- The number of children aged under 16 is projected to increase by 4.8 per cent from 11.5 million in 2006 to 12.1 million in 2016 and further to nearly 13 million by 2031 (see **Table 1.1**). In the 2004-based projections, a drop in the number of children was projected for the first decade.

Figure 1.1

Age pyramid of population, 2006 and 2031

United Kingdom

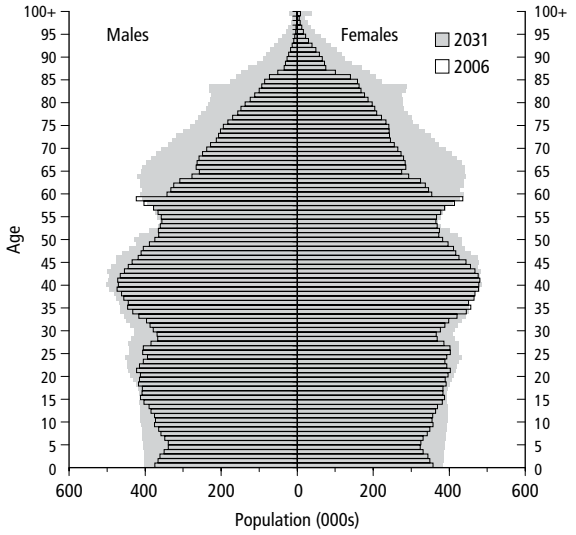

Table 1.1

Population of the United Kingdom by age, 1971–2081

thousands

Year	All ages	Under 16	16–64	65 & over	(80 & over)
	Estimates				
1971	55,928	14,257	34,263	7,408	(1,288)
1981	56,357	12,543	35,339	8,476	(1,572)
1991	57,439	11,685	36,695	9,059	(2,126)
2001	59,113	11,863	37,878	9,373	(2,459)
2006	60,587	11,537	39,362	9,688	(2,700)
	Projections				
2011	62,761	11,643	40,624	10,494	(2,953)
2021	67,191	12,687	41,604	12,900	(3,774)
2031	71,100	12,781	42,541	15,778	(5,425)
	Longer-term projections				
2041	*74,306*	*12,866*	*43,844*	*17,596*	*(6,562)*
2051	*77,236*	*13,440*	*45,050*	*18,745*	*(8,005)*
2061	*79,831*	*13,692*	*45,767*	*20,372*	*(8,240)*
2071	*82,478*	*13,882*	*47,342*	*21,254*	*(9,493)*
2081	*85,252*	*14,272*	*48,093*	*22,887*	*(10,328)*

Table 1.2

Population of the United Kingdom by constituent country, 1971–2051

thousands

Year	United Kingdom	England	Wales	Scotland	Northern Ireland
Estimates					
1971	55,928	46,412	2,740	5,236	1,540
1981	56,357	46,821	2,813	5,180	1,543
1991	57,439	47,875	2,873	5,083	1,607
2001	59,113	49,450	2,910	5,064	1,689
2006	60,587	50,763	2,966	5,117	1,742
Projections					
2011	62,761	52,706	3,038	5,206	1,812
2021	67,191	56,757	3,186	5,326	1,922
2031	71,100	60,432	3,296	5,374	1,999
Longer-term projections					
2041	*74,306*	*63,571*	*3,357*	*5,335*	*2,043*
2051	*77,236*	*66,519*	*3,397*	*5,249*	*2,070*

However, increased fertility assumptions following recent increases in birth rates mean this decline is no longer expected.

- The number of people of working age (currently defined as between ages 16 to 64 for men and 16 to 59 for women) is projected to rise by 2.3 per cent from 37.7 million in 2006 to 38.6 million in 2010. Allowing for the forthcoming change in women's state pension age from 60 to 65 between 2010 and 2020, the working age population will rise further to 41.5 million by 2020. Allowing for the further change in state pension age from 65 to 66 for both sexes between 2024 and 2026, the working age population is projected to reach 43.4 million by 2031. Without the pension age changes the increase would have been much lower, to 40.4 million by 2031.

- The number of people over state pension age is projected to increase by 7.2 per cent from 11.3 million in 2006 to 12.2 million in 2010. Allowing for the change in women's state pension age to 65, the population of pensionable age will rise only slightly further (to 12.7 million) by 2020. A faster increase will then resume, although it will be tempered by the further change in state pension age from 65 to 66 by 2026, with the projected number over state pension age reaching almost 15 million by 2031. Looking further into the future, state pension age will increase in two further stages until it reaches 68 for both sexes by 2046.

- As shown in **Table 1.1**, the population aged 80 and over is expected to grow from 2.7 million in 2006 to reach 5.4 million by 2031. Longer-term projections suggest this rapid increase will continue throughout the projection period, tempered only by periods such as the 2050s where the small population cohorts born in the 1970s reach this oldest age group. By 2081 the projections suggest there will be over 10 million people aged 80 and over.

Due to differences in past and present demographic patterns, and those assumed for the future, projected trends differ for the four countries of the United Kingdom (see **Table 1.2**).

- The population of England is projected to increase by 19 per cent by 2031, Northern Ireland by 15 per cent and Wales by 11 per cent. The projected increase for Scotland, where fertility and life expectancy levels are assumed to remain lower than in the rest of the UK, is 5 per cent. Further details of the results for individual countries are available in the appendices of this volume.

Underlying assumptions

The assumptions underlying the projections are based on an analysis of recent demographic trends. For the UK as a whole the key assumptions for the future are that:

- Average completed family size, which has been falling from a peak of nearly 2.5 children per woman for women born in the mid 1930s, will level off at 1.84 children for women born from the early 1990s onwards. This is an increase from the long-term assumption of 1.74 used in the 2004-based projections, and is the highest fertility assumption used in official projections since the 1994-based set.

- Expectation of life at birth, based on the mortality rates for the year in question, is expected to rise from 77.2 years in 2006 to 82.7 years in 2031 for men, and from 81.5 years in 2006 to 86.2 years in 2031 for women. The 2031 figures are over a year higher than those assumed in the previous projections. Beyond 2031, there is little additional increase in the differential with the life expectancy assumptions from the previous 2004-based projections.

- The long-term net inward migration assumption to the UK is 190,000 persons per year from 2014–15 onwards. This compares with an assumed long-term net inflow of 145,000 a year in the 2004-based projections.

2 Introduction

Purpose

The 2006-based national population projections for the United Kingdom and its constituent countries were produced by the Office for National Statistics (ONS) at the request of the Registrars General of England & Wales, Scotland and Northern Ireland. The assumptions were agreed in consultation with the statistical offices of the four countries.

The primary purpose of the national projections is to provide an estimate of the future population of the UK (and of its constituent countries) as a common framework for use in national planning in a number of different fields. Normally, a new set of projections is made for that purpose every two years, based on assumptions which are judged to be most appropriate from the statistical evidence available at the time. These official sets of projections ensure that the many users of projections can work on consistent assumptions.

History

The first projections of the population of the UK were made by the Government Actuary's Department (GAD) in the 1920s. One of the main uses of these earliest projections was in connection with long-term financial estimates under the Contributory Pensions Acts and other schemes of social insurance. In 1954, responsibility for the production of the official national projections was given to the Government Actuary and since then they have been increasingly used in all areas of government planning. New projections were made each year from 1955 to 1979 and then every second year until 1991. There was then a 1992-based set of national projections. Since then projections have been produced every second year. Additional 'interim' 2001-based and 2003-based projections were carried out following, respectively, the 2001 Census and subsequent revisions to population estimates for England & Wales.

Transfer of responsibilities for national projections

On 31 January 2006, the function of producing the national projections on behalf of the three Registrars General was transferred from the Government Actuary's Department to the Office for National Statistics. The 2006-based national population projections are, therefore, the first projection set to be produced by ONS in consultation with the General Register Office for Scotland, the Northern Ireland Statistics and Research Agency and the Welsh Assembly Government Statistical Directorate.

Publications

This report, the latest in a regular series started in 1970, gives full details of the new national projections made by ONS, based on the estimated population at the middle of 2006. These replace the previous 2004-based projections.[1] Results of the projections also appear in a number of other publications of the Office for National Statistics including Population Trends,[2] Social Trends[3] and the Annual Abstract of Statistics.[4]

The chapters of this report give a summary of the results of the 2006-based national projections, together with a description of the methods employed and of the assumptions on which the projections are based. Key results from the principal projections are available on the National Statistics website at http://www.statistics.gov.uk/statbase/Product.asp?vlnk=8519. Full details, including variant projections, are currently only available on the GAD website at www.gad.gov.uk. It is planned that the full projection results will be added to the National Statistics website during 2008. Further information about data availability is given in Chapter 11.

Projection period

In previous projections, data were published up to 70 years ahead. For the 2006-based projections, the published period has been extended to 75 years ahead and results for 75 to 100 years ahead are available on request from ONS at natpopproj@ons.gsi.gov.uk.

These changes reflect the increasing interest in long-term issues such as pensions and health care. However, the main focus of these projections remains on the first 25 years i.e. the period to 2031. Longer-term results are discussed in this volume where appropriate. However, the long-term figures should be treated with great caution. Population projections become increasingly uncertain the further they are carried forward, and particularly so for smaller geographic areas.

Expert advisory group

As part of the production process for the 2004-based projections round an expert academic group was created to

advise on the assumptions underlying national projections. The group met again in March 2007 to discuss the assumptions for the 2006-based national population projections. The role of this expert group is strictly advisory; responsibility for final decisions on the assumptions remains with ONS and the statistical offices of the devolved administrations. A note of the 2007 meeting of the expert group is included as an Appendix to this volume.

Subnational projections

Subnational population projections are the responsibility of the statistical offices of the individual countries. ONS expects to publish mid-2006 based projections for England, consistent with national projections, in June 2008. Both the General Register Office for Scotland and the Northern Ireland Statistics and Research Agency have recently published 2006-based subnational projections, consistent with the national projections described in this reference volume, on 22 January 2008 and 28 February 2008 respectively. The Welsh Assembly Government Statistical Directorate issued regional 2003-based population projections in June 2005, and in conjunction with local authorities and other interested parties in Wales, have reviewed the provision of future subnational projections. They intend to publish local authority projections using a different methodology by summer 2008.

Other related projections

A number of more specialised projections, all consistent with the national projections, are also prepared by government. These include labour force,[5] household[6] and marital status[7] projections. Marital status projections, consistent with the interim 2003-based national projections, were published in March 2005. A 2006-based marital status projection set is currently being worked on and will be published later in 2008. Communities and Local Government (CLG) published 2004-based household projections for England in March 2007. Labour force projections for the period 2006 to 2021 were published by ONS in January 2006.

Population projections for other countries, carried out on a comparable basis, are produced by organisations such as Eurostat[8] and the United Nations.[9]

Further information

Additional information about the national projections may be obtained from the Office for National Statistics, National Population Projections Branch, 1 Myddelton Street, Islington, London EC1R 1UW.

Telephone: 020 7014 2461
E-mail: NatPopProj@ons.gsi.gov.uk

Further information on the subnational projections may be obtained from:

Office for National Statistics: http://www.statistics.gov.uk/cci/nugget.asp?id=995
General Register Office for Scotland: http://www.gro-scotland.gov.uk/statistics/publications-and-data/popproj/04pop-proj-scottishareas/index.html
Welsh Assembly Government: http://new.wales.gov.uk/topics/statistics/theme/population/pop-project/?lang=en
Northern Ireland Statistics and Research Agency: http://www.nisra.gov.uk/demography/default.asp.htm

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2 Office for National Statistics. *Population Trends*. Palgrave Macmillan (quarterly) and at http://www.statistics.gov.uk/statbase/Product.asp?vlnk=6303&Pos=&ColRank=1&Rank=422

3 Office for National Statistics. *Social Trends*. Palgrave Macmillan (annually) and at http://www.statistics.gov.uk/statbase/Product.asp?vlnk=5748&Pos=&ColRank=1&Rank=422

4 Office for National Statistics. *Annual Abstract of Statistics*. Palgrave Macmillan (annually) and at http://www.statistics.gov.uk/statbase/Product.asp?vlnk=94&Pos=6&ColRank=1&Rank=272

5 Vassilis Madouros. *Labour Force Projections 2006 – 2020 (Full report)* Office for National Statistics (January 2006). Available at http://www.statistics.gov.uk/cci/article.asp?id=1346

6 Communities and Local Government (2007). *2004-based projections of households for England and the regions to 2029*. Available at http://www.communities.gov.uk/news/corporate/new-projection-households

7 Report: 2003-based marital status and cohabitation projections for England and Wales. *Population Trends* 121 pp 77–84 (2005).

8 Eurostat (2005). 2004 EU Population Projections Available at http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL

9 *World Population Prospects: The 2006 Revision*. United Nations (2007). Available at: http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm

3 Results of the projections

Future size of the population

The population of the UK is projected to increase gradually from 60.6 million in 2006 to 71.1 million by 2031 (see Table 3.1 and Figure 3.1). Longer-term projections suggest the population will continue rising strongly beyond 2031, and still be rising at the end of the projection period.

Actual and projected numbers of births and deaths are shown in Figure 3.2. With the single exception of 1976, the UK gained population through natural increase (births less deaths) throughout the 20th century. It is expected that the current gap between births and deaths will continue to grow until about 2018, after which, with the large cohorts born after the Second World War starting to reach advanced ages, the number of deaths will significantly increase.

Of course, long-term projections are very uncertain. In particular, it should be noted that the projected trend in births depends on the assumed future level of fertility and, therefore, has a higher level of uncertainty attached to it than the projected trend in deaths which is strongly influenced by the age structure of the population alive today. The large projected rise in the number of deaths in the second quarter of the century reflects the size of both the large cohorts born after the Second World War, and also those born during the 1960s baby boom.

The projected trend in the size of the UK population is shown in Table 3.1. Appendix II provides a similar analysis for each individual country and is carried forward to 2056. The population of England is projected to increase by 19 per cent by 2031, Northern Ireland by 15 per cent and Wales by 11 per cent. The projected increase for Scotland, where fertility and life expectancy levels are assumed to remain lower than in

Table 3.1

Components of change: five year summary, 2006–2031 (annual averages)

United Kingdom thousands

	2006–11	2011–16	2016–21	2021–26	2026–31
Population at start	60,587	62,761	64,975	67,191	69,260
Births	780	799	805	796	788
Deaths	565	549	552	573	610
Natural change	215	250	253	224	178
Net migration	220	193	190	190	190
Total change	435	443	443	414	368
Population at end	62,761	64,975	67,191	69,260	71,100

Figure 3.1

Actual and projected population of the United Kingdom and constituent countries, 1951–2081

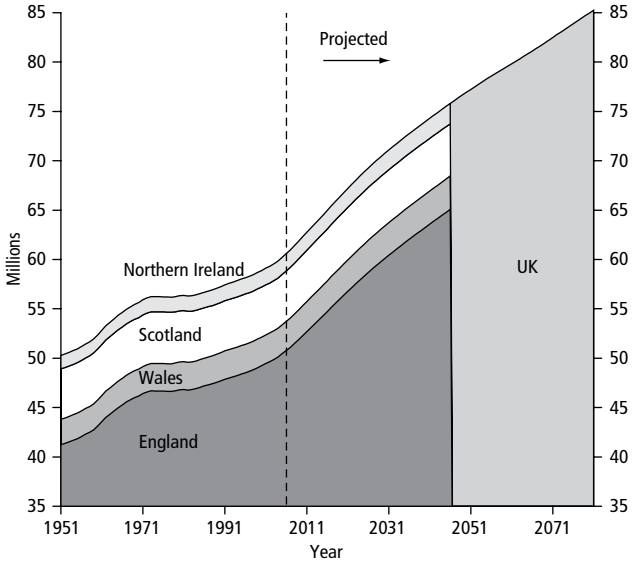
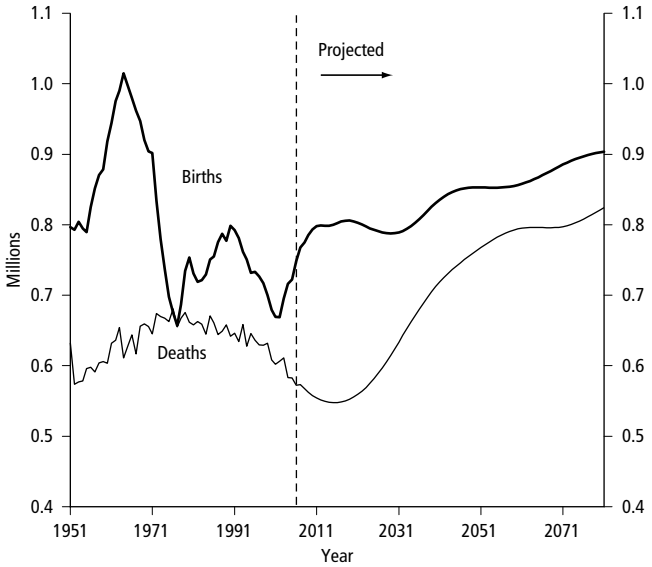


Figure 3.2

Actual and projected births and deaths, 1951–2081

United Kingdom



the rest of the UK, is 5 per cent. Consequently Scotland's population is projected to increase until the early 2030s and then start to fall. The Northern Irish and Welsh populations are both projected to continue growing until around 2050, after which Northern Ireland will plateau whereas the population of Wales is projected to continue increasing but at a very low rate of growth. The population of England is also projected to continue rising throughout the projection period, but much more strongly.

Births, deaths and migration

Figure 3.2 shows the effect of the fluctuation in the birth rates assumed for the next few years. Birth rates have increased in the last few years, and it is assumed that the TFR (see Chapter 6) will continue to rise in the short-term before declining to a long-term assumption of 1.84 children per woman (UK). Thus the number of births is projected to increase, faster at first and then more slowly, until around 2020. The continuing rise in the longer-term, when birth rates are assumed to be constant, is due to increases in the female population of childbearing age resulting from assumed net inward migration for these age groups.

The annual number of deaths has been declining in the last few years and is projected to fall further in the next ten years or so. Thereafter, as the large cohorts born immediately after the Second World War and during the 1960s baby boom begin to reach elderly ages, the trend is consistently, and fairly sharply, upward.

Finally, it is assumed in the 2006-based projections that annual net inward migration into the UK will be 190,000 persons per year from 2014–15 onwards. In the short-term, higher migration assumptions allow for an additional net inflow of migrants from the EU Accession countries.

Of course, in practice, annual numbers of births, deaths and migrants will not follow such smooth patterns. Migration, in particular, can be expected to continue to exhibit unpredictable year-to-year fluctuations.

Age structure

The age structure of the population is projected to change in future years, mainly as a result of past and future fluctuations in the number of births, but also because of the effects of changes in mortality rates and because of the impact of

Table 3.2

Projected population by age, 2006–2031

United Kingdom thousands

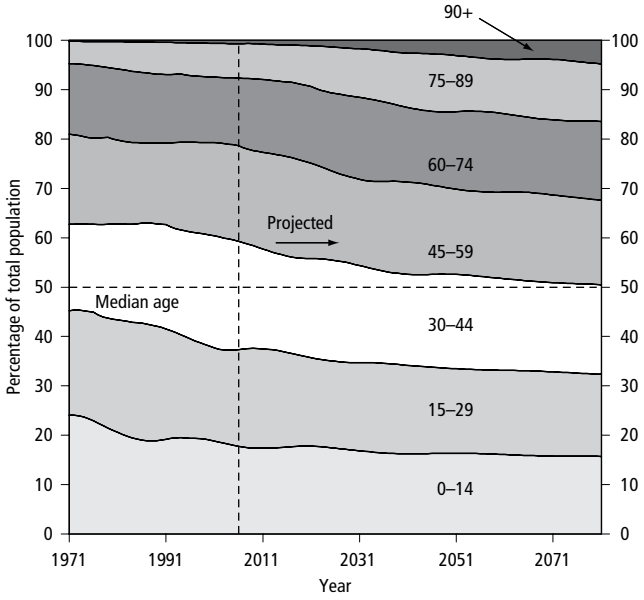
Age group	2006	2011	2016	2021	2026	2031
0–14	10,737	10,912	11,428	11,947	12,026	11,974
15–29	11,876	12,614	12,458	12,024	12,191	12,706
30–44	13,302	12,699	12,691	13,492	14,132	13,975
45–59	11,744	12,295	13,094	12,986	12,398	12,420
60–74	8,269	9,265	9,824	10,432	11,035	11,802
75 & over	4,659	4,975	5,480	6,309	7,477	8,223
All ages	60,587	62,761	64,975	67,191	69,260	71,100
Mean age (years)	39.6	40.1	40.6	41.3	42.0	42.6
Under 16	11,537	11,643	12,096	12,687	12,828	12,781
Working age*	37,707	38,934	40,386	41,604	43,000	43,393
Pensionable age*	11,344	12,184	12,493	12,900	13,431	14,927
Dependants per 1,000 persons of working age						
Under 16	306	299	300	305	298	295
Pensionable age*	301	313	309	310	312	344
Total*	607	612	609	615	611	639

* Working age and pensionable age populations based on the state pension age for given year. Between 2010 and 2020, state pension age will change from 65 for men and 60 years for women, to 65 years for both sexes. Between 2024 and 2026, state pension age will increase from 65 to 66 for both sexes.

Figure 3.3

Actual and projected age distribution, 1971–2081

United Kingdom



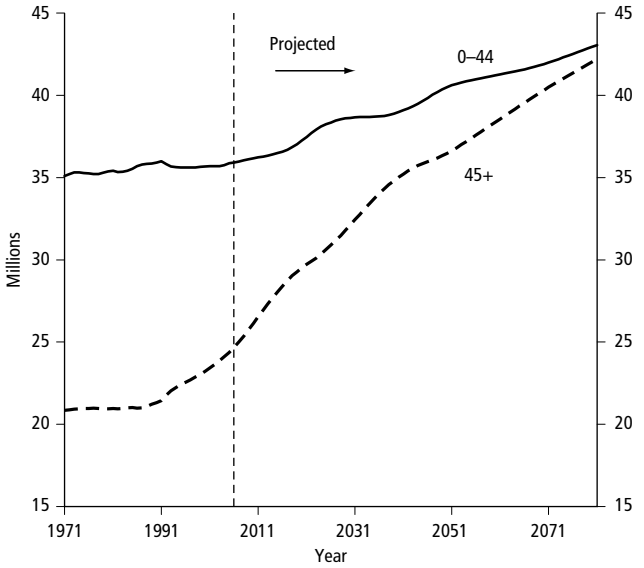
migration. The main effects are summarised for broad age groups in **Table 3.2** and illustrated in **Figure 3.3**.

The age structure will become gradually older with the mean age of the population rising from 39.6 years in 2006 to 42.6 years in 2031. **Figure 1.1** of Chapter 1 illustrates the projected changes in the age structure of the population, including the significant increases projected at older ages.

Figure 3.4

Actual and projected population aged under and over 45, 1971–2081

United Kingdom



At the oldest extreme, the number of centenarians is projected to increase sixfold by 2031. Longer-term projections show continuing ageing with the mean age reaching 44 years around 2050 and continuing to rise slowly from then onwards. **Figure 3.4** shows that the population aged under 45 is expected to increase unevenly, with an overall increase of 2.7 million between 2006 and 2031. (This compares with a projected fall of 0.3 million between 2004 and 2031 in the previous 2004-based projection set. The difference is because of higher fertility assumptions and also higher migration assumptions, as migration is concentrated at the younger ages.) However, the number aged 45 and over is projected to increase more strongly, by around 7.8 million over the same period. At present, there are around 45 per cent more people aged under 45 than there are aged 45 and over, but, by 2081, the groups are projected to be of similar size.

Appendix I gives the projected population by five-year age groups for the UK and for each constituent country. Results are given to 2056 for Wales, Scotland and Northern Ireland and to 2081 for England and the combined countries. Results for individual ages, to the year 2056 only, are available on the GAD website.

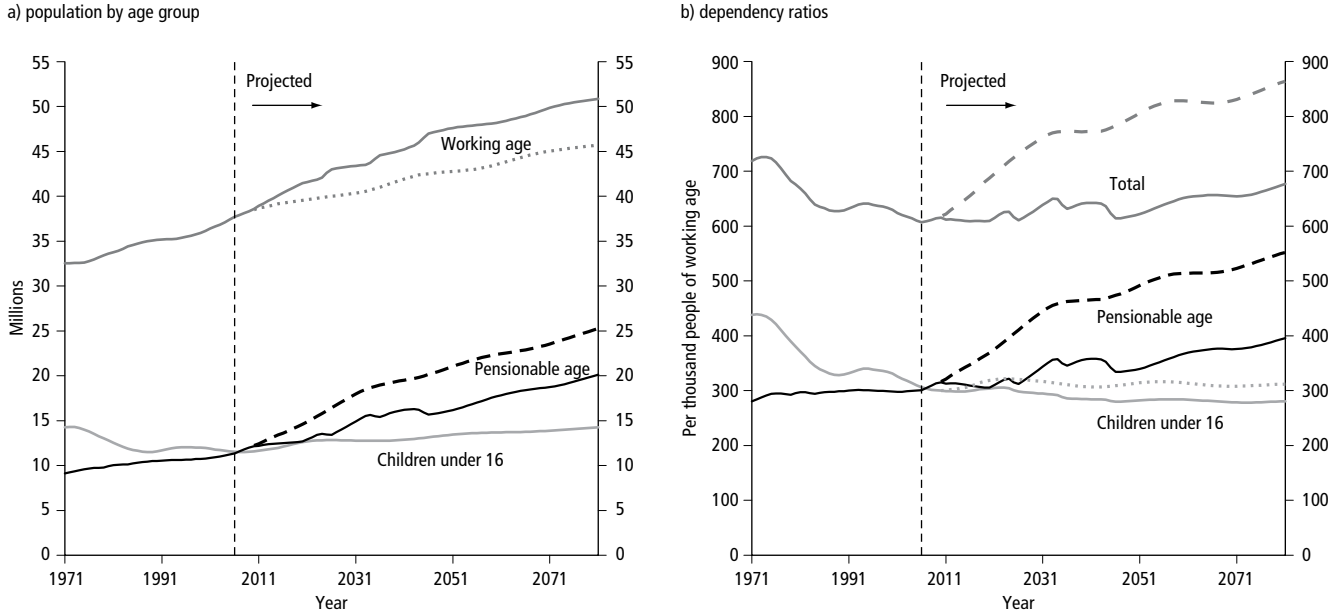
Children and the population of working and pensionable ages

Projected future trends in the size of these three broad subgroups of the population are summarised in **Table 3.2** and illustrated in **Figure 3.5**. The Pensions Act 1995[1] announced a change in state pension age from 65 years for men and 60 years for women as at present, to 65 years for both sexes. This change is to be phased in between April 2010 and March 2020. In addition, The Pensions Act 2007[2] announced further changes for both sexes from 65 to 66 between 2024 and 2026, from 66 to 67 between 2034 and 2036 and from 67 to 68 between 2044 and 2046. **Table 3.2** takes account of these changes and **Figure 3.5(a)** shows the figures for 2010 onwards under the new and old definitions. The detailed projection results on the GAD website show the projected working age and pensionable age populations for the period 2010 onwards based on the changed definitions of state pension age as they occur during the projection period.

Table 3.2 shows that the number of children under the age of 16 is projected to rise by around 11 per cent from 11.5 million in 2006 to 12.8 million by 2026, then dropping back slightly. (Fertility assumptions have been increased for these projections – see Chapter 6 – and this compares with a projected drop of about 4 per cent in the number of children aged under 16 in the first ten years of the previous 2004-based projections.)

Figure 3.5

Actual and projected number of children, populations of working and pensionable ages, and dependency ratios, United Kingdom, 1971–2081



Note: The 'working age' population is that aged between 16 and state pension age. Between April 2010 and March 2020, state pension age will change from 65 years for men and 60 years for women, to 65 years for both sexes. Between 2024 and 2046, state pension age will increase in three stages from 65 years to 68 years for both sexes. The dotted lines show what the projected population at working age and pensionable age (and the resulting dependency ratios) would have been, had the present pension age applied throughout.

The number of 16-year-olds entering the working age population is expected to fall from 2007, from 802,000 in 2007 to a low of 671,000 in 2018 before the larger cohorts of births of 2003 onwards result in a rise. Overall, the projected change in the number of 16 year olds in the first ten years of the projections is a drop of over 13 per cent.

The working age population is projected to rise from 37.7 million now to 38.6 million in 2010. Allowing for the change in women's state pension age from 60 to 65 between 2010 and 2020, it will then rise further to 41.5 million by 2020. And allowing for the further increase in state pension age to 66 for both sexes between 2024 and 2026, the working age population is projected to reach 43.4 million by 2031.

The size of the working age population is affected by a number of factors including the level of migration (much of which is of young adult age), the survivors of births 16 years earlier who enter the working ages and the size of the cohorts about to leave the working age to retire. For these projections, the raising of the state pension age – and therefore the age at which people remain classed as of 'working age' – is also a factor. Overall, the working age population is projected to become older during the projections. The mean age of the working age population is projected to increase from 39 years to almost 42 years by mid century. However, this is almost entirely a consequence of the forthcoming increases in the state pension age; without these increases, the average age of the working age population would remain broadly stable.

The number of people of state pension age is projected to increase from 11.3 million in 2006 to 12.2 million in 2010. Then, however, the increase in women's state pension age will cause the population of pensionable age to rise much more slowly, reaching 12.7 million in 2020. A faster increase will then resume and, despite the further change in state pension age to 66 for both sexes between 2024 and 2026, the number of state pension age is expected to reach 14.9 million by 2031. Despite the further increases in state pension to 68 in 2046, the population of pensionable age is projected to continue rising, reaching 20 million by 2081. Without the changes in state pension age, the population of pensionable age would have risen to 18.0 million by 2031, and to 25 million by 2081.

Dependency ratios

These changes in age structure will, in time, have a marked effect on the future proportion of dependants in the population. **Table 3.2** and **Figure 3.5(b)** show projected dependency ratios, i.e. the number of children under 16 or the population of pensionable age (or the sum of the two) expressed as a percentage of the working age population. These are, of course, somewhat arbitrary boundaries as, in reality, full-time education ends, and retirement starts, at a range of ages.

Further, research has shown that labour market changes have in the past been a more important factor than demographic trends in influencing real (economic) dependency.[3]

The 'total' dependency ratio is projected to stay broadly level for the first period of the projection, starting at 607 dependants per 1,000 persons of working age in 2006, rising slightly to 615 per 1,000 in 2010 and then levelling off during the period to 2020, when women's state pension age is raised to 65 years. It is then expected to increase gradually but with drops during each additional transitional period where the state pension age increases a further year. The longer-term projections suggest a total dependency ratio nearing 700 per 1,000 by 2081. However, this is lower than the total dependency ratio in the early 1970s, although then it was children who comprised the majority of dependants. Research suggests that the cost of supporting a person aged 65 and over is on average greater than that to support a child.[4]

The child ratio fell markedly during the 1970s and early 1980s but is now stabilising after further falls over the last decade. It is projected to stay at about the same level until the mid 2020s, after which a very gradual fall is expected. The changes to state pension age affect the number of people of working age and hence have an impact on the child dependency ratio (the number of children per 1,000 persons of working age). But the pensionable age ratio is much more greatly affected by the forthcoming rises to the state pension age and shows a very similar pattern to that of the total dependency ratio.

Figure 3.6

Actual and projected population aged 16, 1971–2031

United Kingdom

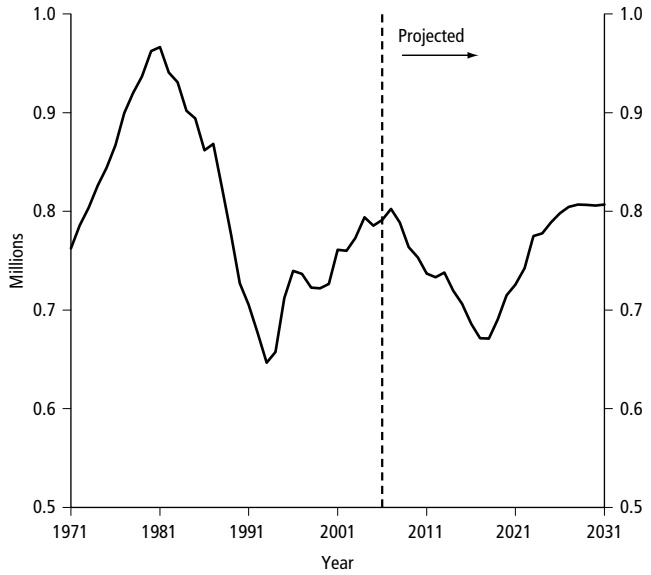
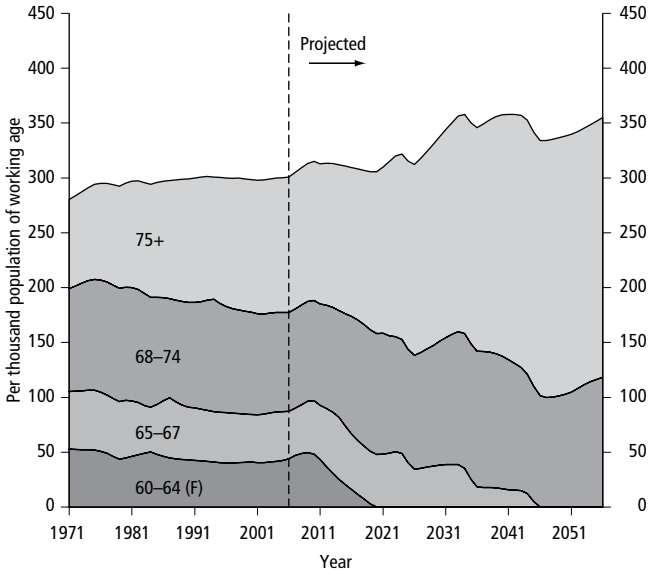


Figure 3.7

Actual and projected components of elderly dependency ratio, 1971–2056

United Kingdom



Of course, without the forthcoming changes in state pension age, the proportion of dependants would have risen earlier and further as indicated by the dotted lines in Figure 3.5(b). At 2021, following the raising of women's state pension age to 65, the total dependency ratio is now projected to be 615 dependants per 1,000 persons of working age, whereas it would have been 695 per 1,000 under the old definition. The projected pensionable age ratio at 2021 is now 310 per 1,000 (compared with 375 per 1,000 under the old definition) and the child ratio is 305 per 1,000 (compared with 320 per 1,000). The differences obviously become greater with the subsequent raising of state pension age to 68.

Figure 3.7 splits the pensionable age dependency ratio into four age bands (60–64, 65–67, 68–74 and 75 and over), with the first two bands representing age groups which become part of the working age population during the projection period. Each of the forthcoming increases in state pension age causes a decrease in the overall ratio, and the proportion in the appropriate age band, during the implementation periods. In the intervening years, however, the trend in the pensionable dependency ratio is strongly upwards. In 2006, persons aged 75 and over represented 41 per cent of the population of state pensionable age but by 2056, following all the state pension age increases, they will account for 67 per cent.

Population ageing will be experienced to a greater or lesser extent in all Western countries. Indeed, the latest Eurostat projections[5] show that in the year 2020, compared with the EU

as a whole, the UK will have proportionately fewer older people, although the overall dependency ratio will be around the EU average.

Projections to 2081

The main focus of the projections is on the period to 2031. However, longer-term projections have been discussed where appropriate in this chapter. But, clearly, projections become increasingly uncertain the further into the future they are carried.

The population of the UK is projected to continue rising strongly throughout the projection period. The annual number of births is expected to still be increasing by the end of the projection period, reaching an estimated 900,000 by 2081. The annual number of deaths is projected to continue dropping until about 2015 then start to increase sharply. This increase is not projected to halt until the 2060s, when the small cohorts of the 1980s reach advanced ages. The excess of birth over deaths is projected to reach a peak of over 250,000 in the late 2010s before reducing. But births are still projected to remain above deaths throughout the projection period. This, combined with the high assumed level of net inward migration, means that the population continues to rise strongly and is projected to reach 85 million by 2081.

Population increases are greatest at the oldest ages. The number of people aged 60 and over is projected to rise throughout the projection period, with more than twice the number aged 60 plus at 2081 compared to 2006 (approaching 28 million compared to 13 million). However, the number of persons aged over 75 is increasing even faster and is projected to double by the late 2030s, while the number aged 90 and over is projected to more than triple over the same period.

Although these very long-term figures are subject to great uncertainty, they show the consequences that would follow if the long-term assumptions of fertility, mortality and migration were to be realised in practice.

References

1 *Pensions Act 1995* Chapter 26 Part II Section 126 and Schedule 4 (see also www.gad.gov.uk/Demography_Data/Population/2004/methodology/pensionage.asp)

2 Pensions Act 2007 Chapter 22 Part I Section 13 and Schedule 3 (see also www.gad.gov.uk/Demography_Data/Population/2006/methodology/pensionage.asp)

3 Johnson P and Falkingham J. *Ageing and economic welfare*. Sage publications (1992).

4 *Replacement migration: is it a solution to declining and aging populations?* United Nations (2000).

5 Eurostat (2005). 2004 EU Population Projections. Available at http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL.

4 Comparison with 2004-based projections

Introduction

In this chapter, the assumptions and results for the 2006-based projections are compared with the previous (2004-based) set of 'full' projections which were fully described in the preceding volume of the PP2 series.[1]

Changes in assumptions

Chapters 6 to 8 describe the fertility, mortality and migration assumptions adopted for the 2006-based projections. Key summary indicators of these assumptions are compared with the assumptions for the 2004-based projections in **Table 4.1**. The main changes are an increase in the assumptions made about future fertility and an increase in the long-term migration assumptions.

Fertility

The long-term assumptions for average completed family size have been increased for each country and, consequently, for the UK as a whole. Since 2002 there have been increases in total fertility rates in all countries of the UK to levels at or above the long-term assumptions used in the 2004-based projections.[2] It was therefore decided to increase the long-term fertility assumptions, with additional increases to the short-term assumptions in the transition from the current level to the stable long-term assumed level of fertility. The assumptions for each country were considered separately and were raised by levels reflecting the current fertility patterns recently experienced there. Revised assumptions about the future number of female migrants also contribute to changes in the projected numbers of future births (see **Table 4.3**).

Mortality

Short- and medium-term period life expectancies are generally higher than in the previous projections, due to lower base levels of mortality after higher than expected falls in mortality in 2004 and 2005 and assumed higher rates of mortality improvement at most ages in the period to 2031. As in the previous 2004-based projections, these improvements are still assumed to converge, for the majority of ages, to an annual rate of improvement of 1 per cent for the rest of the projection period. However, historically the cohorts born between 1923 and 1940 have experienced higher mortality improvements than the cohorts either side, and in the 2006-based projections

Table 4.1

Comparison of 2004-based and 2006-based projection assumptions

		United Kingdom	England	Wales	Scotland	Northern Ireland
Fertility -	Long-term average number of children per woman					
	2006-based	1.84	1.85	1.85	1.65	1.95
	2004-based	*1.74*	*1.75*	*1.75*	*1.60*	*1.80*
Mortality -	Expectation of life at birth in 2031*					
Males	2006-based	82.7	83.0	82.4	80.4	82.2
	2004-based	*81.4*	*81.6*	*81.1*	*79.2*	*81.0*
Females	2006-based	86.2	86.4	86.0	84.8	86.1
	2004-based	*85.0*	*85.2*	*84.8*	*83.7*	*84.9*
Net Migration† -	Annual net flow from 2014–15 onwards**					
	2006-based	190,000	171,500	9,500	8,500	500
	2004-based	*145,000*	*130,000*	*11,500*	*4,000*	*-500*

* Expectations of life for 25 years ahead given as specimen year. Note these are *period* expectations of life based on the mortality rates assumed for the year 2031 and do not take account of the continuing improvement in mortality projected beyond 2031.
† Includes international migration and cross-border migration between the countries of the UK.
**2012–13 for Wales, Scotland and Northern Ireland.

the long-term assumptions have been changed to reflect this. The assumed long-term annual rates of improvement for these cohorts rise from 1 per cent for those born before 1923 to 2.5 per cent for those born in 1931, then decline back to 1 per cent for those born after 1940. The number of projected deaths in the period to 2031 is significantly lower (see **Table 4.3**) due to these changes, but, in the longer-term, there are less significant differences as the increased assumptions of long-term mortality improvement for the cohorts born between 1923 and 1940 no longer apply as they die out.

Migration

The new long-term assumption for net migration to the UK is +190,000 each year compared with +145,000 a year in the 2004-based projections. This increase follows two further years (2004 and 2005) where net migration remained at very high levels. Methodological improvements to the estimation of international migration have also had an impact. These methodological changes have also affected the assumed distribution of international migration within the UK.
In addition, there have been some changes to the assumptions made about cross-border migration flows between the four countries of the UK. The overall result of these changes is that the assumed level of net migration has been increased in England, Scotland and Northern Ireland but is reduced in Wales.

Differences in the migration assumptions between 2004-based and 2006-based are greater in the first few years of the projections. This is mainly because the short-term allowance for additional net migration from the accession countries which joined the EU in May 2004 and January 2007 is higher, and assumed to apply for longer, than in the previous projections (see Chapter 8 for further details of this allowance).

Base population

Table 4.2 shows actual population change between 2004 and 2006 and compares it with the projected change from the previous projections. The population of the UK at mid-2006 was 55,000 (0.1 per cent) higher than envisaged in the 2004-based projections. The majority of this difference is due to an underprojection of natural change, incorporating both an underprojection of the number of births and an overprojection of the number of deaths. The level of net migration to the UK in the first two years of the 2004-based projections was very close to the actual outcome. Most of the remainder of the difference is due to subsequent upwards revisions in the 2004 population estimate which was used as the base for the

Table 4.2

Population change 2004–2006: actual change compared with 2004-based projected change

United Kingdom

	Mid-year estimates 000s	2004-based projections 000s	Difference	
			000s	%
Population at mid-2004	59,846*	59,835	11	0.02%
Components of change (2004–2006)				
Births	1,452	1,428	24	1.7%
Deaths	1,166	1,180	-14	-1.2%
Natural change	286	248	39	--
Net migration	451	450	1	--
Other changes	4**	0	4	--
Total change	742	698	44	--
Population at mid-2006	60,587	60,533	55	0.1%
England	50,763	50,714	49	0.1%
Wales	2,966	2,977	-11	-0.4%
Scotland	5,117	5,108	8	0.2%
Northern Ireland	1,742	1,733	9	0.5%

* Following the publication of the 2004-based projections, the mid-2004 estimates on which they were based were revised downward by 1,000 in December 2005 and upward by 12,000 in August 2007.
** Net movements of Armed Forces and other smaller changes.

2004-based projections. These revisions were largely a consequence of recent improvements to population estimates made by ONS as part of the ongoing Improving Migration and Population Statistics (IMPS) research.[3]

At individual country level, the differences vary from an underprojection of the total population of 0.5 per cent in Northern Ireland to an overprojection of 0.4 per cent in Wales. Overprojection of net cross-border migration flows from the rest of the UK to Wales and underprojection to Scotland also contributed to the discrepancy for both countries.

Total UK population

The 2006-based projection of the total population of the UK is compared with the 2004-based projections in **Figure 4.1**. The base population at mid-2006 is 55,000 higher than envisaged in the 2004-based projections, and the differential continues to increase thereafter. This is due to the combination of higher fertility, migration and life expectancy assumptions.

Figure 4.1

Projected population of the United Kingdom, 2004-based and 2006-based projections

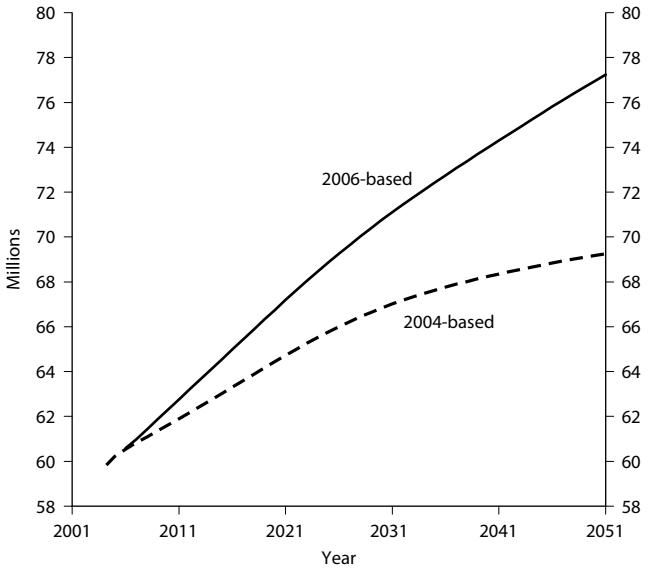


Table 4.3

Change in projected population compared with 2004-based projections

thousands

Country	2006-based projection	2004-based projection	Total change	Change due to: base population*	Change due to: projected births	Change due to: projected deaths†	Change due to: projected migrants
(a) Population at 2011							
England	52,706	51,967	739	49	347	59	285
Wales	3,038	3,037	0	-11	13	4	-6
Scotland	5,206	5,120	86	8	26	4	48
Northern Ireland	1,812	1,767	44	9	14	1	20
United Kingdom	62,761	61,892	870	55	399	68	348
(b) Population at 2021							
England	56,757	54,605	2,152	49	1,106	285	712
Wales	3,186	3,165	20	-11	37	20	-25
Scotland	5,326	5,127	200	8	71	26	94
Northern Ireland	1,922	1,830	92	9	44	8	31
United Kingdom	67,191	64,727	2,464	55	1,258	339	812
(c) Population at 2031							
England	60,432	56,832	3,600	49	1,824	600	1,127
Wales	3,296	3,256	40	-11	52	43	-45
Scotland	5,374	5,065	309	8	107	54	139
Northern Ireland	1,999	1,860	139	9	73	16	41
United Kingdom	71,100	67,013	4,087	55	2,056	714	1,262

* Differences between the estimated population at mid-2006 and the 2004-based projection of the population at mid-2006 (see Table 4.2).
† Reductions in the projected number of deaths (as compared with the 2004-based projections) are shown as positive numbers in this table as they contribute to an increase in the size of the population.

Table 4.4

Change in projected population by age: 2006-based projections compared with 2004-based projections

United Kingdom

	2006		2011		2021		2031	
Age group	000s	%	000s	%	000s	%	000s	%
Under 16	9	0.1	412	3.7	1,288	11.3	1,298	11.3
16–29	81	0.7	365	3.2	300	2.7	1,096	10.1
30–44	3	0.0	112	0.9	671	5.2	840	6.4
45–59	-13	-0.1	-14	-0.1	41	0.3	402	3.3
60–74	-28	-0.3	-42	-0.4	-15	-0.1	24	0.2
75 & over	3	0.1	37	0.7	180	2.9	427	5.5
All ages	55	0.1	870	1.4	2,464	3.8	4,087	6.1

In this principal projection, the population is projected to continue rising for the whole of the projection period, as in the 2004-based projections, but at a much stronger rate of growth. However, as shown in Chapter 9 on variant projections, uncertainty remains regarding how fast the population will grow, and it is still possible that the population could peak in size by the middle of this century.

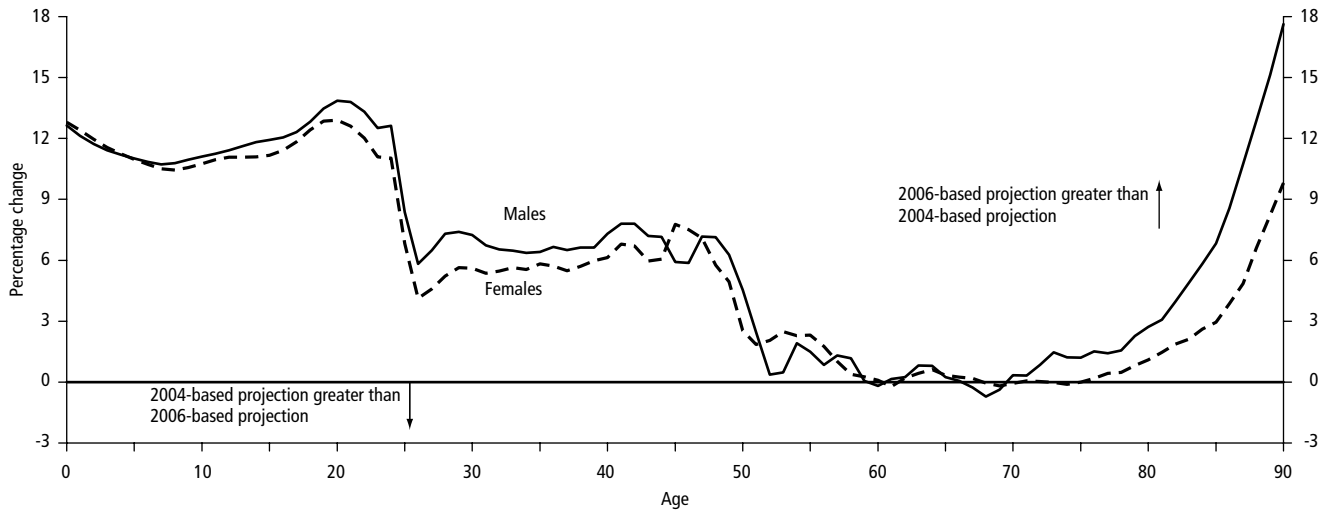
The projected total population of each country is compared with the 2004-based projections in Table 4.3. The difference between the two projections is broken down into changes in the base population and changes in the projected numbers of births, deaths and migrants. Reductions in the projected number of deaths (as compared with the 2004-based projections) are shown as positive numbers in the table as they contribute to an increase in the size of the population.

Populations are higher than in the 2004-based projections for each country, although at 2011 the difference for Wales is negligible. The largest increase at 2031 is for Northern Ireland (7.5 per cent), with both England and Scotland also showing increases over 6 per cent. For Northern Ireland and England the biggest factor was the increase in projected births, whereas for Scotland the increased migration assumptions had the greatest effect. For these three countries all the components of change contributed to increasing the population compared with the 2004-based projections. For Wales, however, a reduced migration assumption and the base population error partly offset the higher fertility and life expectancy assumptions, and

Figure 4.2

Change in projected population at 2031 by age and sex: 2004-based projections compared with 2006-based projections

United Kingdom



resulted in a projected population at 2031 just 1 per cent higher than in the 2004-based projections.

Distribution by age and sex

The change in the projected size of the UK population in particular age-groups is shown in **Table 4.4**. Compared with the 2004-based projections, the UK population at 2031 is higher in all age groups. However, increases are greatest for children and the young adult age group (16–29). The size of these age groups is affected by the higher fertility assumptions and the higher migration assumptions.

The population aged 75 and over has increased mainly because of the assumptions of higher mortality improvements, particularly, in the short- and medium-term, those for the cohorts born between 1923 and 1940. However, for the UK as a whole, the population aged 60–74 is initially slightly lower than previously projected. This results from the projections assuming slightly larger net migration outflows at most older working ages and particularly around retirement age. But by 2031 this is offset by the upward effect of some of the other changes to assumptions mentioned above spreading to older age groups as the population ages.

The changes at individual ages and for each sex at the year 2031 are shown in **Figure 4.2**. Overall, at 2031, the male population of the UK is 6.6 per cent higher than in the 2004-based projections, whereas the female population is 5.7 per cent higher.

References

1 Office for National Statistics (2006) *National Population Projections: 2004-based*. Series PP2 no. 25 Palgrave Macmillan

2 Office for National Statistics (2007): The Changing Demographic Picture of the UK. National Statistician's Annual Article on the Population. *Population Trends* **130**, pp 9–21

3 *Improved Methods for Population Statistics Revisions in 2007*. See www.statistics.gov.uk/statbase/Product.asp?vlnk=14834

5 Base population

Definition

The projections are based on the Registrars General's estimate (published in August 2007) of the resident population of the UK at mid-2006 of some 60.6 million. This estimate is based upon 2001 Census results, with allowance for subsequent births, deaths, migration and ageing of the population.[1] This estimate also takes account of the revisions to the mid-2002 to mid-2005 population estimates of England & Wales also published on 22 August 2007.[2]

The population includes all usually resident persons, whatever their nationality. Members of HM armed forces in the UK are included, but members of HM armed forces and their families who are abroad are excluded and are treated as migrants when they return home. Foreign armed forces stationed in the UK are included.

Base populations for individual countries

The estimates of the population at mid-2006 on which these projections are based are as follows (in thousands):

England	50,763
Wales	2,966
Scotland	5,117
Northern Ireland	1,742
United Kingdom	60,587

A breakdown by age and sex for each country is given in **Appendix I**.

Estimates of the population aged 90 and over

Official mid-year population estimates produced by the Registrars General are prepared by individual age to age 89 with an upper age band for all those aged 90 and over. Estimates of the population aged 90 to 94, 95 to 99, and 100 and over are prepared using the Kannisto Thatcher survivor ratio method,[3] with the results controlled to agree with the official estimates of all those aged 90 and over.

Estimates for those aged 90 and over are now published for England & Wales on an annual basis.[4] Scotland have published population estimates up to age 105 and over for 2002 to 2006.[5]

References

1 Mid-2006 estimates for each constituent country of the UK are available from the National Statistics website at: www.statistics.gov.uk/popest

2 www.statistics.gov.uk/downloads/theme_population/2006_MYEs_FAQs.pdf

3 Thatcher AR, Kannisto V and Andreev K. *The Survivor Method for Estimating Numbers at High Ages*. Demographic Research – Max Planck Institute online journal, Vol 6-1 (2002). From www.demographic-research.org

4 www.statistics.gov.uk/statbase/Product.asp?vlnk=15003

5 www.gro-scotland.gov.uk/statistics/population/population-estimates-for-scottish-centenarians/centenarians-in-scotland.html

6 Fertility

For the UK as a whole the key assumption for the future is that average completed family size, which has been falling from a peak of nearly 2.5 children per woman for women born in the mid 1930s, will level off at 1.84 children for women born in the early 1990s. This long-term assumption is 0.10 higher than the 1.74 children per woman assumed for the 2000-based to 2004-based projections. Although the UK fertility assumption has been lowered on a number of occasions over the last 40 years,[1] this is the first time it has been raised since the 1960s baby boom.

The assumptions underlying the fertility projections are set for each of the UK's constituent countries separately, and then combined to obtain the assumption for the UK as a whole. Assumptions are based on analysis of recent demographic trends and an assessment of their implications for future completed family sizes. This is summarised in the 'Assumption setting' box later in this chapter.

Assumed average completed family size

United Kingdom

Fertility assumptions are formulated in terms of Completed Family Size (CFS) – the average number of children that women born in particular years will have. As **Figure 6.1** illustrates, this *cohort* measure of fertility is more stable than the Total Fertility Rate (TFR), the calendar year (*period*) measure. This is because the CFS 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 reason.[2]

Figure 6.1 summarises recent period and cohort fertility. 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 TFR for the UK fell sharply from the 'baby boom' peak of 2.97 in 1964 to a trough of 1.69 in 1977. During the 1980s it stayed relatively stable around 1.80. In the first half of the 1990s it fell to around 1.70. The turn of the century saw further falls with the lowest figure ever recorded, 1.63, in 2001. Since then, fertility rates have risen each year and, by 2006, the TFR had reached 1.84.

The corresponding cohort figures – actual and assumed completed family sizes for women born in particular years – are also shown in **Figure 6.1**. The CFS is plotted against the year in which the women were, or will be, aged 30 (the approximate mid-point of the 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 CFS in the UK has fallen steadily, with women born in 1961, the most recent cohort for whom we have data up to age 45, having 1.96 children on average.

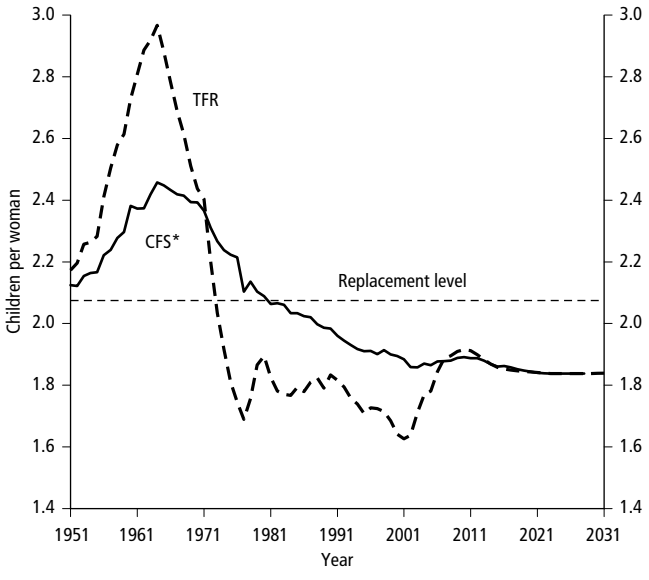
In the 2006-based projections, completed family size has been assumed to eventually level off at 1.84 children per woman, for cohorts born from the early 1990s onwards. This is a higher level than assumed in the 2004-based projections, but is still below 'replacement level'. The 'replacement level' family size of 2.075 shown in **Figure 6.1** represents the approximate number of children per woman needed for the population to replace itself in the long-term (in the absence of migration). The 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 11 per cent below replacement level.

Table 6.1(a) and **Figure 6.2(a)** show the achieved family sizes of selected cohorts at successive ages. The 1965, 1970 and

Figure 6.1

Actual and assumed total fertility rate (TFR) and average completed family size (CFS)*, 1951–2031

United Kingdom



* CFS for cohorts born 30 years earlier (see text).

Table 6.1(a)

Average achieved family size by age and year of birth of woman, women born 1940–1980

United Kingdom

Year of birth	Achieved family size by age (completed years)						
	19	24	29	34	39	44	Final
1940	0.16	1.05	1.91	2.27	2.37	2.39	2.39
1945	0.21	1.06	1.79	2.09	2.20	2.22	2.22
1950	0.23	0.93	1.56	1.93	2.06	2.09	2.09
1955	0.22	0.78	1.43	1.83	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		
1970	0.15	0.57	1.09	1.56			
1975	0.15	0.51	0.98				
1980	0.15	0.50					

Table 6.1(b)

Average number of children between given ages by year of birth of woman, women born 1940–1980

United Kingdom

Year of birth	Average number of children between given ages						
	<20	20–24	25–29	30–34	35–39	40–44	45 and over
1940	0.16	0.90	0.85	0.36	0.10	0.02	0.00
1945	0.21	0.85	0.72	0.30	0.11	0.02	0.00
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		
1970	0.15	0.42	0.52	0.47			
1975	0.15	0.36	0.47				
1980	0.15	0.35					

Figure 6.2(a)

Average achieved family size by age and year of birth of woman, women born 1940–1980

United Kingdom

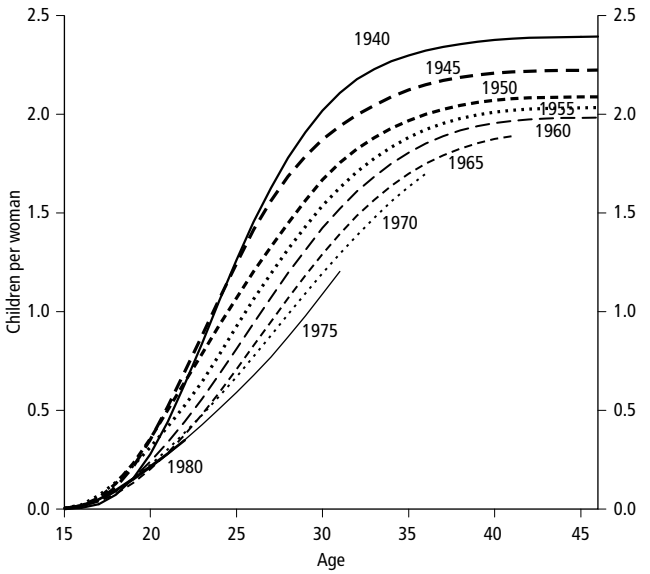
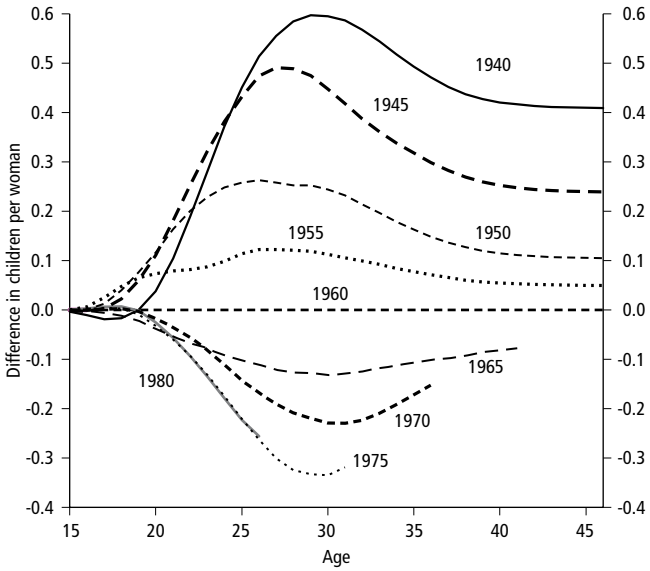


Figure 6.2(b)

Difference between average achieved family size by age and year of birth of woman, 1960 cohort compared with women born 1940–1980

United Kingdom



1975 cohorts have had fewer children by ages 25, 30 and 35 than earlier cohorts (**Figure 6.2(a)**). For example, the 1975 cohort had averaged 0.98 children each by their 30th birthday, 0.11 children fewer on average than the 1970 cohort at the same age (**Table 6.1(a)**).

However, 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, women born in 1965 had 0.22 children on average between ages 35 and 40, compared with only 0.16 for the 1955 cohort. Similarly, women born in 1970 had 0.47 children between ages 30 and 35 compared with 0.44 for those born ten years earlier (**Table 6.1(b)**). 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.

Figure 6.2(b) illustrates this recuperation more clearly by rearranging the data in Figure 6.2(a). The fertility of selected cohorts is shown relative to the 1960 cohort, who completed their fertility at just below two (1.98) children per woman. 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 upward towards the 1960 level.

Figure 6.3(a)

Actual and assumed completed family size, constituent countries of the United Kingdom, women born 1940–1995

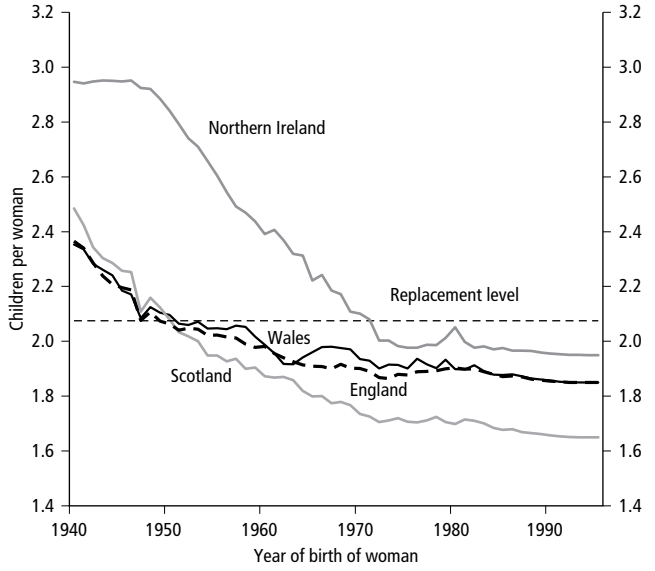
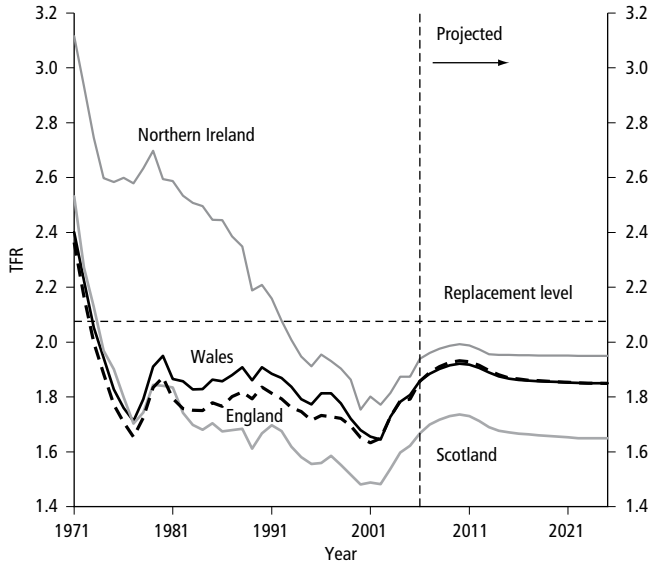


Figure 6.3(b)

Actual and assumed total fertility rates, constituent countries of the United Kingdom, 1971–2025



Women born in 1980 have followed a very similar fertility trajectory up to age 25 to the 1975 cohort (Figures 6.2(a) and (b)). This represents a marked difference from the previous pattern where successive cohorts achieved lower fertility by each age than their predecessors, and suggests that falls in cohort fertility could be bottoming out.

A discussion of the projected future paths of fertility for different cohorts of women born between the early 1960s and the mid-1990s can be found in *Population Trends* 131.[3]

Constituent countries of the United Kingdom

Figures 6.3(a) and (b) show the actual and assumed trends in the CFS and TFR in the individual countries of the UK. All four countries have seen an upturn in the TFR since 2002. Northern Ireland has historically had higher fertility than the rest of the UK and in 2006 its TFR of 1.94 was 0.08 higher than those of England and Wales (both 1.86). Scotland has had lower fertility than England since the early 1980s and in 2006 its TFR, at 1.67, was 0.19 lower than England's TFR. Recent trends do not provide any strong evidence of convergence in the overall levels of fertility between UK countries, so current differentials are reflected in the completed family sizes assumed for the long-term.

The achieved family sizes to date in the individual countries for selected cohorts are shown in Table 6.2. For the 1955 and 1960 cohorts, who can now be effectively regarded as having completed their childbearing, average family sizes were lower in Scotland and slightly higher in Wales than in England.

Table 6.2

Achieved family size by 2006, constituent countries of the United Kingdom, women born 1940–1980

Year of birth of woman	Age	Achieved family size				
		United Kingdom	England	Wales	Scotland	Northern Ireland
1940	Complete	2.39	2.37	2.35	2.48	2.95
1945	Complete	2.22	2.20	2.19	2.26	2.95
1950	Complete	2.09	2.06	2.10	2.08	2.84
1955	Complete	2.03	2.02	2.05	1.95	2.60
1960	Complete	1.98	1.98	1.99	1.87	2.39
1965	Age 41	1.89	1.89	1.94	1.78	2.20
1970	Age 36	1.70	1.70	1.77	1.56	1.90
1975	Age 31	1.20	1.21	1.33	1.10	1.26
1980	Age 26	0.68	0.69	0.77	0.60	0.71

Table 6.3

Actual and assumed average family size for the constituent countries of the United Kingdom, women born 1950–1995

Year of birth of woman	United Kingdom	England	Wales	Scotland	Northern Ireland
1950	2.09	2.06	2.10	2.08	2.84
1955	2.03	2.02	2.05	1.95	2.60
1960	1.98	1.98	1.99	1.87	2.39
1965	1.91	1.91	1.96	1.80	2.22
1970	1.89	1.90	1.93	1.73	2.10
1975	1.86	1.88	1.90	1.71	1.98
1980	1.89	1.90	1.90	1.70	2.05
1985	1.86	1.87	1.88	1.68	1.98
1990	1.84	1.86	1.86	1.66	1.96
1995 & later	1.84	1.85	1.85	1.65	1.95

Note: Figures below the dashed line are partly or wholly projected.

These patterns persist among younger cohorts, where achieved family size to date is higher in Wales, and lower in Scotland, compared with England. But, because fertility rates at ages 31 and above are currently much higher in England than in either Wales or Scotland, the differential between England and Wales for younger cohorts can be expected to narrow, whereas the differential between England and Scotland is likely to widen. In Northern Ireland, achieved family size is relatively high for all but the youngest cohorts, reflecting the fact that fertility rates for women in their thirties are consistently higher in Northern Ireland than elsewhere in the UK.

For the 2006-based projections, the long-term fertility assumptions have been increased from those used in the 2004-based projections in all four UK countries. For **England** and for **Wales**, the assumed long-term CFS is 1.85 children per woman, for **Northern Ireland** 1.95, and for **Scotland** 1.65.

Figure 6.3(b) and **Table 6.3** illustrate, for each constituent country of the UK, the assumed progression from current fertility levels to those assumed for the long-term.

Assumed age pattern of fertility

Table 6.4 summarises assumed fertility rates for the UK by five-year age group. The projections assume further increases in the fertility of women in their thirties and forties in the short-term, alongside small increases for women in their twenties. However, future cohorts who are assumed to experience slightly higher fertility in their twenties are also assumed to have slightly lower fertility at older ages than the cohorts immediately preceding them.

The mean age at motherhood for the UK as a whole is assumed to rise gradually from 27.8 years for the 1960 cohort, who have effectively completed their childbearing, to 29.2 years for women born in the early 1990s onwards. Among the constituent countries of the UK, the mean age at motherhood assumed for the long-term varies from 28.5 years in Wales, to 29.2 years in both England and Scotland, and

Table 6.4

Actual and assumed births per 1,000 women by age and cohort, women born 1950 to 1995

United Kingdom rates per 1,000 women

	Year of birth of woman									
Age group	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995 and later
Under 20	231	220	155	133	152	147	154	135	125	119
20–24	699	561	527	457	418	361	349	360	359	360
25–29	634	650	630	594	522	471	507	513	512	512
30–34	364	403	438	454	466	539	554	532	529	528
35–39	132	163	190	216	273	288	270	264	262	262
40 and over	28	36	43	56	63	59	57	57	57	57
Average family size	2.09	2.03	1.98	1.91	1.89	1.86	1.89	1.86	1.84	1.84
Mean age at motherhood (years)	26.4	27.1	27.8	28.4	28.8	29.2	29.1	29.1	29.2	29.2

Note: Figures to the right of the stepped line are partly or wholly projected.

Assumption setting

The assumptions about completed family size which underlie this projection round are based on an analysis of recent trends in fertility together with other relevant information, such as the views of the expert advisory panel (see Appendix III) and the latest projections published by Eurostat[6] and the UN.[7]

Recent trends in fertility

All four UK countries have seen increases in the TFR from 2002 to 2006, resulting in the UK TFR reaching 1.84 by 2006, its highest level since 1980. Fertility rates among women in their thirties and forties in the UK have continued to rise over the past five years, and at a faster rate than during the 1990s. At the same time, the downwards trend in fertility rates for women in their twenties seen in the 1990s has reversed, with modest increases in fertility seen at these ages. The combination of trends in these two age groups has led to the rapid rise in overall fertility, accompanied by further small increases in the mean age at childbirth.

The article *'Fertility assumptions for the 2006-based national population projections'*[2] discusses some possible factors that may be associated with the recent increases in period fertility, including the contribution of UK born women compared with women born outside the UK and the possible role of policy changes relating to financial support for childbearing.

These increases in period fertility at all ages over 20 are starting to have some impact on the family sizes achieved to date by cohorts of women who have not yet completed their fertility (Figure 6.2(a)). For example, women born in 1980 have had the same number of children on average by age 26 (0.68) as those born in 1975. This represents a marked difference from the pattern seen previously where successive cohorts achieved slightly lower fertility at each age than their predecessors.

Future fertility levels

When the fertility assumptions were set for the 2004-based projections, it was considered too early to judge whether the upwards rise in fertility seen at the start of the decade would be sustained; hence the long-term assumption for the UK was kept at 1.74 (although fertility levels assumed in the short-term were raised slightly). It was noted at that time that there would be a case to raise the long-term assumption in the 2006-based round if these trends were to continue.[8] The recent increases in UK fertility clearly supported raising the long-term assumptions for the 2006-based projections; the key judgement being by how much to raise the assumptions for each UK country.

In order to decide on plausible assumptions for long-term fertility, the completed family sizes that would result from a range of scenarios for possible trends in fertility at different ages were examined – these are described in more detail in the article noted above.[2] The wide range of completed family sizes resulting from these scenarios emphasised the difficulty in setting a long-term assumption at this time. As agreed in consultation with key users, the final projections for the UK and each constituent country have been broadly based on a scenario where fertility rates at ages above 20 continue to increase in the short-term, but where cohorts of women currently in their twenties experience slightly lower fertility in their thirties than the cohorts immediately preceding them, to compensate for relatively higher fertility earlier in their lives. This supported raising the UK assumption by 0.10 rather than the more cautious 0.05 or more extreme 0.15. Assumed long-term family sizes for the individual countries have been aligned with current differentials in fertility, since 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.

29.7 years in Northern Ireland. These mean ages are slightly lower than those assumed in the 2004-based projections due to the slightly younger age pattern of fertility assumed in this projection round.

Assumed sex ratio at birth

It is assumed that there will be 105 boys born for every 100 girls. This is in line with the actual sex ratios recorded in the UK over the decade 1997 to 2006, which averaged 105.2. The average levels in each UK country are similar, although there is substantial year-on-year fluctuation, particularly in Scotland, Wales and Northern Ireland. Varying the sex ratio to reflect small changes over time or any differences between countries would have a very small effect on the resultant UK population projections. Thus the ratio of 105.0 assumed in the 2004-based projections has been maintained in all UK countries.

Distribution of completed family size

The assumptions for these projections have been informed by the use of a birth order probability model for England & Wales maintained by ONS.[4,5] This model also provides details of a distribution of women by number of children that is consistent with the fertility assumptions used for the 2006-based projections.

Table 6.5 shows that the proportion of women childless by age 45 in England and Wales has been increasing in recent years, from an estimated 10 per cent of the 1945 cohort to

Table 6.5

Actual and assumed distribution of women by number of children, consistent with 2006-based projections, women born 1945 to 1995

England and Wales

Cohort born	Average family size of all women	Average family size of women who have children	Number of children (percentages)				
			0	1	2	3	4 or more
1945	2.20	2.43	10	14	43	21	12
1950	2.07	2.39	13	13	44	20	10
1955	2.02	2.40	16	13	41	20	10
1960	1.98	2.43	19	13	38	21	10
1965	1.91	2.35	19	15	38	19	10
1970	1.90	2.32	18	18	37	18	10
1975	1.88	2.31	19	19	36	17	10
1980	1.90	2.34	19	18	36	17	11
1985	1.87	2.32	19	18	36	17	10
1990	1.86	2.31	20	18	36	17	10
1995 and later	1.85	2.30	20	18	36	16	10

Note: Figures below the dashed line are partly or wholly projected.

19 per cent of women born in 1960. The rise in childlessness was the main factor in the reduction in completed family size for cohorts born in the late 1940s 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, childlessness is projected to rise only a little further, to 20 per cent among cohorts born during the 1990s. The drop in completed family size from 1.98 in the 1960 cohort to the 1.85 assumed for those born from the mid-1990s onwards is consistent with both this further slight increase in childlessness and a decrease in the average completed family size of women who have children from 2.43 to 2.30. The family size distribution consistent with the 2006-based projections assumes slightly lower childlessness and a slightly higher average family size for those who have children when compared with the distribution produced alongside the 2004-based projections.

Further details

The projected numbers of births (which depend also on the assumptions made about future migration and, to a lesser extent, mortality) are discussed in Chapter 3. Comparisons with the previous (2004-based) projections are made in Chapter 4, while Chapter 9 presents the results of variant projections based on alternative assumptions about future fertility. The detailed age specific rates assumed in the principal and variant projections for each country are available on the GAD website.

References

1 Shaw C (2007). Fifty years of United Kingdom national population projections: how accurate have they been? *Population Trends* **128** pp 8–23.

2 Smallwood S (2002). The Effect of changes in the timing of childbearing on measuring fertility in England and Wales. *Population Trends* **109** pp 36–45.

3 Jefferies J (2008). Fertility assumptions for the 2006-based national population projections. *Population Trends* **131** pp 19–27.

4 Smallwood S (2002). New estimates of trends in births by birth order in England and Wales. *Population Trends* **108** pp 32–41.

5 For application in population projections, see also Smallwood S (2003). Fertility assumptions for the 2002-based national population projections. *Population Trends* **114** pp 8–18.

6 Eurostat (2005). 2004 EU Population Projections. Available at http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL

7 United Nations – World Population Prospects: the 2006 Revision: http:/esa.un.org/unpp/index.asp?panel=4

8 Office for National Statistics/Government Actuary's Department (2006) *National population projections, 2004-based.* Series PP2 no.25. Chapter 6.

7 Mortality

Past trends in life expectancy

During the 20th century, the UK witnessed a continuation of the pattern of falling death rates that began around the beginning of the 19th century. Over these two centuries there has been a change from a regime of high infant and child mortality, with a preponderance of acute and infectious diseases, to a new pattern in which adult mortality predominates and chronic and degenerative diseases are the most common causes of death.[1] The pattern has been broadly similar in England, Scotland, Wales and Northern Ireland.[2,3,4]

One measure of the death rates in a particular year is the period expectation of life at birth, which is the average number of years a new-born baby would live for, based on the death rates for the given year. **Figure 7.1(a)** shows that there was a fairly steady increase in this measure throughout the 20th century. However, progress was slower between 1950 and 1965, particularly for males and, until 1950, epidemics and severe winters caused significantly higher death rates in some years.

Much of the increase in the period expectation of life at birth in the first half of the 20th century can be attributed to the reduction of infant and child mortality to very low levels by about 1950. Infant and child death rates have now fallen to such low levels that further reductions can have little effect on the expectation of life at birth, which has thus come closer to being a measure of the normal life span. Since about 1940, the increasing control of infectious diseases has considerably reduced the number of early adult deaths, and there has recently been a reduction in the number of those dying early from circulatory diseases.[2,3,4] The greatest decline in death rates at advanced ages has occurred since the 1970s. However, in general, mortality rates at the oldest ages declined less over the 20th century in relative terms than those at younger ages.

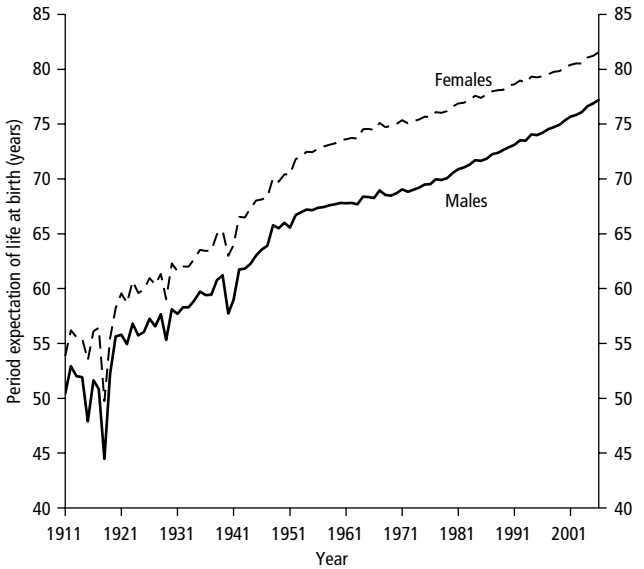
Figure 7.1(b) shows that period life expectancy at age 65 has also risen during the 20th century. For females, the annual increase was relatively constant over the 20th century whereas for males, after an initial period of increasing longevity, period life expectancy at 65 remained almost constant over the period 1940 to 1970. Since 1970 there has been a rapid decline in death rates at advanced ages, particularly for males for whom mortality is currently improving more rapidly than for females. As a result, the age differential in period life expectancy at age 65 between males and females has reduced from around 4.0 years during the 1970s and early 1980s to

Figure 7.1

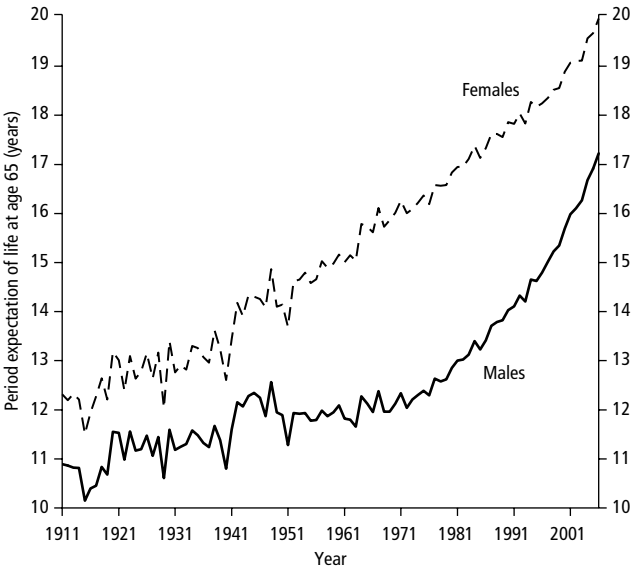
Period expectation of life at birth and at age 65 according to mortality rates experienced in given years, 1911–2006

United Kingdom

a) Period expectation of life at birth



b) Period expectation of life at age 65



2.7 years in 2006. A partial explanation for this may be the different historical patterns in cigarette smoking between men and women, with a higher proportion of males smoking in the past than females and the peak consumption for males being earlier (1940–1960) than for females (around 1960).[5] This might suggest that the rate of increase in female expectation of life at 65 may experience a further slowing down relative to that for males over the next few years.

In many contexts it is more meaningful to calculate the expected average lifetime taking into account known or assumed improvements in death rates in the future (such expectations of life are often referred to as 'cohort' expectations of life). Cohort life expectancies are discussed in greater detail later in this chapter.

A number of publications provide reviews of long-term mortality trends in the UK.[1,2,3,4,6,7,8]

Future prospects for life expectancy

Since the 1980s the period expectation of life at birth in the UK for females has increased by about 1.8 years per decade, while male life expectancy has increased by around 2.4 years per decade. However, there are diverse opinions amongst demographers as to the level of longevity that might reasonably be expected in the future.[8,9,10,11] One can point to Japan, where the period expectation of life at birth in 2006 was about 85.8 years for females and 79.0 years for males,[12] and to other countries in Europe, such as Italy, Norway, Sweden and Switzerland, which also currently have higher period expectations of life than the UK for both males and females.[13] There are also variations in period life expectancy within the UK; for example, the interquartile range in period life expectancy at birth by local authority area in 2004–06 is 2.4 years for males and 2.0 years for females.[14] There is also the possibility of lower incidences of cancer, heart disease and strokes through changes in lifestyle and, through medical advances, greater control of these when they do occur. In particular, mortality rates for heart disease and strokes have fallen quite rapidly and steadily over the 1990s for males and females aged 40 to 64 and to a lesser extent for older men and women.[15]

On the other hand some demographers believe that, despite the possibility of advances in medical practices and of encouraging healthy lifestyles, a law of diminishing returns will apply to death rate reductions at advanced ages, partly because no more than a minority of the population will adopt truly healthy lifestyles. It is also possible that new diseases, or the re-emergence of existing diseases such as tuberculosis, may serve to temper future improvements in mortality.

National Statistics quality review

A review of the methodology for projecting mortality rates in the national population projections for the UK and constituent countries, carried out under the National Statistics Quality Assurance programme, was published in December 2001.[16] The main object of the review was to assess whether the methodology used for projecting mortality rates in the national population projections met the needs of the wide range of users of the projections, met best practices and was founded on good basic data. The review concluded that none of the alternative methodologies assessed would be likely to outperform the methodology used for projections during the 1990s and that the existing methodology should be retained. However, the assumed values for the key parameters used would be reviewed for each new projection round. A number of recommendations for improving the methodology were made in the review and these have been incorporated in recent projections.

Methodology and derivation of United Kingdom base death rates

Rather than focusing directly on expectations of life in formulating the mortality assumptions for population projections, the prospects for death rates at different ages, and for different generations, have been considered separately. In this chapter, the assumptions for the projections are given in the form of central death rates (m_x). The difference between these and the probabilities of dying (q_x) used to carry out the actual projections is described in Chapter 10. The latter figures are shown on the GAD website.

Death rates for the UK in each calendar year in the period 1961 to 2005 have been graduated using a method similar to that used for graduating the English Life Tables No. 15.[17] Population estimates by age for those aged 90 and over from 1979 onwards (and retrospective estimates for earlier years, back to when these persons were aged 80) were calculated using the Kannisto-Thatcher survivor ratio method which is a modified form of the method of extinct generations.[18] The retrospective estimates to age 80 have been found to give more reliable results than using the official population estimates made at the time.

The graduation process leaves considerable fluctuations from year to year at the older ages due to the effect of "epidemic" or "severe winter" years, and at both the oldest and youngest ages due to the small numbers of deaths. Removal of these fluctuations is beyond the scope of the age-graduation method employed. An exponential smoothing method was used to smooth the year to year fluctuations and to "project" the base

Table 7.1

Assumed base death rates (m_x) per 100,000, for individual countries of the United Kingdom, 2006

	Males				Females			
Age	England	Wales	Scotland	Northern Ireland	England	Wales	Scotland	Northern Ireland
0	538	457	538	608	463	389	445	481
2	24	21	29	26	17	15	18	16
12	12	9	16	14	8	8	12	9
22	66	70	101	91	26	23	34	26
32	96	119	156	103	46	53	61	46
42	174	183	257	174	109	118	139	117
52	433	459	566	441	280	297	352	292
62	1,147	1,175	1,569	1,234	694	759	922	734
72	2,853	3,067	3,590	3,112	1,828	1,995	2,281	1,910
82	8,488	8,830	9,688	8,875	6,112	6,326	6,920	6,262
92	23,066	23,609	23,674	23,934	20,132	20,668	20,892	21,340
102	50,516	50,516	50,516	50,516	48,839	48,839	48,839	48,839

death rates for 2006, based on the trends in mortality up to 2005, but giving more weight to recent figures than to earlier data. Actual death rates for 2006 did not become available until after the mortality assumptions for these projections were finalised.

Base death rates for individual countries

Base death rates for the calendar year 2006 were initially calculated for the UK, as described above. Base death rates for the four individual countries of the UK were obtained by adjusting the UK figure at each age in proportion to the particular country's experience relative to the UK in the three years 2003 to 2005. These rates for individual countries are shown for selected ages in Table 7.1. The mortality improvement factors described below were then applied to the projected base death rates for 2006 for each country to obtain the projected mortality rates for future years.

Trends in mortality by age

The smoothed, graduated death rates for the UK reveal oscillations between increases and reductions at older ages for men up to the mid-1970s, as well as temporary increases at middle ages in the 1960s and amongst young men in the 1960s and the early 1970s. Death rates for men aged 15 to 40 generally rose during the mid-1980s to the mid-1990s. These more recent increases have been partly attributable to deaths caused by HIV infection and AIDS.[19] Suicide rates and alcohol-related mortality also increased for men at young ages until the late 1990s.[20] Recent years have also seen little improvement in mortality rates for males in their late forties and early fifties. Apart from increasing mortality rates for women aged between 45 and 60 during the 1960s and early 1970s, death rates are generally falling for women of all ages, with the recent trends of rising death rates during the 1990s for women aged 15 to 30 having been reversed.

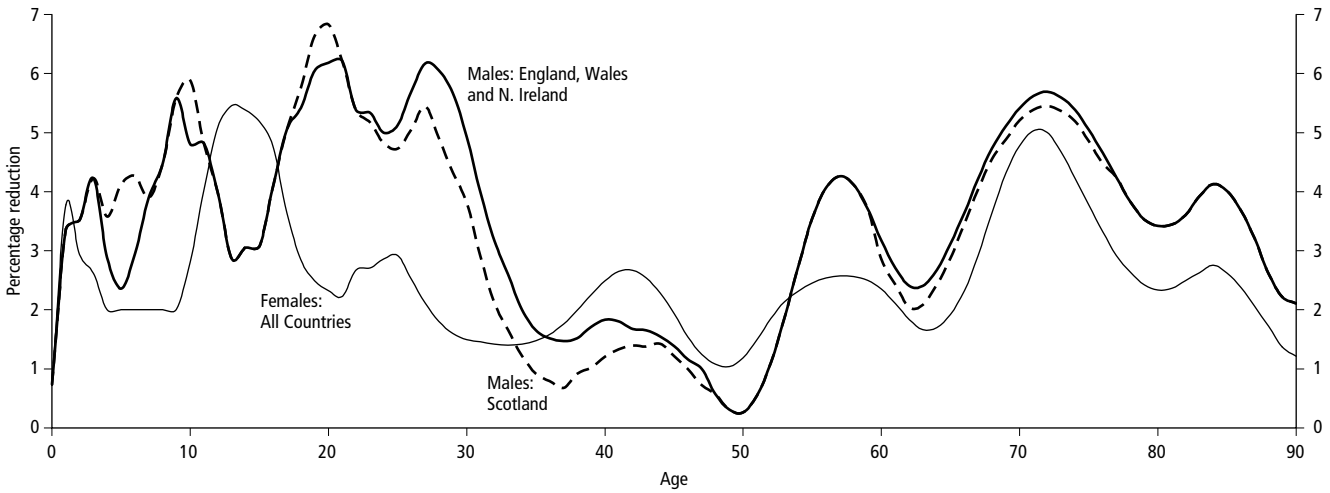
It was assumed that the trends apparent during the period 1961 to 2005 (mostly of falling death rates) would initially continue at similar rates. The changes between the projected base mortality rates for 2006 compared to the smoothed, graduated mortality rates for 2005 were determined. After further smoothing the resulting percentage changes by age and gender were then taken as the base from which the projected improvements in future years would be derived. These assumed smoothed changes in death rates between 2005 and 2006 are shown in Figure 7.2.

Comparisons of the rates of improvement experienced in each individual country with those experienced in the UK as a whole suggested that the assumed initial rates of improvement by age and gender for the UK could be adopted for each individual country, except for Scotland. Mortality for Scottish males at some ages (notably those aged 23 to 47 and, to a lesser extent, those in their sixties and early seventies) has been improving more slowly (or worsening at a higher rate) than elsewhere in the UK in recent years. Slightly higher rates of improvement were assumed for Scottish males at some

Figure 7.2

Assumed smoothed percentage changes in death rates between 2005 and 2006 by age

United Kingdom



young ages. As a result, separate initial rates of mortality improvement were assumed for Scottish males at several ages, as shown in Figure 7.2.

The peak levels of reduction in death rates (of over 4 per cent a year) for both males and females currently in their late sixties and early seventies is consistent with recent trends and appears to be a special feature of the generations born between 1923 and 1940 (centred on the generation born around 1931). It is not understood precisely why the members of the generation born around 1931 have been enjoying higher rates of mortality improvement throughout their adult life than preceding generations, or why the rate of improvement slowed down for following generations. It may, however, be relevant that this generation was the first to benefit from a combination of better childhood health, the conquest of infectious diseases affecting young and middle-aged adults and, in later middle-age, improvements in the treatment of circulatory diseases. Additionally, the men, in particular, have smoked fewer cigarettes than those in preceding generations.

Future improvements in age-specific death rates

Consideration was then given to how the trends might change in the future. In the methodology used for mortality projections in the United Kingdom, 'target' rates of mortality improvement are assumed for a specific future year. Following the recommendations of the National Statistics Quality Review,[16] the target year was taken to be 25 years ahead of the base year for the projections.

Over the period 1965–2005, the average annualised rate of improvement in aggregate standardised mortality rates in the UK has been nearly 1.6 per cent for males and a little over 1.2 per cent for females. The rate of improvement over the latter half of this period was higher for both males and females than over the first half, and particularly so for males. This appears to be partly due to differential trends in smoking behaviour between males and females. Relatively higher numbers of men have now given up smoking and mortality rates for males at older ages have shown large rates of improvement in recent years.

The average annual rate of improvement over the whole of the 20th century was around 1.0 per cent for both males and females although the improvement rates vary by age. There is considerable debate as to whether the impact of future technical, medical and environmental changes will have a greater or lesser effect on improvements in mortality in the future than they had over the 20th century. Taking these various factors into consideration, the rate of improvement for 2031 (the 25th year of the 2006-based projections) has been assumed to be 1.0 per cent for most ages (i.e. equivalent to the average rate of improvement over the whole of the 20th century).

However, those born during the period 1923–1940 (and centred around 1931) have exhibited greater rates of improvement over the last 25 years than those born on either side. There is currently no evidence that these differentials are declining. Similar cohort effects seen in other countries suggest that these differentials may persist well into the oldest ages. As a result, it is now assumed that these cohorts will continue

Table 7.2

Assumed percentage reduction in death rates, m_x, between consecutive calendar years in the projection period and the total reduction over 25 years

United Kingdom Percentages

		2006 to 2007	2010 to 2011	2020 to 2021	2030 to 2031	Reduction over 25 years
Males (England, Wales and Northern Ireland)						
	0	0.74	0.81	0.93	1.00	*20.2*
	2	3.36	2.80	1.64	1.00	*39.0*
	12	3.80	3.13	1.75	1.00	*41.7*
	22	5.12	4.13	2.11	1.00	*49.2*
	32	3.04	2.55	1.55	1.00	*36.9*
	42	1.64	1.49	1.17	1.00	*27.1*
	52	0.58	1.00	1.00	1.00	*20.7*
	62	2.61	3.33	1.00	1.00	*33.1*
	72	5.40	3.36	1.82	1.00	*41.7*
	82	3.32	3.66	1.96	1.00	*46.9*
	92	1.93	2.58	2.72	1.20	*44.8*
Males (Scotland)						
	0	0.74	0.81	0.93	1.00	*20.2*
	2	3.36	2.80	1.64	1.00	*39.0*
	12	3.80	3.13	1.75	1.00	*41.7*
	22	5.12	4.13	2.11	1.00	*49.2*
	32	2.05	1.80	1.28	1.00	*30.2*
	42	1.37	1.28	1.10	1.00	*25.1*
	52	0.58	0.80	0.93	1.00	*19.3*
	62	2.34	3.33	0.93	1.00	*32.5*
	72	5.19	3.23	1.82	1.00	*40.6*
	82	3.32	3.66	1.92	1.00	*46.3*
	92	1.93	2.58	2.72	1.20	*44.7*
Females (all countries)						
	0	0.77	0.80	0.87	1.00	*19.5*
	2	2.88	2.66	2.02	1.00	*41.2*
	12	4.97	4.50	3.15	1.00	*57.1*
	22	2.62	2.43	1.88	1.00	*38.9*
	32	1.41	1.36	1.22	1.00	*26.8*
	42	2.62	2.43	1.88	1.00	*38.8*
	52	1.48	1.21	1.13	1.00	*24.8*
	62	2.07	2.35	1.13	1.00	*31.6*
	72	4.95	2.67	1.83	1.00	*39.9*
	82	2.34	2.82	2.10	1.00	*45.4*
	92	0.99	1.91	2.58	1.20	*42.7*

Notes: Above the stepped line, projections are made by calendar year. Below the line, projections are made by cohort (see text for further details). The first column shows the reductions not from the actual death rates from 2006, but the base death rates for 2006, projected from trends in preceding years.

to experience higher rates of improvement with the assumed rate of improvement in 2031 rising from 1.0 per cent a year for those born before 1923 to a peak of 2.5 per cent a year for those born in 1931 and then declining back to 1.0 per cent a year for those born in 1941 and later. However, there is little evidence of past mortality improvements at the very oldest ages in the UK. As a result, and in order to avoid implausible numbers surviving to extreme ages, the notional assumed rates of improvement in the 25th year of the projections are assumed to reduce from 1 per cent for those born in 1911 to 0.1 per cent for those born in 1902 and earlier.

Table 7.2 shows the reductions in death rates assumed for selected years in the future and the total reduction over the next 25 years for each country of the UK. The transition from current rates of mortality improvement by age and gender, derived from recent trends, to the assumed rates of 1.0 per cent to 2.5 per cent in 2031, is not assumed to take place linearly, but more rapidly at first for males and less rapidly for females, as shown in Table 7.2.

There is also growing evidence of generational effects after the 1940 cohort. Thus, in these projections, convergence to the assumed rate of improvement in 2031 has been done by *cohort* for all those born before 1960 (that is, those below the stepped line in Table 7.2). For those born in 1960 and later (that is, those above the stepped line), for whom there is little evidence of generational effects, the changes in the rates of improvement to the target rate are projected by *calendar year*. Of course, at young ages death rates are already at low levels and the precise assumptions made for future mortality have a relatively minor impact on the projections.

The rates of improvement after 2031 are assumed to remain constant at the rate assumed in 2031 for each year thereafter. So, for those born during the period 1923–1940 (who are assumed to have higher rates of improvement than 1.0 per cent in 2031), it is assumed that they will continue to experience these higher rates of improvement after 2031. (In the 2004-based projections it was assumed that *all* age differentials would disappear over time with a common rate of improvement of 1.0 per cent assumed at every age by 2029.)

The same future improvements are assumed for all countries of the UK except for some differences (generally, slightly smaller improvements) in the period to 2031 at some ages for males in Scotland.

Taking account of the generally higher rates of improvement assumed prior to 2031, this produces an average annualised rate of mortality improvement of nearly 1.4 per cent for both males and females over the next 75 years, which is slightly higher than that experienced over the past 75 years. As Table 7.3 shows, the new projections generally assume higher rates of improvement for the future than experienced over corresponding periods in the past.

Table 7.3

Actual and assumed overall average annual rates of mortality improvement

England & Wales Per cent

	Males		Females	
	Past (actual)	Future (assumed)	Past (actual)	Future (assumed)
Last/next 24 years	2.13	2.12	1.47	2.15
Last/next 44 years	1.54	1.62	1.33	1.64
Last/next 74 years	1.23	1.37	1.27	1.38

Note: Historic estimates are based on comparison of latest (2004–06) interim life tables with English Life Tables for 1930–32, 1960–62 and 1980–82.

Making projections of death rates is speculative and users of projections of numbers of the elderly must bear in mind that the range of possibilities is wide. Variant projections using alternative assumptions for the future reduction in mortality are considered in Chapter 9.

Effect of assumptions

The implications of these assumptions in terms of the period expectation of life at birth are shown in Figure 7.3(a) and Table 7.4. Figure 7.3(b) also shows the implications for period expectations of life at age 65. As can be seen from Table 7.4, the actual period expectation of life at birth for females in the UK in 2006 was higher than the underlying trend figure. Conversely, for males, actual period life expectancy at birth was lower than the trend figure.

As a result of the changes in assumptions, and lower initial levels of mortality because of higher than expected falls in mortality in 2004 and 2005, assumed mortality rates are, in general, lower at most ages than in the previous projections. These lead to increases in period expectations of life at birth in 25 years time of around 1.3 years for males and 1.2 years for females compared to those assumed in the previous projections. Beyond 2031, the differences increase more slowly; for example, in 2056 period life expectancies at birth for the UK are about 1.4 years higher for males and 1.3 years higher for females than in the previous projections.

Table 7.4 also gives ratios of standardised death rates for some future years, together with comparable figures for some past

Figure 7.3

Actual and projected period expectation of life at birth and at age 65 according to death rates for given year, United Kingdom, 1981–2081

United Kingdom

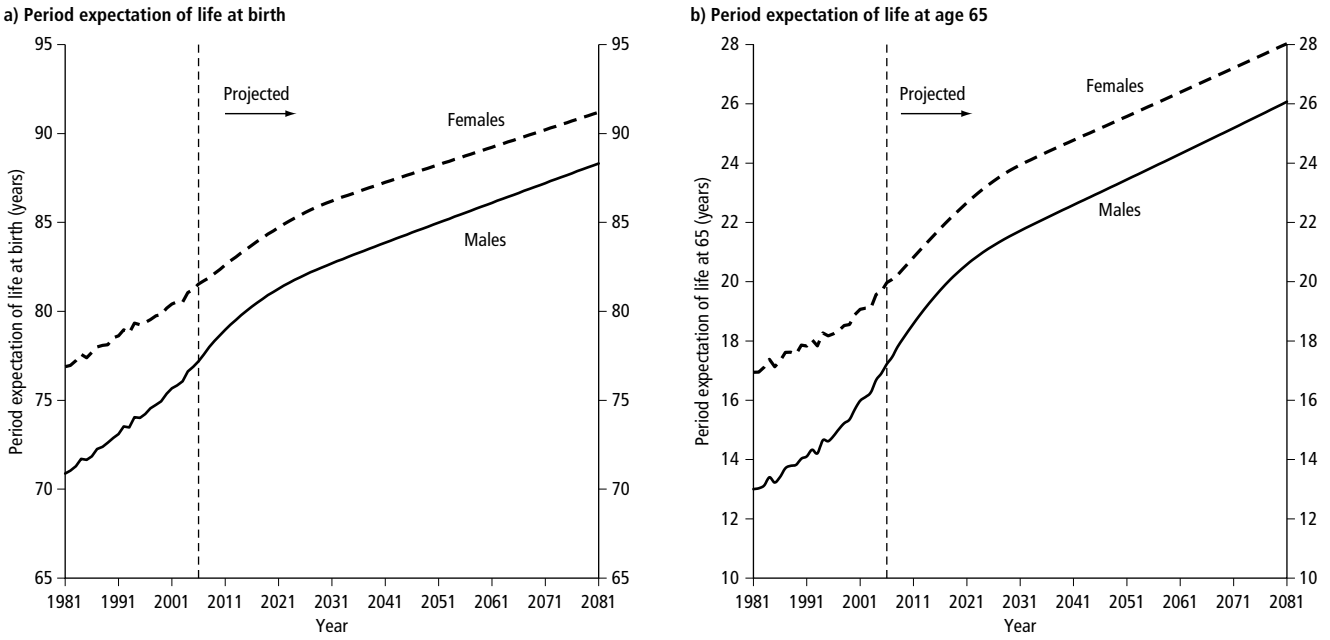


Table 7.4

Actual and projected period expectation of life at birth according to death rates for the given year, and ratios of standardised death rates, 1981–2061

United Kingdom

	Period expectation of life at birth (years)		Ratios of standardised death rates[1] (2000–2002 = 1.00)	
Year	Males	Females	Males	Females
Actual				
1981	70.9	76.9	1.47	1.30
1986	71.9	77.7	1.38	1.23
1991	73.1	78.6	1.25	1.14
1996	74.2	79.4	1.14	1.09
2001	75.7	80.4	0.99	0.99
2006 (actual rates)	77.2	81.5	0.86	0.89
2006 (trend rates)	77.3	81.4	0.86	0.92
Projected				
2011	79.0	82.6	0.73	0.81
2021	81.3	84.7	0.58	0.64
2031	82.7	86.2	0.51	0.54
Longer-term projections				
2041	83.9	87.3	0.46	0.49
2051	85.0	88.2	0.41	0.44
2061	86.1	89.2	0.37	0.40

1 Standardised on 2001 population estimates.

years. The *standardised death rate* is the overall death rate (i.e. total number of deaths divided by total population) resulting from applying the age-specific death rates for a particular year to the population numbers for a standard year, taken here as the year 2001. The ratio of these overall death rates for selected years to that for a standard year (the average of three years, 2000–2002, in this case) is given in the table. This measure is sometimes called the *comparative mortality figure* and details of this index decomposed into age-group indices have been published for the UK.[21]

Expectation of life for generations

So far in this chapter, expectations of life have mainly been calculated on the basis of the death rates *for a particular calendar year* (period life expectancies). However, for some purposes, cohort life expectancies, which allow for future known or assumed changes in mortality are more appropriate measures. Further information on the difference between period and cohort life expectancies is available on the National Statistics and GAD websites.[22] Table 7.5 shows projected period and cohort expectations of life at selected ages for three different years.

Table 7.5 shows that the projected period expectation of life at birth for a male in the UK was 77.2 years on the basis of the death rates for 2006. However, taking into account assumed mortality improvements in later years, we would actually expect a male born in that year to live for 88.1 years. Similarly, the average man aged 65 in 2006 would live for a further 17.2 years based on the mortality rates for 2006. However, taking account of the assumed further mortality improvement after 2006, he would actually be expected to live for a further 20.6 years.

Figure 7.4(a) shows the cohort expectation of life at birth for England & Wales and Figure 7.4(b) shows the cohort expectation of life at age 65 based on the actual death rates experienced in the past or assumed for the future for generations born from 1850 to 2050.

About half of the increase in cohort life expectancies at birth between generations born in 1850 and 1945 was due to the reduction in infant and child mortality to very low levels. Subsequent generations have benefited particularly from the almost complete elimination of deaths from acute and infectious diseases. Figure 7.4(a) illustrates the point that, while current reductions in mortality rates at the older ages will continue to extend the average lifetime, once this reaches around 79 years for males and 83 years for females (i.e. for men and women born in 1950), further progress is likely to be much slower. The great majority of deaths will then be attributable to chronic and degenerative diseases.

While the cohort expectation of life at age 65 for females has been increasing at a fairly steady rate since the 1930s, the

Table 7.5

Expectation of life for persons at various ages for the years 2006, 2011 and 2031

United Kingdom Years

	Males			Females		
Age	2006	2011	2031	2006	2011	2031
a) Period expectation of life						
0	77.2	79.0	82.7	81.5	82.6	86.2
15	62.8	64.5	68.2	67.0	68.1	71.6
60	21.1	22.6	25.8	24.2	25.1	28.3
65	17.2	18.6	21.7	20.0	20.8	23.9
75	10.4	11.4	14.2	12.4	12.9	15.8
85	5.7	6.1	8.2	6.6	6.7	8.9
b) Cohort expectation of life						
0	88.1	88.8	91.3	91.5	92.0	94.2
15	71.8	72.5	75.0	75.3	75.9	78.1
60	24.9	25.7	27.7	27.8	28.4	30.3
65	20.6	21.2	23.2	23.1	23.6	25.5
75	11.9	13.1	15.0	13.5	14.8	16.6
85	5.9	6.5	8.5	6.7	7.2	9.3

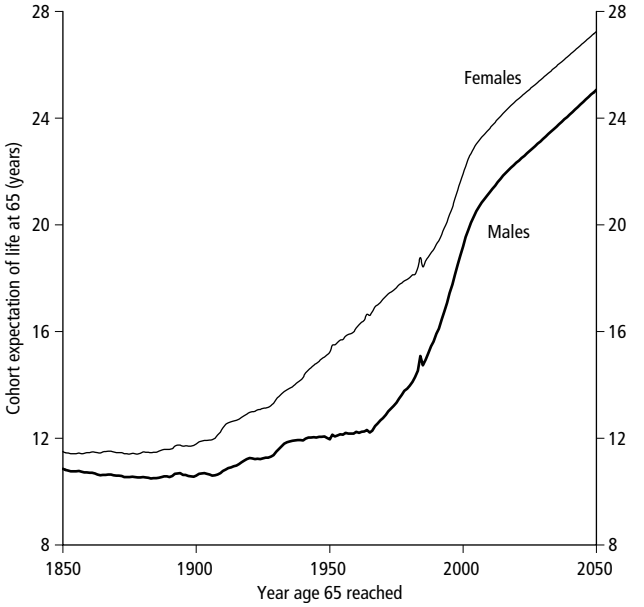
Figure 7.4

Cohort expectation of life at birth and at age 65 according to historic and projected mortality rates, 1850–2050

England & Wales

a) Cohort expectation of life at birth for persons born from 1850 to 2050

b) Cohort expectation of life at age 65 for persons who reach age 65 in the years 1850 to 2050



cohort expectation of life at age 65 for males showed relatively little increase between 1930 and 1970 after which it began to increase more rapidly than for females. As discussed earlier, a partial explanation for this may be the different historical patterns in cigarette smoking between men and women. This is likely to have delayed mortality rates for older males falling to the levels they would have reached had they followed the reductions in female mortality rates experienced during the 1950s and 1960s, rather than indicating a continuing convergence of male mortality rates to those for females.

Constituent countries of the United Kingdom

In principle, a different rate of mortality improvement could have been employed for each country of the UK, perhaps showing a convergence later in the 21st century. However, as discussed earlier, a comparison of mortality improvements for each country with those experienced in the UK suggested that the same rates of mortality improvement by age and gender could be assumed for each country of the UK, except for Scotland, where different rates of improvement were assumed to 2031 for males at certain ages. The resulting projected death rates and expectations of life do vary between countries, of course, as shown in Table 7.6, because of the different starting death rates. Of the four countries, England shows the highest life expectancy and Scotland the lowest.

As can be seen from Table 7.6, compared with the 2004-based projections, period and cohort expectations of life at birth for males are generally higher throughout the first 25 years or so of the projection period, for each of the individual countries of the UK. Period expectations of life at birth for males are projected to be around 1.4 years higher for England, 1.3 years higher for Wales and 1.2 years higher for Scotland and Northern Ireland by 2031. Cohort expectations of life at birth for males are projected to be around 1.6 years higher for each country of the UK by 2031. For females, period life expectancies at birth are around 1.2 years higher for each constituent country, while cohort life expectancies are approximately 1.5 years higher, by 2031.

Mortality differences between males and females

In common with other Northern European countries,[1] the excess of period life expectancy at birth for females over males rose in the UK during the period 1900 to 1970, before declining in more recent years. In the UK the differential has fallen from 6.0 years in 1980 to 4.3 years in 2006; it is projected to fall to about 3.6 years by 2011, then remain around that level for the following twenty-five years before gradually falling to around 3 years by 2081. One reason for this fall is the increasing incidence for women of lung cancer deaths, as compared with falling rates for men. In general,

Table 7.6

Expectation of life at birth for the years 2006, 2011, 2021 and 2031

Corresponding results from the 2004-based projections are shown in brackets

United Kingdom Years

	2006		2011		2021		2031	
a) Period expectation of life								
Males								
England	77.5	*(77.4)*	79.2	*(78.7)*	81.5	*(80.5)*	83.0	*(81.6)*
Wales	76.9	*(76.9)*	78.7	*(78.2)*	81.0	*(80.0)*	82.4	*(81.1)*
Scotland	74.8	*(74.8)*	76.6	*(76.1)*	79.0	*(77.9)*	80.4	*(79.2)*
Northern Ireland	76.2	*(76.8)*	78.4	*(78.1)*	80.8	*(79.8)*	82.2	*(81.0)*
United Kingdom	77.2	*(77.2)*	79.0	*(78.5)*	81.3	*(80.2)*	82.7	*(81.4)*
Females								
England	81.8	*(81.5)*	82.8	*(82.4)*	84.9	*(84.1)*	86.4	*(85.2)*
Wales	81.3	*(81.0)*	82.3	*(81.9)*	84.5	*(83.6)*	86.0	*(84.8)*
Scotland	79.8	*(79.7)*	81.1	*(80.7)*	83.3	*(82.5)*	84.8	*(83.7)*
Northern Ireland	81.1	*(81.2)*	82.5	*(82.1)*	84.6	*(83.8)*	86.1	*(84.9)*
United Kingdom	81.5	*(81.3)*	82.6	*(82.2)*	84.7	*(83.9)*	86.2	*(85.0)*
b) Cohort expectation of life								
Males								
England	88.3	*(86.7)*	89.0	*(87.3)*	90.2	*(88.5)*	91.4	*(89.8)*
Wales	87.9	*(86.2)*	88.5	*(86.9)*	89.8	*(88.1)*	91.0	*(89.4)*
Scotland	86.0	*(84.4)*	86.6	*(85.1)*	88.0	*(86.4)*	89.4	*(87.8)*
Northern Ireland	87.6	*(86.0)*	88.2	*(86.6)*	89.5	*(87.9)*	90.7	*(89.1)*
United Kingdom	88.1	*(86.5)*	88.8	*(87.1)*	90.0	*(88.4)*	91.3	*(89.6)*
Females								
England	91.6	*(90.2)*	92.1	*(90.7)*	93.2	*(91.8)*	94.3	*(92.9)*
Wales	91.2	*(89.8)*	91.8	*(90.3)*	92.9	*(91.4)*	94.0	*(92.5)*
Scotland	90.2	*(88.8)*	90.8	*(89.3)*	92.0	*(90.5)*	93.1	*(91.6)*
Northern Ireland	91.3	*(89.8)*	91.8	*(90.4)*	92.9	*(91.5)*	94.1	*(92.6)*
United Kingdom	91.5	*(90.0)*	92.0	*(90.6)*	93.1	*(91.7)*	94.2	*(92.8)*

women took up smoking later than men and for them the peak of lung cancer deaths and other deaths related to smoking is still to come.

The changing life table

Figure 7.5 illustrates how the survival curve, which shows the proportion of those born in a given year who survive to each age, is getting progressively more rectangular in shape as more and more deaths occur at advanced ages. The charts are based on the average of male and female mortality in England & Wales. In Figure 7.5(a), the survival curves are calculated on a period basis and show the percentages who would survive to successive ages if they experienced the mortality rates of the year shown with no allowance for known or projected changes in mortality rates for the years thereafter. The first, least rectangular, curve represents the life table according to the death rates of the year 1851 and successive curves are given at twenty-year intervals, with the uppermost being the projected life table for the year 2031. From this chart it can be seen that the median age at death, i.e. the age to which half of those born survive, was about 45 on the basis of the death rates of 1851, is now about 82 and is projected to increase to about age 88 by the year 2031.

Views on future levels of mortality improvements and expectations of life

Mortality projections prepared in other countries and by other agencies tend to be based largely on extrapolation of past trends either in rates of mortality improvement or in expectations of life. Expert opinion is often used to inform the assumptions made. It is therefore perhaps helpful to summarise some of the current arguments put forward by experts regarding future levels of mortality improvements and life expectancy, for the UK and for other developed countries.

For the UK, several factors have been identified amongst the likely drivers of future mortality change including the 'cohort effect', the 'ageing of mortality improvement' (where the ages at which the highest rates of improvement have occurred have been increasing over time), increased uncertainty at younger ages, changes in prevalence of cigarette smoking, the effects of other lifestyle changes and medical advances. These are all discussed elsewhere in this chapter.

Appendix III reports a meeting of the NPP Expert Panel at which members were asked their views on the validity of a large range of arguments which might be thought likely to influence future mortality trends. In general the UK experts felt that the current high rates of mortality improvement were likely to continue into the future. Many events were occurring which would increase the chances of longevity increasing such as continuing medical and bio-technological advances, more effective health care systems and better health information, changes in lifestyle behaviour (for example through increasing physical activity and improved diet) and increasing mental and social activity at old ages. Society would be able and willing to afford new treatments. However, there were factors which would work in the opposite direction. These include new 'international' diseases (e.g. avian flu), increasing drug resistance to existing infectious diseases, HIV, hepatitis, increasing obesity etc. Also, not all sectors of the population may choose to adopt lifestyle behaviours leading to increasing longevity. It was acknowledged that there are elements influencing mortality improvement in both directions and that these need to be considered together to determine if the overall effect will be positive or negative. However, it was felt that those factors tending to increase longevity would outweigh negative influences and that the increase in life expectancy over the next 25 years would be similar to that experienced over the preceding 25 years.

There is currently a wide range of opinion amongst demographers, gerontologists, epidemiologists, academics and others as to the likely future pattern of longevity. Proponents of a biological maximal length to life refer to the 'Hayflick' limit – in the 1960s, Hayflick found that certain mammal cells could only divide up to a specific limited number of times, which were roughly linked with the typical lifespans of the organisms involved.[23] Others have argued that lifespan can be viewed as a kind of biological warranty period linked to the reproductive period with physiological decline in the post-reproductive period producing restraints on the duration of life.[24]

Oeppen and Vaupel have observed that past predictions of limits to life expectancy have nearly all been broken afterwards.[11] They have noted that record life expectancy (the highest life expectancy observed in any country of the world at any particular time) has increased at a steady pace over the last 160 years or so and suggest that this is likely to continue into the future. However, Olshansky and others have argued that there will be countervailing trends to the high rates of mortality improvements seen in recent years, driven by increasing levels of obesity, sedentary behaviours and other adverse lifestyle factors.

Some scientists have suggested that medical advances could lead to engineered negligible senescence with radical consequences for future life expectancy. For instance, de Grey[25] believes that there are only seven mechanisms for accumulating damage to the human body and that therapies for reducing or reversing all of these types of damage are currently foreseeable. Given sufficient commitment and resources, the possibility of life expectancy of 150 years, or even longer, may be with us in the next 20 to 30 years.

Given this wide disparity of views as to the likely future course of longevity, users of the projections can gain some insight into the sensitivity of their results to the various views on future mortality by considering the high and low life expectancy variants (see Chapter 9). However, these are intended to represent plausible alternative assumptions and are far from reflecting the extremes of thinking on future mortality.

Latest Eurostat and UN projections

In their 2004-based projections,[26] Eurostat assumed an increasing period life expectancy at birth, though the rate of increase declines over time. Eurostat's assumptions were derived from looking at past rates of mortality improvement and assuming that continued rates of improvement would occur in future, but at a slower pace than those seen in the recent past. The Eurostat projections of period expectations of life at birth for males for the UK are lower than those in the 2006-based national population projections produced by ONS but are broadly similar for females.

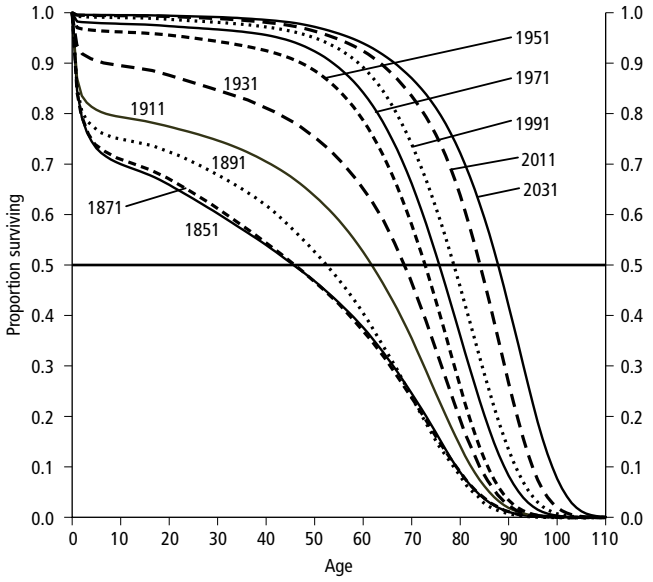
Both the national UK projections and the Eurostat projections assume higher projected period expectations of life at birth for the UK than the current United Nations 2006 Revision.[27]

Figure 7.5

Proportion of persons surviving to successive ages, according to death rates experienced or projected, persons born 1851–2031

England & Wales

a) Proportion surviving on a period basis



b) Proportion surviving on a cohort basis

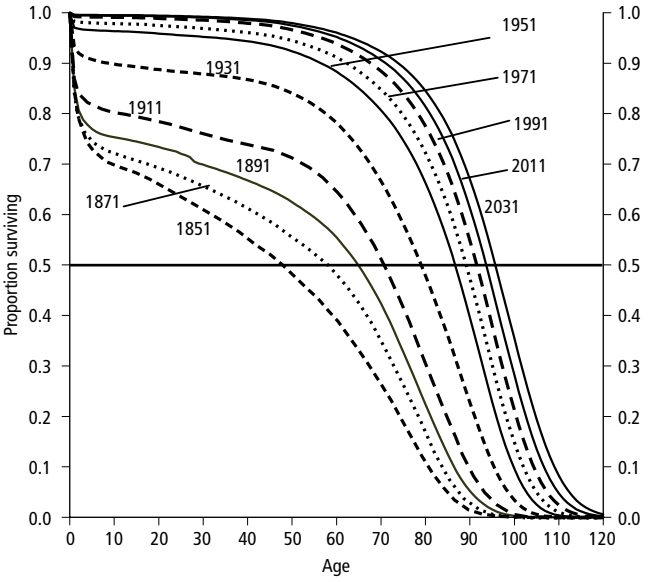


Figure 7.5(b) shows the survival curves calculated on a cohort basis i.e. allowing for known and projected future changes in mortality after the cohort's year of birth. Since mortality rates have, in general, been improving over past years and are projected to continue to improve, the survival curve for a given year in Figure 7.5(b) lies to the right of that for the corresponding year in Figure 7.5(a). From this chart it can be seen that, on a cohort basis, the median age at death for those born in 1851 was actually about 48, and is projected to be about 93 for those born now and to increase further to about age 95 for those born in 2031.

It is clear from Figure 7.5(a) that recent improvements in period expectation of life at birth have been due primarily to increases in survival to elderly ages. In contrast, increases in maximum lifespans have been comparatively small. There is limited scope for further reduction in mortality rates at young and middle ages. Any continuation of recent increases in expectation of life will only be achieved through major falls in mortality at older ages.

Further details

Projected numbers of deaths are discussed in Chapter 3. Comparisons with the previous (2004-based) projections are made in Chapter 4, while Chapter 9 presents the results of variant projections based on alternative assumptions about future mortality. The detailed age specific rates assumed in the principal and variant projections for each country are given on the GAD website at www.gad.gov.uk.

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8 Migration

Introduction

The current methodology for determining assumptions of future migration was introduced for the 1991-based national population projections.[1] With some later modifications,[2] this approach, which standardises the methods and procedures by which the assumptions are formulated, has been the basis of subsequent projections. This chapter summarises the assumptions adopted for the 2006-based population projections.

It is important to emphasise that the migration assumptions are based on past demographic trends. They do not attempt to predict the impact that new or future government policies, changing economic circumstances or other factors (whether in the UK or overseas) might have on migration patterns.

The new long-term assumption for net migration to the UK is +190,000 each year compared with +145,000 a year in the 2004-based projections. This increase follows two years (2004 and 2005) where net migration into the UK was at record levels. Methodological improvements to the estimation of international migration, announced by ONS in April 2007, have also contributed to the increase.[3]

International migration data for 2006 were not available when these long-term assumptions were decided. Estimates for 2006 have subsequently become available and show that net migration to the UK was +191,000 in the calendar year 2006, lower than 2004 and 2005 but still part of a series of historically high levels of migration.[4]

However, although 2006 migration data were not available in time to inform the long-term assumptions, the assumptions for the first few years of the projections were decided at a later stage than the long-term figures. It was therefore possible to take account of provisional data for 2006 in setting the assumption for the first year (2006–07) of the projections.

Figure 8.1 compares the future migration assumptions with historical international migration estimates back to 1991. It is based on mid-year to mid-year, rather than calendar year, figures, so the latest actual data point shown is the estimated 189,000 net inflow to the UK between mid-2005 and mid-2006. The graph also shows the assumptions made for the previous 2004-based projections.

Migrants are defined as individuals who change their country of usual residence for a period of at least a year, so that the country of destination becomes the country of usual residence. Migration figures are derived from several sources.[5] The principal source is the International Passenger Survey (IPS) which became operational in 1964. Adjustments to IPS data are made for people who enter or leave the country initially for a short stay but subsequently decide to remain for a year or more ("visitor switchers"), and for people who intend to be migrants but in reality stay in the UK or abroad for less than one year ("migrant switchers").

Assumptions of migration between the UK and the Irish Republic are added to the IPS figures. Finally, the projections incorporate assumptions, based on advice from the

Figure 8.1

Actual and assumed total net migration, 1991–92 to 2020–21

United Kingdom

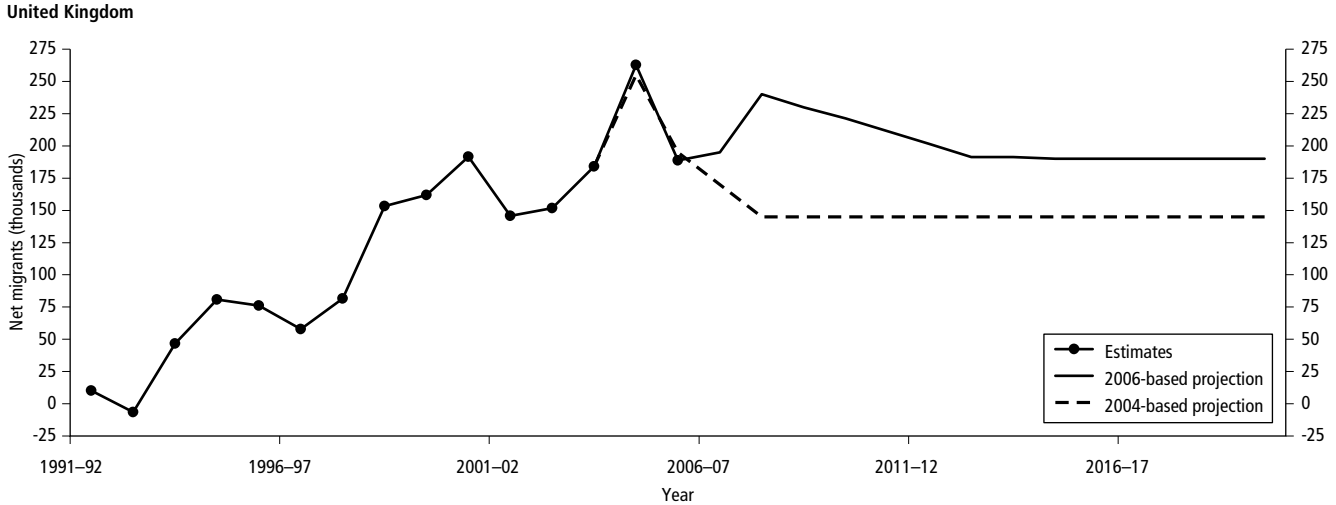


Table 8.1

Long-term annual net international migration assumption by component category, United Kingdom, 2014–15 onwards

	2006-based projection	2004-based projection
IPS	170,000	145,000
Visitor switcher adjustment	20,000	15,000
Migrant switcher adjustment	0	-20,000
Asylum seeker adjustment	10,000	15,000
Irish Republic	-10,000	-10,000
Total	190,000	145,000

Home Office, about the future net flows of asylum seekers (including dependants) not covered by the IPS.

A breakdown of the overall long-term assumption into these component categories is given in Table 8.1.

For the individual countries of the UK, additional assumptions have to be made about the distribution of international migration, and about cross-border flows, between the four countries. A summary of the assumptions for the individual countries is given in Table 8.2.

Table 8.2

Long-term annual net migration assumptions for the United Kingdom and constituent countries, 2014–15 onwards

	2006-based	2004-based	Difference
International net migration			
England	183,000	138,000	45,000
Wales	2,000	5,000	-3,000
Scotland	4,500	2,500	2,000
Northern Ireland	500	-500	1,000
United Kingdom	190,000	145,000	45,000
Cross-border net migration			
England	-11,500	-8,000	-3,500
Wales	7,500	6,500	1,000
Scotland	4,000	1,500	2,500
Northern Ireland	0	0	0
Total net migration			
England	171,500	130,000	41,500
Wales	9,500	11,500	-2,000
Scotland	8,500	4,000	4,500
Northern Ireland	500	-500	1,000
United Kingdom	190,000	145,000	45,000

In the following sections of this chapter, the various component assumptions are considered separately.

International migration

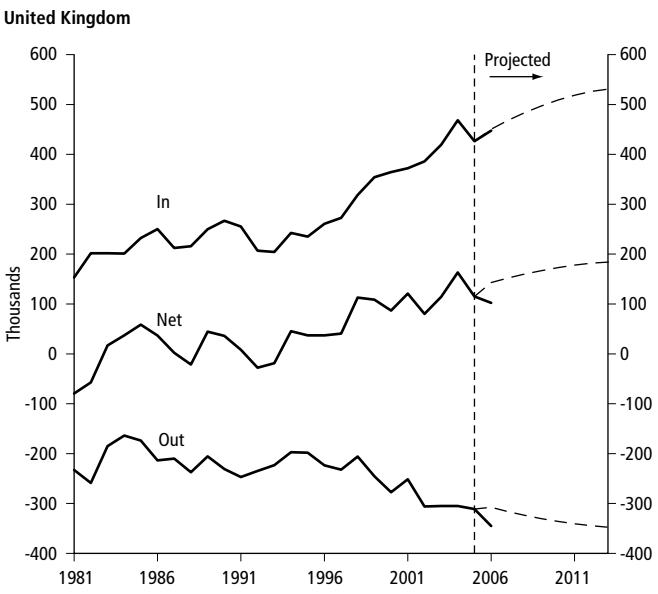
Migration covered by the International Passenger Survey

The assumption about future international migration as recorded by the IPS is illustrated in Figure 8.2. The IPS time-series was projected forward using a form of exponential smoothing but with the various trends gradually 'levelled off' to give constant level projections after ten years. However, to avoid giving an impression that we can accurately predict small year to year future changes, the average net flow projected for the next ten years is taken as the basis for the long-term assumption.

The model projection shown in Figure 8.2 was based on data up to 2005. Data for 2006 did not become available until after the long-term assumptions were finalised but are also shown in Figure 8.2. The actual 2006 gross inflow was in line with the projection from the model but the gross outflow was higher than projected. Consequently the actual net inflow in 2006 was somewhat below that suggested by the underlying trend.

Figure 8.2

Actual and projected IPS* migration to and from the United Kingdom, 1981–2015

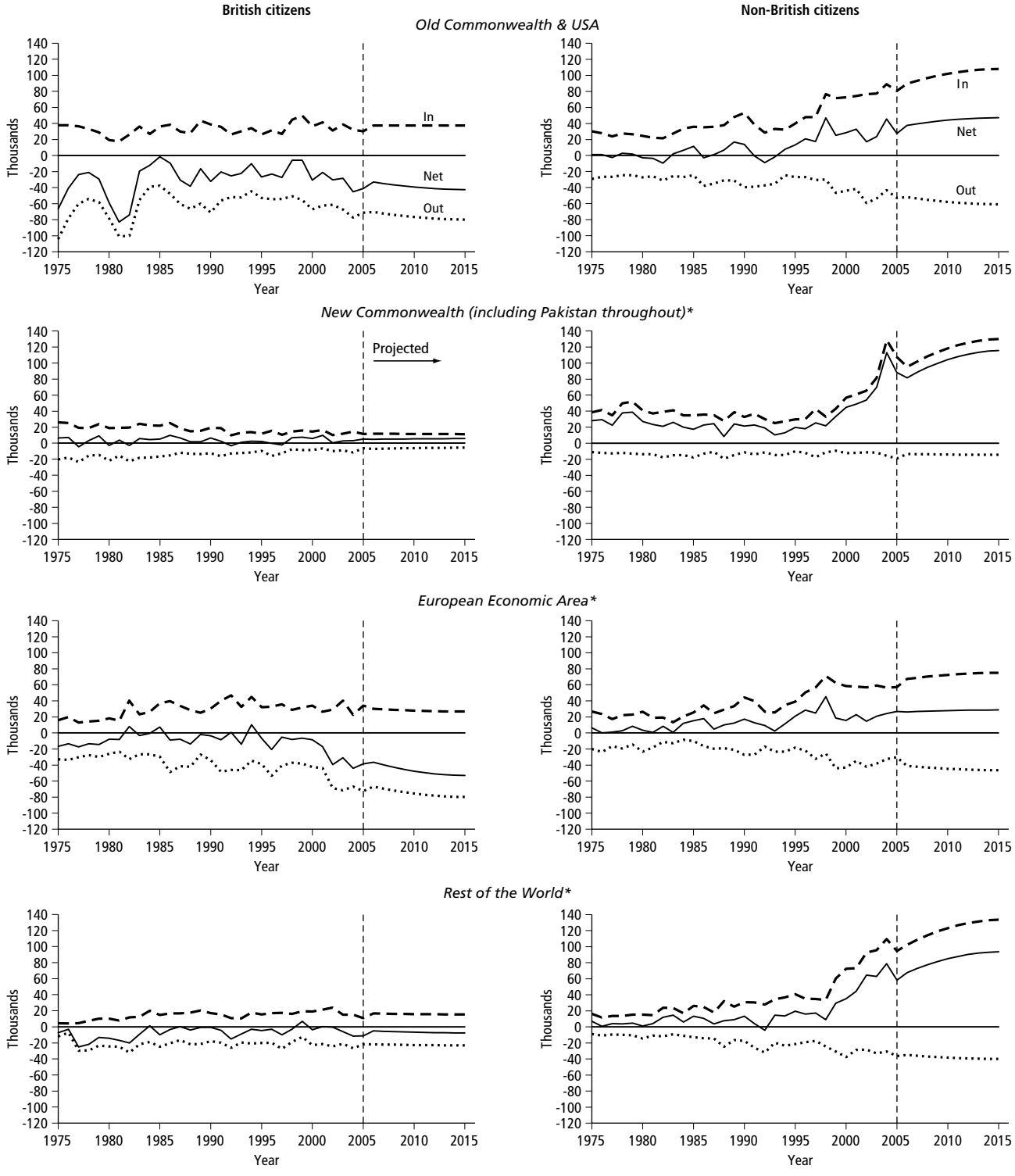


* IPS data for 2003–06 excludes estimates of migration flows to and from the A8 accession countries. A separate allowance is made for migration from these countries (see main text).

The same projection method has also been applied to flows between the UK and four different groups of countries: (a) the Old Commonwealth & USA; (b) the New Commonwealth; (c) the European Economic Area (EEA) and (d) the Rest of the World.[6] All the flows are considered separately for British and non-British citizens. These projections are shown in Figure 8.3.

Figure 8.3

International migration to/from the United Kingdom by citizenship and country of origin/destination, 1975–2005 with projected trends to 2015; International Passenger Survey data



* See note 6 at end of chapter for further details of the composition of these country groupings

The country breakdown is complicated by the enlargement of the EU in May 2004. Ten countries joined the EU that month: the A8 accession countries from Eastern Europe (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia and Slovakia) plus Cyprus and Malta.

To avoid the possibility that migration from the A8 accession countries might distort underlying trends, A8 migration flows for 2003, 2004 and 2005 were excluded from the IPS modelling. Instead, an allowance for additional net migration from the A8 countries was added separately (see below). At the time the modelling was done, it was not possible to remove pre-2003 A8 data from the Rest of the World series. However, pre-2003 flows with A8 countries were very small and this will have had a negligible effect on results.

Migration flows between the UK and Cyprus and Malta (which have been small, both pre and post accession) are included in the IPS modelling. However, they appear in the NCW series prior to 2004 and the EEA series for 2004 and 2005.

The projection method used is additive i.e. the same results are produced by applying the method to each of the eight categories and summing the results as are obtained by applying the method directly to the total migration flows. The advantage of applying the method to these separate, relatively homogeneous, categories is that it may shed light on the key factors underlying the overall trends.

However when disaggregated in this way, IPS sample numbers can become quite small. Therefore, although the projections of the eight series shown in **Figure 8.3** all seem quite plausible, they are not so robust as those for the total flows and the breakdown of the overall IPS assumptions shown in **Table 8.3** should be regarded as purely illustrative. Nevertheless, it is clear that the overall projected IPS net inflow is a result of significant inflows from all the categories of non-British citizens, with some offsetting outflows of British citizens.

The overall annual projected IPS net inflow given by the model is 170,000. The corresponding figure from the 2004-based projections (based on data to 2003) was 145,000. Adding 2004 and 2005 data to the model has therefore had a considerable impact.

Table 8.3

Assumed annual long-term gross migration flows, United Kingdom, 2014–15 onwards

thousands

	Inflow	Outflow	Net flow
Illustrative breakdown of IPS component			
British citizens			
Old Commonwealth & USA	35	75	-40
New Commonwealth	10	5	5
EEA	30	75	-45
Rest of the World	15	25	-5
Non-British citizens			
Old Commonwealth & USA	100	60	45
New Commonwealth	115	15	105
EEA	70	45	30
Rest of the World	120	40	85
Total IPS migration	505	335	170
Adjustment to IPS data (see text)			
Visitor switchers	40	20	20
Migrant switchers	-15	-15	0
Asylum seekers	25	15	10
Irish Republic	10	20	-10
Total civilian migration*	565	375	190

* Long-term gross flows exclude migration from accession countries. A separate allowance has been made for additional net migration from accession countries up to 2011–12 but net flows are assumed to be zero thereafter (see main text).

Note: Figures are independently rounded to nearest 5,000. Therefore, component figures may not sum to totals.

Visitor switchers and migrant switchers

As noted above, migrants are defined as individuals who change their country of usual residence for a period of at least a year. Therefore, adjustments to IPS data are required for people who originally intend to enter or leave the country initially as visitors for a short stay but subsequently decide to remain for a year or more (visitor switchers), and for people who intend to be migrants but in reality stay in the UK or abroad for less than one year (migrant switchers).

The adjustments made for projections are consistent with those made by ONS in recent international migration estimates.[3] However, as with the IPS modelling above, estimates of A8 visitor switcher flows in 2004 and 2005 have been removed from the series as A8 flows are considered separately.

In previous projections, the visitor switcher assumption was based on a simple average of the last ten years' data. However, there is evidence of a step change in the series to a higher level from 2000. Assumptions for these projections have therefore been based on the more recent period since 2000. This has led to an increased annual net visitor switcher adjustment of +20,000 (an inflow of 40,000 and an outflow of 20,000) in these projections. This compares with the assumed annual net inward flow of +15,000 in the 2004-based projections which

would have remained unchanged had we continued to use an assumption based on the average of the last ten years.

The corresponding allowance for migrant switchers is based on the improved method for estimating numbers of migrant switchers announced by ONS in April 2007.[3] This is based on new questions introduced to the International Passenger Survey in 2004 about the original intended length of stay for people who subsequently leave (or return to) the UK after periods of less than one year. Based on data for 2004, 2005 and the first half of 2006, it was estimated that some 3.1% of incoming 'intended' migrants and 4.4% of outgoing intended migrants subsequently became migrant switchers. The proportions previously used by ONS were 5% and 1% respectively.

Applying the revised migrant switcher assumptions to the IPS model results above suggests that the annual IPS inflow of 505,000 and the annual outflow of 335,000 should both be reduced by about 15,000 to allow for migrant switchers. The net migrant switcher adjustment is therefore zero. However, this compares with a net adjustment of -20,000 in the 2004-based projections which would have remained unchanged had the previous proportions of 5% and 1% still been applied. The effect of this methodological improvement is therefore to add 20,000 to the annual migration assumption.

Irish Republic

The IPS has covered migrants to and from the Irish Republic since 1999. However, sample numbers are small and so estimates of flows continue to be based on Irish data sources including the Irish National Quarterly Household Survey. Prior to the 1990s, there tended to be a net inflow to the UK from the Irish Republic. However, since 1991, flows have normally been in the opposite direction with a consistent annual net outflow of around 10,000 since 1997.[4] Following consultation with the Central Statistics Office in Ireland, an assumption of a future annual net outflow of 10,000 has been made. This assumption is unchanged from the previous projections.

Asylum seekers

Asylum seeker assumptions are based on advice from the Home Office. The IPS excludes most, but not all, persons seeking asylum and some dependants of such asylum seekers. An adjustment for those not covered by the IPS is, therefore, necessary. The latest data on the asylum component of international migration reflects the continuation of the fall in asylum applications from their peak in 2002. Thus, the allowance for these projections has been reduced to a net inflow of +10,000 (an inflow of 25,000 and an outflow of 15,000) from the net +15,000 adjustment used in the 2004-based projections.

Gross migration flows

Gross migration flows (i.e. inflows and outflows) are not required in order to produce the projections. The methodology used, therefore, focuses on net flows. **Table 8.3** does show nominal gross flows for the various components (IPS, asylum seekers etc) although these exclude migration flows from the accession countries which are considered separately below. The figures in **Table 8.3** should be treated with caution. For the IPS component, for example, it was noted above that the average net flow over the next ten years from the projection model is used as the basis for the (constant) long-term assumption. However, while it may be defensible to assume constant net flows (and this is common practice amongst national projection makers worldwide), it is less realistic to assume that gross flows will remain constant. Indeed in recent years (since 2001, say), both inflows and outflows have increased steadily and significantly, although the trend in net migration flows has been much more stable. It is quite possible therefore (whether future net migration rises, falls or remains roughly constant) that gross flows will continue to rise in future years.

Allocation of international migration to the constituent countries of the United Kingdom

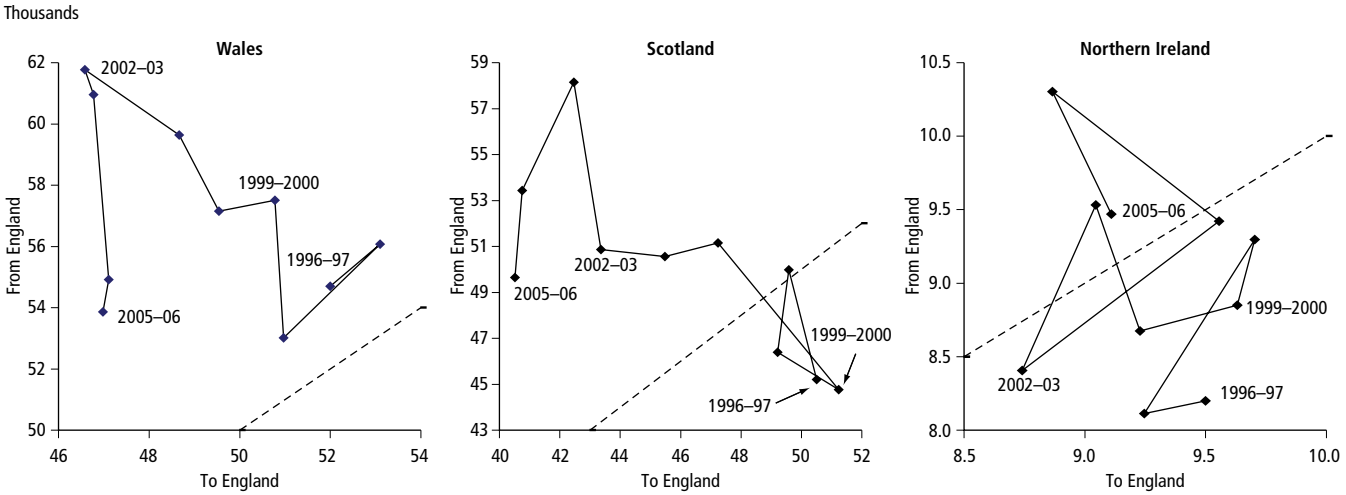
In general, the assumed flows of international migrants for each of the component categories shown in **Table 8.3** were split between England, Wales and Scotland according to the estimated shares observed over recent years.

The distributions applied take account of the revisions to the methodology for estimating the geographic distribution of international inflows announced by ONS in 2007.[3] There have also been revisions to the methodology used by ONS for the geographic distribution of international outflows, but these only affect the distribution at a subnational level within England and Wales.

The revised methodology for estimating the geographical distribution of international inflows uses information from household surveys in combination with IPS data. Previously, IPS data alone had been used. It had been thought for some time that figures for in-migration to London might be overstated, as London is likely to be named as a destination in preference to other lesser known places. Also, some in-migrants may quickly move from an initial destination point in London to another region of the country. For this reason, most recent national projections had made a small allowance

Figure 8.4

Migration between England and the other countries of the United Kingdom, 1996–97 to 2005–06



for possible overestimation of immigration to England and underestimation to Scotland and Wales in the IPS. With the new methodological improvements, these IPS 'corrections' are no longer necessary.

The results of the new ONS research have confirmed the expected overestimation of the London share of international inflows for the period 1999–2005. Scotland and most (but not all) regions of England outside London are now estimated to have higher shares. However, Wales is now estimated to have had a *lower* share of IPS inflows during 1999–2005. The implication of this is that, for Wales, the supposed IPS 'correction' made in recent projections is not only no longer necessary, but was actually operating in the wrong direction.

However, as with the 2004-based projections, it was decided that estimates of Northern Ireland's shares of the various components were not sufficiently robust to base the projection assumptions on them. Instead, the assumptions for Northern Ireland have been based on the total gross flows estimated by the Northern Ireland Statistics and Research Agency.

These calculations produce assumed annual long-term net inflows through international migration of 183,000 to England, 2,000 to Wales, 4,500 to Scotland and 500 to Northern Ireland. Aside from Wales, these assumptions are all higher than those used in the 2004-based projections.

Cross-border migration within the United Kingdom

Regular estimates of the movements of population between the countries of the UK are made by ONS, GROS and NISRA. These estimates are based on changes of residence recorded by the National Health Service Central Register (NHSCR). Two additional years of NHSCR data (for 2004–05 and 2005–06) had become available since the 2004-based projections were prepared.

Numerically, the dominant flows within the UK are between the smaller countries and England. **Figure 8.4** shows the trend in these flows between 1996–97 and 2005–06. Moves from England are plotted against the vertical axes and moves to England are plotted on the horizontal axes. Therefore, points above the dashed diagonal line indicate a net outflow from England, while points below the line indicate a net inflow into England – and the greater the distance the points are from the dashed line, the greater is the net migration flow. The scales differ in the three charts. In particular, flows to and from Northern Ireland are much smaller than those with Wales and Scotland.

Figure 8.4 shows that **Wales** experienced a net gain in population from England throughout the last ten years. The net flows for the last two years have fallen from the very high levels recorded during 2001–04 but are still above the level recorded throughout the 1990s. As a result, the assumed long-term net inflow to Wales has been increased to 7,500 per year, equivalent to the average net gain over the last ten years. This compares with an assumption of 6,500 in the previous projections.

Net flows from England to **Scotland** have continued at historically high levels in the last two years although they have fallen a little from the 2003–04 peak. Consequently, the assumption of a long-term annual net flow from England to Scotland of 4,000 a year (the average recorded over the last

ten years) represents a considerable increase over the 1,500 assumption in the previous projections.

The 2004-based assumption of a long-term net zero flow between England and Northern Ireland has been retained for these projections. Recent flows have fluctuated around a net balance of moves between the two countries.

The data of the last two years shows some reversal of the previous strong upward trends in migration from England to both Wales and Scotland. The trend as it appeared two years ago raised the issue of whether a ten-year average is the most appropriate basis for these assumptions, or whether, as with the IPS modelling, it would be more sensible to adopt a method which gives greater weight to more recent data. We have therefore compared how weighted averages and simple averages calculated over various time periods in the past would have predicted future cross-border flows. The results show that, in most cases, a weighted average approach would

Table 8.4

Short-term annual net migration assumptions, United Kingdom and constituent countries

thousands

	United Kingdom	England	Wales	Scotland	Northern Ireland
Total net migration					
2006–07	**195.0**	**153.5**	**11.0**	**20.5**	**10.0**
2007–08	**240.0**	**210.1**	**11.0**	**16.0**	**2.9**
2008–09	**230.0**	**202.5**	**10.5**	**14.0**	**3.0**
2009–10	**221.4**	**197.4**	**10.5**	**11.5**	**2.0**
2010–11	**211.4**	**189.4**	**10.0**	**10.5**	**1.5**
2011–12	**201.4**	**180.9**	**10.0**	**9.5**	**1.0**
2012–13 & 2013–14	**191.4**	**172.9**	**9.5**	**8.5**	**0.5**
Long-term assumption (2014–15 onwards)	**190.0**	**171.5**	**9.5**	**8.5**	**0.5**
*International migration assumption for 2006–07**					
2006–07	195.0	171.0	3.5	12.0	8.5
International migration assumption (long-term)					
2007–08 onwards	190.0	183.0	2.0	4.5	0.5
*Allowance for additional net migration from accession countries***					
2007–08	50.0	41.5	1.5	4.5	2.5
2008–09	40.0	33.0	1.0	4.0	2.0
2009–10	30.0	24.5	1.0	3.0	1.5
2010–11	20.0	16.5	0.5	2.0	1.0
2011–12	10.0	8.0	0.5	1.0	0.5
Cross-border migration					
2006–07	0	-17.5	7.5	8.5	1.5
2007–08	0	-15.5	7.5	7.0	1.0
2008–09	0	-13.5	7.5	5.5	0.5
2009–10 onwards	0	-11.5	7.5	4.0	0.0
Returning Armed Forces from Germany (including dependants)					
2009–10 to 2013–14 (annual)	1.4	1.4	--	--	--
Reduction in Northern Ireland Armed Forces					
2007–08	0	1.1	--	--	-1.1

* Including accession countries.
** This includes the A8 countries which joined the EU on 1 May 2004 (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) and the A2 countries (Bulgaria and Romania) which joined the EU on 1 January 2007.

not have improved the accuracy of past assumptions of cross-border migration.

Flows between the three smaller countries are, of course, numerically much less significant than those with England. For these projections, net zero flows have been assumed in each case, in line with the average size of the flows over the past ten years. These assumptions are unchanged from the 2004-based projections.

The overall assumptions for cross-border migration with the rest of the UK are summarised in Table 8.2.

Total long-term migration assumptions

The overall long-term assumptions of net migration for the UK and constituent countries, and the corresponding assumptions from the 2004-based projections, are also given in Table 8.2. The overall assumed net inflows to England, Scotland and Northern Ireland have all been increased while that for Wales has been reduced.

The projections, therefore, assume *constant* levels of annual net migration beyond 2014–15. In reality, of course, migration will inevitably continue to fluctuate from year to year. But such long-term fluctuations are impossible to predict. Thus the assumptions in Table 8.2 should be regarded as representing *average* annual levels of net migration for the future.

Assumptions for the short-term

Special assumptions have been applied for the first few years of the projections (2006–07 to 2013–14) and are summarised in Table 8.4. These were decided after the long-term assumptions, thus enabling them to take account of the most up-to-date data available. They differ from the long-term assumptions for the following four reasons:

(a) The assumptions for 2006–07 took account of provisional migration data (notably from IPS and NHSCR) for the second half of 2006. The assumptions for England & Wales were based on the estimates made for the ONS (experimental) quarterly population estimates for June 2007.[7]

(b) An allowance has been made for additional net migration totalling +150,000 over the five years from 2007–08 to 2011–12 from the accession countries which joined the European Union in May 2004 and January 2007. Net migration from the countries which joined the EU in May 2004 is estimated to have fallen slightly between 2004–05 and 2005–06.[8] The projections assume that this decline will continue. [The methods used to construct the assumptions for 2006–07 do not allow the accession country component to be separately identified for this year.]

The average annual level of total net migration to the UK assumed for the period to 2011–12 is therefore around +215,000. This is similar to that actually experienced during 2004–06, the two years following the enlargement of the EU in May 2004, but a little above the assumption of +195,000 for 2006–07 which takes account of some provisional migration data for the second half of 2006.

(c) The figures for the first three years of the projection (2006–07 to 2008–09) assume a gradual transition from current cross-border migration levels (where net flows from England to Scotland are unusually high) to the assumed long-term levels.

(d) Two Armed Forces adjustments have been made. An allowance has been made for the return of 3,600 Armed Forces (and an approximately equal number of dependants) from Germany to the UK during the period 2009–10 to 2013–14.[9] For simplicity, they have all been assumed to

Table 8.5

Assumed long-term net migration by age and sex, United Kingdom

thousands

	2014–15 onwards		
Age group	Persons	Males	Females
0–4	5.2	1.4	3.8
5–9	1.7	1.2	0.5
10–14	2.4	3.2	-0.8
15–19	41.5	23.5	18.0
20–24	81.6	36.8	44.8
25–29	53.3	27.9	25.4
30–34	12.9	3.9	9.0
35–39	6.5	4.2	2.4
40–44	2.1	0.8	1.2
45–49	-2.2	-1.9	-0.2
50–54	-1.3	0.1	-1.4
55–59	-4.8	-2.9	-1.9
60–64	-6.3	-4.7	-1.7
65–69	-2.0	-0.2	-1.8
70–74	-1.6	-1.4	-0.2
75 & over	1.0	0.6	0.5
All ages	190.0	92.5	97.5

return to England. Allowance has also been made for a reduction in the number of Armed Forces stationed in Northern Ireland during 2007–08. Again, for simplicity, they have all been assumed to return to England.

Long-term impact of enlargement of the European Union

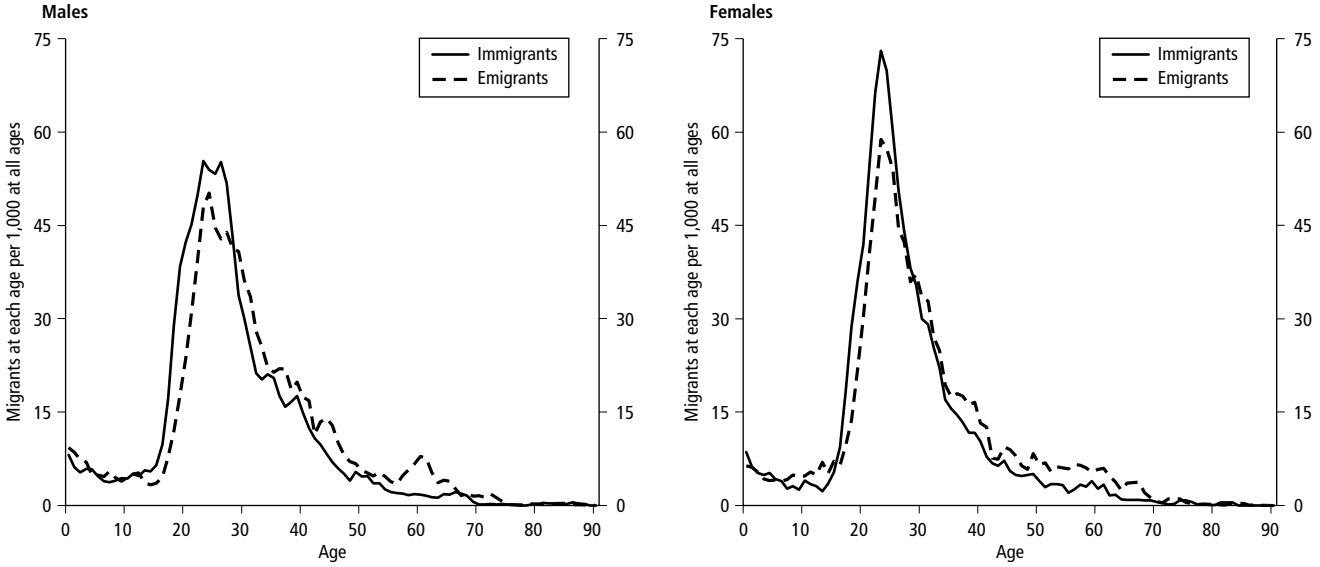
As discussed above, to avoid the possibility that migration from the A8 accession countries might distort underlying trends, data for these countries was excluded, as far as possible, from the modelling of long-term migration flows. Instead, accession country migration flows were considered separately and an allowance for additional net migration from these countries (including also Bulgaria & Romania) in the period to 2011–12 was added (see previous section).

No allowance has been made for additional net migration from these countries beyond 2011–12. However, clearly there is great uncertainty about this. With other EU countries gradually opening their labour markets to accession country citizens and the likelihood of the economies of the new countries gradually 'catching up', most experts believe that net migration from these countries will reduce. However, there is some evidence from past guestworker schemes to Germany and other countries that long-term net flows did not return to zero.[10]

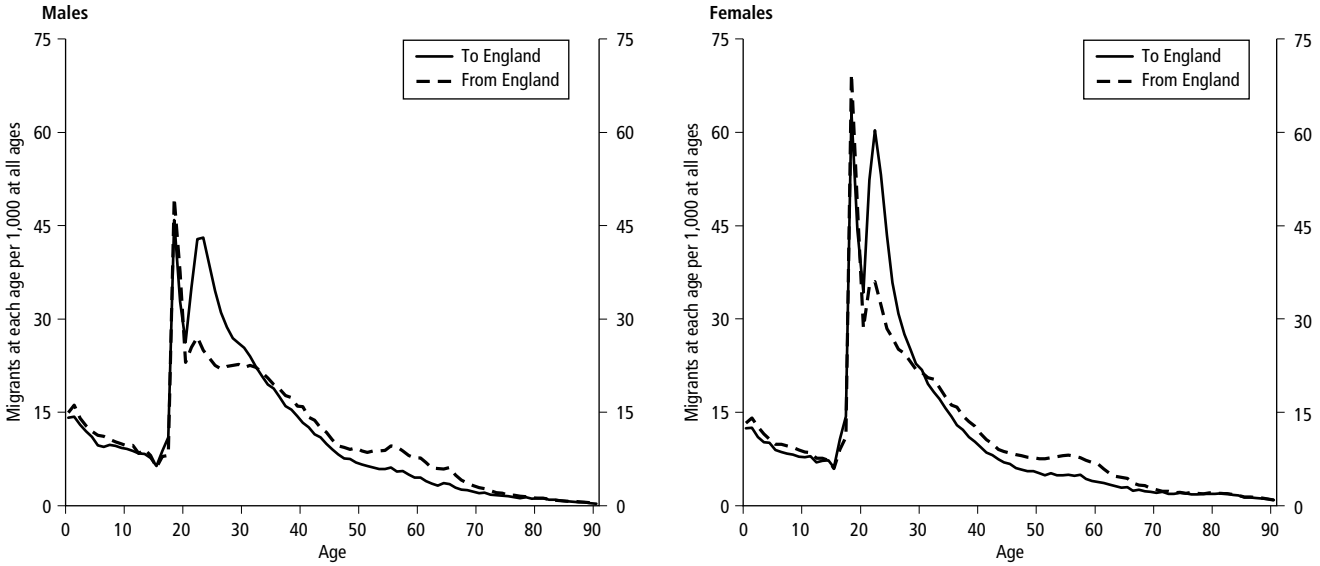
Figure 8.5

Assumed long-term age distribution per thousand migrants

(a) International migration to/from the United Kingdom



(b) Cross-border migration between England and the rest of the United Kingdom



Views on future migration levels

Consideration of how migration projections are prepared in other countries and by other agencies[13,14] suggests that, as in the UK, migration projections tend to be based largely or solely on past demographic trends. While many projection makers say that their assumptions are also informed by expert opinion, few use immigration assumptions "that are justified by any explicit reference to a theory of how or why immigration happens."[13] It is therefore perhaps helpful to summarise some of the current arguments put forward by experts regarding future levels of net migration in the UK.

In March 2007, the NPP Expert Panel were asked what they thought were the most likely levels of total net migration to the UK in the years 2010 and 2030. There was a range of views (see Appendix III, Annex A), but the average response was about +210,000 in 2010 and about +200,000 in 2030. They were also asked for their views on the validity of a large range of arguments which might be thought likely to influence future migration trends. The following list shows factors that were considered to be valid by the majority of the panel and were considered to have the potential to impact on future levels.

Factors that could have an *upwards* impact on net migration:

- There is a likelihood of increasing migration to and from the UK for work related, family reunification/formation and education reasons.
- High population growth in developing countries.
- Population ageing in the UK.
- The relative attractiveness of the UK as a country of destination (for economic and other reasons);
- With increasing globalisation, the increasing ease of movement from one country to another.

Factors that could have a *downwards* impact on net migration:

- Increases in retirement emigration from the UK.
- The likelihood of new EU countries and developing countries 'catching-up' in terms of economic growth;
- Problems with integration leading to more restrictive immigration policies.

Some of the "push" and "pull" factors listed above amongst the upward influences on migration will, amongst others, at least partly explain the general underlying upward trend in net migration to the UK over the last twenty years or so. Some would argue that there is no reason to believe that this upward trend will not continue. Conversely, others question whether it can be justified to assume that net migration will continue at current levels indefinitely, given that these levels have never been experienced in UK history before the last few years.[13]

It should be noted, however, that trends in underlying push and pull factors in western countries do not automatically follow through to corresponding trends in net migration. For example, increases in the numbers of people wishing to enter a country may lead governments to consider more targeted or restrictive immigration policies. The different responses of EU governments to the opening of their labour markets to people from the new accession countries is a reminder that migrant numbers are not just dependent on the demographic characteristics of the sending and receiving countries, but will also be affected by any intervening obstacles or incentives placed on their movement. And the UK government has itself recently introduced a new points based system for immigration to the UK.[11]

There is evidence that levels of international migration are correlated with economic factors such as unemployment rates, although the strength of the relationship may vary from country to country.[15] Nevertheless, few agencies explicitly use explanatory variables (whether economic or other), in projection making other than perhaps in the very short-term. This is often because the explanatory variables are considered to be as, or more, difficult to predict than the demographic variables! The relative strength of the UK economy seen in recent years may not, of course, continue indefinitely. If so, the UK may face increasing competition for migrants both from other EU countries and also from economically emerging nations outside the EU.

Latest Eurostat and UN projections

In their 2004-based projections published in 2005,[16] Eurostat assumed a gradual decline in UK net migration from then current levels to a long-term level of around 100,000 a year. Eurostat's assumptions were derived from a combination of approaches, but the projected decline resulted from their time-series modelling of the UK net migration series. It therefore contrasts with the upward trend projected in our modelling of the IPS time-series (see **Figure 8.2**) and by others who have looked at UK data. This is a useful reminder that while using a projection model may appear to be a purely "objective" way of determining assumptions, the choice of model used is a judgement that may have a significant impact on results.

In recent projections, the UN have used the same long-term migration assumption for the UK as has been applied in the official UK projections. However, in their most recent 2006 Revision published in March 2007, [17] the long-term UK assumption remained at +130,000 per year rather than increasing to +145,000 in line with our, then current, official 2004-based projections. It is not clear why the UN did not adopt the official UK assumption on this occasion.

But even if this is the case, it is unclear whether any long-term flow from accession countries would add to total net migration or just displace people arriving from other countries.

Illegal migration

In line with ONS estimates of total international migration, no explicit or separate allowance has been made in the projections for illegal migrants entering the UK.

Points-based system for immigration

In February 2008, a new points-based system for immigration to the UK was introduced.[11] The long-term assumptions for the 2006-based projections were based on trends up to the end of 2005 and, as noted in the introduction to this chapter, no attempt was made to predict the impact of this or other new or future government policies on migration behaviour.

Age and sex distribution

For England, Wales and Scotland, the assumed age and sex distribution of international migrants has been based on ONS estimates of the age/sex distributions of the various categories of migrants discussed above. In general, the assumed distributions are based on averages of the last five years' data.

For Northern Ireland, where the long-term total migration assumption was not broken down into component categories (see above section on '*Allocation of international migration to the constituent countries of the United Kingdom*'), age distributions were applied based on IPS data for the UK as a whole.

For accession country migration, age and sex distributions were based on IPS data. For cross-border migration, separate age distributions, based on NHSCR data, were calculated for each country.

In each case the age distributions were considered separately for males and females, and for immigrants and emigrants. The long-term distribution for the UK is summarised in **Table 8.5**. The table shows that the projections assume slightly more female migrants than male migrants. Equivalent tables for the individual countries can be found on the GAD website.[12]

The assumed age distributions for international migration to and from the UK, and the NHSCR derived distributions for cross-border migration for England, are shown in **Figure 8.5**. All these distributions are highly peaked at the young working ages, which was also the case for the distributions assumed for cross-border migration for Wales, Scotland and Northern Ireland.

Further details

Chapter 9 presents the results of variant projections based on alternative assumptions about future migration.

References

1 National population projections: a new methodology for determining migration assumptions. *Occasional Paper 42*. OPCS (1993).

2 *National population projections: 1996-based*, ONS Series PP2 no 21. The Stationery Office (1999). Footnote to p 34.

3 *Impact of Revised Methodologies on TIM Estimates*, see www.statistics.gov.uk/statbase/Product.asp?vlnk=507

4 *Total International Migration tables: 1991 – latest*, see www.statistics.gov.uk/statbase/Product.asp?vlnk=15053

5 For a fuller discussion see International Migration Statistics. National Statistics Quality Review Series no. 23. ONS (2003). Available at: www.statistics.gov.uk/about/data/methodology/quality/reviews/population.asp

6 The EEA was taken to be the 15 member states of the EU as constituted before 1 May 2004 (but excluding the Irish Republic which is considered separately) plus Iceland, Liechtenstein and Norway. EEA figures for 2004 and 2005 also include Cyprus and Malta which joined the EU in May 2004; prior to 2004 these countries are included in the New Commonwealth. The eight Eastern European accession countries which joined the EU in May 2004 were, as far as possible (see main text), excluded from the IPS modelling and are considered separately. Bulgaria & Romania, which joined the EU in January 2007, are included in the Rest of the World category.

7 See www.statistics.gov.uk/statbase/Product.asp?vlnk=13523

8 *UK population grows to 60,587,000 in mid-2006*. ONS News Release (22 August 2007)

9 See www.mod.uk/DefenceInternet/DefenceNews/DefencePolicyAndBusiness/BritishForcesToMoveFromGermanyToUk.htm

10 Bohning WR. *Studies in international labour migration*. St Martin's Press. New York (1984).

11 See www.bia.homeoffice.gov.uk/managingborders/managingmigration/apointsbasedsystem/

12 Tables can be downloaded from www.gad.gov.uk/Demography_Data/Population/2006/methodology/migrass.asp

13 Howe N and Jackson R. *Projecting immigration: A Survey of the Current State of Practice and Theory*. Centre for Strategic & International Studies, Washington DC (2005). Available at http://www.csis.org/component/option,com_csis_pubs/task,view/id,2528/

14 Questionnaire on Population Projections: Report on the latest national practices. Paper for Eurostat Working Group on Population Projections. Eurostat (2006).

15 *Analysis and forecasting of international migration by major groups*. Eurostat Working Paper 3/2002/E/no. 17. Eurostat, 2003. http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1073,46587259&_dad=portal&_schema=PORTAL&p_product_code=KS-CC-03-002

16 Eurostat (2005). 2004 EU Population Projections. Available at http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL

17 United Nations – World Population Prospects: the 2006 Revision. Available at: http://esa.un.org/unpp/

9 Variant projections

Background

The results of the population projections, as described in Chapter 3, provide a consistent starting point for all government planning which is affected by the numbers in the population. The projections are based on assumptions judged to be the best that could be made at the time they are adopted. 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. Many users will need to take into account the consequences of future experience differing from the assumptions made and, to this end, the results of variant projections based on alternative assumptions of future fertility, mortality and migration are discussed in this chapter.

Another way of indicating uncertainty is to consider the accuracy of previous sets of projections. A detailed study of the accuracy of past UK national population projections was published recently.[1] This analysis was based on the extensive database of past national projections available on the GAD website.[2] This UK study was followed by an analysis of how UK projections compared with those for other European countries.[3] These articles concluded that in the UK, as in most other countries, fertility had tended to be overpredicted while life expectancy and net inward migration had generally been underpredicted. Compared with other countries, fertility errors were somewhat larger in UK projections, but mortality errors were smaller. Migration errors in UK projections were around the European average.

This chapter summarises the results of official high and low variant projections for the UK. These variant assumptions have been prepared for each of the three components of population change (fertility, life expectancy and net migration). These are intended as plausible alternative scenarios and *not* to represent upper or lower limits for future demographic behaviour. Probabilistic interpretations of population projections are discussed in the *Probabilistic Interpretation of Population Projections* section below.

There are 27 possible combinations of these sets of assumptions. However, aside from the principal projection, only a further 12 of these standard variants have been computed. These are the six possible 'single component' variants (i.e. varying only one component at a time from the principal assumptions); and six selected 'combination' variants: those which produce the largest/smallest total population size, the oldest/youngest age structure and the largest/smallest medium-term dependency ratios.

Variant fertility assumptions

In the long-term, changes in the level of fertility are critical in determining the size of the population. For example, a sustained increase in the level of fertility would clearly increase the number of births. But, in a generation's time, it would also increase the number of women of childbearing age, compounding the effect on births.

Cohorts of women who have already completed their childbearing have shown a wide range of completed family sizes. Therefore, assumptions for generations who have not yet entered the childbearing ages, or who have done so only recently, are necessarily highly speculative.

The assumptions made for the variant fertility projections for the UK are summarised in **Table 9.1** and illustrated in **Figure 9.1**. The low variant assumes that the average family size of successive cohorts will continue to fall, reaching an ultimate

Figure 9.1

Actual and assumed completed family size, United Kingdom, women born 1940–2000

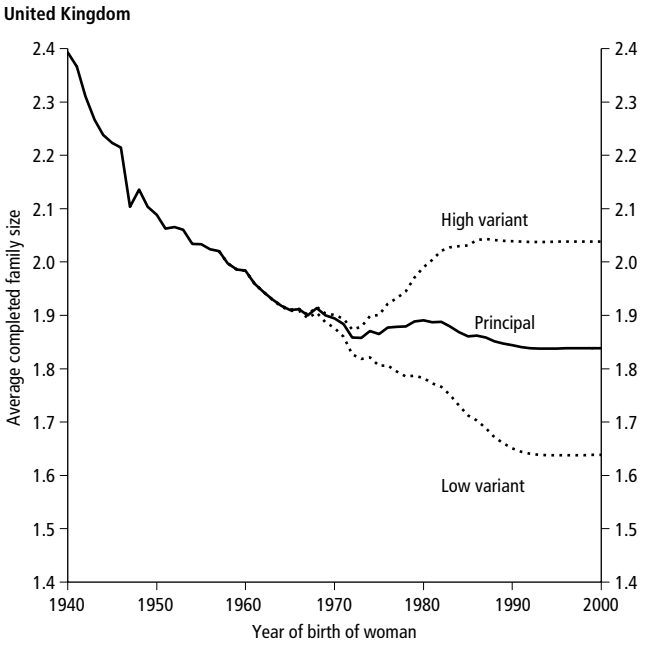


Table 9.1

Actual and assumed average number of children by age and year of birth of woman: variant fertility projections

United Kingdom

Women's year of birth	Average family size	Mean age at motherhood (years)	Average number of children born to women at ages:					
			Under 20	20–24	25–29	30–34	35–39	40 & over
	Actual values							
1945	2.22	26.0	0.21	0.85	0.72	0.30	0.11	0.02
1950	2.09	26.4	0.23	0.70	0.63	0.36	0.13	0.03
1955	2.03	27.1	0.22	0.56	0.65	0.40	0.16	0.04
1960	1.98	27.8	0.16	0.53	0.63	0.44	0.19	0.04
	High variant							
1965	1.91	28.4	0.13	0.46	0.59	0.45	0.22	0.06
1970	1.90	28.8	0.15	0.42	0.52	0.47	0.28	0.07
1975	1.90	29.4	0.15	0.36	0.47	0.55	0.31	0.07
1980	1.99	29.4	0.15	0.35	0.52	0.59	0.31	0.07
1985	2.03	29.4	0.14	0.37	0.55	0.60	0.31	0.07
1990	2.04	29.4	0.13	0.38	0.56	0.60	0.31	0.07
1995 & later	2.04	29.4	0.12	0.38	0.56	0.60	0.31	0.07
	Principal projection							
1965	1.91	28.4	0.13	0.46	0.59	0.45	0.22	0.06
1970	1.89	28.8	0.15	0.42	0.52	0.47	0.27	0.06
1975	1.86	29.2	0.15	0.36	0.47	0.54	0.29	0.06
1980	1.89	29.1	0.15	0.35	0.51	0.55	0.27	0.06
1985	1.86	29.1	0.14	0.36	0.51	0.53	0.26	0.06
1990	1.84	29.2	0.12	0.36	0.51	0.53	0.26	0.06
1995 & later	1.84	29.2	0.12	0.36	0.51	0.53	0.26	0.06
	Low variant							
1965	1.91	28.4	0.13	0.46	0.59	0.45	0.22	0.05
1970	1.88	28.7	0.15	0.42	0.52	0.47	0.26	0.06
1975	1.81	29.0	0.15	0.36	0.47	0.51	0.26	0.06
1980	1.78	28.9	0.15	0.35	0.48	0.49	0.25	0.06
1985	1.71	29.1	0.14	0.34	0.45	0.48	0.25	0.06
1990	1.65	29.3	0.12	0.31	0.43	0.48	0.25	0.06
1995 & later	1.64	29.4	0.11	0.31	0.43	0.47	0.25	0.06

* Figures above the stepped lines are actual values: those below the lines are wholly or partly projected.

level of 1.64 for women born from the early 1990s onwards. Although low by historical standards in the UK, this is well above the latest TFR for the European Union as a whole (1.52 in 2005). Amongst western European countries, TFRs are currently as low as around 1.3 in, for example, Germany and Italy.[4,5]

The high variant would imply a reversal of the recent downward trend in average family size. Under this assumption, family size would continue to decline to 1.87 children for the 1972 cohort, before recovering to reach an ultimate level of 2.04 for women born from the late 1980s onwards. This is around the level of fertility actually achieved by women born in the mid-1950s, but less than that experienced by women born in the 1940s.

In the low variant projection, it is assumed that fertility rates will fall slightly further at most ages. The high variant assumes increases in fertility rates at all ages, except for teenagers.

Total fertility rates and numbers of births

The projected total fertility rates and numbers of births resulting from these alternative assumptions of future fertility levels are shown in Figure 9.2. Experience has shown that there can be quite sudden changes in fertility. It is, therefore, important to demonstrate the effect of significant short-term changes, as well as the long-term effects that would result from sustained levels of fertility significantly above or below that assumed in the principal projection. Consequently, the variants diverge quickly from the principal projection.

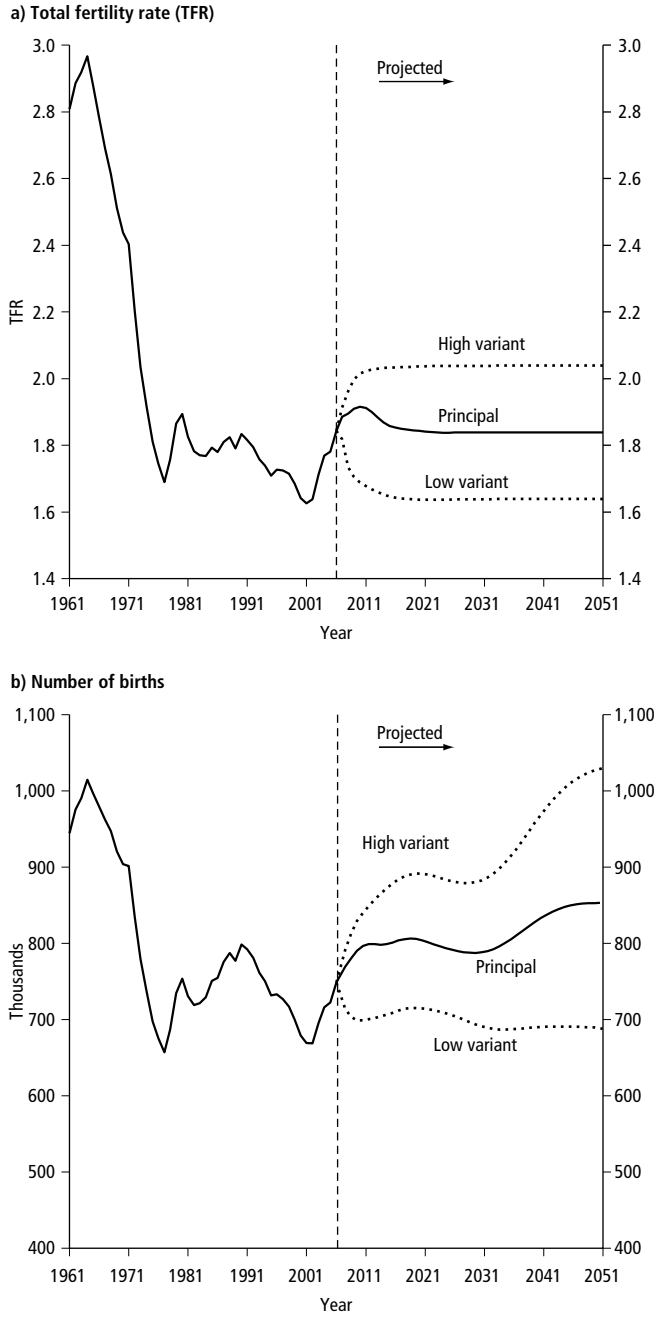
Therefore, the TFR in the high variant rises rapidly from the 2006 level of 1.84, reaching 2.00 by 2009 while the TFR in the low variant falls to 1.71 by the same date.

Under the high variant, the number of births is projected to rise from around 750,000 in 2006, levelling off at nearly 900,000 a year in about ten years' time, before rising again from around 2030. However, under the low variant, the number of births would fall quickly to 700,000 a year and would then continue to fluctuate around this level.

In practice, of course, variations in the timing of childbearing are likely, as in the past, to produce considerable fluctuations in the TFR and the annual numbers of births. Therefore, even if trends in completed family size do tend in the long-term toward the assumptions underlying the principal projection or either of these variants, for any individual year the number of births could differ considerably from those shown here.

Figure 9.2

Actual and projected total fertility rates and numbers of births, United Kingdom, 1961–2051



Effect of fertility variants on total population size

The differences between the projected population in the fertility variants and that in the principal projection are summarised in Table 9.2. Under these alternative assumptions, the population would be about 2 million higher or lower than the principal projection by 2031. These 2 million people would, of course, all be under the age of 25. In the high fertility variant, the projected population at 2031 would be 72.9 million compared with 71.1 million in the principal projection, while in the low variant it would be only 69.0 million. Figure 9.6, later in this chapter, demonstrates how sensitive long-term total population size is to changes in the fertility assumption. By 2081, there is a difference of over 20 million between the total population in the high and low fertility variants.

Variant mortality assumptions

Chapter 7 discussed the current wide range of views about prospects for future longevity. To give some indication of these uncertainties, alternative projections have been made on assumptions of higher and lower life expectancies at birth than in the principal projection. The low life expectancy variant assumes slower improvements in mortality rates than in the principal projection and the high life expectancy variant assumes faster improvements.

In each of these variants it is assumed that, for most ages, the improvements will gradually converge to common 'target rates' of improvement by the year 2031, and continue to improve at

Table 9.2

Population differences between variant fertility projections and principal projection by age, 2011–31

United Kingdom thousands

Year	All ages	0–4	5–9	10–14	15–19	20–24
Difference between high fertility variant and principal projection						
2011	137	137				
2021	879	418	324	137		
2031	1,781	458	445	418	324	137
Difference between low fertility variant and principal projection						
2011	-319	-319				
2021	-1,243	-452	-472	-319		
2031	-2,126	-456	-429	-451	-472	-318

that constant rate thereafter. However, as with the principal projection (see Chapter 7), these mortality projections also assume that those born in the years 1923 to 1940 (cohorts which have consistently experienced relatively high rates of mortality improvement over the last 25 years) will continue to experience higher rates of mortality improvement than the rest of the population.

In the principal projection, it is assumed at most ages that mortality rates will be falling at 1.0 per cent per year by 2031 and will continue at that rate of improvement thereafter. However, for those born between 1923 and 1940, rates of annual improvement in and after 2031 are assumed to rise to a peak of 2.5 per cent a year for those born in 1931 and then decline back to 1.0 per cent a year for those born in 1941 or later.

In the high life expectancy variant, annual improvements in and after 2031 are assumed to be 2.0 per cent at most ages. But, for those born between 1923 and 1940, rates of annual improvement are assumed to rise to a peak of 3.5 per cent a year for those born in 1931 and then decline back to 2.0 per cent a year for those born in 1941 or later. In the low life expectancy variant, it is assumed that mortality rates will have reached constant levels at most ages by 2031. However, for those born between 1923 and 1940, rates of annual improvement are assumed to rise to a peak of 1.5 per cent a year for those born in 1931 and then decline back to zero improvement for those born in 1941 or later.

Because of fluctuations in annual mortality rates, there is always some uncertainty about establishing the 'real' *current* rate of mortality improvement. Further, epidemics (there have been no major ones in recent years), or hard winters, can have a considerable affect on the number of deaths, although this may be partially offset by fewer deaths than normal in the following year. In very recent years, however, excess winter mortality has been relatively low.[6]

Table 9.3

Period expectation of life at birth according to mortality rates assumed for selected years, variant mortality projections, 2006–31

United Kingdom years

	Males			Females		
Year	High life expectancy	Principal projection	Low life expectancy	High life expectancy	Principal projection	Low life expectancy
2006	77.2	77.2	77.2	81.5	81.5	81.5
2011	79.3	79.0	78.7	82.9	82.6	82.4
2021	82.2	81.3	80.4	85.3	84.7	84.2
2031	84.7	82.7	80.7	87.5	86.2	84.9

As such uncertainties could have an immediate effect on the number of deaths recorded, the rates of improvement used for 2006 to 2007 in the principal projection were decreased by two percentage points for the low life expectancy variant and increased by two percentage points for the high life expectancy variant.

Expectations of life and numbers of deaths

The different expectations of life in the variant mortality projections are summarised in Table 9.3 and shown graphically in Figure 9.3. These are *period* expectations of life, calculated on the basis of the death rates for the particular calendar year.

In the high variant, expectation of life at birth for males is projected to increase by 7.5 years from 77.2 in 2006 to 84.7 in 2031, while the corresponding increase for females is 6.0 years (from 81.5 to 87.5). In the low variant, life expectancy rises by around 3.5 years for both sexes, reaching 80.7 and 84.9 respectively by 2031. Figure 9.3 illustrates the further improvements assumed in later years with period life expectancy reaching 95 years for males and 97 years for females by 2081. In the low life expectancy variant, there are only very marginal increases beyond 2031 – as mentioned above, mortality rates in the low life expectancy variant are held constant at most ages after 2031.

Effect of mortality variants on total population size

The differences between the projected populations in the variant mortality projections and the principal projection are summarised in Table 9.4. Compared with the principal projection, the population of the UK in the year 2031 would be about 600,000 higher or lower in the respective variants. The majority of these differences are accounted for by persons aged 75 and over, with only about 10 per cent attributable to ages under 60. The population at 2031 would be 71.7 million in the high life expectancy variant compared with 71.1 million in the principal projection, but 70.5 million given the low life expectancy assumptions. Figure 9.6, later in this chapter, shows that by 2081, there is a difference of over 10 million between the total population in the high and low life expectancy variants.

Variant migration assumptions

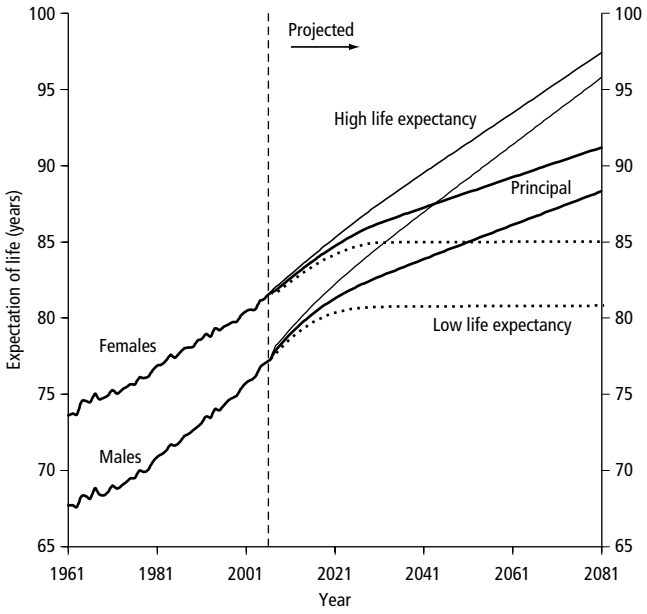
The number of persons entering or leaving the UK has shown considerable year-to-year fluctuation in the recent past. In 1992 and 1993, there was net outward migration. Net migration then increased rapidly until the late 1990s. Between 2000 and 2006, it has averaged around 180,000 per year, with the highest net inflow (244,000) being recorded in 2004.[7]

For the principal projection, it is assumed that there will be a long-term net inflow of 190,000 persons a year to the UK. For the variant projections, annual net migration has been assumed to be 60,000 higher or lower than in the principal projection. So the high and low variants assume annual long-term net

Figure 9.3

Actual and projected period expectation of life and number of deaths, United Kingdom, 1961–2081

a) Period expectation of life at birth (years)*



*According to mortality rates experienced or assumed in given year.

b) Number of deaths (persons)

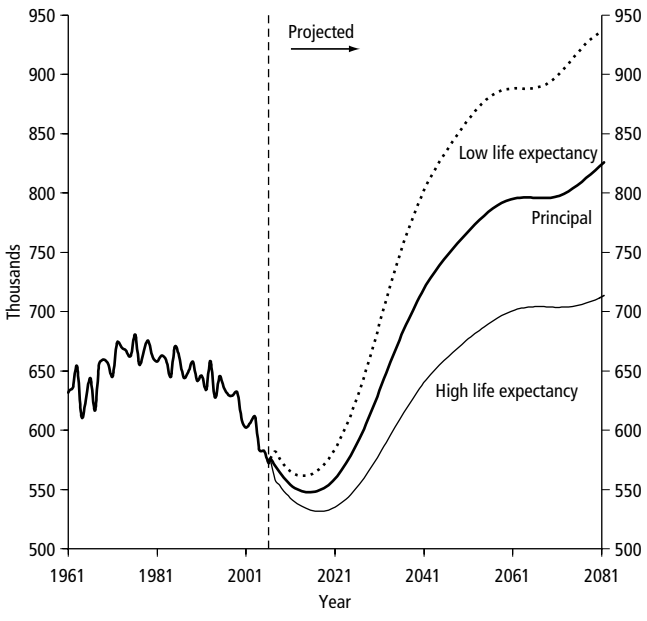


Table 9.4

Population differences between variant mortality projections and principal projection by age, 2011–31

United Kingdom thousands

	Difference between high life expectancy variant and principal projection					Difference between low life expectancy variant and principal projection				
Year	All ages	Under 60	60–74	75–84	85 & over	All ages	Under 60	60–74	75–84	85 & over
2011	45	6	10	13	16	-45	-6	-10	-13	-16
2021	209	26	45	56	82	-211	-27	-47	-57	-81
2031	585	57	114	152	262	-605	-63	-124	-163	-256

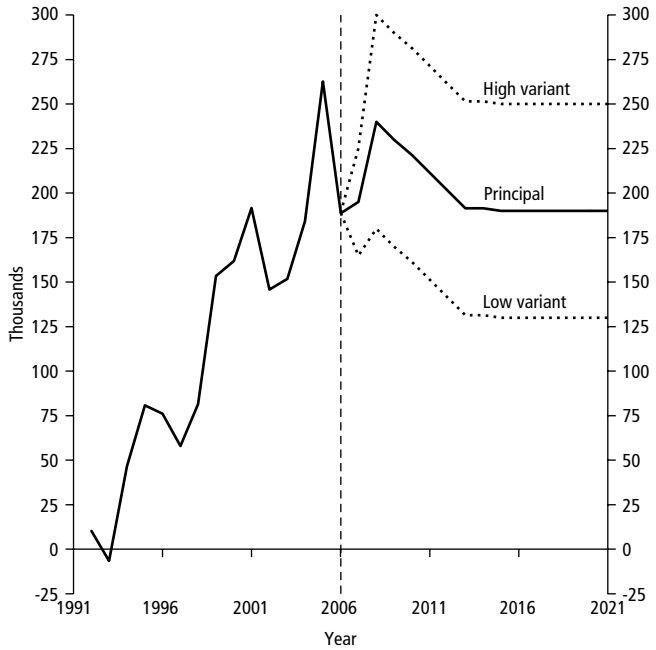
migration to the UK of 250,000 and 130,000 persons respectively. The variant assumptions are shown in Figure 9.4. Because some provisional migration data were available for 2006–07 at the time the projections were made, the allowance for uncertainty in the first year of the projection is only half that for later years.[8]

The high migration variant was calculated by assuming 30,000 more immigrants and 30,000 fewer emigrants each year than in the principal projection and *vice versa* for the low variant. The same age distributions as described in Chapter 8 were then applied.

The point was made earlier in this chapter that these variants are not intended to represent limits for future demographic behaviour. Indeed, in the case of migration, whatever average level occurs in the future, it is highly likely that there will be some years when net migration exceeds the level of the high variant and others where it will be below the level of the low variant. Therefore, these migration variants should be regarded as giving an indication of the implications for the future, if *average* migration levels were to differ significantly from those assumed in the principal projection.

Figure 9.4

Actual and assumed total net migration, United Kingdom, 1991–92 to 2020–21



Effect of migration variants on total population size

The differences between the population in the variant migration projections and the principal projection are summarised in Table 9.5. Unlike the fertility and mortality variants, the migration variants are exactly symmetrical with respect to the principal projection, so only one set of figures is shown in the table.

Clearly, if annual net migration was to average 60,000 more or fewer than assumed in the principal projection, this would lead to 1.5 million more or fewer migrants over the next 25 years. However, because migration is concentrated at young adult ages, there is also a significant second generation effect with the different number of migrants changing the number of women of childbearing age and hence the future number of births. Because migrants are predominantly young, the effect on the number of deaths over this period is considerably smaller.

In fact, Table 9.5 shows that the alternative migration assumptions would lead to 1.9 million more or fewer people in the population at 2031 as compared with the principal projection. But even 25 years ahead, these alternative assumptions would have little effect on the number of people aged over 60. By the year 2031, the population would be 73.0 million in the high migration variant compared with 71.1 million in the principal projection, but only 69.2 million

Table 9.5

Population differences between variant migration projections and principal projection by age, 2011–31

United Kingdom thousands

Year	All ages	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70 & over
Absolute difference between variants and principal projection									
2011	288	34	20	107	68	30	14	10	5
2021	1,043	190	74	200	299	152	67	38	24
2031	1,883	292	229	254	392	381	186	87	62

under the low variant assumptions. Figure 9.6, later in this chapter, shows that by 2081, there is a difference of over 13 million between the total population in the high and low migration variants.

An interesting feature of these migration variants is that, although it is assumed that migration will continue to be concentrated at working ages, there is comparatively little effect on long-term dependency ratios. In the principal projection, the 'elderly dependency ratio' (defined as the number of persons of state pensionable age per 1,000 persons of working age and allowing for the forthcoming changes to state pension age – see Chapter 3) would be 344 per 1,000 at the year 2031. But this ratio is not greatly different under the alternative migration assumptions; in the high and low migration variants, the ratios at 2031 are 336 per 1,000 and 353 per 1,000 respectively.

Previous work has shown that any realistic assumption of future migration could only have a very limited effect on population ageing.[9] In contrast, the raising of state pension age has a much greater effect. If state pension age remained as it is today (65 for men and 60 for women), rather than increasing to 66 to both sexes by 2031, the projected elderly dependency ratio at 2031 would be 445 per 1,000 rather than 344 per 1,000.

Probabilistic interpretation of population projections

The cohort component method used in the UK (and almost universally) to produce population projections does not enable statements of probability to be attached to them, or for confidence intervals to be ascribed to variants.

Internationally, growing attention is now being given to stochastic projection methods which aim to give users information about the expected accuracy of projections. Typically, stochastic forecasts use probability distributions for indicators of fertility, mortality and migration which are derived from some combination of three approaches: a) analysis of past projection errors; b) expert opinion; and c) time-series analysis.

ONS is now considering the use of such methods for the UK national projections using recent analysis of past projection error[1] and expert views on uncertainty collected from the National Population Projections expert advisory panel.

It is also possible to use the information collected from the expert panel to give some possible indication of the probability ranges covered by the current variant assumptions. The panel were asked for their best estimates of a 67 per cent confidence interval for the headline indicators of the total fertility rate, life

Table 9.6

Estimates of uncertainty for the year 2030

United Kingdom

	ONS assumptions High variant – low variant	Expert Panel Width of average 67% confidence interval
Total fertility rate (children per woman)	0.40	0.50
Male period life expectancy at birth (years)	3.7	4.1
Female period life expectancy at birth (years)	2.4	3.7
Annual net migration	120,000	165,000

expectancy at birth and annual net migration in the year 2030 (see Appendix III). In Table 9.6, the average widths of the panellists' confidence intervals are compared with the difference between our high and low variant assumptions for the year 2030. This shows that, in the overall view of the expert panel, the range covered by the official ONS high and low variant assumptions is a little narrower than a 67 per cent confidence interval. However, it should be noted that, in some cases, there were wide ranging views about uncertainty amongst the panel members themselves.

Relative uncertainties of fertility, mortality and migration

Because precise probability statements cannot be ascribed to the variant assumptions, strictly the indications of uncertainty given above for fertility, mortality and migration are not directly comparable with each other. However, Table 9.6 does at least give some support for viewing the high and low variants for each component as covering broadly similar ranges of uncertainty. It is also possible to make some general comments about the relative importance of fluctuations in fertility, mortality and migration for particular users of the projections.

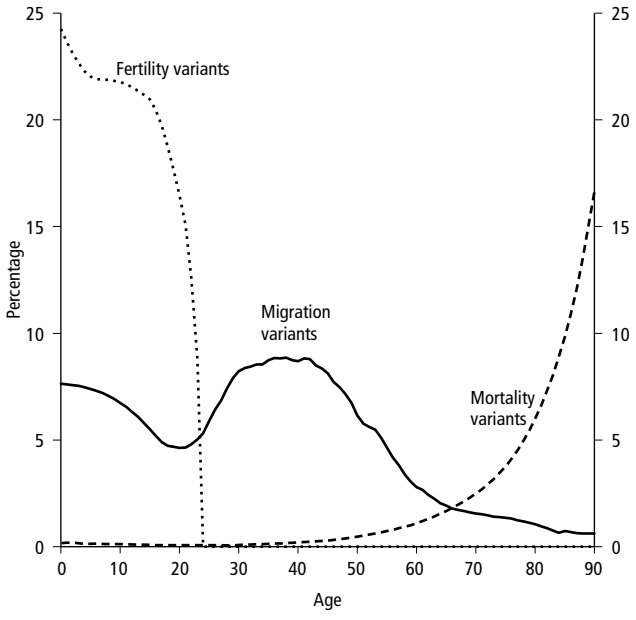
The majority of users are interested principally in the first 20 years of the projection,[10] over which period possible variations in migration numbers or fertility patterns are likely to have a greater impact on the projected size and age structure of the population than variations in mortality rates. However, for applications concerned primarily with the elderly, such as planning health and social care services, interest will centre on variations in mortality. In areas such as long-term social security benefit planning, the effect of both mortality and fertility variants has to be considered, while for other applications, such as those concerned with the size of the workforce and the numbers of households, future migration levels are of particular importance.

Figure 9.5 gives an indication of the relative importance of the assumptions regarding fertility, mortality and migration for the population at each age in 25 years' time. This graph shows the difference between the population in the high and low variant projections at each age, expressed as a percentage of the population in the principal projection. Obviously, the greatest cause of uncertainty at younger ages is fertility. Migration is the most important variable in determining the size of the working age population in 25 years' time, while mortality only begins to become the dominant factor after age 70.

Figure 9.5

Population differences between high and low variants as a percentage of the population in the principal projection by age, 2031

United Kingdom



Combination variants

For particular applications, users may also be interested in projections combining two or more of these alternative scenarios, e.g. high fertility *and* low migration. Some key summary statistics from selected combination variants are given in Table 9.7. For example, the largest total population size would result from combining the high variant assumptions for fertility, life expectancy and migration. With this combination of assumptions, the population would be about 75 million by 2031 and over 90 million by 2056. However, by combining the low variant assumptions for the three components, the population in 50 years' time would be only 66 million, although this would still be higher than the population in 2006.

Similarly, the oldest age structure would occur with a combination of low fertility, high life expectancy and low migration. Over this 50 year period, the highest dependency ratios (amongst the combination variants) occur given high fertility, high life expectancy and low migration. However, in the very long-term, the 'old' and 'young' variants produce respectively the highest and lowest overall dependency ratios of all the possible combination variants. For that reason, results from the high and low medium-term dependency variants are only shown for 50 years ahead (i.e. to 2056) in the detailed results on the GAD website.

Table 9.7

Measures of population structure under the principal and variant projections, 2031 and 2056

United Kingdom

	Total population (000s) (2006=60,587)		Percentage of population aged under 16 (2006=19.0)		Percentage of population aged 65 & over (2006=16.0)		Dependants per 1,000 persons of working age (2006=607)	
Projection	2031	2056	2031	2056	2031	2056	2031	2056
Principal projection	71,100	78,564	18.0	17.3	22.2	25.1	639	639
Standard single component variables								
High fertility (HF)	72,882	83,973	19.5	19.4	21.6	23.4	665	656
High migration (HM)	72,983	82,779	18.1	17.4	21.8	24.6	631	629
High life expectancy (HL)	71,685	81,160	17.8	16.8	22.7	27.2	649	683
Low life expectancy (LL)	70,495	75,858	18.1	17.9	21.7	22.8	628	595
Low migration (LM)	69,217	74,350	17.8	17.2	22.7	25.6	646	651
Low fertility (LF)	68,974	72,851	16.5	15.2	22.9	27.0	616	628
Standard combination variants								
High population size (HP)	75,404	91,053	19.5	18.9	21.7	25.0	668	687
Low population size (LP)	66,540	66,203	16.5	15.6	22.8	25.2	613	591
Old age structure	67,721	71,362	16.2	14.6	23.9	29.9	635	691
Young age structure	74,204	85,609	19.8	20.0	20.7	20.9	648	607
High medium-term dependency ratio	71,531	82,106	19.2	18.7	22.6	26.0	683	711
Low medium-term dedendency ratio	70,198	74,117	16.7	15.9	21.9	24.2	597	571
Special case scenarios								
Replacement fertility	73,448	85,411	19.7	19.7	21.5	23.1	667	657
Constant fertility	71,362	79,501	18.3	17.8	22.1	24.8	646	644
No mortality improvement	68,540	72,925	18.6	18.6	19.7	20.1	589	545
Zero migration (natural change only)	63,801	61,459	16.8	16.0	25.1	29.9	682	736
Zero migration & no mortality improvement	61,238	56,034	17.4	17.5	22.4	24.0	625	608
No change	68,801	73,857	19.0	19.0	19.6	19.9	596	550
Stationary	63,291	61,675	19.1	20.0	21.7	21.8	651	626

Note: Where appropriate, the labels used to identify particular variants in the charts in this article are given in brackets.

Total population size

Figure 9.6 shows the implications for future population growth under each of the 'single component' 2006-based variant projections. The chart also shows the results of the high and low population combination variants described above which, for practical purposes, can be regarded as giving plausible upper and lower bounds for future total population size. The chart shows that there is considerable uncertainty about the future size of the population and that uncertainty widens appreciably through time.

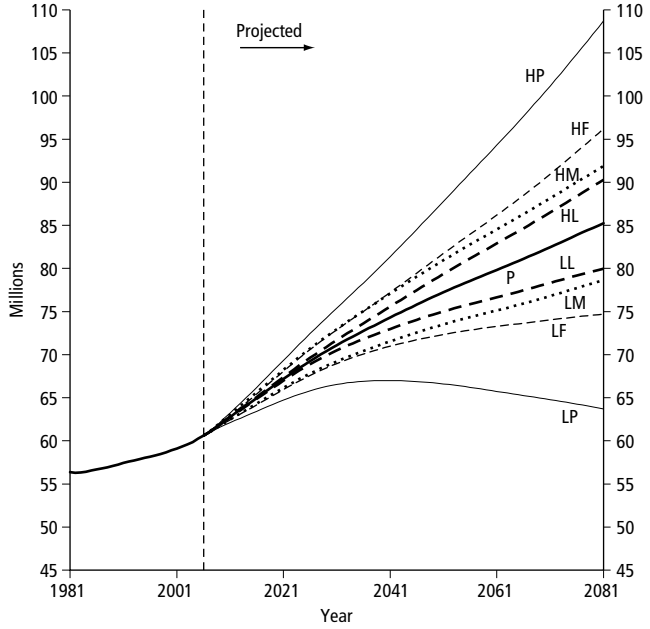
In the principal projection, and all the single component variants, the total population of the UK is projected to continue growing throughout the projection period. But the low population variant (combining the low assumptions of future fertility, life expectancy and net migration) shows that continuing population growth is not inevitable. Under this combination of assumptions, the UK population would peak in size by the middle of the century.

Population aged 65 and over

Figure 9.7 shows the projected proportion of the population aged 65 and over under various alternative assumptions. In this case, as well as the single component variants, the chart also shows the results of the 'old' and 'young' combination variants.

Figure 9.6

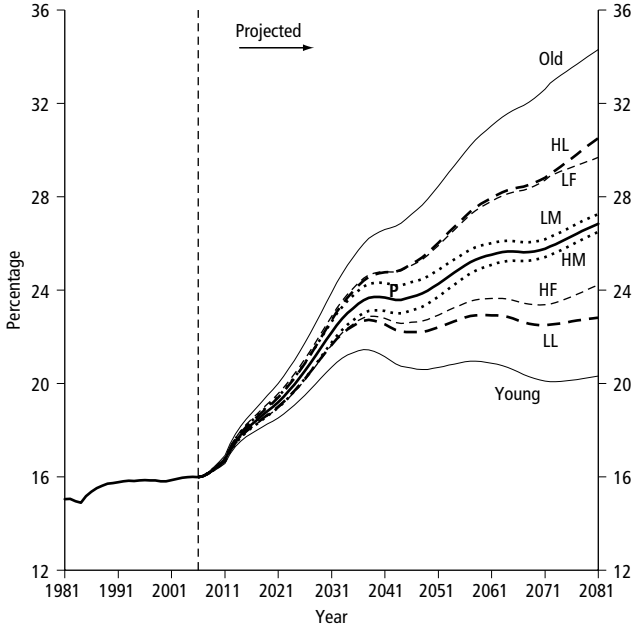
Population of the United Kingdom according to principal and variant 2006-based projections,1981–2081



HP	High fertility, high migration and high life expectancy	LL	Low life expectancy
HF	High fertility	LM	Low migration
HM	High migration	LF	Low fertility
HL	High life expectancy	LP	Low fertility, low migration and low life expectancy
P	Principal projection		

Figure 9.7

Actual and projected percentage of the population aged 65 and over, United Kingdom, 1981–2081



Old	Low fertility, high life expectancy and low migration	HM	High migration
HL	High life expectancy	HF	High fertility
LF	Low fertility	LL	Low life expectancy
LM	Low migration	Young	High fertility, low life expectancy and high migration
P	Principal projection		

Again, these can effectively be regarded as giving upper and lower bounds for the proportion of older people in the population.

The chart shows that population ageing will occur under any plausible set of future assumptions. In 2006, some 16 per cent of the population were aged 65 and over. This is projected to rise steadily to around 30 per cent by 2081 in either the high life expectancy or low fertility variants. Under the high fertility or low life expectancy assumptions, ageing would be significantly reduced but the proportion over 65 would still increase to 23 or 24 per cent. Even in the 'extreme' young variant projection, the proportion would increase to over 20 per cent by 2030.

Variant projections for individual countries

2006-based variant projections are also available for the individual countries of the UK. **Figure 9.8** shows the projected total population of each country to 2056 under each of the single component variants and the high and low population combination variants, i.e. equivalent to **Figure 9.6** above for the UK. Results to 2081 are available on the GAD website, as are individual country versions of **Figure 9.7**.

Special case scenarios

It is also sometimes useful to prepare special case scenarios, or 'what if' projections, to illustrate the consequences of a particular, but not necessarily realistic, set of assumptions. The following four special case projections have been prepared:

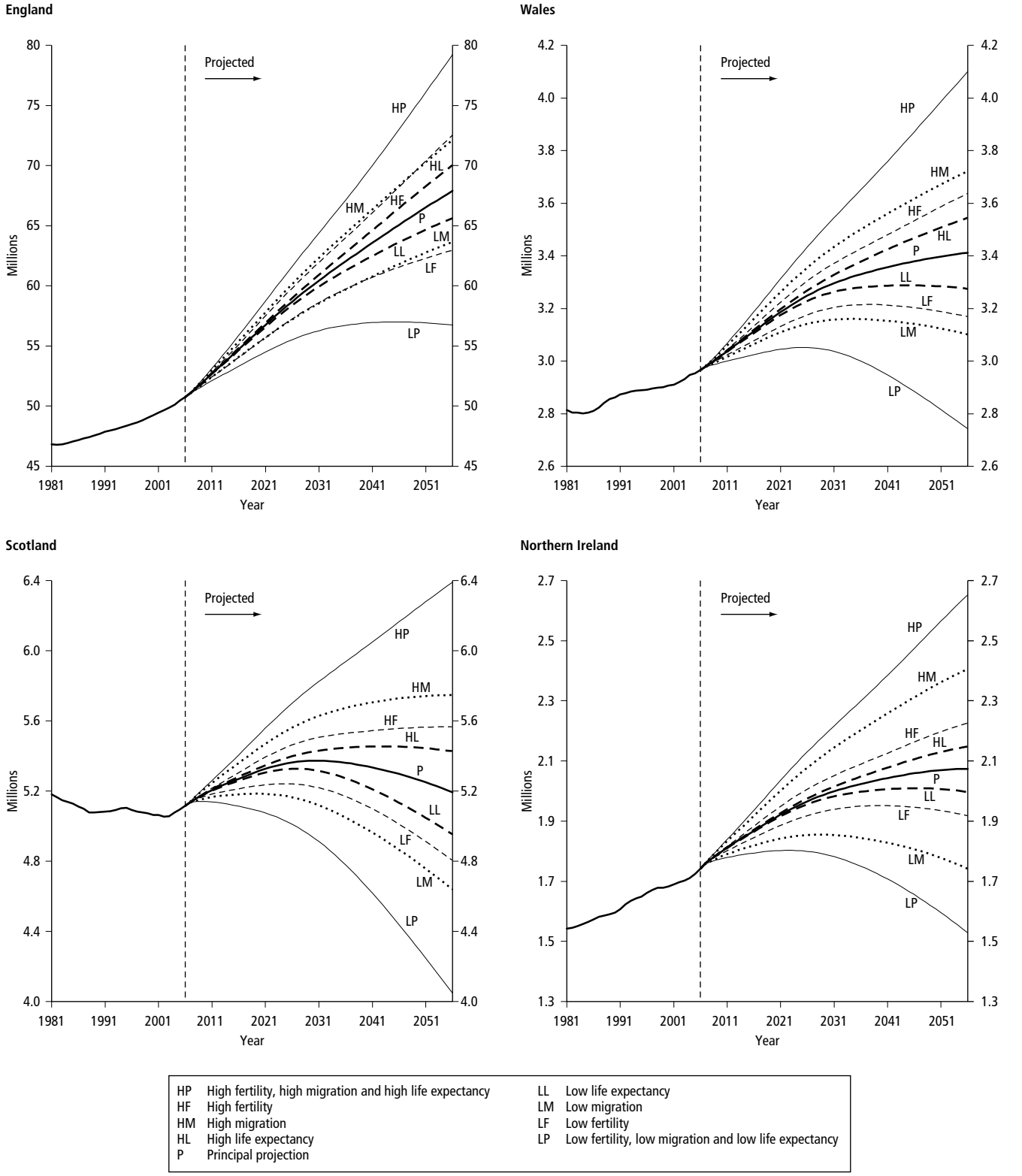
- Replacement fertility
- Constant fertility
- No mortality improvement
- Zero migration (natural change only)

Finally, a further three special case projections, based on combinations of these assumptions, have also been prepared:

- Zero migration and no mortality improvement (also assumes principal fertility)
- No change projection (constant fertility, no mortality improvement, principal migration)

Figure 9.8

Population of the United Kingdom by individual country according to principal and variant 2006-based projections, 1981–2056



HP	High fertility, high migration and high life expectancy	LL	Low life expectancy
HF	High fertility	LM	Low migration
HM	High migration	LF	Low fertility
HL	High life expectancy	LP	Low fertility, low migration and low life expectancy
P	Principal projection		

- Stationary projection (replacement fertility, no mortality improvement, zero migration)

Key indicators from these special case scenarios are included in Table 9.7. As with the single component and combination variants discussed above, all variants are available at UK or individual country level.

Further details

Full details of all the variants discussed in this chapter are available on the GAD website.[11] With some subsequent modifications, the current range of variant projections was introduced for the 2000-based projections and fully described at that time.[12]

References

1 Shaw C (2007). Fifty years of United Kingdom national population projections: how accurate have they been? *Population Trends* **128**, pp 8–23.

2 See www.gad.gov.uk/Demography_Data/Historical_population_projections.asp

3 Keilman N (2007). UK national population projections in perspective: How successful compared to those in other European countries? *Population Trends* **129**, pp 20–30.

4 *Population in Europe 2005: First Results*. Statistics In Focus 16/2006 (Eurostat). Available at: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1073,46587259&_dad=portal&_schema=PORTAL&p_product_code=KS-NK-06-016

5 European Fertility Indicators. Available at: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1073,46870091&_dad=portal&_schema=PORTAL&p_product_code=DEMO_FIND

6 *Excess winter deaths fell in 2006–07.* ONS News Release (November 2007). Available at www.statistics.gov.uk/statbase/Product.asp?vlnk=10805&More=n

7 *Total International Migration tables: 1991 – latest*, see www.statistics.gov.uk/statbase/Product.asp?vlnk=15053

8 No allowance is made for uncertainty in the first year of the projection (2006–07) in the fertility and mortality variants as reasonably accurate birth and death totals can normally be estimated from the data available at the time the projections are finalised.

9 Shaw C (2001). United Kingdom population trends in the 21st century. *Population Trends* **103**, pp 37–46.

10 Joshi H and Diamond I. Demographic projections: who needs to know? From *Population projections: trends, methods and uses*. OPCS Occasional Paper 38. Papers of the Annual Conference of the British Society for Population Studies. OPCS (1990).

11 See www.gad.gov.uk/Population/index.asp?v=Variant&y=2006&subYear=Continue

12 Shaw C (2002). 2000-based variant population projections. *Population Trends* **109**, pp 15–26.

10 Methodology

The cohort component method

The projections are made for successive years running from one mid-year to the next using the cohort component method.* For each age, the starting population plus net inward migrants less the number of deaths produces the number in the population, aged one year older, at the end of the year. To this has to be added survivors of those born during the year. Age is defined as completed years at the last birthday.

Migration is assumed to occur evenly throughout the year. For computing purposes, this is equivalent to assuming that half the migrants in a given year at a given age migrate at the beginning of the year and half at the end of the year. The number of net migrants to be added to obtain the population aged $x + 1$ at the end of the projection year therefore consists of half of those migrating during the year at age x and half of those migrating during the year at age $x + 1$.

The number of deaths in a year is obtained by adding half of the net inward migrants at each age to the number in the population at the beginning of the year and applying the mortality rate q_x.

The number of births in the year are calculated by multiplying the average number of women at each single year of age during the year (taken as the mean of the populations at that age at the beginning and end of the year) by the fertility rate applicable to them during that year. The total number of births in a year is assumed to be divided between the sexes in the ratio of 105 males to 100 females, in line with recent experience.

The number of infants aged 0 at the end of the year is calculated by applying a special "infant mortality rate" (indicated by 'birth' in the mortality rate tables found on the GAD website) to the projected number of births, and adding half the number of net migrants aged 0 last birthday. This special mortality rate is equivalent to about 85 per cent of the conventional full first year of life infant mortality rate used in official statistics.

The projections are computed for each of the component countries of the United Kingdom and the results are added together to produce projections for England & Wales, Great Britain and the UK.

* For a good introduction to projections methodology see Chapters 16 to 18 of Hinde A *Demographic Methods*. Arnold (1998).

Lexis diagram

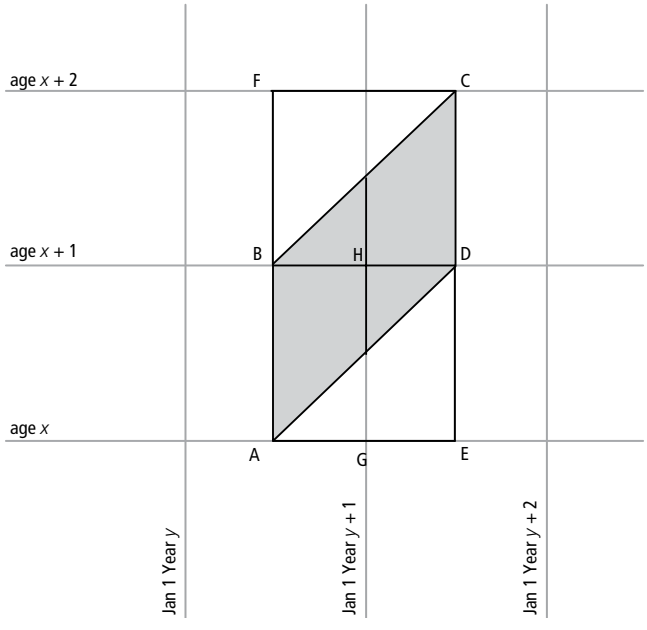
The projection process can be illustrated by means of a Lexis diagram (see **Figure 10.1**). In a Lexis diagram, age is represented on the vertical axis and time on the horizontal axis, and the life of an individual (or of a birth cohort) is represented by a diagonal line (or parallelogram) running from bottom left to top right.

So, in **Figure 10.1**, the line AB represents the population aged x at mid-year y. The size of this cohort one year ahead, i.e. aged $x + 1$ at mid-year $y + 1$, is represented by the line DC. To calculate this population one year ahead (for $x \geq 0$), it is necessary to project deaths and net migration occurring to this cohort between mid-year y and mid-year $y + 1$. The relevant interval of time for this cohort is represented by the shaded parallelogram ABCD.

Full details of the net migration assumptions are given on the GAD website. This gives the assumed number of migrants between one mid-year and the next by age at the time of migration. The net number of migrants aged x between mid-year y and mid-year $y + 1$ is represented by the square ABDE in the Lexis diagram. Similarly, the net number of migrants aged $x + 1$ between mid-year y and mid-year $y + 1$ is represented by the square BFCD.

Figure 10.1

Lexis diagram to illustrate the methodology of the projections



As noted above, it can be assumed for computing purposes that half the migrants in a given year at a given age migrate at the beginning of the year and half at the end of the year. Thus, of net migrants aged x between mid-year y and mid-year $y + 1$, it can be assumed that half add to the population represented by the line AB in the diagram and the other half to the population represented by the line ED. Similarly, of the migrants aged $x + 1$ in this period, half can be added to the population denoted by the line BF and half to the population represented by the line DC. Net migration in the parallelogram ABCD is therefore obtained by adding half of the net migrants aged x (i.e. those adding to the population AB) and half of those aged $x + 1$ (i.e. those adding to the population DC) in this interval.

The number of deaths in a year is obtained by adding half of the net inward migrants at each age to the number in the population at the beginning of the year and applying the mortality rate q_x. This produces, directly, the number of deaths in the parallelogram ABCD.

Finally, there is the special case of projecting the number of infants aged 0 at mid-year $y + 1$. This is obtained as described above. So if $x = 0$ in **Figure 10.1**, the required population is represented by the line ED and it is therefore necessary to project births, deaths and net migration in the triangle represented by ADE.

The relationship between m_x and q_x

The mortality rate q_x is known as the initial mortality rate, or the probability of dying. These are the mortality rates given, for each individual age, on the GAD website. In other statistical publications, and in Chapter 8 of this volume, mortality rates are often shown as central death rates (m_x). These are obtained by dividing the number of deaths during a year at a given age by the average population at that age during the year (usually taken to be the population at the midpoint of the year). The relationship between q_x and m_x is shown by the following equation:

$$q_x \cong \frac{m_x}{1 + 0.5\, m_x}$$

Note that this equation is an approximation as it assumes deaths occur evenly between exact age x and exact age $x + 1$. It does not hold for infant mortality, as infant deaths are concentrated in the first few months of life.

The q_x rates used in the projections are the results of two interpolations. The first interpolation takes place between the q_x rates for adjacent calendar years and produces rates on a mid-year to mid-year basis. The second interpolation is between adjacent ages and gives a set of q_x rates that, in life table terms, relate to exact age $x + ½$ on a mid-year basis. These are assumed to be applicable to the mid-year population at age last birthday.

11 Data availability

Website

Summary information and selected data tables from the 2006-based population projections for the UK and its constituent countries are available from the National Statistics website (at www.statistics.gov.uk/statbase/product.asp?vlnk=8519).

Detailed results of the 2006-based population projections for the UK and its constituent countries are available on the GAD website (at www.gad.gov.uk/population/index.asp?dp=current+projections&subyear=proceed). The results include the principal and variant projections for each country, and a summary of the assumptions on which they are based. The key datasets can be downloaded in Microsoft Excel format along with a set of graphs depicting the results for each country.

For each projection, the following Excel datasets can be downloaded:

- components of change, summary age distributions and dependency ratios
- populations in five-year age groups
- populations by individual age (to age 90)
- fertility rates by individual age
- fertility rates in five-year age groups
- mortality rates by individual age
- net migration by individual age

The projected population numbers are shown in thousands but stored to three decimal places (i.e. to unit level). This does not, of course, imply that the projections are accurate to that level of detail. *Results should always be presented in thousands*.

Additionally, period and cohort life expectancy data derived from historic mortality rates (from 1981 to 2006) and projected mortality rates from the 2006-based national population projections (for 2007 onwards) are available at www.statistics.gov.uk/statbase/product.asp?vlnk=15098

Responsibility for the production of the national population projections transferred to ONS in 2006. However, the complete projections database, which includes detailed projections data from the 1954-based to 2006-based projections, is still available on the GAD website (at www.gad.gov.uk/demography_data/population). It is planned that this database will be added to the National Statistics website during 2008.

Further information

In addition to the standard projection output listed above, the following further details are available on request from the Office for National Statistics (see Chapter 2 for contact details):

- births by age of mother
- deaths by age
- population at individual ages over 90
- projection results from 75 to 100 years ahead

Individual countries

A statistical bulletin analysing the 2006-based national population projections for Wales is available on the Welsh Assembly Government website at: http://new.wales.gov.uk/topics/statistics/headlines/pop-2007/hdw20071023/?lang=en

A statistical publication giving full details of the results for Scotland is available on the General Register Office for Scotland website at: www.gro-scotland.gov.uk/statistics/publications-and-data/popproj/projected-population-of-scotland-(2006-based)/index.html

A Statistical Press Release detailing the 2006-based results for Northern Ireland is available on the website of the Northern Ireland Research & Statistics Agency at: www.nisra.gov.uk/archive/demography/population/projections/popproj06.pdf

Appendices

Appendix I

Age and sex structure of the projected population, 2006–2081

(a) United Kingdom

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041
All ages	**Persons**	**60,587**	**62,761**	**64,975**	**67,191**	**69,260**	**71,100**	**72,747**	**74,306**
	Males	**29,694**	**30,893**	**32,088**	**33,252**	**34,313**	**35,243**	**36,080**	**36,883**
	Females	**30,893**	**31,868**	**32,887**	**33,938**	**34,946**	**35,857**	**36,668**	**37,422**
0–4	Males	1,790	1,992	2,039	2,054	2,032	2,012	2,034	2,100
	Females	1,706	1,907	1,952	1,966	1,945	1,926	1,947	2,009
5–9	Males	1,785	1,798	1,998	2,045	2,060	2,038	2,018	2,040
	Females	1,705	1,717	1,917	1,962	1,976	1,955	1,936	1,957
10–14	Males	1,924	1,795	1,807	2,007	2,053	2,068	2,047	2,027
	Females	1,827	1,704	1,716	1,915	1,960	1,974	1,954	1,935
15–19	Males	2,060	1,975	1,842	1,854	2,054	2,101	2,116	2,095
	Females	1,936	1,852	1,728	1,739	1,939	1,983	1,998	1,977
20–24	Males	2,048	2,248	2,148	2,016	2,028	2,227	2,274	2,290
	Females	1,976	2,115	2,018	1,893	1,905	2,104	2,149	2,163
25–29	Males	1,930	2,235	2,415	2,314	2,182	2,195	2,394	2,441
	Females	1,926	2,189	2,308	2,209	2,084	2,096	2,295	2,340
30–34	Males	2,010	1,999	2,292	2,470	2,371	2,240	2,252	2,452
	Females	2,030	2,011	2,264	2,382	2,284	2,159	2,171	2,370
35–39	Males	2,281	2,029	2,012	2,304	2,482	2,383	2,253	2,266
	Females	2,317	2,058	2,035	2,287	2,405	2,307	2,183	2,196
40–44	Males	2,305	2,285	2,030	2,015	2,305	2,482	2,385	2,256
	Females	2,358	2,317	2,057	2,034	2,286	2,404	2,307	2,183
45–49	Males	2,056	2,274	2,253	2,002	1,988	2,276	2,453	2,358
	Females	2,095	2,345	2,304	2,047	2,025	2,276	2,394	2,298
50–54	Males	1,820	2,018	2,234	2,215	1,969	1,957	2,243	2,419
	Females	1,863	2,068	2,316	2,276	2,023	2,003	2,253	2,371
55–59	Males	1,928	1,768	1,963	2,175	2,159	1,921	1,912	2,194
	Females	1,982	1,822	2,025	2,271	2,234	1,986	1,968	2,215
60–64	Males	1,584	1,824	1,679	1,870	2,079	2,066	1,839	1,833
	Females	1,656	1,922	1,770	1,972	2,215	2,181	1,939	1,924
65–69	Males	1,293	1,473	1,709	1,582	1,767	1,970	1,963	1,750
	Females	1,398	1,577	1,839	1,700	1,898	2,137	2,107	1,875
70–74	Males	1,086	1,163	1,343	1,571	1,463	1,641	1,837	1,835
	Females	1,252	1,306	1,483	1,738	1,614	1,807	2,040	2,015
75–79	Males	849	910	1,006	1,178	1,389	1,304	1,471	1,656
	Females	1,110	1,113	1,183	1,357	1,599	1,494	1,680	1,903
80–84	Males	564	625	710	813	969	1,151	1,093	1,245
	Females	892	892	928	1,014	1,179	1,398	1,318	1,491
85–89	Males	273	340	407	496	589	717	860	831
	Females	547	601	630	693	787	932	1,113	1,064
90 and over	Males	106	143	201	274	376	492	635	797
	Females	317	352	414	484	591	734	916	1,134
0–15	Males	5,912	5,961	6,187	6,485	6,557	6,533	6,515	6,577
	Females	5,625	5,682	5,909	6,202	6,271	6,248	6,231	6,289
16–29	Males	5,626	6,082	6,061	5,804	5,852	6,108	6,368	6,416
	Females	5,450	5,802	5,728	5,481	5,537	5,791	6,048	6,093
30–44	Males	6,597	6,313	6,335	6,789	7,157	7,105	6,890	6,974
	Females	6,706	6,386	6,356	6,703	6,975	6,870	6,661	6,750
45–59	Males	5,804	6,060	6,450	6,392	6,116	6,155	6,608	6,971
	Females	5,940	6,235	6,645	6,594	6,282	6,265	6,615	6,884
60–74	Males	3,964	4,460	4,731	5,023	5,309	5,678	5,639	5,419
	Females	4,305	4,805	5,093	5,409	5,726	6,125	6,086	5,815
75 and over	Males	1,792	2,018	2,324	2,761	3,322	3,664	4,059	4,528
	Females	2,867	2,958	3,156	3,549	4,155	4,558	5,028	5,593

thousands

2046	2051	2056	2061	2066	2071	2076	2081	Sex	Age
75,810	**77,236**	**78,564**	**79,831**	**81,119**	**82,478**	**83,878**	**85,252**	**Persons**	**All ages**
37,671	**38,426**	**39,139**	**39,827**	**40,524**	**41,248**	**41,982**	**42,698**	**Males**	
38,140	**38,810**	**39,425**	**40,005**	**40,595**	**41,231**	**41,896**	**42,554**	**Females**	
2,156	2,177	2,178	2,184	2,207	2,244	2,280	2,303	Males	0–4
2,063	2,083	2,084	2,089	2,111	2,146	2,180	2,202	Females	
2,106	2,162	2,183	2,185	2,190	2,213	2,250	2,286	Males	5–9
2,020	2,074	2,093	2,095	2,100	2,122	2,157	2,191	Females	
2,049	2,115	2,171	2,192	2,194	2,199	2,222	2,259	Males	10–14
1,956	2,018	2,072	2,092	2,093	2,098	2,120	2,155	Females	
2,075	2,097	2,162	2,219	2,240	2,241	2,247	2,270	Males	15–19
1,958	1,979	2,042	2,096	2,115	2,117	2,122	2,144	Females	
2,268	2,249	2,271	2,337	2,393	2,414	2,416	2,422	Males	20–24
2,143	2,124	2,145	2,207	2,261	2,281	2,282	2,288	Females	
2,457	2,436	2,416	2,439	2,504	2,561	2,582	2,584	Males	25–29
2,355	2,334	2,316	2,337	2,399	2,453	2,473	2,474	Females	
2,499	2,514	2,494	2,475	2,497	2,563	2,620	2,641	Males	30–34
2,415	2,430	2,410	2,391	2,413	2,475	2,529	2,549	Females	
2,465	2,513	2,529	2,509	2,490	2,513	2,579	2,636	Males	35–39
2,395	2,440	2,454	2,435	2,416	2,438	2,500	2,554	Females	
2,270	2,468	2,516	2,533	2,513	2,495	2,518	2,585	Males	40–44
2,196	2,395	2,440	2,455	2,436	2,417	2,439	2,502	Females	
2,231	2,245	2,443	2,492	2,509	2,490	2,473	2,497	Males	45–49
2,176	2,189	2,387	2,433	2,448	2,429	2,412	2,434	Females	
2,326	2,202	2,218	2,415	2,465	2,483	2,466	2,450	Males	50–54
2,276	2,156	2,170	2,367	2,413	2,430	2,411	2,395	Females	
2,369	2,280	2,160	2,177	2,373	2,424	2,443	2,428	Males	55–59
2,333	2,241	2,123	2,138	2,335	2,382	2,399	2,382	Females	
2,110	2,283	2,199	2,085	2,105	2,299	2,350	2,372	Males	60–64
2,169	2,287	2,198	2,084	2,100	2,296	2,344	2,362	Females	
1,749	2,019	2,189	2,112	2,005	2,028	2,220	2,273	Males	65–69
1,864	2,105	2,223	2,138	2,029	2,048	2,241	2,290	Females	
1,641	1,646	1,906	2,072	2,004	1,907	1,934	2,122	Males	70–74
1,797	1,790	2,026	2,143	2,065	1,962	1,984	2,175	Females	
1,662	1,492	1,506	1,751	1,911	1,855	1,772	1,805	Males	75–79
1,886	1,687	1,687	1,915	2,031	1,961	1,868	1,895	Females	
1,412	1,427	1,290	1,314	1,538	1,688	1,647	1,583	Males	80–84
1,698	1,692	1,520	1,532	1,746	1,859	1,802	1,724	Females	
960	1,102	1,126	1,029	1,064	1,257	1,392	1,370	Males	85–89
1,218	1,400	1,406	1,274	1,298	1,491	1,599	1,560	Females	
866	997	1,179	1,307	1,321	1,372	1,570	1,813	Males	90 and over
1,222	1,388	1,629	1,785	1,786	1,826	2,033	2,277	Females	
6,719	6,871	6,964	7,001	7,032	7,098	7,196	7,298	Males	0–15
6,425	6,569	6,657	6,692	6,722	6,784	6,877	6,975	Females	
6,392	6,365	6,419	6,555	6,696	6,776	6,802	6,826	Males	16–29
6,069	6,043	6,094	6,223	6,358	6,433	6,457	6,480	Females	
7,234	7,495	7,539	7,516	7,500	7,571	7,717	7,862	Males	30–44
7,006	7,264	7,304	7,281	7,264	7,330	7,468	7,605	Females	
6,926	6,727	6,821	7,085	7,347	7,397	7,382	7,375	Males	45–59
6,785	6,586	6,680	6,939	7,197	7,241	7,222	7,210	Females	
5,501	5,949	6,294	6,269	6,114	6,234	6,505	6,767	Males	60–74
5,830	6,183	6,447	6,365	6,194	6,306	6,569	6,827	Females	
4,900	5,019	5,101	5,402	5,834	6,172	6,381	6,570	Males	75 and over
6,024	6,166	6,242	6,505	6,860	7,137	7,302	7,456	Females	

Appendix I

Age and sex structure of the projected population, 2006–2081

(b) Great Britain

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041
All ages	**Persons**	**58,846**	**60,950**	**63,107**	**65,269**	**67,294**	**69,101**	**70,724**	**72,263**
	Males	**28,841**	**30,003**	**31,168**	**32,304**	**33,342**	**34,255**	**35,079**	**35,873**
	Females	**30,005**	**30,947**	**31,940**	**32,966**	**33,952**	**34,846**	**35,645**	**36,390**
0–4	Males	1,733	1,930	1,976	1,991	1,972	1,955	1,977	2,042
	Females	1,651	1,847	1,891	1,906	1,887	1,871	1,892	1,954
5–9	Males	1,724	1,740	1,935	1,981	1,996	1,978	1,960	1,983
	Females	1,648	1,662	1,857	1,901	1,915	1,897	1,881	1,902
10–14	Males	1,861	1,734	1,749	1,944	1,990	2,005	1,986	1,969
	Females	1,766	1,647	1,660	1,855	1,899	1,913	1,895	1,879
15–19	Males	1,993	1,911	1,782	1,796	1,991	2,037	2,053	2,034
	Females	1,873	1,792	1,672	1,685	1,880	1,924	1,938	1,920
20–24	Males	1,983	2,180	2,084	1,955	1,970	2,165	2,211	2,226
	Females	1,914	2,053	1,960	1,839	1,853	2,047	2,091	2,106
25–29	Males	1,875	2,167	2,345	2,249	2,121	2,136	2,331	2,377
	Females	1,870	2,122	2,243	2,149	2,028	2,042	2,236	2,280
30–34	Males	1,952	1,943	2,225	2,402	2,306	2,179	2,194	2,389
	Females	1,971	1,953	2,196	2,316	2,222	2,102	2,116	2,310
35–39	Males	2,218	1,970	1,956	2,236	2,413	2,318	2,192	2,207
	Females	2,252	1,998	1,976	2,219	2,338	2,245	2,125	2,139
40–44	Males	2,242	2,222	1,973	1,958	2,238	2,414	2,321	2,196
	Females	2,292	2,251	1,997	1,975	2,218	2,337	2,245	2,126
45–49	Males	1,998	2,212	2,191	1,946	1,933	2,211	2,387	2,295
	Females	2,035	2,279	2,238	1,987	1,967	2,208	2,328	2,237
50–54	Males	1,769	1,962	2,172	2,154	1,914	1,903	2,179	2,353
	Females	1,812	2,008	2,250	2,212	1,964	1,945	2,185	2,305
55–59	Males	1,880	1,718	1,908	2,115	2,100	1,867	1,859	2,131
	Females	1,933	1,772	1,967	2,207	2,170	1,927	1,910	2,149
60–64	Males	1,542	1,779	1,631	1,817	2,021	2,009	1,787	1,782
	Females	1,611	1,874	1,722	1,914	2,152	2,118	1,882	1,868
65–69	Males	1,260	1,433	1,667	1,537	1,717	1,916	1,909	1,700
	Females	1,361	1,535	1,793	1,653	1,843	2,076	2,047	1,820
70–74	Males	1,060	1,133	1,307	1,532	1,421	1,595	1,786	1,785
	Females	1,219	1,271	1,443	1,694	1,569	1,755	1,982	1,958
75–79	Males	829	887	980	1,146	1,354	1,266	1,430	1,610
	Females	1,081	1,084	1,152	1,320	1,559	1,453	1,631	1,849
80–84	Males	551	610	693	792	943	1,123	1,062	1,210
	Females	870	869	904	988	1,147	1,363	1,281	1,448
85–89	Males	268	332	398	484	574	698	839	807
	Females	535	586	614	675	766	907	1,085	1,035
90 and over	Males	104	140	197	268	367	480	619	777
	Females	311	345	405	472	576	715	892	1,106
0–15	Males	5,717	5,767	5,992	6,284	6,358	6,339	6,327	6,392
	Females	5,440	5,499	5,723	6,010	6,080	6,061	6,050	6,111
16–29	Males	5,452	5,894	5,879	5,632	5,683	5,936	6,191	6,239
	Females	5,282	5,624	5,560	5,324	5,382	5,633	5,884	5,930
30–44	Males	6,412	6,134	6,153	6,596	6,957	6,911	6,706	6,792
	Females	6,515	6,201	6,169	6,510	6,778	6,685	6,486	6,576
45–59	Males	5,647	5,891	6,271	6,215	5,946	5,981	6,424	6,779
	Females	5,780	6,059	6,455	6,405	6,100	6,080	6,424	6,691
60–74	Males	3,861	4,345	4,605	4,886	5,160	5,520	5,481	5,267
	Females	4,191	4,680	4,958	5,262	5,564	5,949	5,910	5,645
75 and over	Males	1,751	1,970	2,267	2,690	3,238	3,568	3,949	4,404
	Females	2,798	2,884	3,074	3,455	4,047	4,438	4,890	5,437

thousands

2046	2051	2056	2061	2066	2071	2076	2081	Sex	Age
73,751	**75,166**	**76,490**	**77,759**	**79,049**	**80,411**	**81,812**	**83,189**	**Persons**	**All ages**
36,652	**37,400**	**38,110**	**38,797**	**39,493**	**40,217**	**40,951**	**41,667**	**Males**	
37,100	**37,766**	**38,380**	**38,962**	**39,556**	**40,194**	**40,862**	**41,522**	**Females**	
2,097	2,119	2,121	2,128	2,152	2,189	2,224	2,248	Males	0–4
2,007	2,027	2,029	2,036	2,058	2,093	2,127	2,150	Females	
2,048	2,103	2,124	2,127	2,134	2,158	2,195	2,230	Males	5–9
1,964	2,017	2,037	2,039	2,046	2,068	2,103	2,137	Females	
1,992	2,056	2,112	2,133	2,136	2,143	2,167	2,204	Males	10–14
1,901	1,962	2,015	2,035	2,038	2,044	2,067	2,102	Females	
2,017	2,039	2,104	2,160	2,181	2,184	2,191	2,215	Males	15–19
1,904	1,925	1,987	2,040	2,060	2,062	2,069	2,092	Females	
2,208	2,191	2,214	2,278	2,334	2,355	2,358	2,366	Males	20–24
2,088	2,071	2,093	2,155	2,208	2,228	2,230	2,237	Females	
2,393	2,374	2,357	2,380	2,445	2,501	2,522	2,525	Males	25–29
2,295	2,277	2,261	2,283	2,344	2,397	2,417	2,420	Females	
2,435	2,451	2,433	2,416	2,440	2,504	2,560	2,582	Males	30–34
2,354	2,369	2,352	2,335	2,357	2,419	2,472	2,492	Females	
2,402	2,449	2,465	2,447	2,431	2,455	2,519	2,576	Males	35–39
2,334	2,378	2,393	2,376	2,360	2,382	2,443	2,496	Females	
2,212	2,406	2,453	2,470	2,453	2,437	2,461	2,526	Males	40–44
2,140	2,334	2,379	2,394	2,377	2,361	2,383	2,445	Females	
2,171	2,188	2,382	2,429	2,447	2,431	2,416	2,440	Males	45–49
2,119	2,133	2,327	2,372	2,387	2,371	2,355	2,378	Females	
2,264	2,144	2,162	2,355	2,403	2,421	2,407	2,393	Males	50–54
2,215	2,099	2,114	2,308	2,353	2,369	2,353	2,339	Females	
2,304	2,219	2,102	2,122	2,314	2,363	2,383	2,370	Males	55–59
2,269	2,181	2,067	2,084	2,276	2,322	2,339	2,324	Females	
2,049	2,221	2,140	2,029	2,051	2,241	2,291	2,313	Males	60–64
2,104	2,223	2,139	2,028	2,046	2,238	2,284	2,303	Females	
1,700	1,960	2,129	2,055	1,951	1,976	2,164	2,216	Males	65–69
1,809	2,042	2,161	2,081	1,975	1,995	2,184	2,232	Females	
1,594	1,600	1,851	2,016	1,950	1,856	1,885	2,068	Males	70–74
1,744	1,738	1,965	2,084	2,009	1,910	1,933	2,120	Females	
1,616	1,450	1,464	1,701	1,859	1,805	1,724	1,758	Males	75–79
1,832	1,637	1,638	1,857	1,974	1,908	1,819	1,846	Females	
1,373	1,388	1,254	1,278	1,494	1,642	1,604	1,540	Males	80–84
1,650	1,643	1,475	1,487	1,693	1,807	1,754	1,679	Females	
933	1,072	1,095	1,000	1,034	1,220	1,354	1,334	Males	85–89
1,182	1,360	1,366	1,236	1,260	1,446	1,554	1,518	Females	
843	970	1,147	1,272	1,285	1,335	1,526	1,764	Males	90 and over
1,190	1,349	1,583	1,735	1,735	1,773	1,973	2,213	Females	
6,533	6,683	6,777	6,816	6,852	6,919	7,018	7,120	Males	0–15
6,246	6,389	6,478	6,515	6,549	6,613	6,707	6,804	Females	
6,221	6,199	6,256	6,391	6,530	6,610	6,639	6,667	Males	16–29
5,911	5,890	5,944	6,072	6,205	6,280	6,307	6,334	Females	
7,049	7,306	7,350	7,333	7,323	7,396	7,541	7,683	Males	30–44
6,828	7,081	7,123	7,105	7,093	7,161	7,298	7,434	Females	
6,740	6,551	6,646	6,906	7,164	7,215	7,205	7,203	Males	45–59
6,602	6,413	6,509	6,763	7,016	7,061	7,047	7,041	Females	
5,344	5,782	6,120	6,100	5,953	6,073	6,340	6,597	Males	60–74
5,657	6,003	6,265	6,192	6,031	6,143	6,402	6,655	Females	
4,765	4,880	4,960	5,251	5,672	6,003	6,208	6,397	Males	75 and over
5,854	5,989	6,062	6,315	6,662	6,935	7,100	7,256	Females	

Appendix I

Age and sex structure of the projected population, 2006–2081

(c) England & Wales

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041
All ages	**Persons**	**53,729**	**55,744**	**57,837**	**59,943**	**61,931**	**63,727**	**65,363**	**66,928**
	Males	**26,371**	**27,482**	**28,610**	**29,717**	**30,737**	**31,646**	**32,477**	**33,284**
	Females	**27,358**	**28,262**	**29,226**	**30,226**	**31,194**	**32,081**	**32,885**	**33,644**
0–4	Males	1,595	1,784	1,832	1,850	1,837	1,824	1,850	1,915
	Females	1,520	1,707	1,753	1,770	1,757	1,746	1,770	1,832
5–9	Males	1,581	1,601	1,789	1,836	1,855	1,841	1,829	1,855
	Females	1,512	1,529	1,716	1,761	1,779	1,766	1,755	1,779
10–14	Males	1,703	1,590	1,609	1,797	1,844	1,863	1,849	1,837
	Females	1,615	1,510	1,527	1,714	1,759	1,777	1,764	1,752
15–19	Males	1,824	1,750	1,634	1,653	1,841	1,889	1,907	1,894
	Females	1,713	1,639	1,533	1,550	1,736	1,782	1,799	1,787
20–24	Males	1,812	1,998	1,912	1,797	1,816	2,004	2,052	2,070
	Females	1,746	1,881	1,797	1,690	1,707	1,894	1,939	1,957
25–29	Males	1,718	1,993	2,164	2,077	1,962	1,982	2,169	2,217
	Females	1,716	1,950	2,070	1,985	1,878	1,896	2,082	2,128
30–34	Males	1,799	1,786	2,053	2,223	2,137	2,022	2,042	2,229
	Females	1,808	1,795	2,023	2,142	2,057	1,951	1,969	2,155
35–39	Males	2,033	1,816	1,801	2,066	2,235	2,150	2,037	2,057
	Females	2,052	1,832	1,817	2,044	2,163	2,079	1,973	1,991
40–44	Males	2,047	2,037	1,820	1,804	2,069	2,238	2,154	2,041
	Females	2,081	2,050	1,831	1,816	2,043	2,162	2,078	1,973
45–49	Males	1,815	2,019	2,009	1,795	1,781	2,044	2,213	2,130
	Females	1,840	2,069	2,039	1,821	1,808	2,034	2,153	2,070
50–54	Males	1,604	1,782	1,984	1,975	1,766	1,754	2,014	2,182
	Females	1,642	1,815	2,043	2,014	1,799	1,787	2,012	2,131
55–59	Males	1,711	1,557	1,732	1,931	1,925	1,722	1,712	1,970
	Females	1,757	1,604	1,776	2,002	1,975	1,765	1,754	1,978
60–64	Males	1,407	1,618	1,479	1,650	1,846	1,842	1,648	1,641
	Females	1,466	1,703	1,558	1,729	1,952	1,927	1,723	1,715
65–69	Males	1,146	1,309	1,518	1,394	1,561	1,751	1,751	1,569
	Females	1,231	1,398	1,631	1,496	1,665	1,884	1,863	1,666
70–74	Males	965	1,033	1,195	1,398	1,291	1,451	1,634	1,639
	Females	1,102	1,151	1,316	1,542	1,422	1,587	1,800	1,783
75–79	Males	760	810	895	1,051	1,238	1,153	1,304	1,476
	Females	983	981	1,045	1,205	1,421	1,318	1,477	1,681
80–84	Males	507	561	635	726	867	1,029	969	1,106
	Females	796	792	820	897	1,049	1,244	1,164	1,313
85–89	Males	248	307	367	445	528	644	771	739
	Females	492	538	561	614	697	831	992	941
90 and over	Males	96	130	183	248	338	442	571	716
	Females	286	318	372	433	526	653	818	1,013
0–15	Males	5,245	5,308	5,535	5,822	5,905	5,901	5,904	5,978
	Females	4,990	5,061	5,284	5,567	5,645	5,641	5,644	5,714
16–29	Males	4,989	5,408	5,405	5,188	5,250	5,502	5,753	5,810
	Females	4,832	5,156	5,111	4,904	4,973	5,219	5,466	5,520
30–44	Males	5,878	5,639	5,673	6,093	6,441	6,411	6,233	6,328
	Females	5,941	5,677	5,671	6,002	6,263	6,192	6,020	6,119
45–59	Males	5,130	5,358	5,725	5,702	5,472	5,520	5,939	6,281
	Females	5,239	5,488	5,858	5,837	5,582	5,586	5,919	6,179
60–74	Males	3,518	3,960	4,192	4,442	4,697	5,045	5,034	4,850
	Females	3,799	4,252	4,504	4,768	5,038	5,398	5,385	5,164
75 and over	Males	1,611	1,809	2,079	2,470	2,971	3,268	3,615	4,037
	Females	2,556	2,628	2,798	3,149	3,693	4,045	4,451	4,948

thousands

2046	2051	2056	2061	2066	2071	2076	2081	Sex	Age
68,454	**69,917**	**71,297**	**72,623**	**73,968**	**75,376**	**76,820**	**78,238**	**Persons**	**All ages**
34,079	**34,848**	**35,580**	**36,290**	**37,007**	**37,750**	**38,501**	**39,236**	**Males**	
34,375	**35,069**	**35,717**	**36,333**	**36,960**	**37,626**	**38,318**	**39,002**	**Females**	
1,970	1,994	2,000	2,010	2,036	2,073	2,110	2,135	Males	0–4
1,885	1,907	1,913	1,922	1,947	1,983	2,017	2,041	Females	
1,920	1,975	1,999	2,005	2,015	2,041	2,079	2,115	Males	5–9
1,840	1,893	1,916	1,921	1,931	1,955	1,991	2,026	Females	
1,863	1,928	1,983	2,007	2,013	2,023	2,049	2,087	Males	10–14
1,777	1,838	1,891	1,914	1,919	1,929	1,953	1,990	Females	
1,882	1,908	1,972	2,028	2,051	2,058	2,068	2,093	Males	15–19
1,775	1,800	1,861	1,914	1,936	1,942	1,952	1,976	Females	
2,057	2,045	2,071	2,136	2,192	2,215	2,221	2,232	Males	20–24
1,944	1,933	1,957	2,019	2,072	2,094	2,100	2,110	Females	
2,236	2,223	2,211	2,237	2,302	2,358	2,381	2,388	Males	25–29
2,145	2,133	2,122	2,146	2,207	2,261	2,283	2,289	Females	
2,277	2,296	2,283	2,272	2,298	2,363	2,419	2,443	Males	30–34
2,200	2,218	2,206	2,195	2,219	2,281	2,334	2,356	Females	
2,244	2,292	2,311	2,299	2,288	2,314	2,379	2,435	Males	35–39
2,177	2,223	2,241	2,228	2,217	2,242	2,304	2,357	Females	
2,062	2,249	2,297	2,317	2,305	2,294	2,321	2,386	Males	40–44
1,991	2,177	2,223	2,241	2,229	2,218	2,243	2,305	Females	
2,019	2,041	2,227	2,276	2,296	2,285	2,275	2,302	Males	45–49
1,966	1,984	2,170	2,216	2,234	2,223	2,213	2,238	Females	
2,101	1,993	2,016	2,201	2,250	2,271	2,262	2,253	Males	50–54
2,049	1,947	1,966	2,151	2,197	2,216	2,205	2,196	Females	
2,136	2,059	1,954	1,978	2,162	2,212	2,234	2,226	Males	55–59
2,096	2,017	1,916	1,936	2,120	2,167	2,187	2,177	Females	
1,894	2,058	1,986	1,886	1,912	2,094	2,145	2,169	Males	60–64
1,936	2,054	1,977	1,880	1,901	2,084	2,132	2,152	Females	
1,567	1,813	1,974	1,907	1,814	1,842	2,022	2,075	Males	65–69
1,661	1,879	1,996	1,923	1,830	1,853	2,034	2,083	Females	
1,472	1,476	1,713	1,870	1,811	1,727	1,758	1,934	Males	70–74
1,598	1,597	1,809	1,926	1,858	1,771	1,796	1,975	Females	
1,487	1,341	1,352	1,576	1,727	1,678	1,606	1,642	Males	75–79
1,670	1,501	1,506	1,711	1,826	1,766	1,687	1,716	Females	
1,262	1,280	1,162	1,182	1,386	1,528	1,493	1,436	Males	80–84
1,502	1,500	1,354	1,368	1,561	1,673	1,625	1,558	Females	
855	987	1,012	929	958	1,135	1,262	1,243	Males	85–89
1,074	1,240	1,249	1,136	1,161	1,335	1,440	1,408	Females	
775	890	1,056	1,175	1,191	1,239	1,419	1,643	Males	90 and over
1,087	1,229	1,444	1,586	1,592	1,633	1,821	2,048	Females	
6,123	6,276	6,375	6,424	6,468	6,543	6,646	6,752	Males	0–15
5,852	5,998	6,092	6,138	6,180	6,251	6,349	6,450	Females	
5,804	5,796	5,861	5,999	6,140	6,225	6,262	6,298	Males	16–29
5,514	5,506	5,567	5,698	5,833	5,913	5,948	5,982	Females	
6,583	6,837	6,892	6,888	6,891	6,971	7,119	7,264	Males	30–44
6,369	6,618	6,669	6,664	6,666	6,741	6,881	7,018	Females	
6,257	6,093	6,197	6,454	6,708	6,768	6,771	6,781	Males	45–59
6,112	5,948	6,052	6,303	6,552	6,607	6,605	6,611	Females	
4,933	5,347	5,673	5,664	5,537	5,663	5,925	6,177	Males	60–74
5,194	5,529	5,783	5,729	5,589	5,708	5,962	6,211	Females	
4,378	4,499	4,582	4,861	5,264	5,580	5,779	5,965	Males	75 and over
5,334	5,470	5,553	5,801	6,140	6,407	6,573	6,730	Females	

Appendix I

Age and sex structure of the projected population, 2006–2081

(d) England

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041
All ages	**Persons**	**50,763**	**52,706**	**54,724**	**56,757**	**58,682**	**60,432**	**62,033**	**63,571**
	Males	**24,926**	**25,995**	**27,080**	**28,146**	**29,134**	**30,019**	**30,832**	**31,623**
	Females	**25,837**	**26,711**	**27,644**	**28,611**	**29,549**	**30,413**	**31,201**	**31,948**
0–4	Males	1,513	1,694	1,740	1,759	1,748	1,739	1,765	1,828
	Females	1,442	1,622	1,666	1,683	1,673	1,664	1,689	1,749
5–9	Males	1,493	1,517	1,698	1,743	1,762	1,751	1,742	1,768
	Females	1,428	1,450	1,629	1,672	1,690	1,680	1,671	1,696
10–14	Males	1,606	1,500	1,523	1,704	1,750	1,768	1,758	1,748
	Females	1,523	1,425	1,446	1,625	1,669	1,687	1,676	1,667
15–19	Males	1,720	1,650	1,542	1,565	1,746	1,791	1,810	1,800
	Females	1,615	1,545	1,446	1,467	1,646	1,689	1,707	1,697
20–24	Males	1,713	1,890	1,809	1,701	1,724	1,905	1,950	1,969
	Females	1,649	1,780	1,701	1,601	1,622	1,801	1,845	1,863
25–29	Males	1,637	1,896	2,058	1,977	1,869	1,893	2,073	2,119
	Females	1,635	1,855	1,972	1,891	1,792	1,814	1,992	2,036
30–34	Males	1,716	1,704	1,955	2,116	2,036	1,929	1,953	2,133
	Females	1,721	1,712	1,926	2,042	1,962	1,863	1,884	2,063
35–39	Males	1,934	1,732	1,717	1,967	2,128	2,048	1,942	1,966
	Females	1,947	1,743	1,731	1,945	2,061	1,981	1,883	1,904
40–44	Males	1,941	1,937	1,734	1,719	1,968	2,129	2,050	1,945
	Females	1,971	1,943	1,739	1,728	1,942	2,058	1,979	1,880
45–49	Males	1,718	1,913	1,909	1,709	1,695	1,943	2,103	2,026
	Females	1,739	1,957	1,930	1,729	1,719	1,931	2,048	1,969
50–54	Males	1,513	1,684	1,877	1,874	1,679	1,667	1,913	2,072
	Females	1,547	1,713	1,930	1,904	1,705	1,697	1,908	2,024
55–59	Males	1,608	1,466	1,635	1,825	1,824	1,634	1,625	1,867
	Females	1,652	1,508	1,673	1,889	1,865	1,670	1,662	1,873
60–64	Males	1,320	1,518	1,389	1,554	1,741	1,743	1,561	1,555
	Females	1,377	1,599	1,463	1,626	1,839	1,817	1,628	1,622
65–69	Males	1,075	1,226	1,422	1,307	1,468	1,649	1,655	1,484
	Females	1,156	1,311	1,529	1,404	1,565	1,774	1,755	1,573
70–74	Males	906	968	1,119	1,309	1,210	1,365	1,539	1,548
	Females	1,035	1,080	1,233	1,446	1,333	1,491	1,694	1,680
75–79	Males	714	761	839	985	1,160	1,081	1,226	1,390
	Females	924	922	981	1,130	1,333	1,236	1,388	1,583
80–84	Males	476	528	597	681	812	965	909	1,040
	Females	746	745	771	843	984	1,167	1,092	1,234
85–89	Males	233	289	345	418	495	604	723	693
	Females	461	504	528	577	655	780	931	884
90 and over	Males	91	123	172	234	318	416	536	672
	Females	270	299	350	407	495	614	768	952
0–15	Males	4,957	5,026	5,249	5,527	5,610	5,612	5,621	5,697
	Females	4,717	4,793	5,012	5,285	5,363	5,365	5,373	5,445
16–29	Males	4,725	5,121	5,121	4,922	4,989	5,235	5,477	5,535
	Females	4,575	4,884	4,847	4,655	4,729	4,970	5,207	5,262
30–44	Males	5,591	5,372	5,406	5,802	6,132	6,106	5,945	6,043
	Females	5,638	5,397	5,396	5,715	5,965	5,902	5,745	5,848
45–59	Males	4,839	5,063	5,421	5,408	5,198	5,244	5,640	5,964
	Females	4,938	5,179	5,534	5,521	5,289	5,298	5,618	5,866
60–74	Males	3,301	3,713	3,930	4,170	4,419	4,757	4,755	4,587
	Females	3,567	3,990	4,226	4,476	4,737	5,082	5,077	4,875
75 and over	Males	1,514	1,700	1,953	2,317	2,786	3,065	3,394	3,796
	Females	2,401	2,470	2,629	2,958	3,467	3,797	4,180	4,653

thousands

2046	2051	2056	2061	2066	2071	2076	2081	Sex	Age
65,075	**66,519**	**67,885**	**69,200**	**70,532**	**71,923**	**73,350**	**74,753**	**Persons**	**All ages**
32,405	**33,161**	**33,882**	**34,582**	**35,289**	**36,020**	**36,761**	**37,487**	**Males**	
32,671	**33,359**	**34,003**	**34,618**	**35,242**	**35,903**	**36,588**	**37,266**	**Females**	
1,882	1,906	1,914	1,925	1,951	1,988	2,024	2,050	Males	0–4
1,801	1,823	1,830	1,841	1,865	1,901	1,935	1,960	Females	
1,831	1,886	1,909	1,917	1,928	1,954	1,991	2,027	Males	5–9
1,755	1,808	1,830	1,837	1,848	1,872	1,908	1,942	Females	
1,775	1,837	1,892	1,916	1,923	1,935	1,960	1,998	Males	10–14
1,692	1,752	1,804	1,827	1,834	1,844	1,869	1,905	Females	
1,790	1,816	1,879	1,934	1,958	1,965	1,977	2,002	Males	15–19
1,688	1,713	1,773	1,825	1,848	1,855	1,865	1,890	Females	
1,959	1,950	1,976	2,039	2,094	2,118	2,125	2,137	Males	20–24
1,853	1,844	1,869	1,928	1,981	2,003	2,010	2,021	Females	
2,138	2,128	2,119	2,145	2,208	2,263	2,287	2,294	Males	25–29
2,054	2,044	2,035	2,060	2,120	2,172	2,195	2,202	Females	
2,179	2,198	2,188	2,179	2,206	2,269	2,324	2,348	Males	30–34
2,107	2,125	2,115	2,106	2,131	2,191	2,243	2,266	Females	
2,146	2,192	2,211	2,202	2,193	2,220	2,283	2,338	Males	35–39
2,083	2,126	2,145	2,135	2,127	2,152	2,212	2,264	Females	
1,969	2,149	2,195	2,215	2,206	2,198	2,225	2,288	Males	40–44
1,902	2,081	2,125	2,143	2,134	2,125	2,151	2,211	Females	
1,922	1,947	2,126	2,173	2,193	2,185	2,177	2,205	Males	45–49
1,872	1,894	2,072	2,116	2,135	2,126	2,118	2,144	Females	
1,996	1,895	1,921	2,099	2,147	2,168	2,161	2,154	Males	50–54
1,947	1,851	1,874	2,052	2,096	2,115	2,107	2,100	Females	
2,025	1,953	1,855	1,882	2,059	2,107	2,130	2,124	Males	55–59
1,988	1,913	1,819	1,843	2,020	2,065	2,085	2,077	Females	
1,793	1,949	1,881	1,787	1,816	1,991	2,040	2,065	Males	60–64
1,830	1,946	1,873	1,782	1,807	1,982	2,028	2,049	Females	
1,482	1,714	1,867	1,805	1,717	1,748	1,921	1,971	Males	65–69
1,570	1,775	1,890	1,821	1,734	1,760	1,934	1,981	Females	
1,392	1,395	1,619	1,768	1,713	1,634	1,668	1,837	Males	70–74
1,508	1,509	1,709	1,823	1,759	1,677	1,706	1,877	Females	
1,405	1,268	1,278	1,489	1,633	1,588	1,519	1,557	Males	75–79
1,574	1,417	1,423	1,617	1,729	1,672	1,598	1,630	Females	
1,189	1,209	1,099	1,118	1,310	1,445	1,413	1,360	Males	80–84
1,415	1,414	1,279	1,294	1,476	1,584	1,538	1,476	Females	
805	931	956	879	907	1,073	1,194	1,177	Males	85–89
1,010	1,168	1,177	1,073	1,098	1,262	1,364	1,333	Females	
727	838	996	1,110	1,127	1,173	1,343	1,555	Males	90 and over
1,022	1,156	1,361	1,496	1,503	1,544	1,723	1,940	Females	
5,840	5,991	6,090	6,141	6,188	6,264	6,366	6,472	Males	0–15
5,582	5,725	5,819	5,868	5,913	5,984	6,082	6,183	Females	
5,535	5,533	5,599	5,734	5,873	5,958	5,998	6,036	Males	16–29
5,261	5,259	5,322	5,450	5,583	5,663	5,701	5,737	Females	
6,294	6,538	6,594	6,596	6,605	6,686	6,831	6,974	Males	30–44
6,092	6,332	6,384	6,384	6,392	6,468	6,606	6,741	Females	
5,943	5,795	5,902	6,154	6,399	6,460	6,468	6,483	Males	45–59
5,807	5,658	5,765	6,011	6,251	6,306	6,310	6,321	Females	
4,667	5,058	5,366	5,360	5,246	5,373	5,629	5,873	Males	60–74
4,909	5,230	5,472	5,426	5,299	5,420	5,668	5,907	Females	
4,126	4,246	4,330	4,596	4,978	5,279	5,469	5,649	Males	75 and over
5,020	5,155	5,240	5,479	5,806	6,061	6,222	6,378	Females	

Appendix I

Age and sex structure of the projected population, 2006–2056

(e) Wales

thousands

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041	2046	2051	2056
All ages	**Persons**	**2,966**	**3,038**	**3,113**	**3,186**	**3,248**	**3,296**	**3,330**	**3,357**	**3,379**	**3,397**	**3,412**
	Males	**1,445**	**1,487**	**1,530**	**1,570**	**1,603**	**1,628**	**1,646**	**1,661**	**1,675**	**1,687**	**1,698**
	Females	**1,521**	**1,550**	**1,583**	**1,616**	**1,645**	**1,668**	**1,684**	**1,696**	**1,704**	**1,710**	**1,713**
0–4	Males	82	89	92	91	88	86	85	87	88	88	86
	Females	78	85	87	87	84	82	81	83	84	84	82
5–9	Males	88	84	91	93	93	90	87	87	89	90	89
	Females	84	80	87	89	89	86	84	83	85	86	86
10–14	Males	97	90	86	93	95	94	92	89	89	90	91
	Females	92	85	81	89	91	90	87	85	85	86	87
15–19	Males	104	99	92	88	95	97	97	94	92	91	93
	Females	98	94	87	83	91	93	92	90	87	87	88
20–24	Males	99	109	103	96	92	99	101	101	98	95	95
	Females	97	100	96	89	85	93	95	94	91	89	89
25–29	Males	81	97	106	100	93	89	96	98	98	95	93
	Females	81	95	98	93	86	82	90	92	91	89	86
30–34	Males	83	82	98	106	101	93	90	97	99	98	96
	Females	87	83	97	100	95	88	84	92	94	93	91
35–39	Males	98	84	84	99	108	102	95	91	98	100	100
	Females	105	89	86	99	102	98	91	87	94	96	96
40–44	Males	106	100	86	85	101	109	104	97	93	100	102
	Females	111	107	91	88	101	104	100	93	89	96	98
45–49	Males	97	107	101	87	86	101	110	104	98	94	101
	Females	101	112	108	93	89	103	105	101	94	90	98
50–54	Males	91	97	107	101	87	87	102	110	105	98	95
	Females	95	102	113	109	94	91	104	107	102	96	92
55–59	Males	102	92	97	107	101	88	88	102	111	106	99
	Females	105	95	103	113	110	95	92	105	108	104	97
60–64	Males	87	100	90	96	105	100	87	87	101	110	105
	Females	90	104	95	103	113	110	95	92	105	108	104
65–69	Males	71	83	96	87	93	101	97	85	85	99	107
	Females	76	87	101	93	100	110	108	93	91	103	106
70–74	Males	59	65	76	89	81	87	95	91	80	81	94
	Females	67	71	82	96	88	96	106	103	90	88	100
75–79	Males	46	49	56	67	78	72	78	86	82	73	74
	Females	59	59	64	75	88	82	89	98	96	84	82
80–84	Males	31	33	38	45	55	65	60	65	73	70	63
	Females	50	47	49	55	65	77	72	79	87	86	76
85–89	Males	15	19	21	26	32	40	48	45	50	56	55
	Females	30	33	33	37	42	51	61	58	64	72	71
90 and over	Males	5	8	11	14	20	26	35	44	47	52	60
	Females	16	19	22	25	31	39	49	61	66	73	84
0–15	Males	288	282	286	295	295	289	283	281	283	286	285
	Females	273	268	272	282	282	276	271	269	271	273	273
16–29	Males	264	287	284	266	261	267	276	275	270	264	262
	Females	257	272	265	249	244	249	259	258	253	247	246
30–44	Males	287	267	267	291	309	305	288	285	290	299	298
	Females	303	280	274	287	299	290	275	271	277	286	285
45–59	Males	291	295	305	294	274	276	299	317	313	298	295
	Females	301	310	324	315	293	288	301	313	304	290	287
60–74	Males	217	248	262	271	279	288	279	263	267	289	306
	Females	232	262	279	292	302	316	308	289	286	299	310
75 and over	Males	97	109	126	152	185	203	221	240	252	252	252
	Females	155	158	169	192	226	248	271	296	314	315	313

Appendix I

Age and sex structure of the projected population, 2006–2056

(f) Scotland thousands

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041	2046	2051	2056
All ages	**Persons**	**5,117**	**5,206**	**5,270**	**5,326**	**5,363**	**5,374**	**5,361**	**5,335**	**5,297**	**5,249**	**5,194**
	Males	**2,469**	**2,520**	**2,557**	**2,587**	**2,605**	**2,609**	**2,602**	**2,589**	**2,572**	**2,552**	**2,530**
	Females	**2,647**	**2,685**	**2,713**	**2,739**	**2,758**	**2,765**	**2,760**	**2,746**	**2,725**	**2,697**	**2,664**
0–4	Males	137	146	144	141	136	130	127	127	127	125	121
	Females	131	140	138	135	130	125	122	122	122	120	117
5–9	Males	143	139	147	145	142	136	131	128	128	128	126
	Females	136	133	141	139	136	131	126	123	123	123	121
10–14	Males	157	144	139	147	145	142	137	132	129	129	129
	Females	151	137	133	141	140	137	132	126	124	124	123
15–19	Males	169	161	147	142	150	149	146	140	135	132	132
	Females	160	153	139	135	143	142	139	134	128	126	126
20–24	Males	171	181	172	158	153	161	159	156	151	146	143
	Females	168	172	164	149	145	154	152	149	144	139	136
25–29	Males	156	174	182	172	158	154	162	160	157	151	146
	Females	154	172	173	164	150	146	154	152	150	144	139
30–34	Males	154	157	172	179	170	156	151	159	158	155	149
	Females	163	158	173	174	165	151	147	156	154	151	146
35–39	Males	185	154	155	170	178	168	155	150	158	156	153
	Females	200	166	159	174	175	166	152	148	157	155	152
40–44	Males	195	185	153	154	169	177	167	154	150	158	156
	Females	210	200	166	159	175	175	167	153	149	157	156
45–49	Males	183	192	182	150	152	167	174	165	152	148	155
	Females	195	210	200	166	159	174	175	167	152	149	157
50–54	Males	165	180	189	179	148	149	164	172	163	150	146
	Females	171	193	208	198	164	158	173	174	166	152	148
55–59	Males	169	161	176	184	175	145	147	161	169	160	148
	Females	175	168	190	205	195	162	156	171	173	164	151
60–64	Males	135	160	153	167	176	167	139	141	155	163	155
	Females	145	171	164	185	200	191	159	153	168	170	162
65–69	Males	114	124	149	143	157	165	157	131	134	148	155
	Females	130	137	162	157	178	192	184	154	148	163	165
70–74	Males	95	100	111	134	130	143	152	145	122	124	138
	Females	118	120	128	152	148	168	182	175	146	141	156
75–79	Males	70	77	85	95	116	114	126	134	129	109	112
	Females	99	103	107	115	138	135	154	168	162	136	132
80–84	Males	44	49	58	66	76	94	93	104	111	108	92
	Females	75	77	84	90	98	119	117	135	148	143	121
85–89	Males	20	25	31	39	47	55	68	69	78	85	83
	Females	43	49	53	61	68	76	93	93	108	120	117
90 and over	Males	8	10	14	20	29	38	48	61	69	80	91
	Females	25	27	32	39	50	63	75	92	103	120	139
0–15	Males	472	459	457	462	452	438	423	414	410	407	401
	Females	450	438	439	443	434	420	407	398	394	391	386
16–29	Males	463	486	474	444	432	434	438	429	416	403	395
	Females	450	469	449	421	410	414	418	409	397	384	376
30–44	Males	534	495	480	504	516	501	473	464	465	469	459
	Females	573	524	498	507	515	493	466	457	460	463	454
45–59	Males	517	533	546	513	474	461	485	498	483	458	450
	Females	541	571	598	568	518	494	504	512	491	465	457
60–74	Males	343	385	413	444	462	475	448	417	410	435	447
	Females	392	428	454	494	525	551	525	481	463	474	482
75 and over	Males	141	161	188	221	267	299	334	367	387	381	378
	Females	242	256	276	305	355	393	439	489	521	519	509

Appendix I

Age and sex structure of the projected population, 2006–2056

(g) Northern Ireland thousands

Age	Sex	2006 (base)	2011	2016	2021	2026	2031	2036	2041	2046	2051	2056
All ages	**Persons**	**1,742**	**1,812**	**1,868**	**1,922**	**1,966**	**1,999**	**2,023**	**2,043**	**2,059**	**2,070**	**2,074**
	Males	**853**	**890**	**921**	**949**	**972**	**988**	**1,000**	**1,011**	**1,019**	**1,025**	**1,029**
	Females	**888**	**921**	**947**	**973**	**994**	**1,011**	**1,023**	**1,032**	**1,040**	**1,044**	**1,045**
0–4	Males	57	62	63	63	60	58	57	58	59	59	57
	Females	55	59	60	60	58	55	55	56	56	56	55
5–9	Males	60	58	62	63	63	61	58	57	58	59	59
	Females	57	55	60	61	61	58	56	55	56	57	57
10–14	Males	64	61	58	62	64	63	61	58	57	58	59
	Females	61	57	55	60	61	61	58	56	55	56	57
15–19	Males	67	64	61	58	62	64	63	61	58	57	58
	Females	64	60	56	54	59	60	60	57	55	54	55
20–24	Males	65	68	64	60	58	62	63	63	61	58	57
	Females	62	63	58	54	52	56	57	57	55	52	52
25–29	Males	56	68	69	65	61	59	63	64	64	62	59
	Females	56	67	65	60	56	55	59	60	60	57	55
30–34	Males	58	57	67	69	64	61	59	63	64	64	61
	Females	59	59	68	66	61	57	56	60	61	61	58
35–39	Males	63	58	57	68	69	65	61	59	63	64	64
	Females	66	61	59	69	67	62	58	56	61	62	61
40–44	Males	63	63	58	56	67	68	64	60	58	62	63
	Females	66	66	60	59	68	67	62	58	56	60	62
45–49	Males	57	62	62	57	55	66	67	63	59	57	61
	Females	60	66	65	60	59	68	66	61	57	56	60
50–54	Males	51	56	61	61	56	54	65	66	62	59	56
	Females	51	60	65	65	59	58	67	66	61	57	55
55–59	Males	48	50	55	60	59	54	53	63	64	61	58
	Females	49	50	59	64	64	58	57	66	65	60	56
60–64	Males	42	45	48	53	57	57	52	51	61	62	59
	Females	45	48	49	57	63	62	57	56	65	64	59
65–69	Males	33	39	43	45	50	55	54	50	49	59	60
	Females	37	43	46	47	55	61	60	55	55	63	62
70–74	Males	27	30	36	39	42	46	51	51	47	46	55
	Females	33	34	40	44	45	52	58	58	53	52	61
75–79	Males	20	22	26	31	35	37	41	46	46	42	42
	Females	29	29	31	37	40	41	49	54	54	50	49
80–84	Males	13	15	17	21	26	29	31	35	39	39	37
	Females	22	23	24	27	32	35	36	43	48	49	45
85–89	Males	6	8	9	12	15	19	21	23	27	30	31
	Females	12	15	16	18	21	25	28	29	35	40	40
90 and over	Males	2	3	4	6	9	12	16	20	23	27	32
	Females	6	7	10	12	15	19	24	29	32	39	45
0–15	Males	195	193	195	200	200	194	188	185	186	188	187
	Females	185	184	186	192	191	186	180	178	178	180	180
16–29	Males	175	187	182	172	169	172	177	176	171	165	163
	Females	169	178	168	157	155	159	164	163	158	153	150
30–44	Males	184	178	182	192	200	193	183	182	185	190	188
	Females	191	185	188	194	196	185	175	174	178	183	181
45–59	Males	156	169	178	177	170	174	184	192	186	176	175
	Females	160	175	189	189	182	185	191	193	183	173	172
60–74	Males	102	115	126	137	149	158	157	152	157	167	174
	Females	114	125	135	148	162	175	175	169	173	179	182
75 and over	Males	41	47	57	70	84	97	110	124	134	139	141
	Females	69	74	81	94	108	121	137	155	170	177	180

Appendix II

Projected components of population change, 2006–2056 (annual averages)

thousands

	2006 –2011	2011 –2016	2016 –2021	2021 –2026	2026 –2031	2031 –2036	2036 –2041	2041 –2046	2046 –2051	2051 –2056
United Kingdom										
Population at start	60,587	62,761	64,975	67,191	69,260	71,100	72,747	74,306	75,810	77,236
Births	780	799	805	796	788	797	822	844	852	853
Deaths	565	549	552	573	610	657	701	733	757	777
Natural change	215	250	253	224	178	139	122	111	95	76
Net migration	220	193	190	190	190	190	190	190	190	190
Total change	435	443	443	414	368	329	312	301	285	266
Population at end	62,761	64,975	67,191	69,260	71,100	72,747	74,306	75,810	77,236	78,564
Great Britain										
Population at start	58,846	60,950	63,107	65,269	67,294	69,101	70,724	72,263	73,751	75,166
Births	756	775	780	773	766	775	800	821	829	830
Deaths	551	535	537	557	594	639	681	713	736	755
Natural change	205	239	243	215	172	135	118	108	93	75
Net migration	216	192	190	190	190	190	190	190	190	190
Total change	421	432	432	405	361	325	308	298	283	265
Population at end	60,950	63,107	65,269	67,294	69,101	70,724	72,263	73,751	75,166	76,490
England & Wales										
Population at start	53,729	55,744	57,837	59,943	61,931	63,727	65,363	66,928	68,454	69,917
Births	699	718	725	720	715	725	750	772	781	783
Deaths	497	483	485	503	536	579	618	647	669	688
Natural change	202	235	240	217	178	146	132	124	112	95
Net migration	201	184	181	181	181	181	181	181	181	181
Total change	403	419	421	398	359	327	313	305	293	276
Population at end	55,744	57,837	59,943	61,931	63,727	65,363	66,928	68,454	69,917	71,297
England										
Population at start	50,763	52,706	54,724	56,757	58,682	60,432	62,033	63,571	65,075	66,519
Births	664	683	690	685	682	692	716	737	747	749
Deaths	466	453	455	472	503	543	580	608	629	648
Natural change	198	230	235	214	178	149	136	129	117	102
Net migration	191	174	172	172	172	172	172	172	172	172
Total change	389	404	407	385	350	320	308	301	289	273
Population at end	52,706	54,724	56,757	58,682	60,432	62,033	63,571	65,075	66,519	67,885
Wales										
Population at start	2,966	3,038	3,113	3,186	3,248	3,296	3,330	3,357	3,379	3,397
Births	35	36	35	34	33	33	34	34	34	33
Deaths	31	30	30	31	33	36	38	39	40	40
Natural change	4	5	5	3	0	-3	-4	-5	-6	-7
Net migration	11	10	10	10	10	10	10	10	10	10
Total change	14	15	15	13	9	7	5	4	4	3
Population at end	3,038	3,113	3,186	3,248	3,296	3,330	3,357	3,379	3,397	3,412
Scotland										
Population at start	5,117	5,206	5,270	5,326	5,363	5,374	5,361	5,335	5,297	5,249
Births	57	56	55	53	51	50	50	50	49	48
Deaths	54	52	53	54	57	61	64	66	67	67
Natural change	3	4	3	-1	-6	-11	-14	-16	-18	-20
Net migration	15	9	9	9	9	9	9	9	9	9
Total change	18	13	11	7	2	-2	-5	-8	-10	-11
Population at end	5,206	5,270	5,326	5,363	5,374	5,361	5,335	5,297	5,249	5,194
Northern Ireland										
Population at start	1,742	1,812	1,868	1,922	1,966	1,999	2,023	2,043	2,059	2,070
Births	24	25	25	24	23	22	23	23	23	22
Deaths	14	14	14	15	16	18	19	20	21	22
Natural change	10	11	10	8	6	4	3	3	2	0
Net migration	4	1	1	1	1	1	1	1	1	1
Total change	14	11	11	9	7	5	4	3	2	1
Population at end	1,812	1,868	1,922	1,966	1,999	2,023	2,043	2,059	2,070	2,074

Appendix III

National population projections expert advisory group

Notes of meeting held on 16 March 2007

Location: Office for National Statistics (ONS),
1 Drummond Gate, London

Expert group

Professor David Coleman, University of Oxford

John Hollis, Greater London Authority

Professor Mike Murphy, London School of Economics

Professor Phil Rees, University of Leeds

Professor John Salt, University College London

Professor Robert Wright, University of Strathclyde

ONS Centre for Demography attendees

Guy Goodwin, Co-Director, ONSCD

Peter Goldblatt, Co-Director, ONSCD

Chris Shaw, National Population Projections Branch

Adrian Gallop, National Population Projections Branch

Julie Jefferies, Fertility Analysis Unit

Mita Saha, National Population Projections Branch

Observers

Kirsty MacLachlan, General Register Office for Scotland (GROS)

Cecilia MacIntyre, GROS

Robert Beatty, Northern Ireland Statistics and Research Agency (NISRA)

Emma Arnell-Smith, National Assembly for Wales (NAW)

Patrick Collier, Home Office

1. Introduction

1.1. Guy Goodwin welcomed everyone on behalf of the Office for National Statistics (ONS) and gave a brief introduction. Chris Shaw then gave a more detailed explanation of the purpose of the expert group and outlined the timetable for the assumption setting and consultation process for the 2006-based population projections.

1.2. The expert meeting is now considered to be an integral part of the national population projections assumption setting process. The main aim of this meeting was to have an informed discussion about the long-term assumptions for the forthcoming UK-level population projections. A separate consultation process exists for each of the four constituent countries of the UK.

1.3. The role of the expert panel is strictly advisory. It was emphasised that ONS was not seeking a consensus where none exists and wanted to hear the full range of views on the key assumptions. Though all opinions would be considered, the final decision on the assumptions to be adopted for the next set of projections rests with ONS and the Registrars General.

1.4. This was the second meeting of the expert advisory panel. The first meeting had taken place in 2005 prior to the production of the 2004-based national population projections and was judged to have been an extremely useful exercise. For example, it helped to inform a major change on long-term mortality improvement and brought the issue of the impact of migration on future fertility trends to the fore. It was expected that some comments from this meeting could be fed into the immediate consultation process for the 2006-based projections, while other opinions might need to be considered over a longer timeframe.

1.5. The 2006-based population projections are scheduled for publication in late October 2007. The headline assumptions will be pre-announced in *Population Trends*[1] in September 2007.

1.6. ONS would give introductory presentations on each of the three assumption sets – fertility, mortality and migration, after which the floor would be opened up for general discussion. A questionnaire on the assumptions had been sent to all of the experts before the meeting. It was planned that the questionnaire results would be published in the summer together with the notes of this meeting in order to help inform the individual country consultations.[2]

2. Fertility

2.1. Introduction

2.1.1. Julie Jefferies' fertility presentation began by looking at recent trends in fertility. She illustrated how the UK Total Fertility Rate (TFR) had hit a low of 1.63 in 2001 but has been recovering steadily ever since, reaching 1.79 in 2005. This raises the question of whether the recent TFR upturn is the start of a sustained increase in fertility or just a temporary phenomenon. The actual TFR exceeded that of the 2004-based projected value for 2005 of 1.77. Evidence from the first three quarters of 2006 suggests it is also likely to exceed the projected 2006 value.

2.1.2. Within the European Union (EU), countries such as France, Denmark and Sweden have shown a similar increase in recent years, though it is worth noting that the UK has seen one of the fastest increases during this period. However, this increase isn't apparent in all EU countries. In the Netherlands and Germany, for example, the TFR has fluctuated. In the Republic of Ireland, the TFR has shown a steady increase from 2001 to 2004, but provisional 2005 data indicates a decline. This provides a reminder that we ought to be cautious in assuming that increases will continue.

2.1.3. With reference to age-specific fertility rates in the UK, it was shown that there have been continued increases since the mid-1970s for women in their thirties and forties, whereas rates have been declining steadily since 1980 for women in their twenties. However, in the last three years there has been a recovery in rates for women aged 25–29 and a bottoming out of the falling rates for 20–24 year olds, which may possibly be signalling a slowing down in the postponement of fertility.

2.1.4. In terms of cohort fertility, the increases in age-specific fertility rates since 2001 are not yet sufficient to have had any significant impact on achieved family size. The 2004-based projections assumed that Completed Family Size (CFS) would continue to fall. With reference to achieved family size, evidence for women born from 1940 to 1975 in England & Wales shows a steady decline at each age. There are indications, however, that women born in 1980 are displaying a similar pattern to women born in 1975, which suggests that the decline in family size from cohort to cohort could be stopping.

2.1.5. The second half of Julie's presentation focused on the impact of international migration on fertility. At the 2005 expert group meeting, the panel had noted that almost all the standard explanations for low fertility might be expected to continue to influence rates down rather than up. However, the impact of immigration and the consequential increase in the ethnic minority population was mentioned as one significant factor which could possibly cause UK rates to rise.

2.1.6. Over the last decade, 1.7 million women of childbearing age have arrived to live in the UK compared to 1.1 million who left. Whereas in 1995, some 12.6 per cent of births in England & Wales were to non UK-born mothers, by 2005 the figure had risen to 20.8 per cent. The largest numbers of births to non UK-born mothers are to women born in the Asian sub-continent. More recently, the proportion of births to mothers from the EU accession (A8) countries has risen. However, in 2005 just 1 per cent of births could be attributed to women from A8 countries, compared to 5.4 per cent from Pakistan, India and Bangladesh.

2.1.7. If international migration was the major factor influencing the upward trend in fertility, we might expect areas with high levels of in-migration, such as London, to have above average fertility rates. However, though London had by far the highest proportion of births to mothers born outside the UK – 51 per cent in 2005 – its TFR and recent growth in TFR are below the average for England. This suggests that migration is just one of several processes influencing the increasing fertility rate.

2.1.8. The two key mechanisms by which migration may have an impact on fertility were then discussed. The first is the effect of net in-migration on the size and age composition of the female population at childbearing age. Based on some preliminary research, it was suggested that net migration is cancelling out the decline in births that would otherwise have occurred due to the ageing on of the population.

2.1.9. The second mechanism is the effect of migration on fertility rates. Cohort fertility rates will be affected if there are differences in eventual completed family

size between in-migrants, out-migrants and the non-migrant population. There may also be differences in fertility rates between different in-migrant groups. Here, it was demonstrated that there are clear differences in TFRs in England & Wales between women born in different countries. Provisional estimates based on birth registrations and Labour Force Survey (LFS) data show, for example, that women born in Bangladesh and Pakistan combined had the highest TFR in 2005 – 4.9, compared to 1.6 for UK-born women. Focusing on the recent upturn in fertility rates, LFS estimates suggest that from 2002 to 2005, the TFR increased from 1.5 to 1.6 for UK-born women but faster for non UK-born women – from 2.3 to 2.6. In addition, migration may have an effect on the timing of childbearing for migrants and this may have an impact on period fertility.

2.1.10. By using General Household Survey (GHS) data on intended fertility, it was shown that non UK-born women intend to have larger families than UK-born women. It was noted, however, that the women born outside the UK are far from a homogeneous group, with women from Pakistan standing out in particular as intending to have considerably larger numbers of children than the foreign-born as a whole.

2.1.11. Finally, the question of whether second generation migrant fertility is converging towards that of the indigenous population was discussed. Census data suggests that the TFR for women living in England & Wales and born in Pakistan, for example, was 4.7 in 2001. Work carried out for experimental population estimates by ethnic group, based on 2001 Census data, estimated the TFR for all women of Pakistani ethnic origin (including the UK-born second generation) to be much lower – 2.9 in 2002. This supports the idea of convergence, although patterns differ for other groups and further research on this area is required.

2.2. Discussion

2.2.1. Discussing the recent rise in fertility rates, the experts were cautious about whether it heralded a long-term change. As one panel member noted, there is not enough information at present to determine if this upswing is just a blip, or something more significant. It was argued that while the rise in TFR will inevitably be reflected in cohort fertility, the size of the impact could not yet be assessed. It was noted that after a comparable rise in the late 1970s, rates then fell. One expert felt that fertility rates would drop back in the future, and pointed out that the rise in fertility rates was happening in each of the constituent countries of the UK, suggestive of a period effect.

2.2.2. There was some discussion of how fertility is affected by different forces. The increasing numbers of women in higher education mirroring the decline in fertility in the 20-24 year age group was noted, as was the link with economic cycles and the possible effect of the provision of pre-school child care. One panel member argued that there was no evidence to date that policy intervention has any effect on childbearing. It was also noted that LFS data suggests that increased numbers of young women from ethnic minorities are becoming involved in the workforce.

2.2.3. One of the panel members questioned whether there was scope to investigate past intentions on childbearing in relation to actual behaviour. It was also noted that the UK is not an isolated case within the EU with regard to the recent rise in fertility, and there was some suggestion that we should look to France which seems to be leading the way in this trend.

2.2.4. In terms of assessing the impact of migration and ethnicity on fertility, one panel member suggested that there was evidence that some ethnic groups, such as the Chinese and East African Asians, were 'over-converging', while for others, such as women from Somalia and Pakistan, there were cultural and religious barriers which may prevent them assimilating to UK-born levels. The impact of A8 migration, it was argued, may also prove to be quite complex. It was also noted that ONS is currently working with City University on a project to link birth notifications (that contain information on ethnicity) with registrations data.

2.2.5. It was noted that it is also important to determine what is driving up fertility rates of UK-born women. Of the increase at older ages, there is a need to determine how much is due to catching up related to the postponement of childbearing and how much is just due to higher completed family size. The impact of childlessness was also raised as a vital component to consider.

2.2.6. Chris noted that, in their questionnaire responses, the experts generally did not anticipate much change from current fertility levels.

3. Mortality

3.1. Introduction

3.1.1. Adrian Gallop's mortality presentation began by illustrating the trend of increasing period life expectancy from 1850 to the present day. In particular, it was noted that life expectancy at birth improved especially rapidly during the first half of the 20th century, since when the rate of increase has slowed. In contrast, period expectation of life at age 65 has seen steeper increases in the latter half of the 20th century. Female life expectancy at age 65 has seen a fairly steady linear increase. Male expectation of life at 65 lagged someway behind females in the 1950s to 1970s, although it now appears to be catching up.

3.1.2. The UK mortality projections involve estimating trend rates of mortality improvement by age and gender for the base year of the projections, setting target rates of mortality improvement for a target year and then making assumptions on the method and speed of convergence from the current improvement rates to the target rates and thereafter. In considering age-specific mortality rate improvement, the 'golden cohort' effect was illustrated with the use of lexis diagrams which showed the annual improvement in age-specific mortality rates since the 1960s. Peak levels of mortality improvement appear to be a special feature of the generations born between 1923 and 1940 (centred on the generation born around 1931). It was explained that the current mortality projections methodology involves projecting rates by cohort for older generations, but by age for younger generations where there is no evidence of a cohort effect taking place.

3.1.3. There are a large number of potential drivers for future mortality change, such as reduced deprivation, better housing, government support for improving health, medical advances, a decline in smoking, increased obesity, the emergence of new diseases and re-emergence of old ones, environmental change and so on. The dramatic linear decline in deaths due to circulatory diseases over the last few decades was noted, as were the persistent differentials in life expectancy by social class.

3.1.4. Finally, life expectancy trends were examined within an international context. It was shown that within many developed countries, male to female life expectancy differentials appear to be falling. It was also shown that UK female life expectancy at birth does not rank as well as UK male life expectancy at birth in the international league table.

3.2. Discussion

3.2.1. Firstly, the reasons for the marked mortality improvement among the 'golden generation' were discussed. It has been suggested that factors may include improved diet, the introduction of the NHS and the decline in smoking, but no-one knows for certain. Mortality improvement for this generation is now driving improvements in overall life expectancy, but as this cohort diminishes in size, so its influence on overall mortality measures will decline. However, two members of the expert panel expressed scepticism over the significance of the cohort effect. One argued that the cohort effect was in fact much less important than it appeared, and could not see a significant effect on life expectancy. It was also pointed out that though the male and female historical smoking trends differ, the mortality improvement graphs for males and females display similar patterns.

3.2.2. There was also some discussion of two sets of issues which may influence future mortality. The first set related to health and lifestyle factors, most significantly the impact of obesity, particularly in relation to younger cohorts. The second set of issues related more directly towards the older generations, and whether improved healthcare can continue to spur on life expectancy increases.

3.2.3. Despite the improvement in mortality rates, one expert commented that maximum life expectancies did not seem to be rising much. However, there is a lack of robust data for the oldest ages, and there was some question about what would happen to death rates at the very oldest ages when the numbers increase. While over time we are witnessing a rectangularisation of the life table curve, there is currently nothing in the data to suggest whether or not there may be a limit to life.

3.2.4. In terms of possible convergence between the

sexes, one expert thought that this was likely to continue due to the convergence of types of work, for example with the transition from manual to non-manual labour for males, as well as a convergence of lifestyles. Another expert questioned whether this convergence was being driven by males or females. In reference to social class differentials, it was argued that convergence was unlikely, but that it was important to note the underlying upward social mobility of the population. It was again suggested that we should look to the experience of other countries such as France, who are ahead of the UK in the life expectancy league tables.

3.2.5. Chris noted that, in their questionnaire responses, the experts generally appeared to expect that life expectancy will continue to increase linearly, as it had done over the past 25 years. This means that the expert group are far more optimistic than the 2004-based assumption of 1 per cent per annum long-term mortality rate improvement. Chris speculated that annual mortality improvement would need to be around 2 per cent in order to achieve the life expectancy improvements suggested by the expert panel. One panel member noted that the actuarial profession had the tendency to be too pessimistic, always wanting to 'bend the curve down'.

4. Migration

4.1. Introduction

4.1.1. Chris Shaw's migration presentation began with an illustration of international UK migration trends from 1991 to 2005. Net migration levels were shown to have reached a record high in 2004 at over 220,000, falling to 185,000 in 2005. This compares to the long-term net migration assumption of 145,000 per annum in the 2004-based projections.

4.1.2. In terms of UK net international migration by citizenship, it was shown that for non-British citizens there was an increasing net inflow, reaching nearly 300,000 in 2005 compared to an increasing net outflow of British citizens which had reached around 100,000 in 2005. The corresponding gross flows show non-British inflows increasing to around 500,000 in 2005, whereas British inflows have remained fairly steady at around 100,000. Both British and non-British outflows had reached around 200,000 in 2005.

4.1.3. With reference to net migration by country of last residence, the largest proportion of migrants in 2004 came from the New Commonwealth (over 120,000) followed by those in the Other Foreign category. Migration from the EU and the Old Commonwealth has fluctuated around net zero in recent years. An analysis of UK net migration by motive showed fluctuation in the key categories of study, work and family, but an overall increasing trend in each category in the 1991 to 2004 period.

4.1.4. The drivers for migration change include an ageing population giving rise to gaps in the labour market and rising dependency ratios, a large potential supply of new immigrants (although this could also lead to more restrictive policies) and the strength of the UK economy. However, the 2004-based projections assume continued high migration levels indefinitely, even though these had never been experienced in the UK up to a few years ago. It was asked if this was a reasonable assumption to make, or were we risking a repeat of the 'baby boom' errors of the 1960s?

4.1.5. It was noted that at the previous expert meeting, the extra migration associated with EU expansion was viewed as a short-term phenomenon. Were the expert group still of this opinion, and if so at what point would it tail off? The next projections would also need to consider the impact of Bulgaria and Romania entering the EU.

4.2. Discussion

4.2.1. The discussion began with comments about the problems of migration definition and duration of stay. In particular, the difference between the UN definition of a migrant which is based on 'usual residence' for at least 12 months and short-term migration was raised. There were also several comments made about the lack of adequate emigration data.

4.2.2. One expert member commented on how asylum had made a huge contribution to Total International Migration (TIM) during the 1990s, but that now visitors switching status to migrants was a more important factor. It was argued it is important to look at the individual components of TIM and that it would be useful to disaggregate

migration flows by motive. Another member suggested it would be helpful to break down the data by migrants from countries that have free entry to the UK and those that don't.

4.2.3. Some experts disputed that the ageing population would be a main driver in determining future migration changes. One panel member thought the marriage market and demand from further education would be more important.

4.2.4. EU accession was viewed as a critical factor, and the recent influx of migrants from Poland was discussed. One expert argued that the recent wave of Polish immigration to the UK could in part be explained by the restrictions imposed in Germany. Another expert suggested that there was some evidence that in the long-term, Poles were returning back to their country. The experts generally felt that the UK would not experience a large second wave of EU migration, as migrants from Romania and Bulgaria were more likely to go elsewhere, particularly with a points based entry system and restrictions to work and free movement. One expert, however, suggested that the entry of Turkey into the EU, with its large population and young age structure, may have a significant impact in future years, as might the entry of countries such as Ukraine and Moldova. It was generally thought that it was still too soon after the 2004 accession to establish a stable pattern of EU migration.

4.2.5. Lastly, there was a brief discussion on a methodological issue. Currently, and for the 2006-based projections, assumptions about future migration are based on numbers. The question was raised whether it would be better to compile and apply the migration assumptions by using rates which may be theoretically better than using numbers. It was noted, however, that a constant rate assumption with a rising population would probably imply an increase in emigrants and thus a decrease in net migration. The suggestion that the use of rates may possibly lead to implausible results which buck recent trends, meant that several of the experts argued that it may be unwise to make such a switch.

4.2.6. Overall, the experts seemed to think that while future migration numbers may drop back from recent high levels, the long-term flows are likely to be significantly higher than those assumed in the 2004-based projections. However, it was acknowledged that future migration patterns are extremely difficult to predict. One expert stressed the need to highlight the variant migration assumptions. The experts also seemed to support a simple long-term constant assumption, as this reflects our lack of knowledge and there isn't the justification to do anything else.

5. Conclusion

5.1. Both ONS and the expert panel members commented that they found the meeting to be a useful exercise. However, one expert suggested that the results of the advance questionnaire should be circulated before the meeting and the meeting structured around it.

References

1 Report: 2006-based population projections: underlying long-term assumptions. *Population Trends* **129**, pp 83–84.

2 Annex A: Summary of responses to Expert Group questionnaire.

Annex A

Summary of responses to Expert Group questionnaire

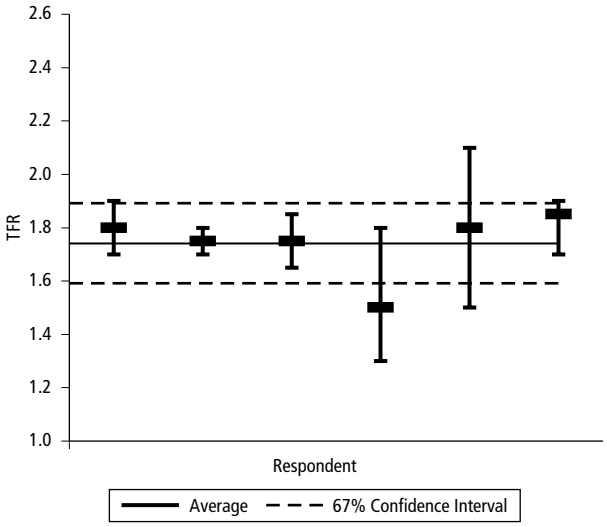
(i) Headline indicators

The expert group completed a questionnaire where they were asked what they thought were the most likely future levels of fertility, life expectancy and migration. The group's views on the most likely levels of the total fertility rate, period life expectancy at birth and total net migration to the UK (and associated 67% confidence intervals) in the years 2010 and 2030 are shown below.

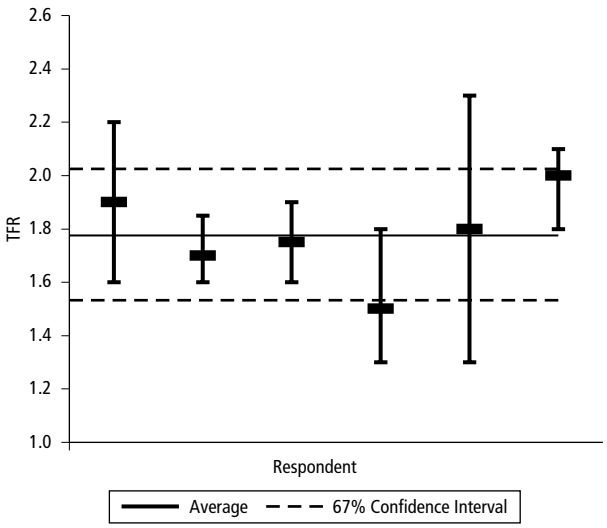
Responses on fertility assumptions

Total fertility rate (TFR)

Respondents' estimates of the TFR in 2010



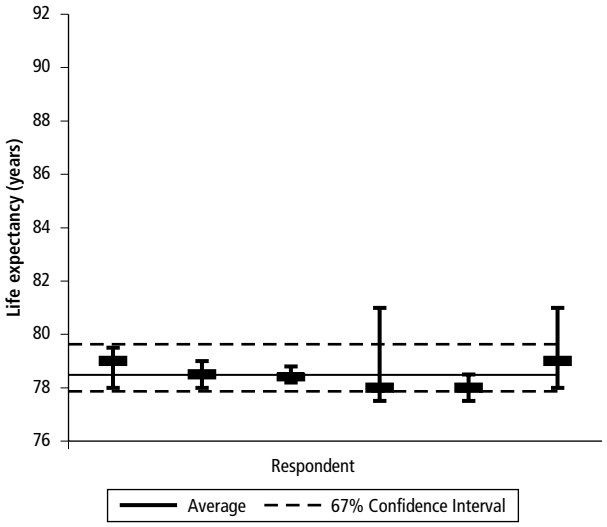
Respondents' estimates of the TFR in 2030



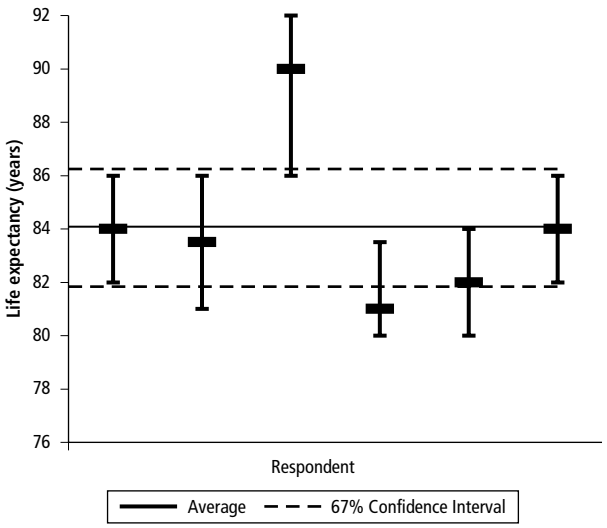
Responses on mortality assumptions

Period life expectancy at birth, males

Respondents' estimates of period EOL(0) in 2010, males



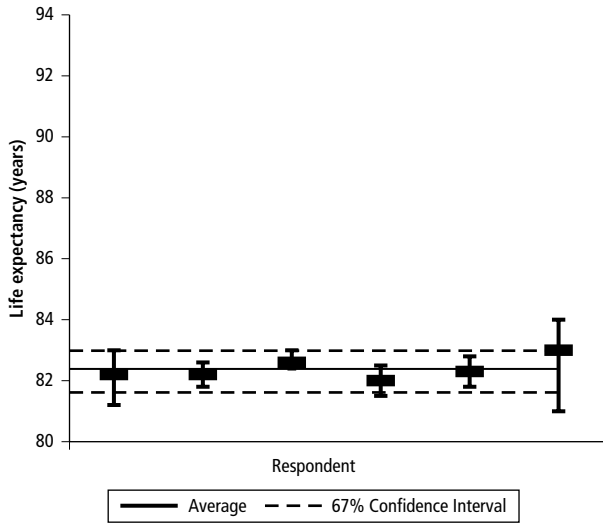
Respondents' estimates of period EOL(0) in 2030, males



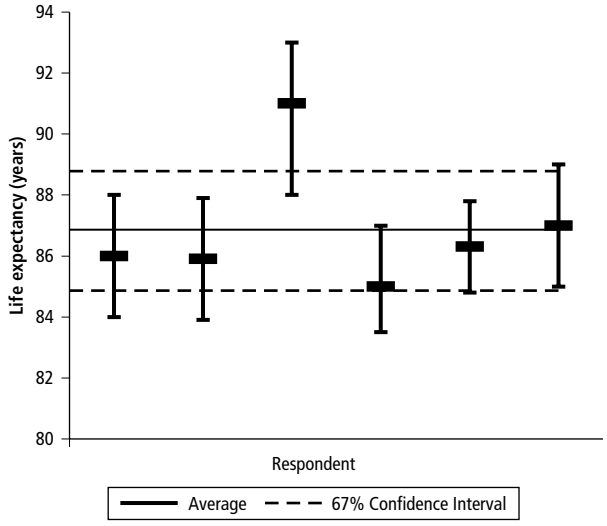
Responses on mortality assumptions

Period life expectancy at birth, females

Respondents' estimates of period life expectancy for females in 2010



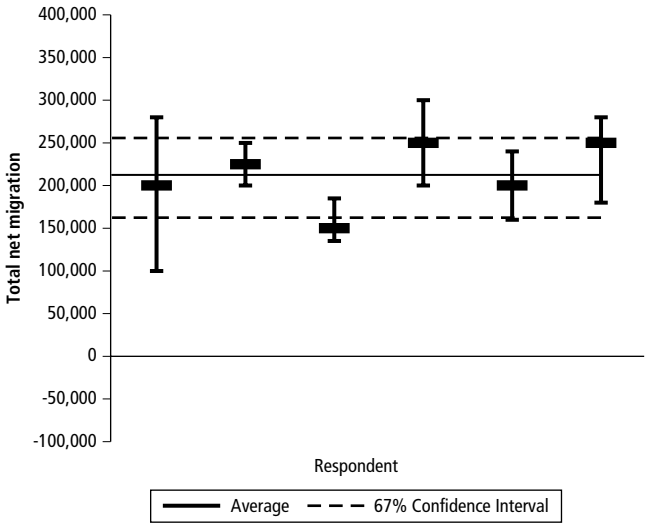
Respondents' estimates of period life expectancy for females in 2030



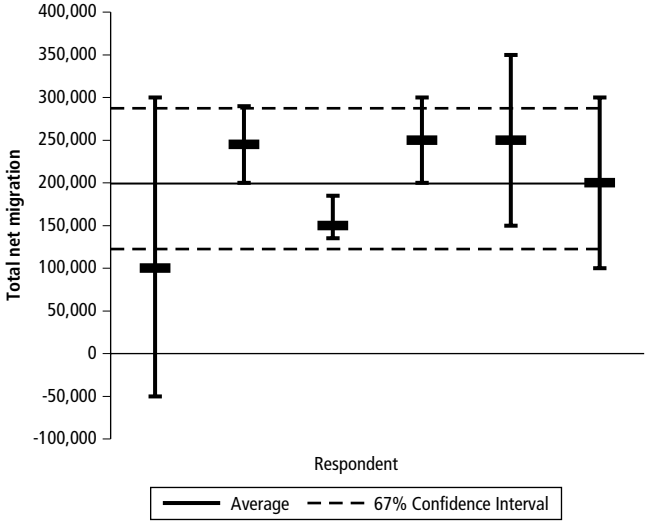
Responses on migration assumptions

Annual net migration

Respondents' estimates of total net migration in 2010



Respondents' estimates of total net migration in 2030



(ii) Influences on future trends

The panel were also asked for their views on the validity and importance of a wide range of arguments which might be thought likely to influence future fertility, mortality and migration trends. This part of the questionnaire was devised by the International Institute for Applied Systems Analysis (IIASA) in Vienna and was adapted by ONS for use in the UK. The following list shows factors that were considered to be valid by the majority of the panel *and* were considered to have the potential to impact on future levels.

Fertility

Factors that could have an *upwards* impact on fertility:

- Increasing social acceptability of having children at older ages
- Government being likely to improve financial support for children through child subsidies and tax benefits
- Increases in union dissolution and re-formation leading to additional children in new partnerships
- Medically assisted conceptions solving more fecundity problems in future

Factors that could have a *downwards* impact on fertility:

- Family formation being postponed due to time spent in education
- Fewer grandmothers available to help with childcare (due to increased female labour force participation and increasing retirement age)
- Women delaying pregnancy to older ages where there is a higher risk of not getting pregnant
- Decreasing proportion of unplanned births due to improvements in contraception.
- Convergence in fertility rates of ethnic minority women resident in the UK with fertility rates of indigenous women

Mortality

Factors that could have an *upwards* impact on life expectancy:

- Greater understanding of bio-medical ageing processes leading to the development of effective anti-ageing strategies
- Breakthroughs in the understanding of carcinogenic processes leading to reduced mortality from cancer
- Medical advances leading to previously life-threatening diseases becoming containable
- Progress in preventive medicine
- Better information about health
- A continued decrease in smoking prevalence
- Effective and easily affordable new technologies

Factors that could *diminish or reverse* increases in life expectancy:

- Increasing drug resistance to known infectious diseases
- Negative impact on health of increased stress levels
- Majority of immigration will be from countries with higher mortality than UK

Migration

Factors that could have an *upwards* impact on net migration:

- Likelihood of increasing migration to and from the UK for work related, family reunification/formation and education reasons
- High population growth in developing countries
- Population ageing in the UK
- The relative attractiveness of the UK as a country of destination (for economic and other reasons)
- With increasing globalisation, the increasing ease of movement from one country to another

Factors that could have a *downwards* impact on net migration:

- Increases in retirement emigration from the UK
- The likelihood of new EU countries and developing countries 'catching-up' in terms of economic growth
- Problems with integration leading to more restrictive immigration policies

Further details

Full details of the results of the expert group questionnaire are available from ONS on request.