APPENDICES

Appendix 1

Membership of Expert Group

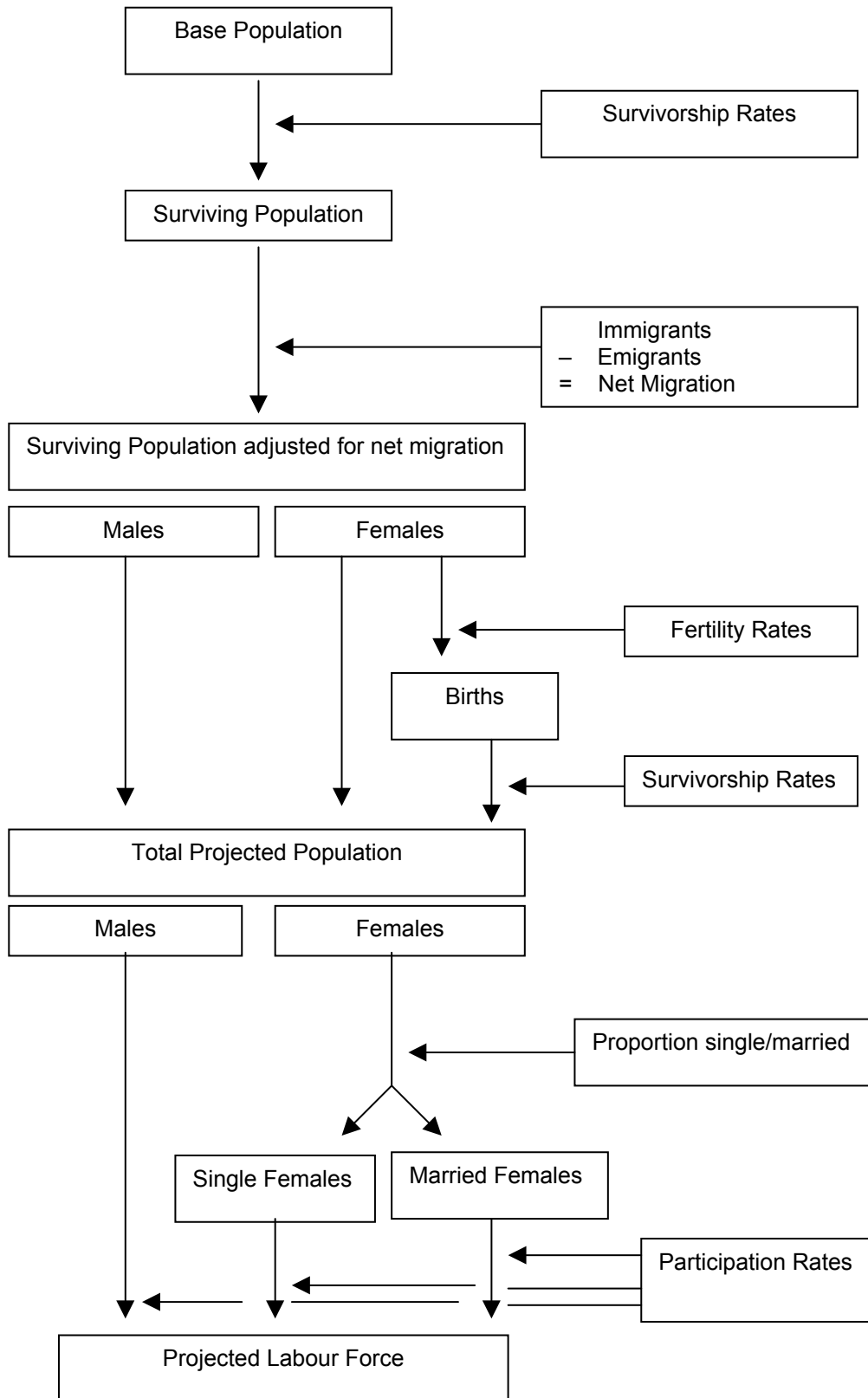|	
Aidan Punch Chairperson	Central Statistics Office
Padraig Dalton	Central Statistics Office
Deirdre Cullen	Central Statistics Office
Kieran Walsh	Central Statistics Office
Joseph Keating	Central Statistics Office
Helen Cahill Secretary	Central Statistics Office
Tom Healy	Department of Education and Science
Máire O'Mahony	Department of Environment and Local Government
Bruce McCormack	Department of Environment and Local Government
Niall Cussen	Department of Environment and Local Government
Loretta O'Sullivan	Department of Finance
Hugh Magee	Department of Health and Children
Paul Morrin	Department of Social, Community and Family Affairs
Aedan Hall	Department of the Taoiseach
Damien Courtney	Cork Institute of Technology
Brian Hughes	Dublin Institute of Technology
Edgar Morgenroth	Economic and Social Research Institute
Adele Bergin	Economic and Social Research Institute
Jim Walsh	National University of Ireland, Maynooth
William Hynes	University College Dublin
Brendan Walsh	University College Dublin
Shane Whelan	University College Dublin

Appendix 2

Description of population and labour force projection model
2006 - 2041

Projections of the population have been compiled on an annual basis up to 2041. The model used is the demographic component method which projects the base 2006 population forward under the chosen assumptions governing births, deaths and net migration. This is illustrated graphically in Figure A.

The 2006 Census of Population data are first disaggregated by age and sex. The death and gross migration rates which these groups are assumed to experience in the following year are then applied. The assumed fertility rates are applied to the female population aged 15-49. The population projected in this way then becomes the base population for the following year. The whole procedure is repeated.

One hundred different single year age groups are distinguished (0-1 to 99+) for both males and females. After the base population is aged a year the appropriate survivorship ratios (see Appendix 3) are applied to it. Next the assumed migration effects are included. The assumed outward and inward flows are broken down by age and sex on the basis of the distributions estimated for the inter-censal period 2002-2006. This yields the surviving population adjusted for net migration but without an estimate of the number of children born in the year. The age specific fertility rates for the projection year are applied to the projected female population to estimate the projected births. These births are then divided into males and females on the basis of the ratios experienced for recent years. The appropriate survivorship ratios are then applied to male and female births before these are added in to yield the total projected population.

The assumed labour force participation rates are applied to the projected population aged 15 years and over to give the projected labour force.

Figure A

Diagram of population and labour force projection model

```
┌─────────────────────┐
│   Base Population    │
└─────────────────────┘
           │                        ┌─────────────────────┐
           │ ◄──────────────────────│ Survivorship Rates  │
           ▼                        └─────────────────────┘
┌─────────────────────┐
│ Surviving Population │
└─────────────────────┘
           │                        ┌─────────────────────┐
           │                        │    Immigrants       │
           │ ◄──────────────────────│  −  Emigrants       │
           ▼                        │  =  Net Migration   │
┌───────────────────────────────────────────┐
│ Surviving Population adjusted for net migration │
└───────────────────────────────────────────┘
┌─────────────┐   ┌─────────────┐
│    Males    │   │   Females   │
└─────────────┘   └─────────────┘
      │               │    │              ┌─────────────────┐
      │               │    │ ◄────────────│ Fertility Rates │
      │               │    ▼              └─────────────────┘
      │               │  ┌────────┐
      │               │  │ Births │       ┌─────────────────────┐
      │               │  └────────┘  ◄────│ Survivorship Rates  │
      ▼               ▼     ▼             └─────────────────────┘
┌───────────────────────────────────────────┐
│        Total Projected Population          │
└───────────────────────────────────────────┘
┌─────────────┐   ┌─────────────┐
│    Males    │   │   Females   │
└─────────────┘   └─────────────┘
      │               │               ┌──────────────────────────┐
      │               │ ◄─────────────│ Proportion single/married│
      │            ┌──┴──┐            └──────────────────────────┘
      │            ▼     ▼
      │    ┌──────────────┐ ┌────────────────┐
      │    │Single Females│ │ Married Females│
      │    └──────────────┘ └────────────────┘
      │          │                 │         ┌──────────────────┐
      │          │                 │ ◄───────│Participation Rates│
      ▼          ▼                 ▼         └──────────────────┘
┌───────────────────────────────────────────┐
│           Projected Labour Force           │
└───────────────────────────────────────────┘
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Appendix 3

Glossary of technical terms

Age specific fertility rate: The age specific fertility rate for a particular age group is the number of live births to women in that age group per 1,000 females in the same age group.

Labour force participation rate: The number of persons at work or unemployed (either looking for first regular job or having lost or given up previous job) in a particular age group expressed as a percentage of all persons in that age group.

Life expectancy: The average number of additional years a person would live if current mortality trends were to continue. The expectation of life at birth represents the mean length of life of individuals who are subjected since birth to current mortality trends. Life expectancy is usually compiled on the basis of a life table showing the probability of dying at each age for a given population according to the age specific death rates prevailing in a given period.

Net Migration: The net effect of immigration and emigration. A positive entry denotes that inward migration exceeds outward migration and vice-versa.

Old dependency ratio: The population aged 65 years and over expressed as a percentage of the population aged 15-64 years.

Survivorship ratio: The survivorship ratio at age x, S_x, is calculated as

$$S_x = L_x / L_{x-1}$$

where L_x is the population aged between x and x+1 assuming that 100,000 births occur each year according to the Life Tables.

Total dependency ratio: The sum of the young and old dependency ratios.

Total fertility rate (TFR): The TFR represents the theoretical average number of children who would be born alive to a woman during her lifetime if she were to pass through her child bearing years (ages 15-49) conforming to the age specific fertility rates of a given year. The rate refers to a theoretical female cohort.

The TFR is compiled by summing the age specific fertility rates for the relevant five-year age groups, dividing by 1,000 and multiplying by 5. The small number of births for which the age of the mother is not stated is distributed in proportion to the stated categories.

Young dependency ratio: The population aged 0-14 years expressed as a percentage of the population aged 15-64 years.

Appendix 4

Availability of data

Detailed results of the projections are available in Excel and comma delimited formats on the CSO website (see http://www.cso.ie/releasespublications/po_lab_project.htm). The detailed data files contain projections of the population for each year from 2006 to 2041 classified by sex and single year of age. Births, deaths and net migration are analysed by sex only. The detailed projections are provided for the six combinations of fertility and migration assumptions distinguished in the publication (i.e. M1F1, M1F2, M2F1, M2F2, M0F1 and M0F2).

For further information contact:

Census Inquiries Section
Central Statistics Office
Swords Business Campus
Balheary Road
Swords,
Co. Dublin

Phone +353 1 895 1460/1461/1462
LoCall   1890 236 787

E-mail: census@cso.ie
Web: www.cso.ie

Appendix 5

SUPPORTING TABLES

Table A1 Population classified by sex at each census since 1841

Census year	Persons	Males	Females
	Thousands		
1841	6,529	3,222	3,306
1851	5,112	2,494	2,617
1861	4,402	2,169	2,233
1871	4,053	1,992	2,061
1881	3,870	1,912	1,958
1891	3,469	1,729	1,740
1901	3,222	1,610	1,612
1911	3,140	1,590	1,550
1926	2,972	1,507	1,465
1936	2,968	1,520	1,448
1946	2,955	1,495	1,460
1951	2,961	1,507	1,454
1956	2,898	1,463	1,435
1961	2,818	1,417	1,402
1966	2,884	1,449	1,435
1971	2,978	1,496	1,482
1979	3,368	1,693	1,675
1981	3,443	1,729	1,714
1986	3,541	1,770	1,771
1991	3,526	1,753	1,772
1996	3,626	1,800	1,826
2002	3,917	1,946	1,971
2006	4,240	2,121	2,119

Table A2 Females in selected age groups at each census since 1926

Census year	Females aged 20-39 years	Females aged 15-49 years
	Thousands	
1926	404	709
1936	408	694
1946	413	704
1951	389	670
1961	313	598
1966	316	607
1971	339	627
1979	442	750
1981	466	780
1986	505	839
1991	501	869
1996	537	934
2002	618	1,032
2006	684	1,112

Table A3   Life expectancy at various ages, 1925 - 2006

Period		0	5	10	30	40	50	60	70	80	90
							Age in years				
							Males				
1	1925-1927	57.4	59.5	55.2	38.4	30.4	22.7	15.8	10.0	5.8	3.3
2	1935-1937	58.2	60.1	55.8	38.5	30.3	22.4	15.5	10.0	6.0	3.1
3	1940-1942	59.0	60.7	56.3	38.9	30.6	22.5	15.4	9.6	5.7	3.6
4	1945-1947	60.5	61.5	56.9	39.2	30.6	22.4	15.1	9.2	5.3	3.2
5	1950-1952	64.5	63.6	58.8	40.3	31.3	22.8	15.4	9.2	5.0	2.7
6	1960-1962	68.1	65.7	60.8	41.7	32.4	23.5	15.8	9.7	5.1	2.5
7	1965-1967	68.6	65.7	60.8	41.7	32.2	23.4	15.6	9.7	5.2	2.6
8	1970-1972	68.8	65.5	60.6	41.5	32.1	23.3	15.6	9.7	5.4	2.8
9	1978-1980	69.5	65.7	60.8	41.7	32.2	23.3	15.7	9.5	5.3	2.9
10	1980-1982	70.1	66.1	61.3	42.1	32.6	23.6	15.9	9.7	5.4	2.9
11	1985-1987	71.0	66.8	61.9	42.7	33.1	24.0	16.0	9.7	5.3	2.8
12	1990-1992	72.3	68.0	63.1	43.9	34.4	25.2	17.0	10.4	5.8	3.0
13	1995-1997	73.0	68.6	63.6	44.5	35.1	25.8	17.5	10.6	5.9	3.0
14	2001-2003	75.1	70.7	65.7	46.5	37.0	27.8	19.2	11.9	6.5	3.3
*	2004-2006	76.7	72.1	67.2	47.9	38.3	29.0	20.4	12.8	7.1	3.9
							Females				
1	1925-1927	57.9	59.2	54.9	38.6	30.8	23.2	16.4	10.7	6.5	3.7
2	1935-1937	59.6	60.4	56.1	39.2	31.2	23.3	16.2	10.6	6.5	3.4
3	1940-1942	61.0	61.4	56.9	39.9	31.6	23.5	16.3	10.4	6.4	4.2
4	1945-1947	62.4	62.5	57.9	40.5	32.1	23.9	16.4	10.2	6.0	3.8
5	1950-1952	67.1	65.4	60.6	42.2	33.3	24.7	16.8	10.2	5.6	3.2
6	1960-1962	71.9	69.0	64.1	44.7	35.3	26.3	18.1	11.0	5.9	3.0
7	1965-1967	72.9	69.6	64.8	45.2	35.7	26.6	18.4	11.2	6.1	3.1
8	1970-1972	73.5	70.0	65.1	45.6	36.0	27.0	18.7	11.5	6.2	3.2
9	1978-1980	75.0	71.0	66.1	46.5	36.8	27.6	19.2	11.9	6.4	3.4
10	1980-1982	75.6	71.5	66.6	47.0	37.3	28.0	19.5	12.2	6.7	3.5
11	1985-1987	76.7	72.4	67.5	47.8	38.1	28.7	20.1	12.6	6.8	3.3
12	1990-1992	77.9	73.5	68.6	48.9	39.2	29.8	21.1	13.5	7.4	3.6
13	1995-1997	78.5	74.1	69.1	49.5	39.8	30.3	21.5	13.7	7.5	3.7
14	2001-2003	80.3	75.7	70.8	51.1	41.4	31.9	22.9	14.8	8.2	4.1
*	2004-2006	81.5	76.8	71.9	52.2	42.4	32.9	23.9	15.7	8.8	4.6

* The 2005 Life Tables referenced here were produced by the CSO as a special exercise for this projections publication. A set of Life Tables for 2005-2007 using Census 2006 data will be published during 2008

Table A4   Projected life expectancy at various ages, 2010 - 2042

Period		0	5	10	30	40	50	60	70	80	90
							Age in years				
							Males				
16	2010-2012	79.7	75.0	70.0	50.6	41.0	31.5	22.6	14.7	8.5	4.3
17	2015-2017	81.6	76.9	71.9	52.4	42.7	33.2	24.2	16.0	9.4	4.8
18	2020-2022	83.1	78.4	73.4	53.8	44.1	34.5	25.4	17.1	10.2	5.2
19	2025-2027	84.3	79.5	74.5	54.9	45.2	35.5	26.3	17.9	10.8	5.5
20	2030-2032	85.1	80.3	75.3	55.7	45.9	36.3	27.0	18.5	11.3	5.7
21	2035-2037	85.8	81.0	76.0	56.3	46.6	36.9	27.6	19.0	11.7	6.0
22	2040-2042	86.5	81.7	76.7	57.0	47.2	37.5	28.2	19.5	12.1	6.2
							Females				
16	2010-2012	83.2	78.5	73.5	53.8	44.0	34.4	25.3	16.8	9.6	4.7
17	2015-2017	84.4	79.7	74.7	55.0	45.1	35.6	26.3	17.7	10.3	5.0
18	2020-2022	85.5	80.7	75.8	56.0	46.1	36.5	27.2	18.5	10.8	5.2
19	2025-2027	86.3	81.6	76.6	56.8	46.9	37.2	27.9	19.1	11.3	5.5
20	2030-2032	87.0	82.2	77.2	57.4	47.5	37.9	28.5	19.6	11.7	5.7
21	2035-2037	87.6	82.8	77.9	58.0	48.1	38.4	29.0	20.1	12.1	5.9
22	2040-2042	88.3	83.4	78.5	58.6	48.7	39.0	29.6	20.6	12.5	6.1

Table A5   Labour force participation rates, 1991 - 2021 (%)

Age group	Actual*			Assumed		
	1996	2002	2006	2011	2016	2021
	Males					
25 - 29	92.1	91.5	92.7	92.0	92.0	92.0
30 - 34	94.8	93.8	93.8	94.0	94.0	94.0
35 - 39	93.9	93.8	93.9	94.0	94.0	94.0
40 - 44	92.8	92.1	93.8	94.0	94.0	94.0
45 - 49	89.7	89.8	91.9	93.0	94.0	94.0
50 - 54	84.3	85.4	85.8	87.0	87.5	88.0
55 - 59	72.6	75.2	76.4	77.0	78.0	79.0
60 - 64	51.8	55.7	58.3	60.0	61.0	62.0
65 and over	15.3	15.1	14.5	16.0	18.0	20.0
	Married females					
25 - 29	66.8	65.7	70.1	75.0	76.0	77.0
30 - 34	59.8	65.7	71.2	72.0	74.0	75.0
35 - 39	55.4	61.3	63.8	66.0	68.0	69.0
40 - 44	49.9	64.0	64.8	67.0	69.0	70.0
45 - 49	41.8	61.6	65.2	67.0	68.0	69.0
50 - 54	35.2	50.5	61.4	63.0	63.0	63.0
55 - 59	26.5	37.2	47.3	47.0	48.0	49.0
60 - 64	14.8	21.5	30.4	32.0	33.0	34.0
65 and over	2.6	2.9	4.1	4.0	5.5	6.0
	Other females					
25 - 29	85.3	86.6	84.4	85.0	86.0	87.0
30 - 34	83.7	84.8	80.9	82.0	83.0	84.0
35 - 39	80.8	80.8	78.1	80.0	81.0	81.0
40 - 44	79.7	79.6	75.3	78.0	79.0	80.0
45 - 49	78.0	73.4	72.0	76.0	77.0	78.0
50 - 54	69.3	66.3	67.5	72.0	73.0	74.0
55 - 59	55.3	47.1	61.5	64.0	65.0	66.0
60 - 64	35.4	37.7	40.0	41.0	42.0	43.0
65 and over	5.8	4.1	4.9	6.0	7.0	8.0

*   Source: Labour Force Survey 1996; Quarterly National Household Surveys 2002, 2006

Table A6   Actual and projected labour force, 1996 - 2021

Year	Males	Females			Persons
		Married	Other	Total	
		Thousands			
Actual*					
1996	925.1	322.1	260.2	582.3	1,507.4
2002	1,076.6	414.5	349.8	764.3	1,840.9
2006	1,223.2	475.0	419.8	894.8	2,118.0
M1					
2011	1,392.4	546.3	482.7	1,029.0	2,421.5
2016	1,532.7	620.0	511.8	1,131.8	2,664.5
2021	1,653.1	674.7	537.3	1,212.0	2,865.2
M2					
2011	1,371.9	541.5	472.2	1,013.7	2,385.6
2016	1,480.7	605.3	487.3	1,092.6	2,573.3
2021	1,568.8	647.1	501.5	1,148.5	2,717.3
M0					
2011	1,269.3	517.2	419.7	936.9	2,206.2
2016	1,302.6	550.8	407.9	958.7	2,261.3
2021	1,335.0	562.3	412.2	974.5	2,309.5

* Source: Labour Force Surveys 1996; Quarterly National Household Surveys 2002, 2006

Table A7 Labour force participation Rates (ILO) of females aged 15 years or over distinguishing mothers by number of dependant children 2000 to 2007

%

	Age group								Total
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50+	
2000									
Mothers (wives or partners with children or lone mothers)	*	54.2	62.2	59.5	58.2	58.4	53.8	28.6	49.0
No dependant children	*	*	*	*	*	63.9	58.0	24.1	29.7
One dependent child	*	59.3	75.0	75.1	67.9	64.3	56.2	31.2	54.8
Two dependent children	*	39.0	53.2	60.0	63.0	61.0	53.6	38.8	56.5
Three or more dependent children	*	*	39.9	42.8	49.5	52.3	48.2	39.8	47.7
Wives (or partners) without children	*	85.7	94.5	94.5	89.3	75.3	64.2	17.9	44.4
Other females (ie children in family units or other females not in family units)	26.2	69.1	92.2	91.3	88.1	80.4	73.2	12.2	45.9
All Females	26.3	67.8	82.4	71.1	64.3	61.6	56.7	20.3	47.1
2002									
Mothers (wives or partners with children or lone mothers)	*	48.7	59.2	60.7	59.5	62.8	60.7	31.7	51.5
No dependant children	*	*	*	*	*	62.4	62.8	26.3	32.1
One dependent child	*	56.0	72.3	75.9	72.8	68.7	63.7	35.5	58.3
Two dependent children	*	25.2	50.7	60.6	63.8	65.4	62.1	43.6	59.0
Three or more dependent children	*	*	26.6	41.3	48.6	56.6	53.0	38.0	48.2
Wives (or partners) without children	*	88.1	92.5	96.0	86.5	80.2	68.4	20.3	46.9
Other females (ie children in family units or other females not in family units)	22.0	66.5	92.6	91.3	86.5	82.5	72.4	13.9	46.3
All Females	22.3	65.2	81.3	73.0	65.1	66.2	62.8	22.7	48.8
2004									
Mothers (wives or partners with children or lone mothers)	*	47.8	58.4	58.6	59.4	63.6	61.4	35.7	52.8
No dependant children	*	*	*	*	*	71.8	64.7	29.5	35.6
One dependent child	*	54.6	72.6	73.9	72.8	69.7	64.6	39.3	59.3
Two dependent children	*	29.6	45.2	59.3	63.7	66.0	61.7	48.9	58.8
Three or more dependent children	*	*	34.1	36.2	48.5	56.9	54.3	44.3	48.9
Wives (or partners) without children	*	86.8	92.7	91.9	87.2	78.6	67.3	22.3	46.6
Other females (ie children in family units or other females not in family units)	19.7	67.9	89.1	90.5	88.7	78.7	75.1	14.7	46.6
All Females	20.0	66.0	79.4	71.8	65.6	66.1	63.4	25.0	49.4
2006									
Mothers (wives or partners with children or lone mothers)	*	53.2	61.3	64.2	60.9	63.9	63.9	39.6	55.7
No dependant children	*	*	*	*	*	76.8	67.8	35.7	41.2
One dependent child	*	62.3	70.4	78.8	75.0	71.3	64.6	40.7	61.9
Two dependent children	*	21.7	52.6	63.0	63.8	65.8	65.7	51.6	61.1
Three or more dependent children	*	*	37.7	40.0	49.7	56.2	57.4	49.7	50.7
Wives (or partners) without children	*	89.6	92.6	95.1	90.2	77.5	73.1	27.0	50.8
Other females (ie children in family units or other females not in family units)	22.5	69.7	90.2	89.9	87.7	79.4	74.1	17.9	49.4
All Females	22.8	68.8	81.3	75.4	67.0	66.3	66.0	28.9	52.5

* Population estimates of less than 1,000 are deemed too small for publication purposes due to reliability concerns. Sampling or other survey errors are greater in respect of smaller values or estimates of change.

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Appendix 6

Method of projecting mortality[8]

Mortality rates were projected by estimating the current rate of improvement by single year of age and sex and assuming that this rate of improvement will decline over a twenty-five year period to a long-term average improvement rate not dissimilar to the rates observed in the long-term past. The analysis showed that the current rate of decline of mortality for males averaged around 5 per cent per annum across most ages, with surprisingly little variation. For females, the current rate of decline oscillated with age around an average rate of 3.5 per cent per annum. It was assumed that there would be no mortality improvements at ages from 100 years and upwards.

The Expert Group judged it reasonable to apply the same rate of decline to male and female mortality rates in the estimates for the long-term future and, following reflection, a long term rate of 1.5 per cent per annum was settled upon as not unreasonable for all ages up to age 90 years from 2031 onwards. For each year between 2005 and 2031, the mortality declines for that year were calculated by linear interpolation.

Estimating the current rate of improvement in mortality

- A graduated life table was prepared for 2004-2006 following the same methodology as that employed for previous Irish Life Tables. The annualised percentage fall in mortality at each age for each sex was calculated from the graduated tables. This gave the average rate of improvement per annum over the three year period 2002 to 2005.
- There were large fluctuations in the mortality declines at the early ages but from age 11 years to age 90 years, the annual rate of decline tended to oscillate about 5 per cent for males and, with somewhat greater amplitude, about 3.5 per cent for females.
- It was found that replacing the age-specific current rates of decline in mortality with the average rate of 5 per cent per annum for males and 3.5 per cent per annum for females up to age 90 years produced almost identical life expectancies at age 0 years and at age 65 years, both now and for each projected year. It was decided to adopt the averaged rate at each age in place of the calculated age-specific rates to ensure that projected age-specific mortality rates are mutually consistent (so, for example, that projected mortality rates in each future year increase with increasing age at the older ages).
- A zero per cent improvement (i.e. no improvement) was assumed for ages of 100 years and over. For ages 91 years to 99 years, the current rate of improvement was estimated by linear interpolation between the assumed rate of improvement at age 90 years (5% for males and 3.5% for females) and the zero per cent rate of improvement at age 100 years.

Projecting mortality improvements from 2031 onwards

- The average rate of improvement over the 76-year period 1926-2002 was 1.43 per cent per annum for males and 2.1 per cent per annum for females (when calculated as a simple average of the rates of improvement at each age from age 0 years to age 100 years over that period). There is a pronounced age structure effect to the improvements, with the rate of improvement generally lowering with increasing age. However, over more recent periods, the age pattern is less pronounced with later ages now showing large improvements. Also, in more recent decades, males are recording larger proportionate falls in mortality rates than females.
- It is difficult to settle on an annual rate of mortality improvement assumed to hold from 2031 onwards. Following discussion, the Expert Group decided that an annual decline of 1.5 per cent was reasonable to apply to both sexes up to age 90 years, as it is not very dissimilar to the average rate of mortality decline over the long term past. Moreover, when the other elements of the projection approach are taken into account, estimates of period life expectancies which emerge in 2041 are close to those produced by the projection methodology employed in the last projection. For ages of 100 years and over, no mortality improvements from calendar year 2031 were assumed. For ages 91 years to age 99 years, the rate of improvement was estimated by linear interpolation in each projected calendar year.

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[8] The Expert Group are indebted to Dr Shane Whelan, UCD specifically for his input into mortality part of the projection work. The methodology employed is described in greater detail in Recent Trends in Mortality and Morbidity in Ireland, Symposium to the Statistical and Social Inquiry Society of Ireland, 24th January 2008.

Projecting mortality improvements between 2005 and 2031

- As explained above, the projection methodology estimated the current rate of mortality decline for the year 2005 for each sex at each age. This turned out to be approximately 5 per cent per annum for males, and approximately 3.5 per cent per annum for females, up to age 90 years. For any calendar year after 2031, the reduction in mortality over that year is assumed to be 1.5 per cent for each sex and at each age up to age 90 years. For all years between 2005 and 2031, the mortality declines for that year at each age is a simple linear interpolation between the decline in 2005 and that assumed in 2031. For ages of 100 years and over, no improvements were assumed either now or in the future while for ages between 90 years and 100 years, the rates of mortality decline were estimated by linear interpolation in each future calendar year.