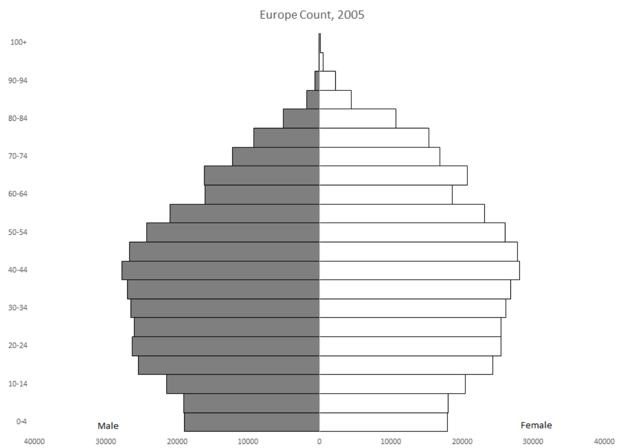
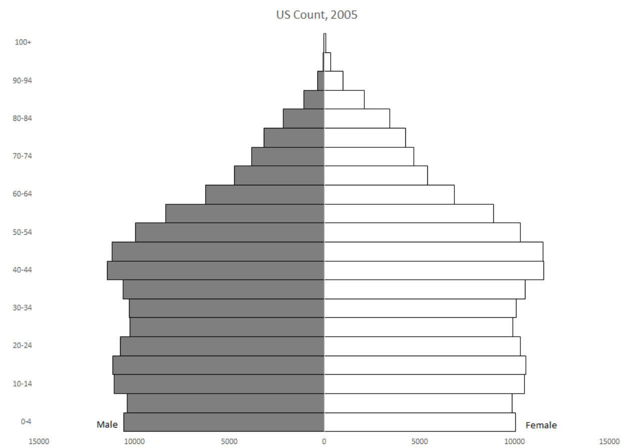
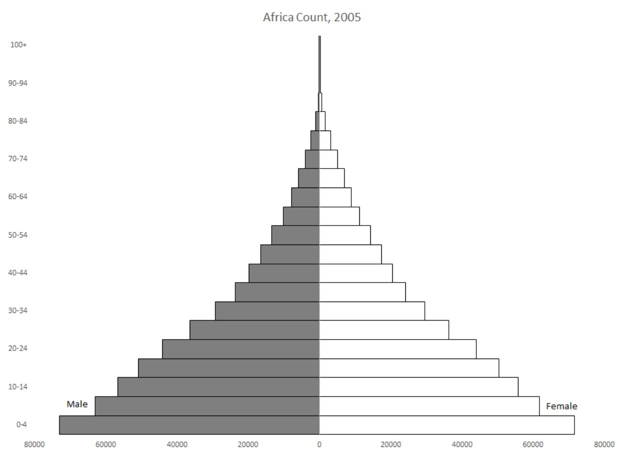
Population and Health and Analysis: Practical 1

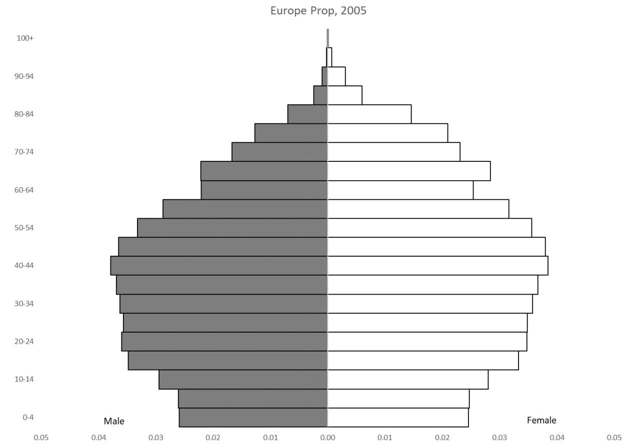
201374125 *University of Liverpool*

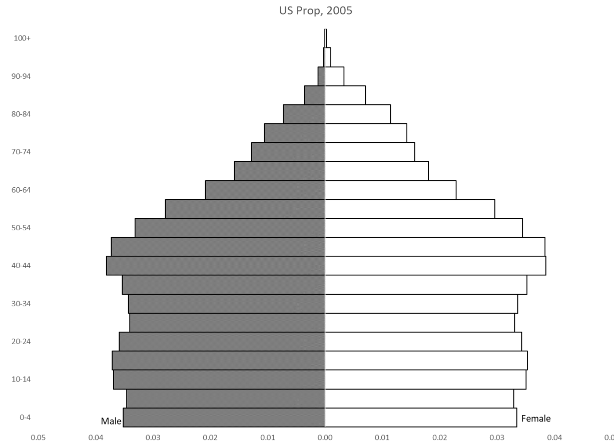
Assessment 1: Age Sex Distribution

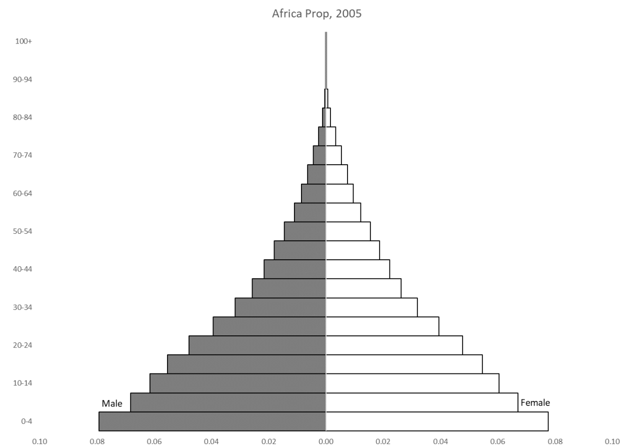








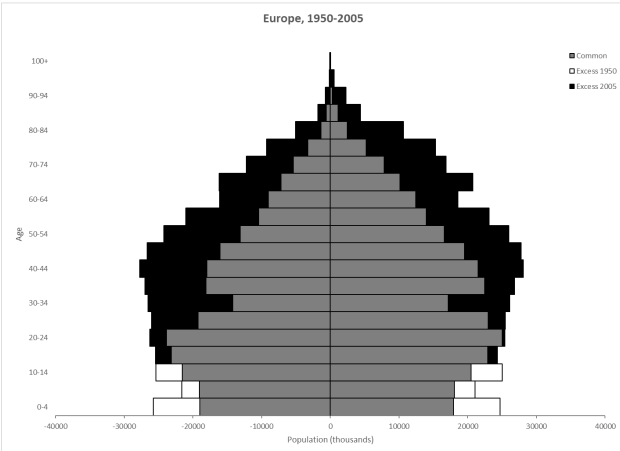


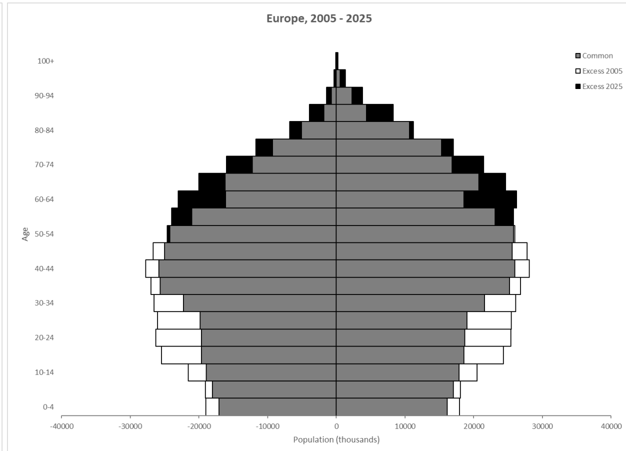


Both the US and European population pyramids and population proportional pyramids share a similar pattern, with the peak populations around ages 40-44. The US has a noticeably higher proportion of a younger population than Europe, which may be attributable to cultural differences driven by religious beliefs. Religion is considered an important part of half of US women, but for less than 1/6th of European women, and Catholic and Protestant women have notably higher fertility than those who do not identify with either religion (Frejka and Westoff, 2008).

The striking difference between the African population pyramid and both the US and Europe can be attributed mostly to the difference in life expectancy between the regions. The average total life expectancy in Africa is far below both that of the US and Europe (Statista, 2019), stemming from the lack of access to medication for preventable diseases such as malaria, tuberculosis, and HIV (United Nations, 2016). The very high levels of a younger population in Africa compared with the US and Europe is attributable to the much higher birth rate, for which many African countries have among the highest rate in the world (Statista, 2016). Africa is considered the least developed region in the world, and with that comes the determinants of fertility, where the level of education and health, in addition to cultural differences such as use of contraception and age at marriage drive up the rate of births in Africa (Bongaarts et al., 2006). Particularly it seems likely that in order to ensure support in later life, parents may feel encouraged to have more children, due to the low life expectancy.

Assessment 2





These two figures represent what is considered to be an aging population (See ONS and Office for National Statistics, 2018), as is typical of many developed countries. Aging populations occur when birth rate is reduced below previous levels, while the death rate decreases, leading to a population with a higher average age. This is shown on these two figures by the black bars, which indicate the increase in population between the two years compared on each figure, with the bars showing a higher number of people in the higher age groups. These graphs also indicate the reduction in birth rate, as the white bars on each indicate a net loss in the number of people in the lower age groups between the years.

The aging population in Europe can be attributed to a number of factors relating the economic development, where better healthcare means far fewer people are dying from preventable diseases, and thus the rate of mortality is lower. There has been a shift in family size in Europe, while typically a family would have had more than two children on average in many European countries this number is now less than two, Goldstein et al. (2004) primarily attribute this to the cultural shift in what is considered to be the ideal family size. Algan and Cahuc (2005) attribute this shift to the increase in female employment in European countries, in addition to the cultural shift.

References

Yann Algan and Pierre Cahuc. The roots of low european employment: Family culture? In *NBER International Seminar on Macroeconomics*, pages 65–109. Cambridge, MIT Press, 2005.

John Bongaarts, Odile Frank, and Ron Lesthaeghe. The Proximate Determinants of Fertility in Sub-Saharan Africa. *Population and Development Review*, 2006. ISSN 00987921. doi: 10/ddgps3.

Tomas Frejka and Charles F. Westoff. Religion, Religiousness and Fertility in the US and in Europe: Religion, religiosité et fécondité aux Etats-Unis et en Europe. *European Journal of Population / Revue européenne de Démographie*, 24(1):5–31, March 2008. ISSN 0168-6577, 1572-9885. doi: 10/fgwxm5.

Joshua Goldstein, Wolfgang Lutz, and Maria Rita Testa. The emergence of Sub-Replacement Family Size Ideals in Europe. *Population Research and Policy Review*, 22(5/6):479–496, 2004. doi: 10/fb7vck.

ONS and Office for National Statistics. Ageing - Office for National Statistics. 2018.

Statista. • Countries with the highest birth rates 2016 | Statista. 2016.

Statista. • Life expectancy in Africa in 2018 | Statistic. 2019.

United Nations. Dying from lack of medicines | Africa Renewal. 2016.

Population and Health and Analysis: Practical 2

201374125 *University of Liverpool*

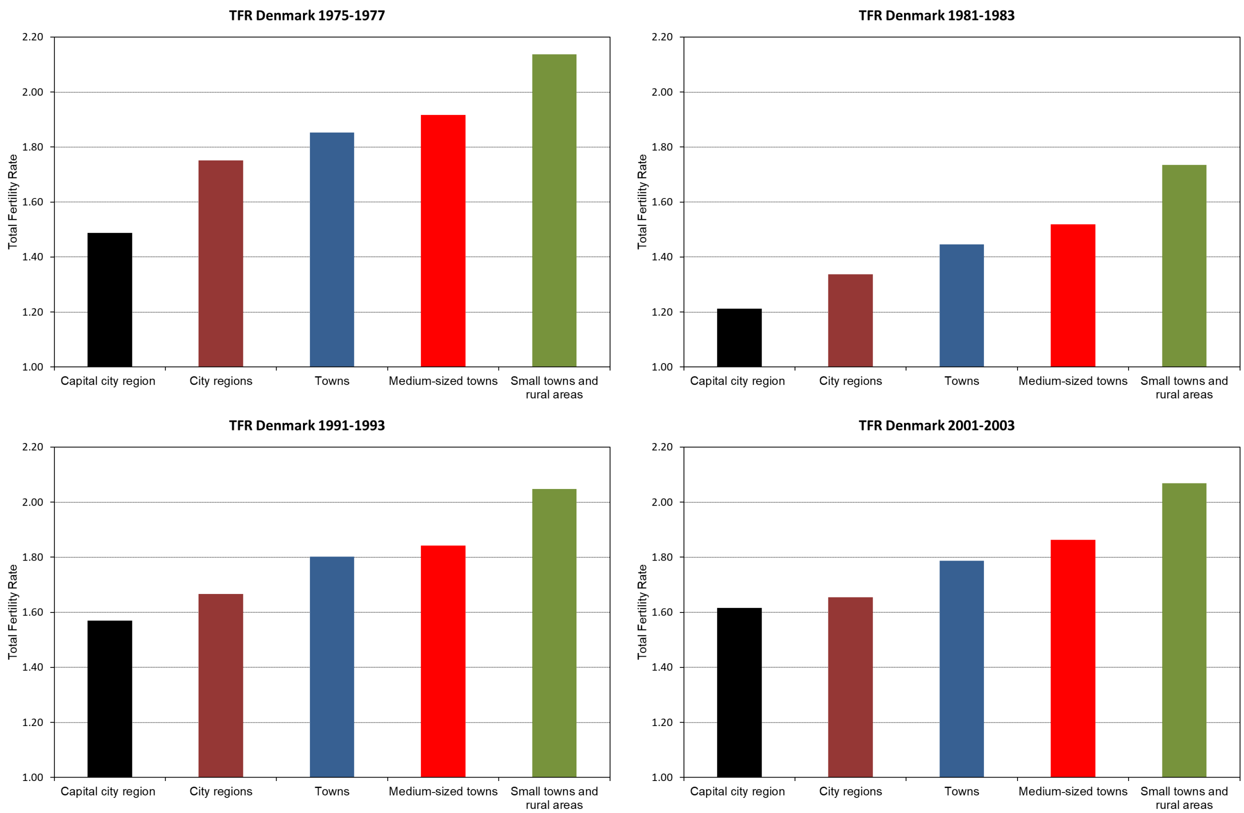


Figure 1: Total Fertility Rate in Denmark by Region Type and Year

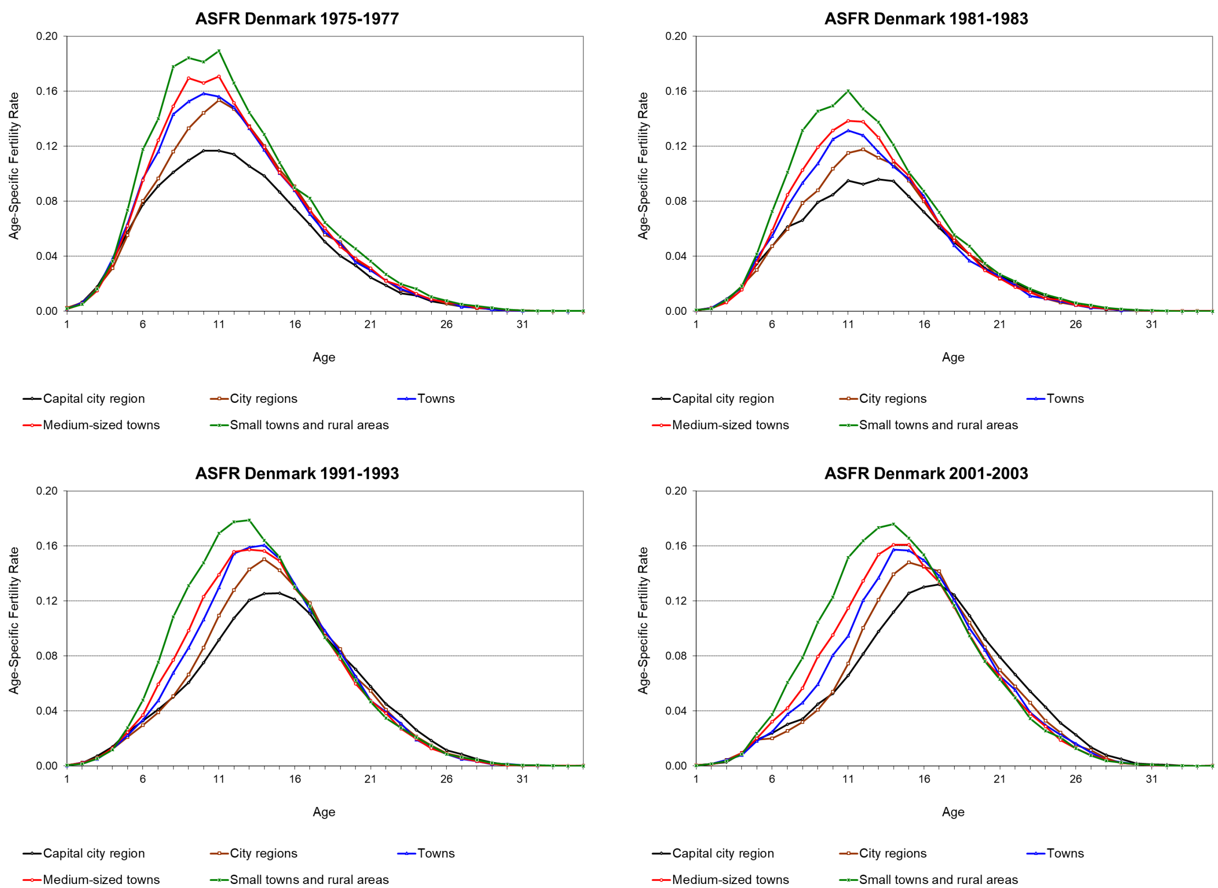


Figure 2: Age Specific Fertility Rate in Denmark by Region Type and Year

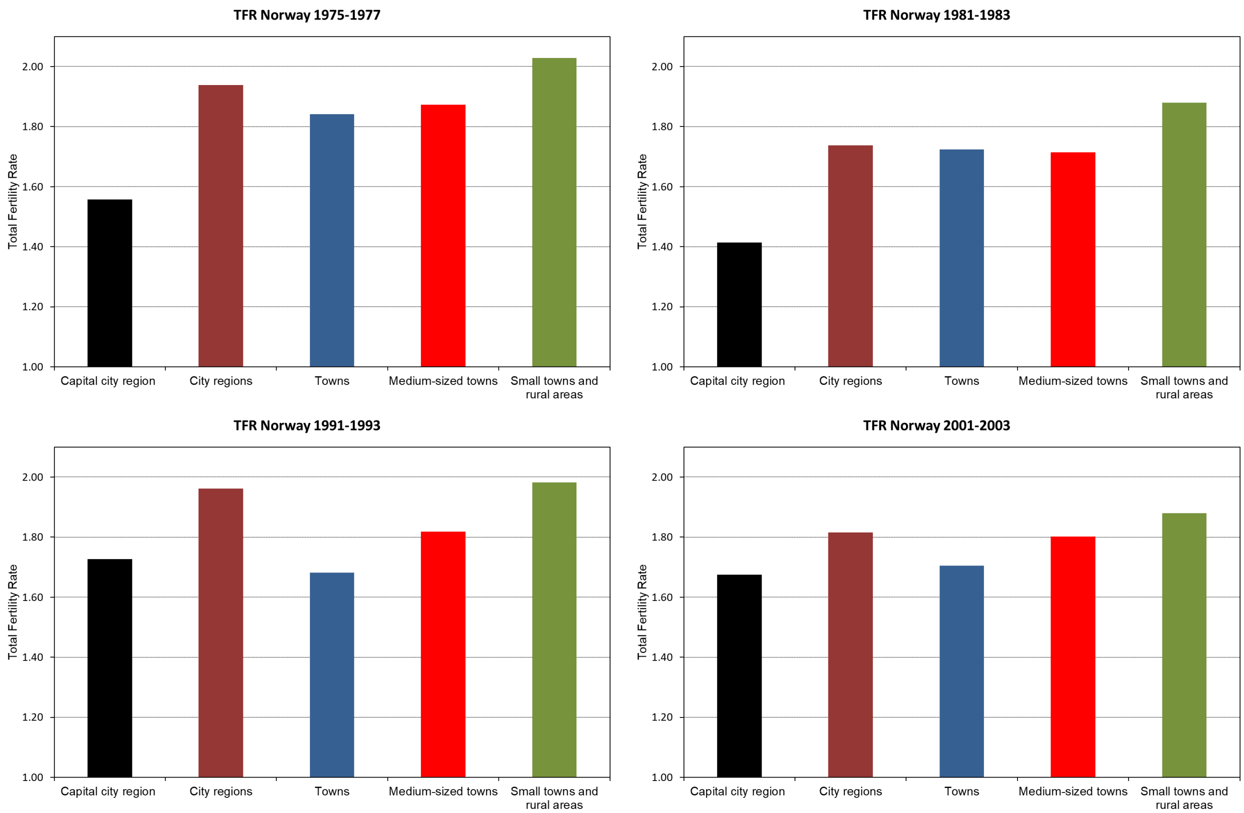


Figure 3: Total Fertility Rate in Norway by Region Type and Year

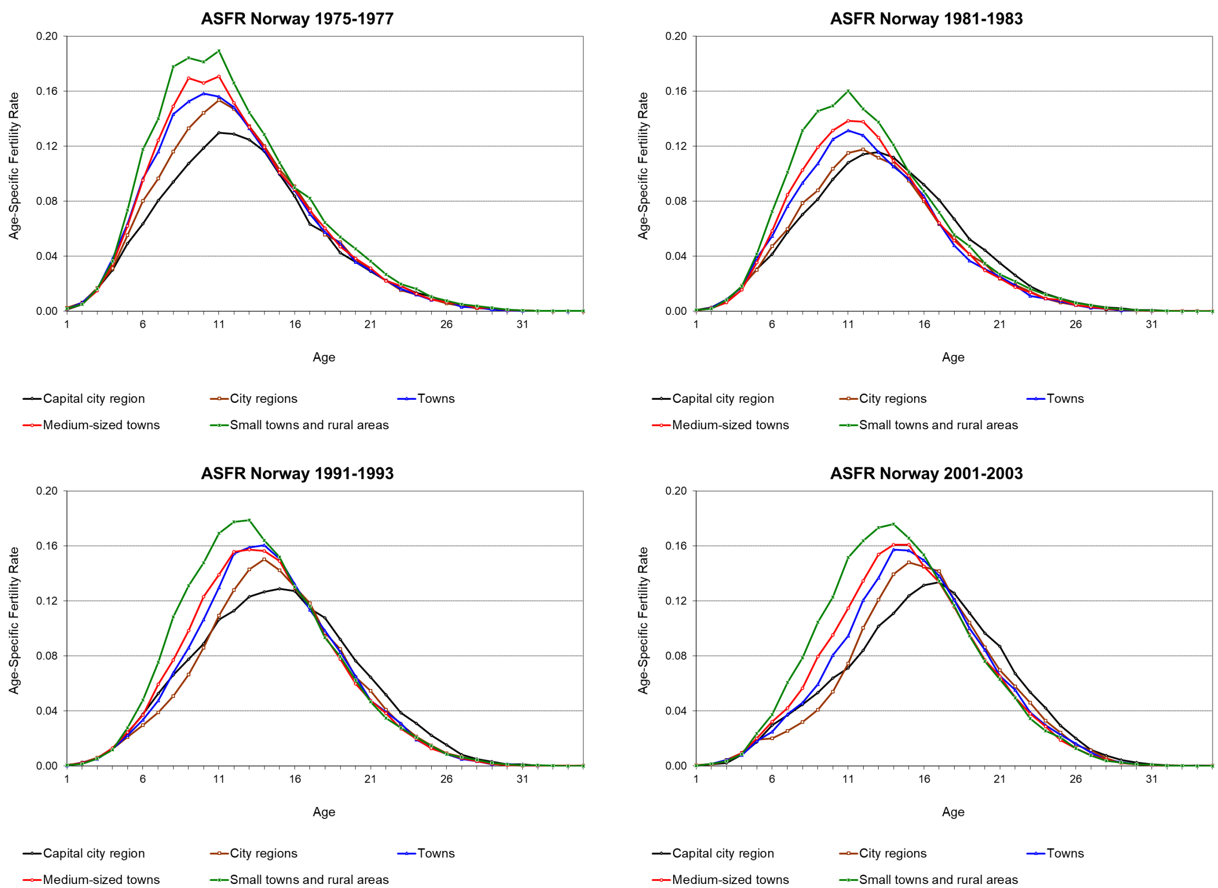


Figure 4: Age Specific Fertility Rate in Norway by Region Type and Year

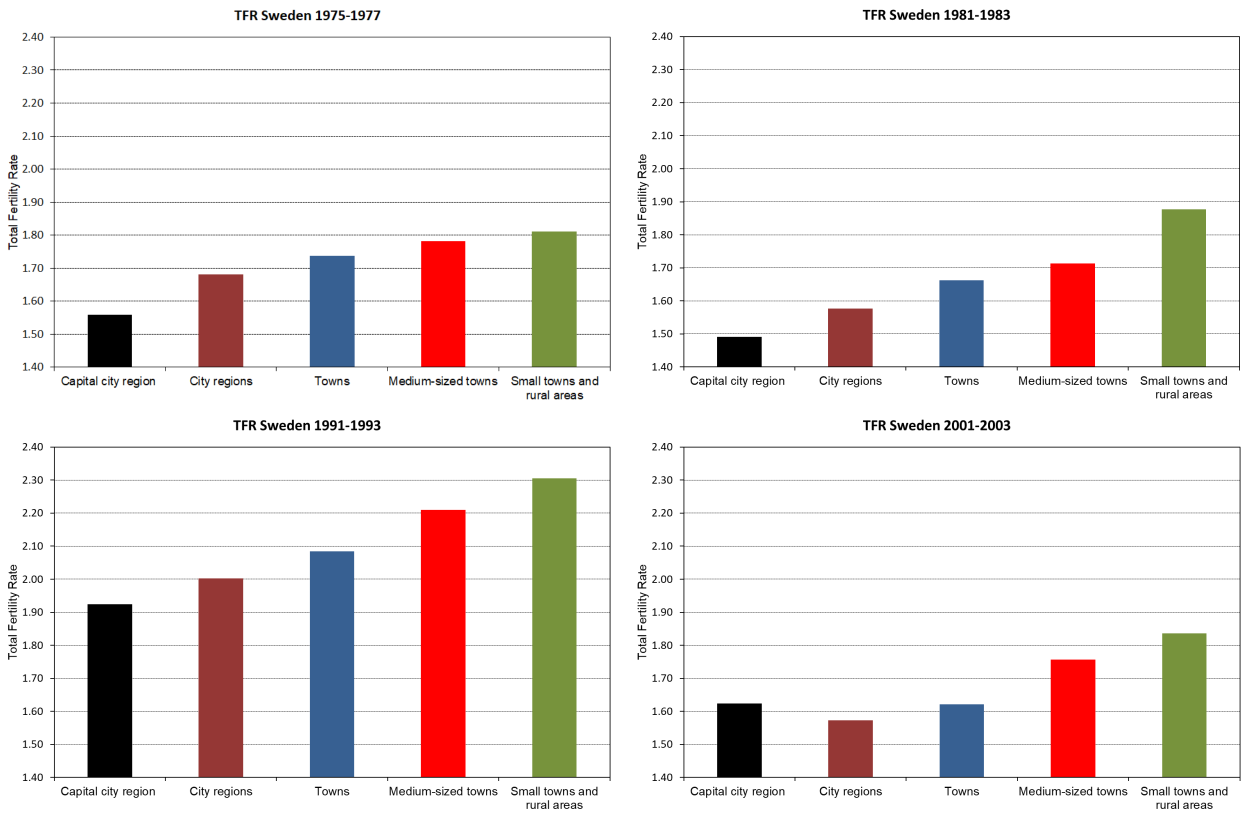


Figure 5: Total Fertility Rate in Sweden by Region Type and Year

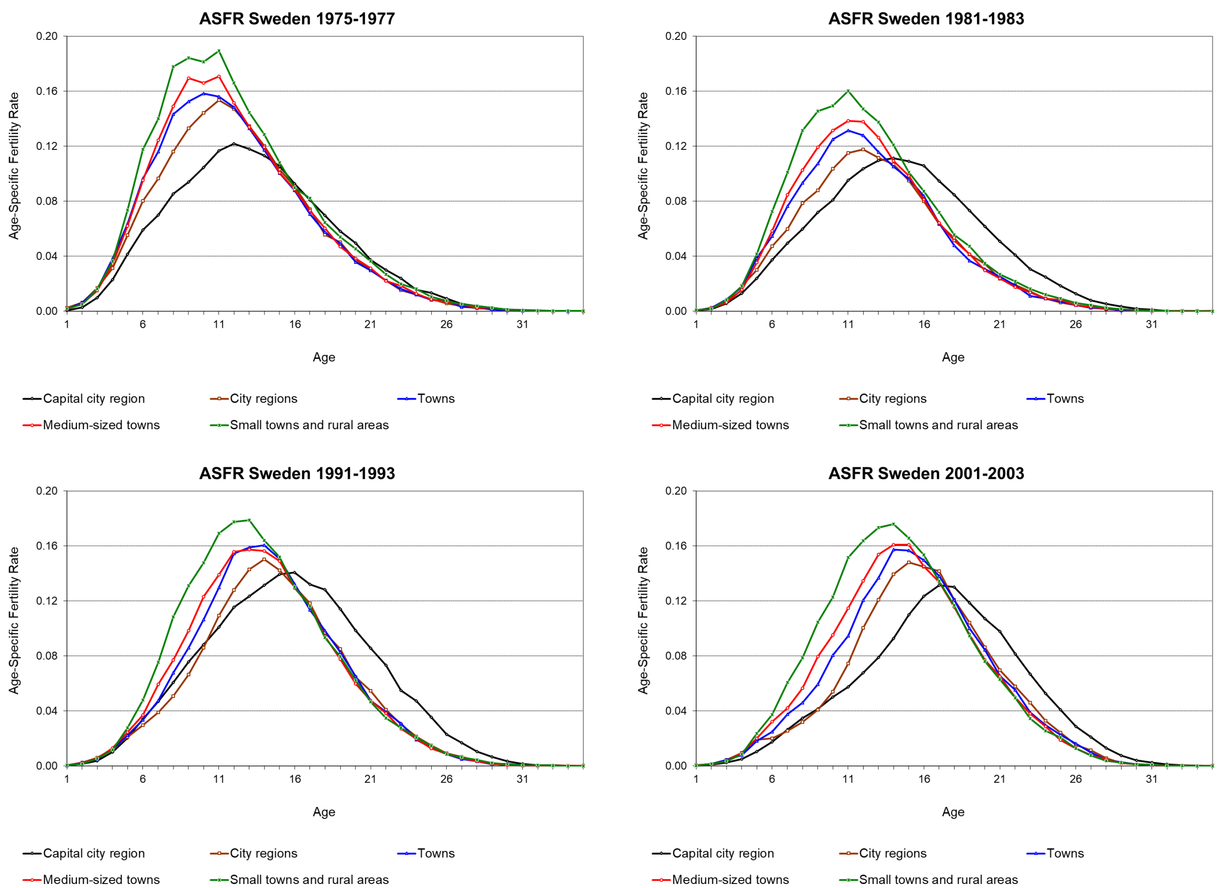


Figure 6: Age Specific Fertility Rate in Sweden by Region Type and Year

Overall fertility appears to decline steadily through time, with the lowest rates of fertility observed in 2001-2003 for both Norway and Sweden (Figures 3, 5), fertility in Denmark however saw a low during 1981-1983 (Figure 1. This dip in Denmark may be attributed to the increase in high educational achievement with women during the 1981-1994 time period, suggesting that women began to have less time for children (Gerster et al., 2007). Similarly, educational achievement is attributed to the decreasing rate of fertility in both Norway, (Kravdal, 2001) and Sweden (Oláh, 2003), although second birth fertility is noted as being higher than average for both.

Overall the fertility in Sweden is much lower than both other countries (Figure 5). Following the second world war, it is noted that Sweden did not match the increased levels of fertility of other European countries (Hoem, 1990). However, the graph from 1991-1993 shows far higher fertility for this time period, noted that this has perhaps been the result of recent social policy that encourages both fertility and female labour market involvement through child benefits, and the expansion of public daycare (Hoem, 1990).

Figures 2, 4, and 6 each indicate an increasing age specific fertility across all regions in all countries by year. Noticeably, the age specific fertility rate is increasing at a higher rate within city centres. Education and professional employment is concentrated within city centres (Meier, 2014). These demographics often have lower rates of fertility at a younger age, due to a focus on career development, before intending to have children (Mortensen et al., 2012).

References

Mette Gerster, Niels Keiding, Lisbeth B. Knudsen, and Katrine Strandberg-Larsen. Education and second birth rates in Denmark 1981-1994. *Demographic Research*, 17:181–210, November 2007. ISSN 1435-9871. doi: 10.4054/DemRes.2007.17.8.

Jan M. Hoem. Social Policy and Recent Fertility Change in Sweden. *Population and Development Review*, 16(4):735, December 1990. ISSN 00987921. doi: 10.2307/1972965.

Øystein Kravdal. The High Fertility of College Educated Women in Norway: An Artefact of the Separate Modelling of Each Parity Transition. *Demographic Research*, 5:187–216, December 2001. ISSN 1435-9871. doi: 10.4054/DemRes.2001.5.6.

Lars Meier. *Migrant Professionals in the City: Local Encounters, Identities and Inequalities*. Routledge, 2014. ISBN 1-134-67461-9.

Luise Lermark Mortensen, Hanne Kristine Hegaard, Anders Nyboe Andersen, and Janne Gasseholm Bentzen. Attitudes towards motherhood and fertility awareness among 20–40-year-old female health-care professionals. *The European Journal of Contraception & Reproductive Health Care*, 17(6):468–481, 2012. ISSN 1362-5187.

Livia Sz. Oláh. Gendering Fertility. *Population Research and Policy Review*, 22(2):171–200, 2003. ISSN 01675923. doi: 10.1023/A:1025089031871.

Population and Health and Analysis: Practical 3

201374125 *University of Liverpool*

Assessment

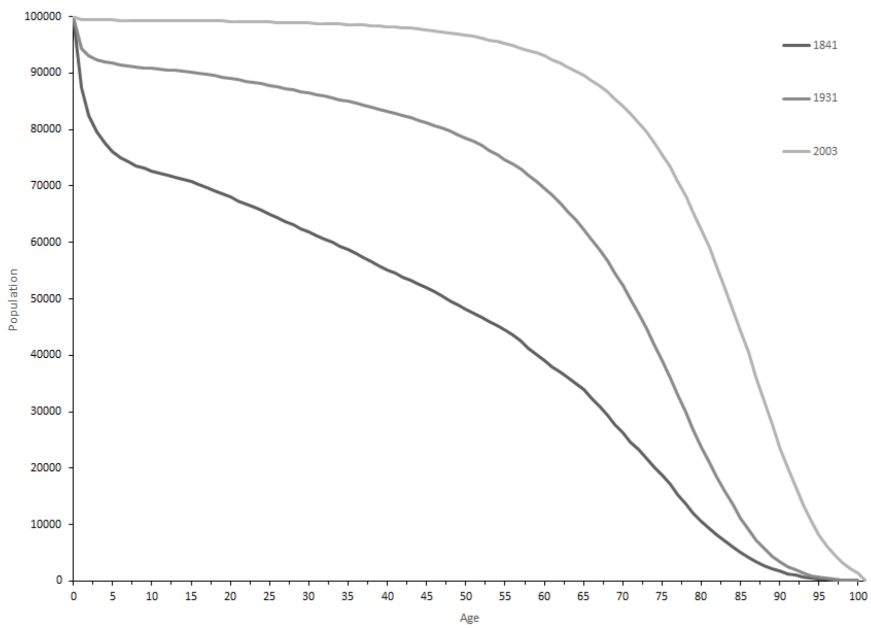


Figure 1: Number of female persons alive by age in three selected years in England and Wales

Figure 1 gives the values of l_x from Table 1, where l_x is the number of persons alive at exact age x, selected are three distinct years for comparison.

Life expectancy has increased dramatically from 1841 until 2003 (Oeppen and Vaupel, 2002), this has led to a very high proportion of the population to survive birth and live until old age in the year 2003. By contrast, in 1841, there is a very high birth mortality, indicated by the sharp drop off at lower ages, and an overall sharper decline in the proportion of persons alive at any given age (Figure 1). In 1931 there is a less sharp drop off after birth, and more closely resembles the modern life expectancy, with reduced infant mortality due to improvements in hospital hygiene and techniques as well as economic development (Wennemo, 2008). The curve for 2003 indicates a very low infant mortality rate, characterised by the almost non existent drop off in l_x at year 0. Additionally this curve shows very little drop off until older age, at around 70 years old. Improvements in healthcare, improved understanding in general health, including smoking healthy eating, and less dangerous working environments mean that fewer persons now die at younger ages throughout life (Bartley, 2004, Wennemo, 2008).

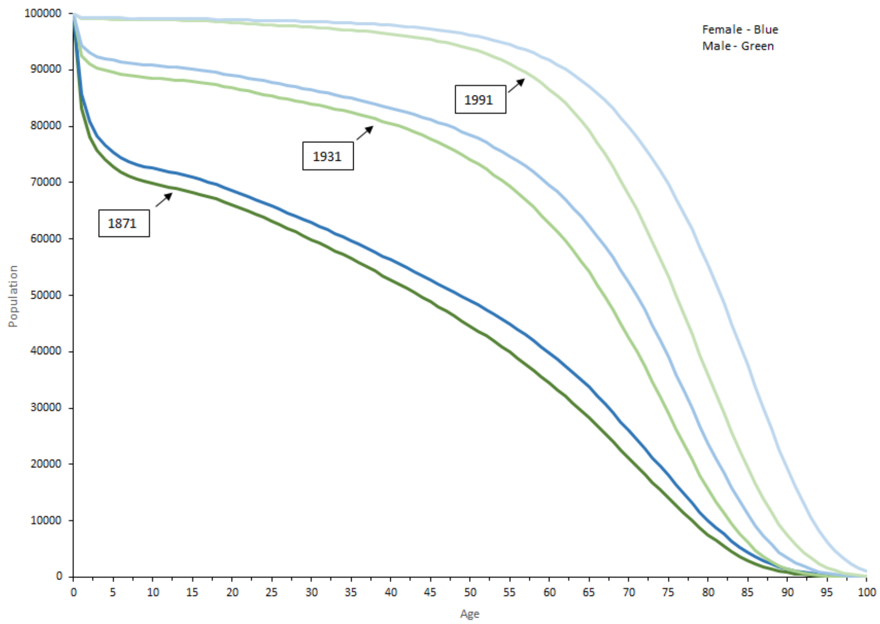


Figure 2: Number of females and males alive in England and Wales, by age and year

Figure 2 shows that on average, females have always had a higher life expectancy than males for each year observed. This gap was slightly narrower in 1871, but appears to widen by 1991, where life expectancy in old age is noticeably lower for males. The gender gap in 1871 is relatively small, due to the prevalence of disease that killed both men and women similarly, contributing to the overall lower life expectancy for both. By the 20th century male working conditions were often poorer than for women (Bartley, 2004), and male smoking rates were higher, while the risk of dying during labour for women was reduced (Wennemo, 2008). Both females and males show overall similar trends in infant mortality as is expected.

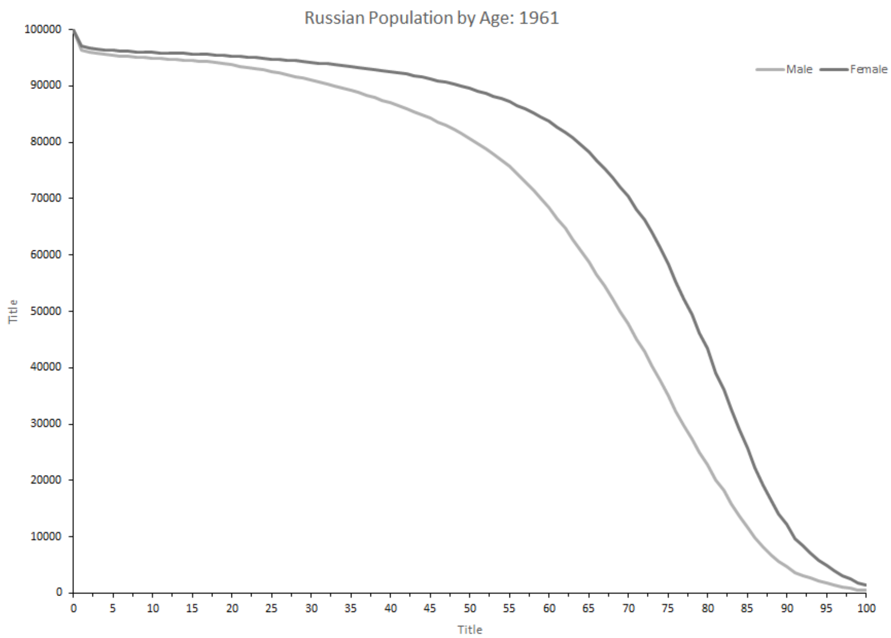


Figure 3: Number of females and males alive in Russia, 1961

Russian male life expectancy shares similarities with England, in that women have consistently had higher life expectancy. However, in 1991, male life expectancy is dramatically lower overall than female. The overall lower life expectancy in Russia is mainly attributed to alcohol abuse, in addition to accidents and violence, particularly for the male population (Leon et al., 1997). This explains the far lower life expectancy for males in Russia, even as recently as 2003 (Figure 5).

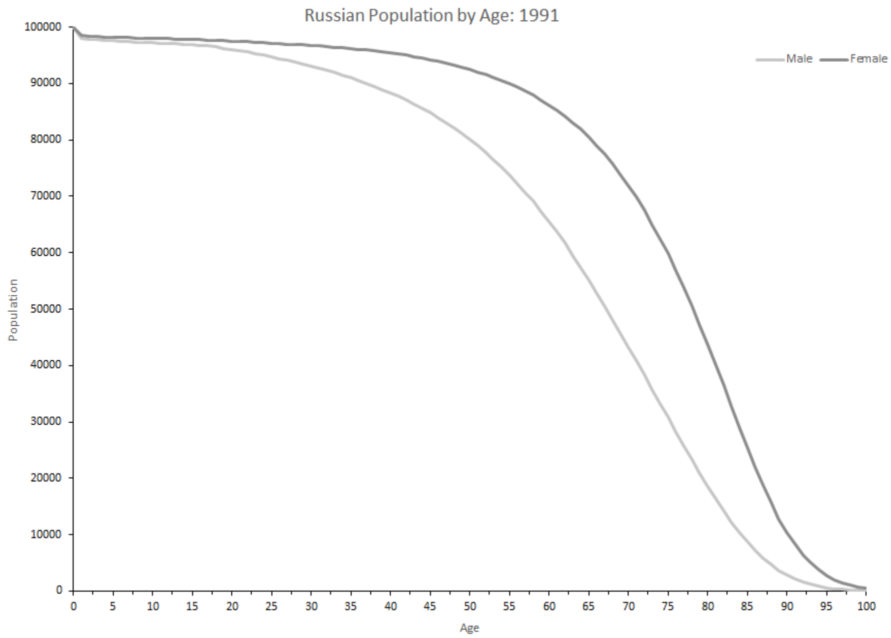


Figure 4: Number of females and males alive in Russia, 1991

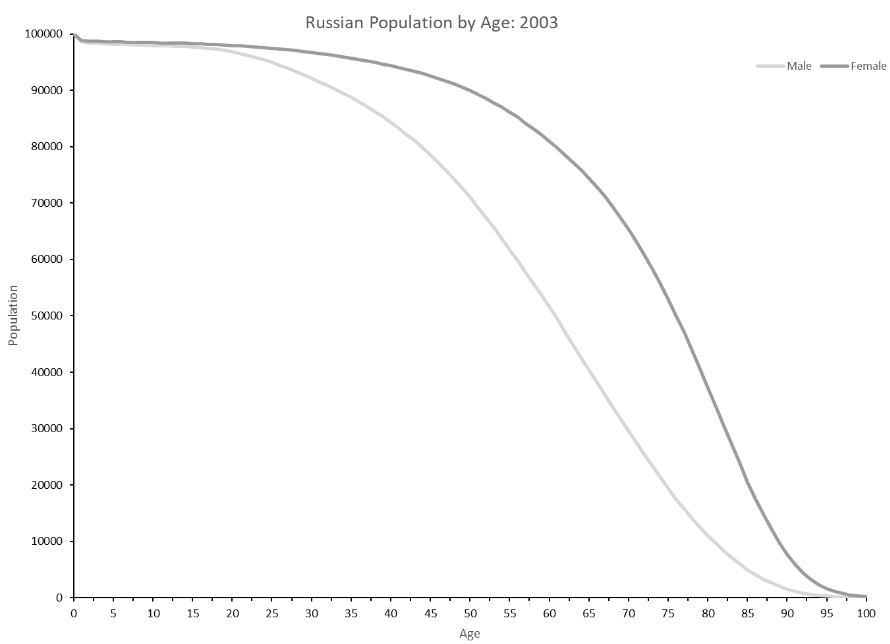
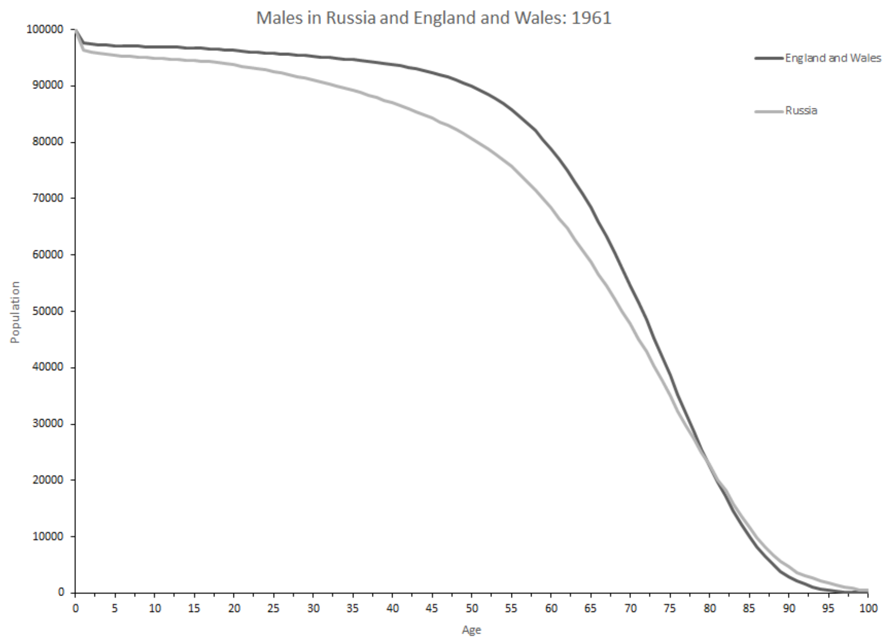
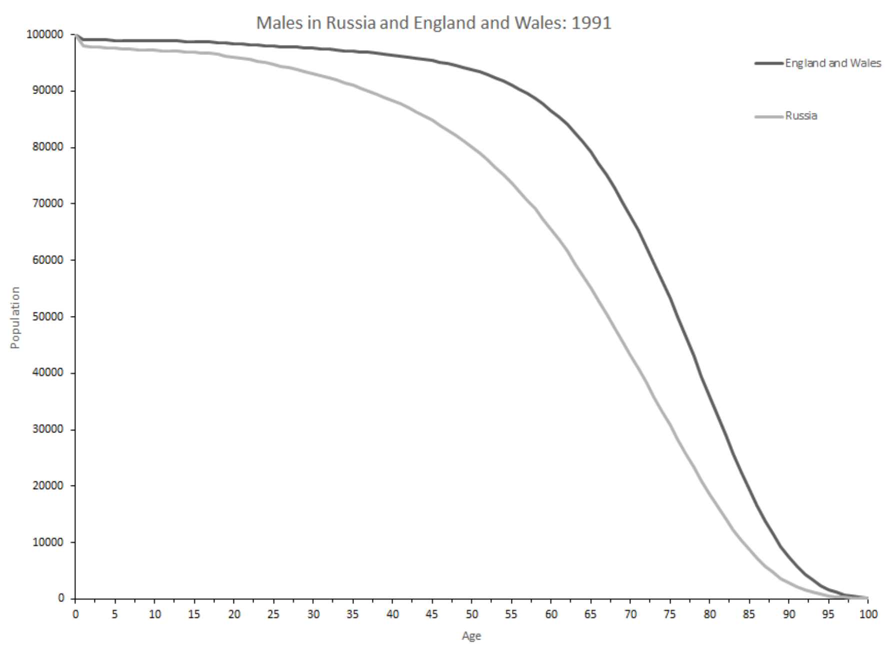


Figure 5: Number of females and males alive in Russia, 2003


Males in Russia and England and Wales: 1961
England and Wales
Russia
Population
Age
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100


Males in Russia and England and Wales: 1991
England and Wales
Russia
Population
Age
0
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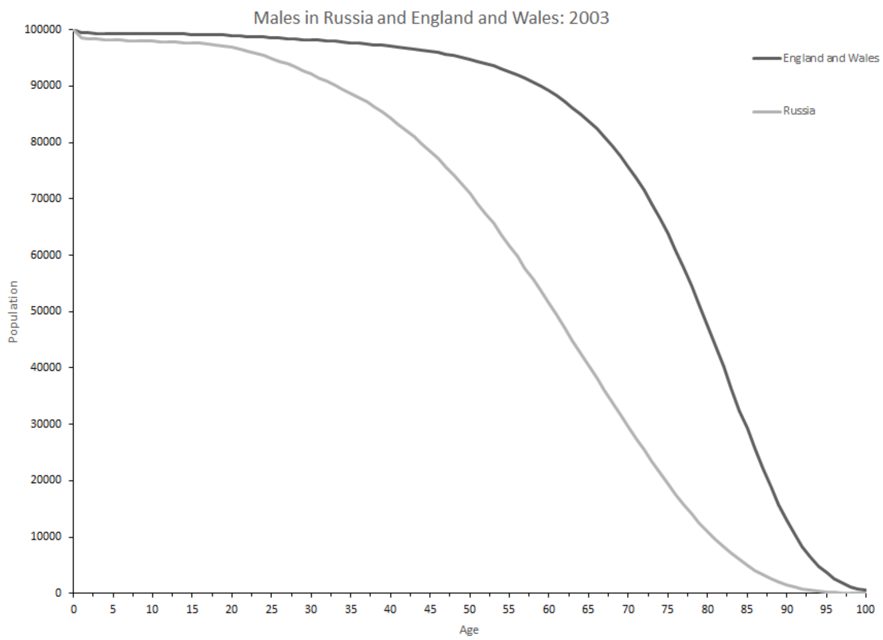

Overall there is a much lower male life expectancy in Russia compared with England, with an even widening gap. As mentioned above, this relates to the prominent alcohol abuse, violence and prevalence of accidents within Russia which has lead to an increase in preventable deaths within Russia (Leon et al., 1997). Leon and Shkolnikov (1998) particularly note that this very high mortality is a stark contrast to those born in Britain, and does not reflect statistical artefacts as suggested in previous studies.

References

M Bartley. Employment status, employment conditions, and limiting illness: Prospective evidence from the British household panel survey 1991-2001. *Journal of Epidemiology & Community Health*, 58(6): 501–506, June 2004. ISSN 0143-005X. doi: 10.1136/jech.2003.009878.

David A Leon and Vladimir M Shkolnikov. Social stress and the Russian mortality crisis. *JAMA*, 279 (10):790–791, 1998. ISSN 0098-7484.

David A Leon, Laurent Chenet, Vladimir M Shkolnikov, Sergei Zakharov, Judith Shapiro, Galina Rakhmanova, Sergei Vassin, and Martin McKee. Huge variation in Russian mortality rates 1984–94: Artefact, alcohol, or what? *The lancet*, 350(9075):383–388, 1997. ISSN 0140-6736.

Jim Oeppen and James W Vaupel. Broken limits to life expectancy. 2002. ISSN 0036-8075.

Irene Wennemo. Infant mortality, public policy and inequality - a comparison of 18 industrialised countries 1950-85. *Sociology of Health & Illness*, 15(4):429–446, June 2008. ISSN 01419889. doi: 10.1111/j.1467-9566.1993.tb00354.x.

Table 1: England and Wales Life Table for Females

Age	M_x	a_x	q_x	p_x	l_x	d_x	L_x	T_x	e_x
1	0.0004	0.5	0.0004	0.9996	99495	38	99476	7968330	80.1
2	0.0003	0.5	0.0003	0.9997	99457	25	99444	7868854	79.1
3	0.0002	0.5	0.0002	0.9998	99432	17	99423	7769410	78.1
4	0.0002	0.5	0.0002	0.9998	99415	16	99407	7669987	77.2
5	0.0001	0.5	0.0001	0.9999	99399	14	99393	7570580	76.2
6	0.0001	0.5	0.0001	0.9999	99386	11	99380	7471187	75.2
7	0.0001	0.5	0.0001	0.9999	99374	7	99371	7371807	74.2
8	0.0001	0.5	0.0001	0.9999	99367	8	99363	7272436	73.2
9	0.0001	0.5	0.0001	0.9999	99359	8	99355	7173073	72.2
10	0.0001	0.5	0.0001	0.9999	99351	9	99346	7073718	71.2
11	0.0001	0.5	0.0001	0.9999	99342	10	99337	6974371	70.2
12	0.0002	0.5	0.0001	0.9999	99332	15	99325	6875034	69.2
13	0.0001	0.5	0.0001	0.9999	99317	10	99312	6775710	68.2
14	0.0001	0.5	0.0001	0.9999	99307	13	99300	6676398	67.2
15	0.0001	0.5	0.0001	0.9999	99294	14	99287	6577097	66.2
16	0.0002	0.5	0.0002	0.9998	99280	19	99271	6477810	65.3
17	0.0002	0.5	0.0002	0.9998	99261	20	99251	6378540	64.3
18	0.0002	0.5	0.0002	0.9998	99241	24	99229	6279288	63.3
19	0.0003	0.5	0.0003	0.9997	99217	31	99202	6180059	62.3
20	0.0003	0.5	0.0003	0.9997	99187	28	99173	6080856	61.3
21	0.0003	0.5	0.0003	0.9997	99159	26	99146	5981683	60.3
22	0.0003	0.5	0.0003	0.9997	99133	29	99119	5882537	59.3
23	0.0003	0.5	0.0003	0.9997	99105	31	99090	5783418	58.4
24	0.0003	0.5	0.0003	0.9997	99074	28	99060	5684328	57.4
25	0.0003	0.5	0.0003	0.9997	99047	26	99033	5585268	56.4
26	0.0003	0.5	0.0003	0.9997	99020	33	99004	5486234	55.4
27	0.0003	0.5	0.0003	0.9997	98987	31	98971	5387231	54.4
28	0.0004	0.5	0.0004	0.9996	98956	39	98937	5288260	53.5
29	0.0005	0.5	0.0005	0.9995	98917	45	98895	5189323	52.5
30	0.0005	0.5	0.0005	0.9995	98872	49	98847	5090428	51.5
31	0.0004	0.5	0.0004	0.9996	98823	42	98801	4991581	50.5
32	0.0005	0.5	0.0005	0.9995	98780	46	98757	4892780	49.5
33	0.0005	0.5	0.0005	0.9995	98734	46	98711	4794023	48.6
34	0.0006	0.5	0.0006	0.9994	98688	63	98656	4695312	47.6
35	0.0006	0.5	0.0006	0.9994	98624	61	98594	4596656	46.6
36	0.0007	0.5	0.0007	0.9993	98564	68	98530	4498062	45.7
37	0.0007	0.5	0.0007	0.9993	98496	66	98463	4399532	44.7
38	0.0008	0.5	0.0008	0.9992	98430	82	98389	4301069	43.7
39	0.0008	0.5	0.0008	0.9992	98348	81	98307	4202680	42.8
40	0.0010	0.5	0.0010	0.9990	98267	99	98217	4104373	41.8
41	0.0010	0.5	0.0010	0.9990	98167	102	98116	4006156	40.8
42	0.0011	0.5	0.0011	0.9989	98065	109	98010	3908040	39.9
43	0.0013	0.5	0.0013	0.9987	97956	129	97891	3810030	38.9
44	0.0015	0.5	0.0015	0.9985	97827	149	97753	3712138	38.0
45	0.0015	0.5	0.0015	0.9985	97678	147	97605	3614386	37.0
46	0.0018	0.5	0.0018	0.9982	97531	173	97445	3516781	36.1
47	0.0021	0.5	0.0021	0.9979	97359	203	97257	3419336	35.2
48	0.0022	0.5	0.0022	0.9978	97156	211	97051	3322078	34.2
49	0.0023	0.5	0.0023	0.9977	96945	220	96835	3225028	33.3
50	0.0026	0.5	0.0026	0.9974	96725	255	96597	3128193	32.4
51	0.0028	0.5	0.0028	0.9972	96470	271	96334	3031595	31.5
52	0.0030	0.5	0.0030	0.9970	96199	291	96054	2935261	30.6
53	0.0033	0.5	0.0033	0.9967	95908	317	95750	2839207	29.7
54	0.0035	0.5	0.0035	0.9965	95591	334	95424	2743458	28.8
55	0.0040	0.5	0.0040	0.9960	95257	381	95067	2648034	27.9
56	0.0045	0.5	0.0045	0.9955	94876	424	94664	2552967	27.0
57	0.0041	0.5	0.0041	0.9959	94452	391	94257	2458302	26.1
58	0.0052	0.5	0.0051	0.9949	94062	484	93820	2364045	25.2
59	0.0058	0.5	0.0058	0.9942	93578	544	93306	2270225	24.3
60	0.0065	0.5	0.0065	0.9935	93034	601	92734	2176919	23.5
61	0.0069	0.5	0.0069	0.9931	92433	636	92115	2084185	22.6
62	0.0072	0.5	0.0071	0.9929	91798	654	91470	1992070	21.8
63	0.0082	0.5	0.0081	0.9919	91143	740	90773	1900599	20.9
64	0.0092	0.5	0.0091	0.9909	90403	825	89991	1809826	20.1
65	0.0104	0.5	0.0103	0.9897	89578	926	89115	1719835	19.3
66	0.0107	0.5	0.0107	0.9893	88652	946	88179	1630720	18.5
67	0.0122	0.5	0.0121	0.9879	87706	1062	87175	1542541	17.7
68	0.0136	0.5	0.0135	0.9865	86644	1166	86061	1455366	16.9
69	0.0151	0.5	0.0150	0.9850	85478	1283	84836	1369304	16.1
70	0.0165	0.5	0.0164	0.9836	84194	1381	83504	1284468	15.4
71	0.0184	0.5	0.0182	0.9818	82813	1508	82059	1200964	14.6
72	0.0215	0.5	0.0212	0.9788	81305	1727	80442	1118905	13.9
73	0.0241	0.5	0.0238	0.9762	79578	1892	78632	1038464	13.2
74	0.0271	0.5	0.0268	0.9732	77686	2080	76646	959832	12.5
75	0.0305	0.5	0.0301	0.9699	75606	2273	74469	883186	11.9
76	0.0340	0.5	0.0335	0.9665	73333	2453	72106	808716	11.2
77	0.0384	0.5	0.0377	0.9623	70880	2669	69545	736610	10.6
78	0.0427	0.5	0.0418	0.9582	68211	2849	66786	667065	10.0
79	0.0482	0.5	0.0471	0.9529	65361	3079	63822	600279	9.4
80	0.0535	0.5	0.0521	0.9479	62283	3245	60660	536457	8.8
81	0.0595	0.5	0.0578	0.9422	59038	3413	57332	475796	8.3
82	0.0691	0.5	0.0668	0.9332	55625	3717	53767	418465	7.8
83	0.0810	0.5	0.0778	0.9222	51909	4039	49889	364698	7.3
84	0.0765	0.5	0.0737	0.9263	47870	3527	46107	314808	6.8
85	0.0927	0.5	0.0886	0.9114	44343	3928	42379	268702	6.3
86	0.1116	0.5	0.1057	0.8943	40415	4273	38278	226323	5.9
87	0.1250	0.5	0.1177	0.8823	36142	4252	34016	188044	5.5
88	0.1389	0.5	0.1299	0.8701	31889	4143	29818	154029	5.2
89	0.1538	0.5	0.1429	0.8571	27746	3964	25764	124211	4.8
90	0.1702	0.5	0.1568	0.8432	23783	3730	21918	98447	4.5
91	0.1856	0.5	0.1699	0.8301	20053	3406	18350	76529	4.2
92	0.2093	0.5	0.1895	0.8105	16647	3154	15070	58179	3.9
93	0.2396	0.5	0.2140	0.7860	13493	2887	12049	43110	3.6
94	0.2562	0.5	0.2271	0.7729	10606	2408	9401	31061	3.3
95	0.2844	0.5	0.2490	0.7510	8197	2041	7177	21659	3.0
96	0.3113	0.5	0.2694	0.7306	6156	1659	5327	14482	2.7
97	0.3387	0.5	0.2897	0.7103	4498	1303	3846	9155	2.4
98	0.3652	0.5	0.3088	0.6912	3195	987	2702	5309	2.0
99	0.3802	0.5	0.3195	0.6805	2208	705	1856	2607	1.4
100	2.0000	0.5	1.0000	0.0000	1503	1503	751	751	1.0

Table 2: England and Wales Life Table for Males

	Age	M_x	a_x	q_x	p_x	l_x	d_x	L_x	T_x	e_x
3	1	0.0004	0.5	0.0004	0.9996	99421	37	99403	7539868	75.9
4	2	0.0003	0.5	0.0003	0.9997	99384	25	99372	7440465	74.9
5	3	0.0002	0.5	0.0002	0.9998	99359	22	99348	7341093	73.9
6	4	0.0002	0.5	0.0002	0.9998	99338	15	99330	7241745	72.9
7	5	0.0001	0.5	0.0001	0.9999	99323	12	99316	7142415	71.9
8	6	0.0001	0.5	0.0001	0.9999	99310	13	99304	7043098	70.9
9	7	0.0001	0.5	0.0001	0.9999	99298	9	99293	6943794	69.9
10	8	0.0001	0.5	0.0001	0.9999	99289	11	99283	6844501	68.9
11	9	0.0001	0.5	0.0001	0.9999	99278	12	99272	6745217	67.9
12	10	0.0001	0.5	0.0001	0.9999	99266	9	99261	6645945	67.0
13	11	0.0001	0.5	0.0001	0.9999	99257	12	99251	6546684	66.0
14	12	0.0001	0.5	0.0001	0.9999	99245	14	99238	6447433	65.0
15	13	0.0002	0.5	0.0002	0.9998	99231	15	99224	6348195	64.0
16	14	0.0002	0.5	0.0002	0.9998	99216	19	99207	6248971	63.0
17	15	0.0003	0.5	0.0003	0.9997	99197	25	99185	6149764	62.0
18	16	0.0003	0.5	0.0003	0.9997	99172	31	99157	6050579	61.0
19	17	0.0005	0.5	0.0005	0.9995	99142	48	99118	5951422	60.0
20	18	0.0007	0.5	0.0007	0.9993	99094	69	99059	5852305	59.1
21	19	0.0006	0.5	0.0006	0.9994	99025	59	98996	5753245	58.1
22	20	0.0008	0.5	0.0008	0.9992	98966	77	98928	5654250	57.2
23	21	0.0007	0.5	0.0007	0.9993	98889	67	98856	5555322	56.2
24	22	0.0007	0.5	0.0007	0.9993	98822	73	98786	5456466	55.2
25	23	0.0008	0.5	0.0008	0.9992	98749	79	98710	5357680	54.3
26	24	0.0007	0.5	0.0007	0.9993	98670	74	98633	5258970	53.3
27	25	0.0008	0.5	0.0008	0.9992	98596	81	98556	5160337	52.4
28	26	0.0008	0.5	0.0008	0.9992	98515	81	98475	5061781	51.4
29	27	0.0007	0.5	0.0007	0.9993	98434	67	98400	4963307	50.4
30	28	0.0009	0.5	0.0009	0.9991	98367	84	98325	4864906	49.5
31	29	0.0008	0.5	0.0008	0.9992	98283	83	98241	4766582	48.5
32	30	0.0008	0.5	0.0008	0.9992	98199	80	98159	4668341	47.6
33	31	0.0010	0.5	0.0010	0.9990	98119	93	98072	4570182	46.6
34	32	0.0011	0.5	0.0011	0.9989	98026	105	97973	4472109	45.6
35	33	0.0011	0.5	0.0011	0.9989	97921	104	97869	4374136	44.7
36	34	0.0010	0.5	0.0010	0.9990	97816	103	97765	4276268	43.7
37	35	0.0012	0.5	0.0012	0.9988	97714	114	97657	4178502	42.8
38	36	0.0012	0.5	0.0012	0.9988	97600	119	97540	4080846	41.8
39	37	0.0013	0.5	0.0013	0.9987	97481	126	97418	3983305	40.9
40	38	0.0013	0.5	0.0013	0.9987	97355	127	97291	3885887	39.9
41	39	0.0015	0.5	0.0015	0.9985	97228	141	97157	3788596	39.0
42	40	0.0016	0.5	0.0016	0.9984	97086	159	97007	3691439	38.1
43	41	0.0016	0.5	0.0016	0.9984	96928	159	96848	3594432	37.1
44	42	0.0019	0.5	0.0019	0.9981	96769	186	96676	3497584	36.2
45	43	0.0022	0.5	0.0022	0.9978	96583	209	96478	3400908	35.3
46	44	0.0021	0.5	0.0021	0.9979	96374	205	96271	3304430	34.3
47	45	0.0023	0.5	0.0023	0.9977	96169	217	96060	3208159	33.4
48	46	0.0027	0.5	0.0027	0.9973	95952	260	95822	3112099	32.5
49	47	0.0030	0.5	0.0030	0.9970	95692	291	95546	3016277	31.6
50	48	0.0033	0.5	0.0033	0.9967	95401	314	95244	2920730	30.7
51	49	0.0035	0.5	0.0035	0.9965	95087	328	94923	2825486	29.8
52	50	0.0040	0.5	0.0040	0.9960	94759	381	94568	2730563	28.9
53	51	0.0043	0.5	0.0043	0.9957	94378	402	94177	2635995	28.0
54	52	0.0046	0.5	0.0046	0.9954	93976	433	93760	2541817	27.1
55	53	0.0050	0.5	0.0050	0.9950	93543	466	93310	2448058	26.2
56	54	0.0055	0.5	0.0054	0.9946	93077	507	92823	2354748	25.4
57	55	0.0062	0.5	0.0062	0.9938	92570	571	92285	2261924	24.5
58	56	0.0069	0.5	0.0069	0.9931	91999	631	91684	2169640	23.7
59	57	0.0073	0.5	0.0072	0.9928	91368	660	91038	2077956	22.8
60	58	0.0079	0.5	0.0079	0.9921	90708	716	90350	1986918	22.0
61	59	0.0089	0.5	0.0089	0.9911	89992	800	89592	1896568	21.2
62	60	0.0104	0.5	0.0104	0.9896	89192	926	88729	1806976	20.4
63	61	0.0112	0.5	0.0112	0.9888	88266	986	87773	1718248	19.6
64	62	0.0122	0.5	0.0122	0.9878	87280	1061	86750	1630475	18.8
65	63	0.0137	0.5	0.0136	0.9864	86219	1169	85635	1543725	18.0
66	64	0.0151	0.5	0.0150	0.9850	85050	1277	84411	1458091	17.3
67	65	0.0162	0.5	0.0161	0.9839	83773	1346	83100	1373679	16.5
68	66	0.0178	0.5	0.0177	0.9823	82427	1458	81698	1290580	15.8
69	67	0.0200	0.5	0.0198	0.9802	80969	1606	80166	1208882	15.1
70	68	0.0226	0.5	0.0223	0.9777	79362	1773	78476	1128717	14.4
71	69	0.0244	0.5	0.0241	0.9759	77589	1869	76655	1050241	13.7
72	70	0.0265	0.5	0.0261	0.9739	75721	1979	74731	973586	13.0
73	71	0.0302	0.5	0.0298	0.9702	73741	2197	72643	898854	12.4
74	72	0.0335	0.5	0.0330	0.9670	71545	2359	70366	826211	11.7
75	73	0.0378	0.5	0.0371	0.9629	69186	2570	67901	755846	11.1
76	74	0.0427	0.5	0.0418	0.9582	66617	2784	65225	687944	10.5
77	75	0.0468	0.5	0.0457	0.9543	63833	2916	62374	622720	10.0
78	76	0.0524	0.5	0.0510	0.9490	60916	3110	59361	560345	9.4
79	77	0.0584	0.5	0.0568	0.9432	57807	3281	56166	500984	8.9
80	78	0.0636	0.5	0.0616	0.9384	54526	3360	52846	444818	8.4
81	79	0.0734	0.5	0.0708	0.9292	51166	3621	49355	391972	7.9
82	80	0.0788	0.5	0.0758	0.9242	47545	3603	45743	342617	7.5
83	81	0.0888	0.5	0.0850	0.9150	43942	3736	42074	296874	7.1
84	82	0.0992	0.5	0.0945	0.9055	40206	3799	38306	254800	6.7
85	83	0.1149	0.5	0.1086	0.8914	36406	3955	34429	216494	6.3
86	84	0.1013	0.5	0.0964	0.9036	32451	3129	30887	182065	5.9
87	85	0.1284	0.5	0.1206	0.8794	29322	3537	27554	151178	5.5
88	86	0.1471	0.5	0.1370	0.8630	25785	3533	24019	123624	5.1
89	87	0.1643	0.5	0.1518	0.8482	22253	3379	20563	99605	4.8
90	88	0.1791	0.5	0.1644	0.8356	18874	3103	17323	79042	4.6
91	89	0.1937	0.5	0.1766	0.8234	15771	2785	14379	61719	4.3
92	90	0.2104	0.5	0.1903	0.8097	12986	2472	11751	47340	4.0
93	91	0.2271	0.5	0.2040	0.7960	10515	2145	9442	35590	3.8
94	92	0.2564	0.5	0.2273	0.7727	8370	1902	7419	26148	3.5
95	93	0.2865	0.5	0.2506	0.7494	6468	1621	5657	18729	3.3
96	94	0.2855	0.5	0.2499	0.7501	4847	1211	4241	13072	3.1
97	95	0.3421	0.5	0.2921	0.7079	3636	1062	3105	8830	2.8
98	96	0.3474	0.5	0.2960	0.7040	2574	762	2193	5726	2.6
99	97	0.3772	0.5	0.3173	0.6827	1812	575	1524	3533	2.3
100	98	0.3869	0.5	0.3242	0.6758	1237	401	1036	2008	1.9
101	99	0.4063	0.5	0.3377	0.6623	836	282	695	972	1.4
102	100	2.0000	0.5	1.0000	0.0000	554	554	277	277	1.0
103										

Table 3: Russian Life Table for Females

Age	M_x	a_x	q_x	p_x	l_x	d_x	L_x	T_x	e_x
0	0.0112	0.09	0.0111	0.9889	100000	1109	98991	7183242	72.6
1	0.0012	0.5	0.0012	0.9988	98891	120	98831	7084251	71.7
2	0.0007	0.5	0.0007	0.9993	98771	66	98738	6985419	70.7
3	0.0005	0.5	0.0005	0.9995	98705	48	98681	6886681	69.8
4	0.0005	0.5	0.0005	0.9995	98657	46	98634	6788000	68.8
5	0.0004	0.5	0.0004	0.9996	98611	42	98590	6689366	67.9
6	0.0004	0.5	0.0003	0.9997	98569	34	98551	6590777	66.9
7	0.0003	0.5	0.0003	0.9997	98534	30	98519	6492225	65.9
8	0.0003	0.5	0.0003	0.9997	98504	32	98488	6393706	64.9
9	0.0003	0.5	0.0003	0.9997	98472	26	98460	6295218	63.9
10	0.0003	0.5	0.0003	0.9997	98447	27	98433	6196758	63.0
11	0.0003	0.5	0.0003	0.9997	98420	26	98407	6098325	62.0
12	0.0003	0.5	0.0003	0.9997	98394	29	98380	5999918	61.0
13	0.0003	0.5	0.0003	0.9997	98365	29	98351	5901539	60.0
14	0.0004	0.5	0.0004	0.9996	98336	40	98316	5803188	59.0
15	0.0005	0.5	0.0005	0.9995	98296	52	98270	5704872	58.1
16	0.0006	0.5	0.0006	0.9994	98244	59	98215	5606602	57.1
17	0.0007	0.5	0.0007	0.9993	98185	68	98151	5508387	56.1
18	0.0008	0.5	0.0008	0.9992	98117	76	98079	5410236	55.2
19	0.0008	0.5	0.0008	0.9992	98041	83	98000	5312157	54.2
20	0.0010	0.5	0.0010	0.9990	97958	94	97912	5214158	53.3
21	0.0009	0.5	0.0009	0.9991	97865	91	97819	5116246	52.3
22	0.0010	0.5	0.0010	0.9990	97774	99	97724	5018427	51.4
23	0.0011	0.5	0.0011	0.9989	97674	111	97619	4920703	50.4
24	0.0012	0.5	0.0012	0.9988	97563	118	97504	4823084	49.5
25	0.0014	0.5	0.0014	0.9986	97445	136	97377	4725580	48.5
26	0.0014	0.5	0.0014	0.9986	97308	135	97241	4628203	47.6
27	0.0015	0.5	0.0015	0.9985	97173	142	97102	4530962	46.7
28	0.0016	0.5	0.0016	0.9984	97031	157	96953	4433860	45.7
29	0.0017	0.5	0.0017	0.9983	96874	165	96792	4336907	44.8
30	0.0019	0.5	0.0019	0.9981	96709	183	96618	4240116	43.9
31	0.0018	0.5	0.0018	0.9982	96526	177	96438	4143498	43.0
32	0.0020	0.5	0.0020	0.9980	96349	194	96252	4047060	42.0
33	0.0022	0.5	0.0022	0.9978	96155	216	96047	3950808	41.1
34	0.0023	0.5	0.0023	0.9977	95940	222	95829	3854761	40.2
35	0.0025	0.5	0.0025	0.9975	95718	243	95596	3758932	39.3
36	0.0026	0.5	0.0026	0.9974	95475	251	95349	3663336	38.4
37	0.0028	0.5	0.0028	0.9972	95224	265	95091	3567987	37.5
38	0.0029	0.5	0.0029	0.9971	94959	271	94824	3472895	36.6
39	0.0031	0.5	0.0031	0.9969	94688	294	94541	3378072	35.7
40	0.0036	0.5	0.0035	0.9965	94394	335	94226	3283531	34.8
41	0.0036	0.5	0.0036	0.9964	94059	342	93888	3189305	34.0
42	0.0038	0.5	0.0038	0.9962	93717	354	93540	3095417	33.1
43	0.0043	0.5	0.0043	0.9957	93363	397	93165	3001876	32.2
44	0.0045	0.5	0.0045	0.9955	92966	416	92758	2908712	31.4
45	0.0050	0.5	0.0050	0.9950	92550	459	92321	2815954	30.5
46	0.0053	0.5	0.0053	0.9947	92092	484	91850	2723633	29.7
47	0.0056	0.5	0.0056	0.9944	91608	513	91351	2631783	28.8
48	0.0062	0.5	0.0062	0.9938	91095	563	90813	2540432	28.0
49	0.0067	0.5	0.0067	0.9933	90532	605	90229	2449619	27.1
50	0.0076	0.5	0.0075	0.9925	89927	677	89588	2359389	26.3
51	0.0081	0.5	0.0081	0.9919	89250	723	88889	2269801	25.5
52	0.0083	0.5	0.0083	0.9917	88527	735	88160	2180913	24.7
53	0.0091	0.5	0.0091	0.9909	87793	797	87394	2092753	23.9
54	0.0102	0.5	0.0101	0.9899	86996	882	86555	2005359	23.2
55	0.0103	0.5	0.0102	0.9898	86114	881	85673	1918804	22.4
56	0.0129	0.5	0.0128	0.9872	85232	1090	84688	1833131	21.6
57	0.0117	0.5	0.0116	0.9884	84143	975	83655	1748444	20.9
58	0.0133	0.5	0.0132	0.9868	83168	1095	82620	1664789	20.1
59	0.0142	0.5	0.0141	0.9859	82073	1159	81493	1582168	19.4
60	0.0135	0.5	0.0134	0.9866	80914	1083	80372	1500675	18.7
61	0.0170	0.5	0.0169	0.9831	79831	1347	79157	1420303	17.9
62	0.0162	0.5	0.0160	0.9840	78484	1258	77855	1341146	17.2
63	0.0175	0.5	0.0174	0.9826	77226	1341	76556	1263291	16.5
64	0.0198	0.5	0.0196	0.9804	75885	1488	75141	1186735	15.8
65	0.0201	0.5	0.0199	0.9801	74397	1481	73656	1111594	15.1
66	0.0232	0.5	0.0229	0.9771	72916	1670	72081	1037938	14.4
67	0.0262	0.5	0.0259	0.9741	71245	1842	70324	965857	13.7
68	0.0291	0.5	0.0287	0.9713	69403	1991	68408	895533	13.1
69	0.0306	0.5	0.0301	0.9699	67413	2032	66397	827125	12.5
70	0.0337	0.5	0.0332	0.9668	65381	2167	64297	760729	11.8
71	0.0381	0.5	0.0374	0.9626	63213	2366	62030	696432	11.2
72	0.0411	0.5	0.0403	0.9597	60847	2450	59622	634402	10.6
73	0.0458	0.5	0.0447	0.9553	58397	2613	57090	574780	10.1
74	0.0508	0.5	0.0496	0.9504	55784	2765	54402	517689	9.5
75	0.0572	0.5	0.0556	0.9444	53019	2949	51545	463288	9.0
76	0.0627	0.5	0.0608	0.9392	50070	3045	48548	411743	8.5
77	0.0701	0.5	0.0677	0.9323	47025	3185	45432	363195	8.0
78	0.0777	0.5	0.0747	0.9253	43840	3277	42201	317763	7.5
79	0.0886	0.5	0.0848	0.9152	40563	3441	38842	275561	7.1
80	0.0929	0.5	0.0888	0.9112	37122	3297	35473	236719	6.7
81	0.1054	0.5	0.1001	0.8999	33825	3386	32132	201246	6.3
82	0.1143	0.5	0.1081	0.8919	30439	3291	28794	169114	5.9
83	0.1262	0.5	0.1187	0.8813	27148	3223	25537	140320	5.5
84	0.1559	0.5	0.1447	0.8553	23926	3461	22195	114783	5.2
85	0.1586	0.5	0.1470	0.8530	20465	3008	18961	92588	4.9
86	0.1644	0.5	0.1519	0.8481	17457	2652	16131	73627	4.6
87	0.1892	0.5	0.1729	0.8271	14804	2559	13525	57497	4.3
88	0.2274	0.5	0.2042	0.7958	12245	2500	10995	43972	4.0
89	0.2428	0.5	0.2165	0.7835	9745	2110	8690	32977	3.8
90	0.2560	0.5	0.2269	0.7731	7635	1733	6769	24287	3.6
91	0.2843	0.5	0.2489	0.7511	5903	1469	5168	17519	3.4
92	0.3035	0.5	0.2635	0.7365	4433	1168	3849	12351	3.2
93	0.3388	0.5	0.2897	0.7103	3265	946	2792	8501	3.0
94	0.3363	0.5	0.2879	0.7121	2319	668	1985	5709	2.9
95	0.3853	0.5	0.3231	0.6769	1652	534	1385	3724	2.7
96	0.3928	0.5	0.3284	0.6716	1118	367	934	2339	2.5
97	0.4022	0.5	0.3348	0.6652	751	251	625	1404	2.2
98	0.4369	0.5	0.3585	0.6415	499	179	410	779	1.9
99	0.4203	0.5	0.3473	0.6527	320	111	265	369	1.4
100	2.0000	0.5	1.0000	0.0000	209	209	105	105	1.0

Table 4: Russian Life Table for Males

Age	M_x	a_x	q_x	p_x	l_x	d_x	L_x	T_x	e_x
0	0.0145	0.08	0.0143	0.9857	100000	1428	98686	5850945	59.3
1	0.0015	0.5	0.0015	0.9985	98572	151	98497	5752259	58.4
2	0.0009	0.5	0.0009	0.9991	98421	91	98375	5653762	57.5
3	0.0007	0.5	0.0007	0.9993	98330	65	98297	5555387	56.5
4	0.0007	0.5	0.0007	0.9993	98264	70	98230	5457090	55.6
5	0.0006	0.5	0.0006	0.9994	98195	55	98167	5358860	54.6
6	0.0005	0.5	0.0005	0.9995	98140	54	98113	5260693	53.6
7	0.0005	0.5	0.0005	0.9995	98086	51	98061	5162580	52.6
8	0.0005	0.5	0.0005	0.9995	98036	51	98010	5064519	51.7
9	0.0005	0.5	0.0005	0.9995	97985	48	97961	4966508	50.7
10	0.0004	0.5	0.0004	0.9996	97937	43	97916	4868547	49.7
11	0.0005	0.5	0.0005	0.9995	97894	47	97871	4770632	48.7
12	0.0006	0.5	0.0006	0.9994	97847	54	97820	4672761	47.8
13	0.0006	0.5	0.0006	0.9994	97793	58	97764	4574941	46.8
14	0.0007	0.5	0.0007	0.9993	97735	69	97700	4477177	45.8
15	0.0010	0.5	0.0010	0.9990	97666	95	97619	4379476	44.9
16	0.0014	0.5	0.0014	0.9986	97571	132	97506	4281858	43.9
17	0.0018	0.5	0.0018	0.9982	97440	171	97354	4184352	43.0
18	0.0021	0.5	0.0021	0.9979	97269	204	97167	4086998	42.1
19	0.0025	0.5	0.0025	0.9975	97065	242	96944	3989831	41.2
20	0.0031	0.5	0.0031	0.9969	96823	297	96675	3892887	40.3
21	0.0035	0.5	0.0035	0.9965	96527	340	96356	3796212	39.4
22	0.0039	0.5	0.0039	0.9961	96186	375	95999	3699856	38.5
23	0.0043	0.5	0.0043	0.9957	95811	413	95605	3603857	37.7
24	0.0048	0.5	0.0048	0.9952	95398	461	95168	3508252	36.9
25	0.0053	0.5	0.0053	0.9947	94937	501	94687	3413085	36.0
26	0.0055	0.5	0.0055	0.9945	94436	516	94178	3318398	35.2
27	0.0060	0.5	0.0059	0.9941	93920	559	93641	3224220	34.4
28	0.0063	0.5	0.0063	0.9937	93361	585	93069	3130580	33.6
29	0.0066	0.5	0.0066	0.9934	92777	609	92472	3037511	32.8
30	0.0072	0.5	0.0072	0.9928	92168	663	91837	2945038	32.1
31	0.0070	0.5	0.0069	0.9931	91505	636	91187	2853202	31.3
32	0.0072	0.5	0.0072	0.9928	90870	652	90544	2762014	30.5
33	0.0079	0.5	0.0079	0.9921	90218	712	89862	2671470	29.7
34	0.0083	0.5	0.0083	0.9917	89506	740	89136	2581608	29.0
35	0.0089	0.5	0.0088	0.9912	88766	785	88373	2492472	28.2
36	0.0095	0.5	0.0094	0.9906	87981	829	87566	2404099	27.5
37	0.0101	0.5	0.0101	0.9899	87152	877	86713	2316533	26.7
38	0.0107	0.5	0.0107	0.9893	86275	922	85814	2229819	26.0
39	0.0115	0.5	0.0114	0.9886	85353	975	84865	2144005	25.3
40	0.0134	0.5	0.0133	0.9867	84378	1125	83816	2059140	24.6
41	0.0133	0.5	0.0133	0.9867	83253	1103	82701	1975324	23.9
42	0.0136	0.5	0.0135	0.9865	82150	1112	81594	1892623	23.2
43	0.0153	0.5	0.0152	0.9848	81037	1231	80422	1811029	22.5
44	0.0164	0.5	0.0163	0.9837	79806	1300	79156	1730607	21.9
45	0.0178	0.5	0.0177	0.9823	78507	1389	77812	1651451	21.2
46	0.0184	0.5	0.0182	0.9818	77118	1404	76416	1573639	20.6
47	0.0198	0.5	0.0196	0.9804	75714	1485	74972	1497222	20.0
48	0.0218	0.5	0.0216	0.9784	74229	1600	73429	1422251	19.4
49	0.0228	0.5	0.0226	0.9774	72629	1640	71809	1348822	18.8
50	0.0261	0.5	0.0258	0.9742	70989	1830	70074	1277013	18.2
51	0.0264	0.5	0.0261	0.9739	69159	1804	68257	1206939	17.7
52	0.0264	0.5	0.0260	0.9740	67355	1753	66479	1138682	17.1
53	0.0292	0.5	0.0288	0.9712	65602	1888	64658	1072204	16.6
54	0.0320	0.5	0.0315	0.9685	63714	2006	62711	1007545	16.1
55	0.0308	0.5	0.0303	0.9697	61708	1869	60774	944834	15.5
56	0.0370	0.5	0.0364	0.9636	59839	2176	58752	884060	15.0
57	0.0338	0.5	0.0333	0.9667	57664	1919	56704	825309	14.6
58	0.0376	0.5	0.0369	0.9631	55745	2059	54715	768605	14.0
59	0.0400	0.5	0.0393	0.9607	53686	2108	52632	713889	13.6
60	0.0416	0.5	0.0407	0.9593	51578	2100	50528	661257	13.1
61	0.0509	0.5	0.0496	0.9504	49478	2455	48251	610729	12.7
62	0.0469	0.5	0.0458	0.9542	47023	2154	45946	562478	12.2
63	0.0508	0.5	0.0495	0.9505	44869	2221	43759	516533	11.8
64	0.0545	0.5	0.0531	0.9469	42648	2263	41517	472774	11.4
65	0.0541	0.5	0.0527	0.9473	40385	2127	39322	431257	11.0
66	0.0586	0.5	0.0569	0.9431	38259	2178	37170	391935	10.5
67	0.0621	0.5	0.0602	0.9398	36081	2174	34994	354765	10.1
68	0.0660	0.5	0.0639	0.9361	33907	2167	32824	319771	9.7
69	0.0680	0.5	0.0658	0.9342	31740	2088	30696	286948	9.3
70	0.0732	0.5	0.0706	0.9294	29652	2093	28606	256251	9.0
71	0.0799	0.5	0.0768	0.9232	27559	2118	26500	227646	8.6
72	0.0820	0.5	0.0787	0.9213	25441	2003	24440	201145	8.2
73	0.0895	0.5	0.0857	0.9143	23438	2008	22434	176706	7.9
74	0.0963	0.5	0.0919	0.9081	21430	1969	20445	154272	7.5
75	0.1042	0.5	0.0991	0.9009	19461	1928	18497	133826	7.2
76	0.1076	0.5	0.1021	0.8979	17533	1790	16638	115329	6.9
77	0.1134	0.5	0.1073	0.8927	15743	1689	14899	98691	6.6
78	0.1174	0.5	0.1109	0.8891	14054	1558	13275	83792	6.3
79	0.1312	0.5	0.1231	0.8769	12496	1539	11727	70517	6.0
80	0.1297	0.5	0.1218	0.8782	10958	1335	10290	58790	5.7
81	0.1452	0.5	0.1354	0.8646	9623	1303	8971	48500	5.4
82	0.1566	0.5	0.1452	0.8548	8320	1208	7716	39529	5.1
83	0.1667	0.5	0.1539	0.8461	7112	1094	6565	31813	4.8
84	0.1959	0.5	0.1784	0.8216	6017	1074	5481	25248	4.6
85	0.1999	0.5	0.1817	0.8183	4944	898	4495	19768	4.4
86	0.2009	0.5	0.1826	0.8174	4045	739	3676	15273	4.2
87	0.2264	0.5	0.2034	0.7966	3307	673	2971	11597	3.9
88	0.2615	0.5	0.2313	0.7687	2634	609	2330	8626	3.7
89	0.2750	0.5	0.2418	0.7582	2025	490	1780	6297	3.5
90	0.2938	0.5	0.2561	0.7439	1535	393	1339	4517	3.4
91	0.3181	0.5	0.2744	0.7256	1142	313	985	3178	3.2
92	0.3295	0.5	0.2829	0.7171	829	234	711	2192	3.1
93	0.3682	0.5	0.3110	0.6890	594	185	502	1481	3.0
94	0.3645	0.5	0.3083	0.6917	409	126	346	979	2.8
95	0.3916	0.5	0.3275	0.6725	283	93	237	633	2.7
96	0.4165	0.5	0.3447	0.6553	190	66	158	396	2.5
97	0.3915	0.5	0.3274	0.6726	125	41	104	238	2.3
98	0.4016	0.5	0.3345	0.6655	84	28	70	134	1.9
99	0.4309	0.5	0.3545	0.6455	56	20	46	64	1.4
100	2.0000	0.5	1.0000	0.0000	36	36	18	18	1.0

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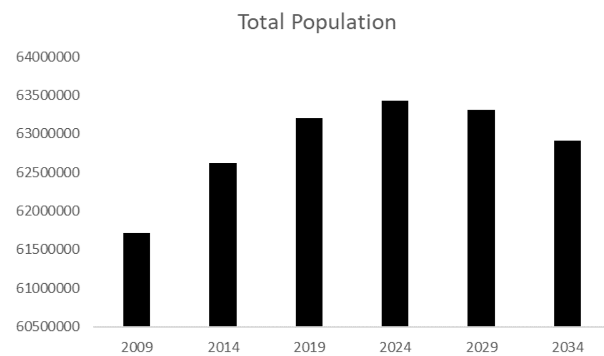

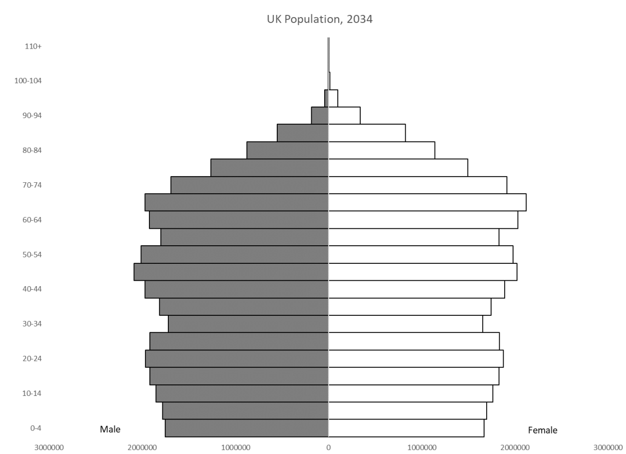

The total population is predicted to hit a peak of around 634,000 in 2024 before steadily decreasing to 629,000 in 2034 (Total Population). Comparing the UK population pyramid in 2009 to the population in 2034 shows the shift from a population with the largest age group between 40-44 years old, with a slight decrease towards the younger age groups, and a sharper increase towards older age groups in 2009, to a much more uniform distribution of population by age groups in 2034. Peaks can be seen at around age group 55-60 with a similar peak in the 70s. These two figures give the result of what is an aging population, where lower birth rates, along with increased life expectancy means that the average age of the population is increasing.

The modern drop in birth rate within the UK can be attributed to the improvement in healthcare, and hospital conditions meaning childhood mortality has dropped and women are having fewer children (Wennemo, 2008). There is now widespread access to contraception which women have more control over their births, and women are far more likely to be in education or work, meaning they are less likely to have children until later life, and as such have fewer children (Oláh, 2003). Life expectancy in addition have improved through improvement in working conditions, and healthcare (Bartley, 2004).

The decreasing population following 2024 is due to the predicted mortality rates overcoming the future birth rates, due to the majority of the population living to an old age at which they reach their life expectancy.

There is a view that an aging population within the UK will lead to a growing welfare state, as many older people rely on external support in their daily lives (Gusmano and Okma, 2018). However, it is often suggested that these views are unfounded, as pension spending has increased sufficiently to support many older people later in life, and often the age at which people are able to work effectively has increased (Gusmano and Okma, 2018). However, it should be considered that adjustments will have to be made, and many countries such as Japan and South Korea have pushed for pension privatisation with their rapidly aging populations (Asher and Kimura, 2015). It is suggested that public pension spending in the United Kingdom will similarly have to be curbed, as the majority of elderly people who are eligible for pensions now are able to both support themselves financially, and are generally healthier than they used to be (Gusmano and Okma, 2018).

References

Mukul G Asher and Fukunari Kimura. *Strengthening Social Protection in East Asia*. Routledge, 2015. ISBN 1-317-51067-4.

M Bartley. Employment status, employment conditions, and limiting illness: Prospective evidence from the British household panel survey 1991-2001. *Journal of Epidemiology & Community Health*, 58(6): 501–506, June 2004. ISSN 0143-005X. doi: 10.1136/jech.2003.009878.

Michael K. Gusmano and Kieke G. H. Okma. Population Aging and the Sustainability of the Welfare State. *Hastings Center Report*, 48:S57–S61, September 2018. ISSN 00930334. doi: 10.1002/hast.915.

Livia Sz. Oláh. Gendering Fertility. *Population Research and Policy Review*, 22(2):171–200, 2003. ISSN 01675923. doi: 10.1023/A:1025089031871.

Irene Wennemo. Infant mortality, public policy and inequality - a comparison of 18 industrialised countries 1950-85. *Sociology of Health & Illness*, 15(4):429–446, June 2008. ISSN 01419889. doi: 10.1111/j.1467-9566.1993.tb00354.x.

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Population Projection 2009 to 2109 with current mortality and fertility rates

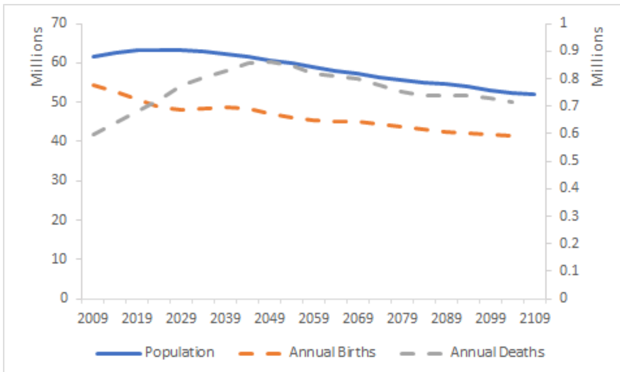

Figure 1: Population Dynamics for current mortality and fertility rates, 2009 to 2109 for the United Kingdom

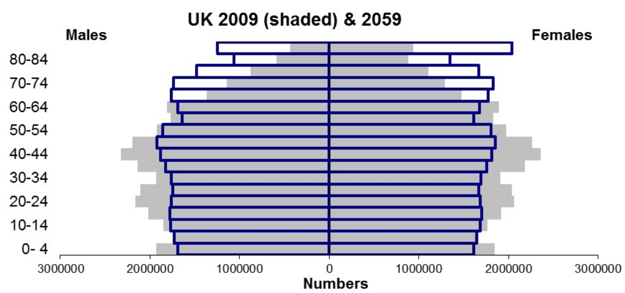

Figure 2: Population Pyramid for current mortality and fertility rates, 2009 and 2109 for the United Kingdom

Figure 1 shows that given current mortality and fertility rates, the annual death rate will overtake the annual birth rate around 2020, meaning population growth will begin to decrease. The annual births will continue to decrease at a steady rate from 2009 until 2109, whereas the annual death rates are predicted to increase at a higher rate until 2049, until they begin to drop at a slower rate until 2109. Figure 2 shows that in 2059 there will be a very large proportion of the population who are above the current age to be considered elderly and retired (65), far higher than the proportion of elderly people in 2009. Additionally the proportion of young people in 2109 is far less than in 2009, with a much more even spread of people within each age group.

The drop off in peak population is a result of the increased overall mortality above birth rates due to an increasing elderly population (Gusmano and Okma, 2018), where an elderly population is at a higher risk of age related illness. Additionally, birth rates within the United Kingdom have been steadily decreasing, influenced by an increased proportion of women working in professional careers, which has led to families with fewer children, and women having children later in life (Gerster et al., 2007).

Population Projection 2009 to 2109 with an increase in life expectancy

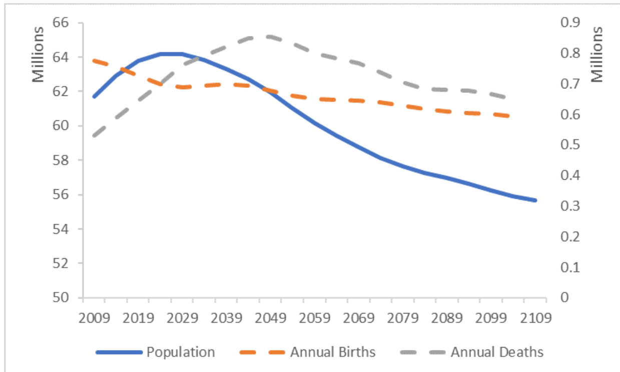

Figure 3: Population Dynamics for current mortality and fertility rates, 2009 to 2109

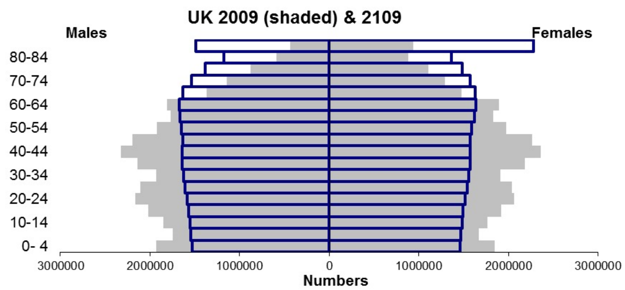

Figure 4: Population Dynamics for current mortality and fertility rates, 2009 to 2109

Figure 3 shows that while the population will initially increase at a high rate with increased life expectancy until 2025, this rate quickly slows and begins to decrease at a similar rate. This is reflected in the number of annual deaths, which dramatically increase early on, before slowing when the population size is reduced. Figure 4 shows that a very high proportion of the population in 2109 will be elderly, which is why the number of annual deaths is expected to be so high, similarly this graph shows that there is a far lower proportion of persons in younger age groups, and the groups themselves are far more evenly spread.

Considering further improvement to healthcare within the United Kingdom would suggest a further increase to life expectancy. The sharp drop off indicates the increase in an elderly population (Gusmano and Okma, 2018), additionally it should be considered the strain an elderly population could have on the welfare state in the UK, where fewer people are working and therefore contributing to taxes, but far more are reliant on the government support (Gusmano and Okma, 2018).

Population Projection 2009 to 2109 with annual net migration of 150,000

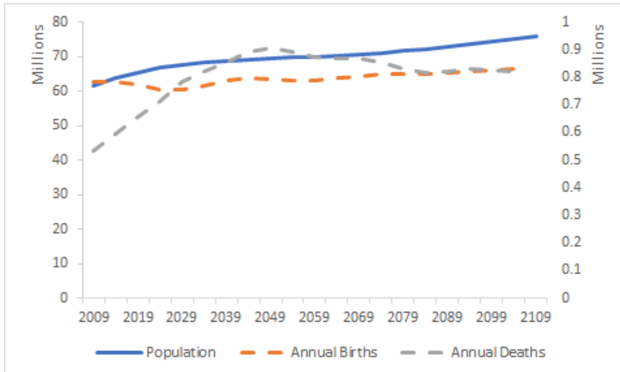

Figure 5: Population Dynamics for current mortality and fertility rates, 2009 to 2109

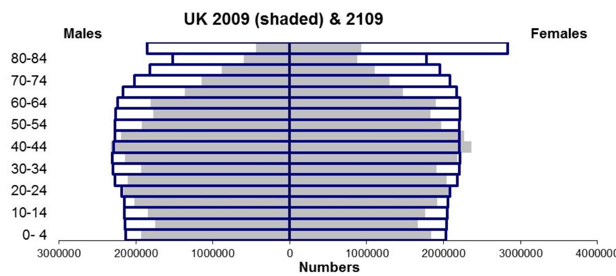

Figure 6: Population Dynamics for current mortality and fertility rates, 2009 to 2109

Figure 5 shows that including net migration into the population prediction leads to a continued increase in the overall population, this is influenced by both the migration itself, and the rate of births, which is expected to increase with the influx of new populations. The death rate again is predicted to rise initially but drop off, but the rate of immigration in addition to the increased birth rates means that the population does not have an initial drop off. Figure 6 shows that similarly to the other population estimates, the number of elderly people will be far higher in 2109 than in 2009, but additionally the number of people in each age group is predicted to be higher in 2109, excluding the 40-44 age group.

While this figure shares the same mortality rates reflecting the aging population, the increase in immigration ensures that that population continues to climb due to the increase in healthily ages individuals, additionally this increase in population would likely alleviate the strain due to the increase in working age individuals shown on Figure 6.

References

Mette Gerster, Niels Keiding, Lisbeth B. Knudsen, and Katrine Strandberg-Larsen. Education and second birth rates in Denmark 1981-1994. *Demographic Research*, 17:181–210, November 2007. ISSN 1435-9871. doi: 10.4054/DemRes.2007.17.8.

Michael K. Gusmano and Kieke G. H. Okma. Population Aging and the Sustainability of the Welfare State. *Hastings Center Report*, 48:S57–S61, September 2018. ISSN 00930334. doi: 10.1002/hast.915.

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First Birth

Table 1: Survival Function for First Born Child

Interval	Total	Deaths	Lost	Survival	Error	Lower.95..CI	Upper.95..CI
15-16	3980	35	0	0.9912	0.0015	0.9878	0.9937
16-17	3945	99	0	0.9663	0.0029	0.9602	0.9715
17-18	3846	176	0	0.9221	0.0042	0.9133	0.9300
18-19	3670	286	2	0.8502	0.0057	0.8388	0.8610
19-20	3382	289	109	0.7764	0.0066	0.7631	0.7891
20-21	2984	308	112	0.6947	0.0074	0.6800	0.7089
21-22	2564	300	88	0.6120	0.0079	0.5963	0.6273
22-23	2176	280	79	0.5318	0.0082	0.5156	0.5477
23-24	1817	261	84	0.4536	0.0083	0.4373	0.4698
24-25	1472	235	75	0.3793	0.0082	0.3632	0.3954
25-26	1162	166	60	0.3237	0.0081	0.3079	0.3395
26-27	936	156	40	0.2686	0.0078	0.2533	0.2840
27-28	740	103	38	0.2302	0.0076	0.2155	0.2451
28-29	599	91	31	0.1943	0.0073	0.1803	0.2087
29-30	477	64	19	0.1677	0.0070	0.1543	0.1816
30-31	394	42	21	0.1493	0.0068	0.1363	0.1629
31-32	331	41	16	0.1304	0.0065	0.1179	0.1435
32-33	274	26	19	0.1176	0.0063	0.1055	0.1303
33-34	229	19	19	0.1074	0.0062	0.0956	0.1199
34-35	191	15	22	0.0984	0.0061	0.0869	0.1108
35-36	154	6	7	0.0945	0.0061	0.0830	0.1068
36-37	141	7	6	0.0897	0.0060	0.0784	0.1020
37-38	128	0	12	0.0897	0.0060	0.0784	0.1020
38-39	116	4	13	0.0864	0.0060	0.0751	0.0987
39-40	99	2	6	0.0846	0.0060	0.0733	0.0970
40-41	91	1	10	0.0837	0.0060	0.0723	0.0960
41-42	80	2	6	0.0815	0.0061	0.0701	0.0939
42-43	72	1	5	0.0803	0.0061	0.0689	0.0928
43-44	66	0	7	0.0803	0.0061	0.0689	0.0928
44-45	59	0	7	0.0803	0.0061	0.0689	0.0928
45-46	52	0	52	0.0803	0.0061	0.0689	0.0928

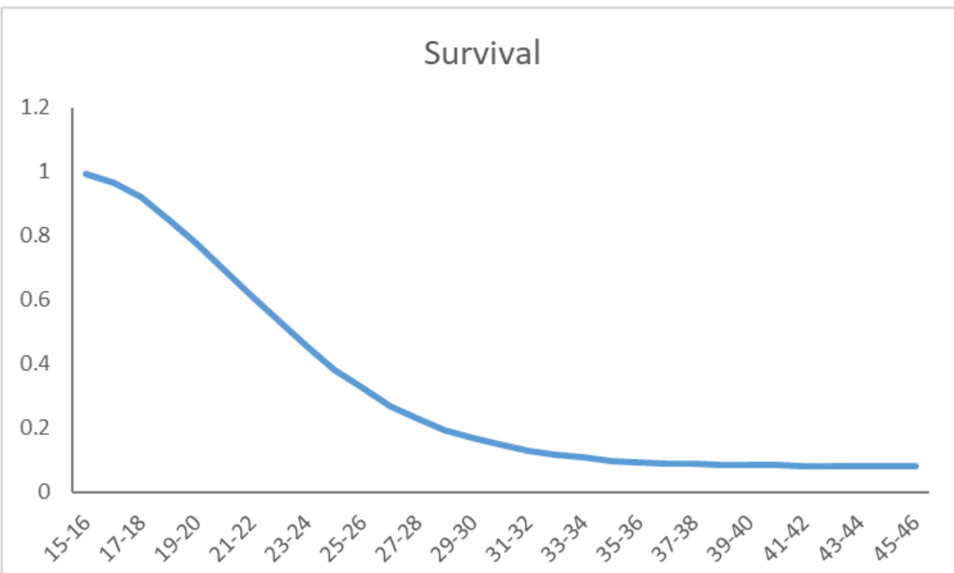

Figure 1: Survival Function for Age at First Born Child

Table 2: Hazard Function for First Born Child

Interval	Total	Failure	Error	Hazard	Error.1	Lower.95..CI	Upper.95..CI
15-16	3980	0.0088	0.0015	0.0088	0.0015	0.0059	0.0118
16-17	3945	0.0337	0.0029	0.0254	0.0026	0.0204	0.0304
17-18	3846	0.0779	0.0042	0.0468	0.0035	0.0399	0.0538
18-19	3670	0.1498	0.0057	0.0811	0.0048	0.0717	0.0905
19-20	3382	0.2236	0.0066	0.0908	0.0053	0.0803	0.1013
20-21	2984	0.3053	0.0074	0.1110	0.0063	0.0987	0.1234
21-22	2564	0.3880	0.0079	0.1266	0.0073	0.1123	0.1409
22-23	2176	0.4682	0.0082	0.1402	0.0084	0.1239	0.1566
23-24	1817	0.5464	0.0083	0.1587	0.0098	0.1395	0.1779
24-25	1472	0.6207	0.0082	0.1784	0.0116	0.1557	0.2012
25-26	1162	0.6763	0.0081	0.1582	0.0122	0.1342	0.1822
26-27	936	0.7314	0.0078	0.1862	0.0148	0.1571	0.2152
27-28	740	0.7698	0.0076	0.1538	0.0151	0.1242	0.1835
28-29	599	0.8057	0.0073	0.1691	0.0177	0.1345	0.2038
29-30	477	0.8323	0.0070	0.1470	0.0183	0.1111	0.1829
30-31	394	0.8507	0.0068	0.1159	0.0178	0.0809	0.1508
31-32	331	0.8696	0.0065	0.1355	0.0211	0.0941	0.1769
32-33	274	0.8824	0.0063	0.1034	0.0202	0.0637	0.1431
33-34	229	0.8926	0.0062	0.0905	0.0207	0.0498	0.1311
34-35	191	0.9016	0.0061	0.0870	0.0224	0.043	0.1309
35-36	154	0.9055	0.0061	0.0407	0.0166	0.0081	0.0732
36-37	141	0.9103	0.0060	0.0520	0.0197	0.0135	0.0906
37-38	128	0.9103	0.0060	0.0000	.	.	.
38-39	116	0.9136	0.0060	0.0372	0.0186	0.0008	0.0737
39-40	99	0.9154	0.0060	0.0211	0.0149	0	0.0502
40-41	91	0.9163	0.0060	0.0117	0.0117	0	0.0346
41-42	80	0.9185	0.0061	0.0263	0.0186	0	0.0628
42-43	72	0.9197	0.0061	0.0145	0.0145	0	0.0429
43-44	66	0.9197	0.0061	0.0000	.	.	.
44-45	59	0.9197	0.0061	0.0000	.	.	.
45-46	52	0.9197	0.0061	0.0000	.	.	.

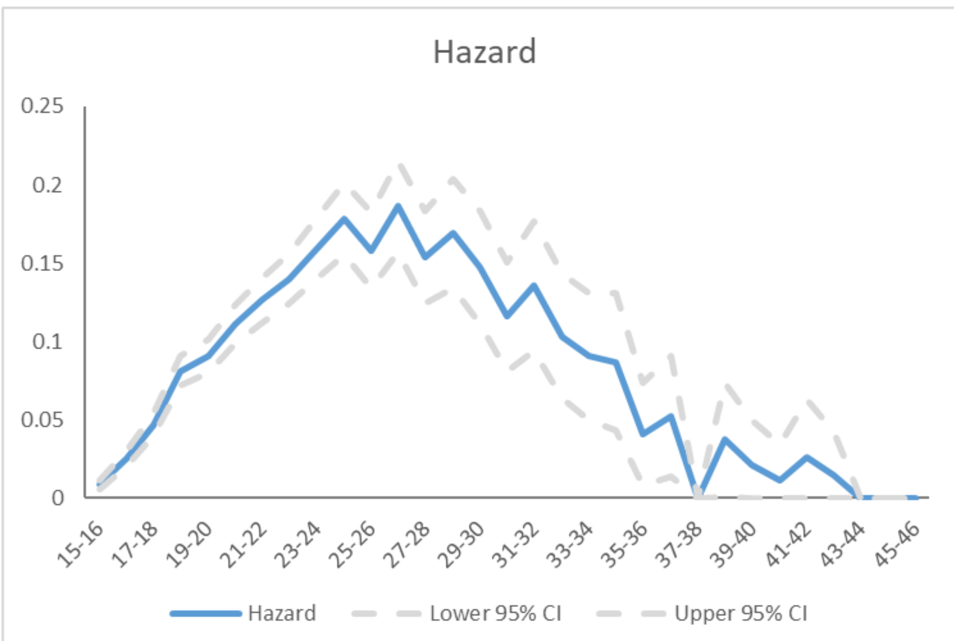

Figure 2: Hazard Function for Age at First Born Child

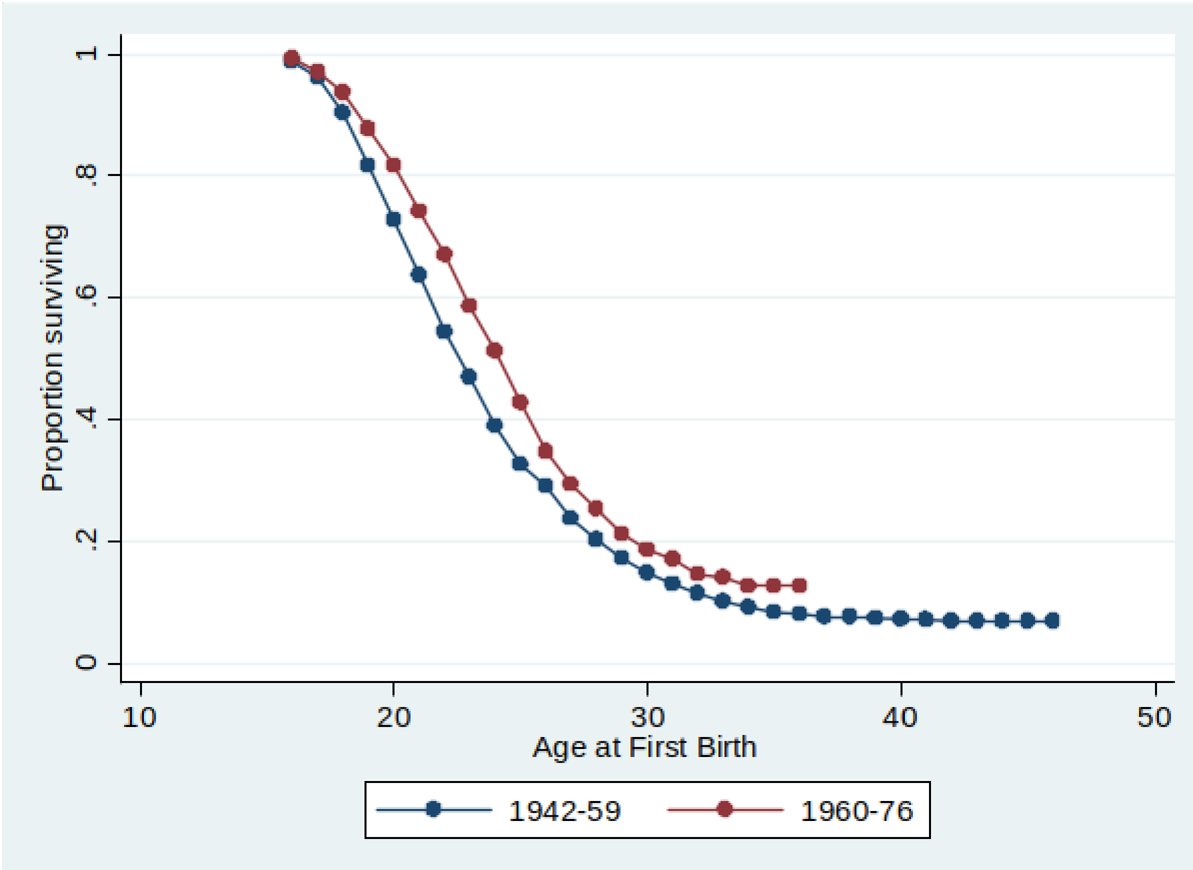

Figure 3: Survival Function for Age at First Born Child by Cohort

Table 3: Survival Function for Second Born Child

Interval	Total	Deaths	Lost	Survival	Error	Lower.95..CI	Upper.95..CI
15-16	3980	35	0	0.9912	0.0015	0.9878	0.9937
16-17	3945	99	0	0.9663	0.0029	0.9602	0.9715
17-18	3846	176	0	0.9221	0.0042	0.9133	0.9300
18-19	3670	286	2	0.8502	0.0057	0.8388	0.8610
19-20	3382	289	109	0.7764	0.0066	0.7631	0.7891
20-21	2984	308	112	0.6947	0.0074	0.6800	0.7089
21-22	2564	300	88	0.6120	0.0079	0.5963	0.6273
22-23	2176	280	79	0.5318	0.0082	0.5156	0.5477
23-24	1817	261	84	0.4536	0.0083	0.4373	0.4698
24-25	1472	235	75	0.3793	0.0082	0.3632	0.3954
25-26	1162	166	60	0.3237	0.0081	0.3079	0.3395
26-27	936	156	40	0.2686	0.0078	0.2533	0.2840
27-28	740	103	38	0.2302	0.0076	0.2155	0.2451
28-29	599	91	31	0.1943	0.0073	0.1803	0.2087
29-30	477	64	19	0.1677	0.0070	0.1543	0.1816
30-31	394	42	21	0.1493	0.0068	0.1363	0.1629
31-32	331	41	16	0.1304	0.0065	0.1179	0.1435
32-33	274	26	19	0.1176	0.0063	0.1055	0.1303
33-34	229	19	19	0.1074	0.0062	0.0956	0.1199
34-35	191	15	22	0.0984	0.0061	0.0869	0.1108
35-36	154	6	7	0.0945	0.0061	0.0830	0.1068
36-37	141	7	6	0.0897	0.0060	0.0784	0.1020
37-38	128	0	12	0.0897	0.0060	0.0784	0.1020
38-39	116	4	13	0.0864	0.0060	0.0751	0.0987
39-40	99	2	6	0.0846	0.0060	0.0733	0.0970
40-41	91	1	10	0.0837	0.0060	0.0723	0.0960
41-42	80	2	6	0.0815	0.0061	0.0701	0.0939
42-43	72	1	5	0.0803	0.0061	0.0689	0.0928
43-44	66	0	7	0.0803	0.0061	0.0689	0.0928
44-45	59	0	7	0.0803	0.0061	0.0689	0.0928
45-46	52	0	52	0.0803	0.0061	0.0689	0.0928

Second Birth

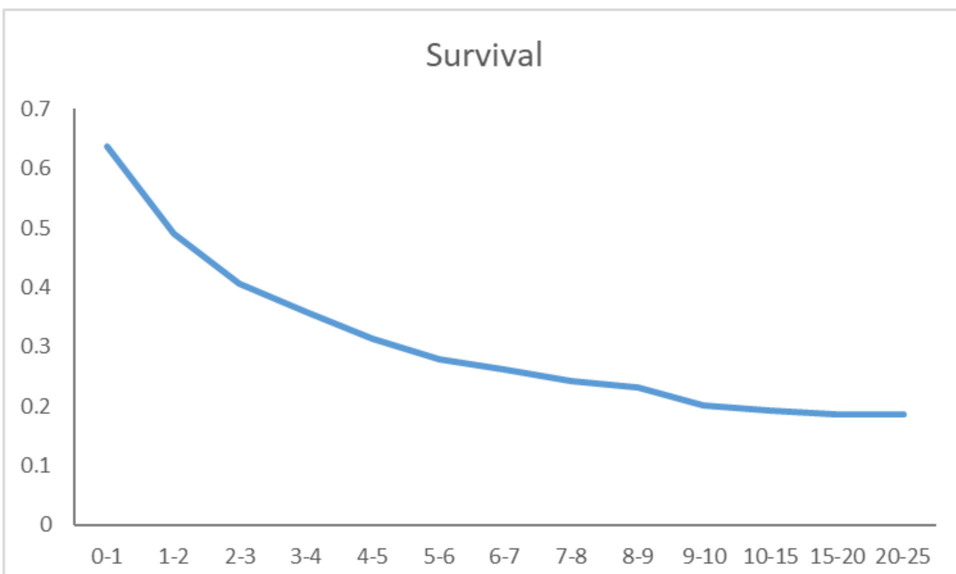

Figure 4: Survival Function for Age at Second Born Child

Table 4: Hazard Function for Second Born Child

Interval	Total	Failure	Error	Hazard	Error.1	Lower.95..CI	Upper.95..CI
15-16	3980	0.0088	0.0015	0.0088	0.0015	0.0059	0.0118
16-17	3945	0.0337	0.0029	0.0254	0.0026	0.0204	0.0304
17-18	3846	0.0779	0.0042	0.0468	0.0035	0.0399	0.0538
18-19	3670	0.1498	0.0057	0.0811	0.0048	0.0717	0.0905
19-20	3382	0.2236	0.0066	0.0908	0.0053	0.0803	0.1013
20-21	2984	0.3053	0.0074	0.1110	0.0063	0.0987	0.1234
21-22	2564	0.3880	0.0079	0.1266	0.0073	0.1123	0.1409
22-23	2176	0.4682	0.0082	0.1402	0.0084	0.1239	0.1566
23-24	1817	0.5464	0.0083	0.1587	0.0098	0.1395	0.1779
24-25	1472	0.6207	0.0082	0.1784	0.0116	0.1557	0.2012
25-26	1162	0.6763	0.0081	0.1582	0.0122	0.1342	0.1822
26-27	936	0.7314	0.0078	0.1862	0.0148	0.1571	0.2152
27-28	740	0.7698	0.0076	0.1538	0.0151	0.1242	0.1835
28-29	599	0.8057	0.0073	0.1691	0.0177	0.1345	0.2038
29-30	477	0.8323	0.0070	0.1470	0.0183	0.1111	0.1829
30-31	394	0.8507	0.0068	0.1159	0.0178	0.0809	0.1508
31-32	331	0.8696	0.0065	0.1355	0.0211	0.0941	0.1769
32-33	274	0.8824	0.0063	0.1034	0.0202	0.0637	0.1431
33-34	229	0.8926	0.0062	0.0905	0.0207	0.0498	0.1311
34-35	191	0.9016	0.0061	0.0870	0.0224	0.043	0.1309
35-36	154	0.9055	0.0061	0.0407	0.0166	0.0081	0.0732
36-37	141	0.9103	0.0060	0.0520	0.0197	0.0135	0.0906
37-38	128	0.9103	0.0060	0.0000	.	.	.
38-39	116	0.9136	0.0060	0.0372	0.0186	0.0008	0.0737
39-40	99	0.9154	0.0060	0.0211	0.0149	0	0.0502
40-41	91	0.9163	0.0060	0.0117	0.0117	0	0.0346
41-42	80	0.9185	0.0061	0.0263	0.0186	0	0.0628
42-43	72	0.9197	0.0061	0.0145	0.0145	0	0.0429
43-44	66	0.9197	0.0061	0.0000	.	.	.
44-45	59	0.9197	0.0061	0.0000	.	.	.
45-46	52	0.9197	0.0061	0.0000	.	.	.

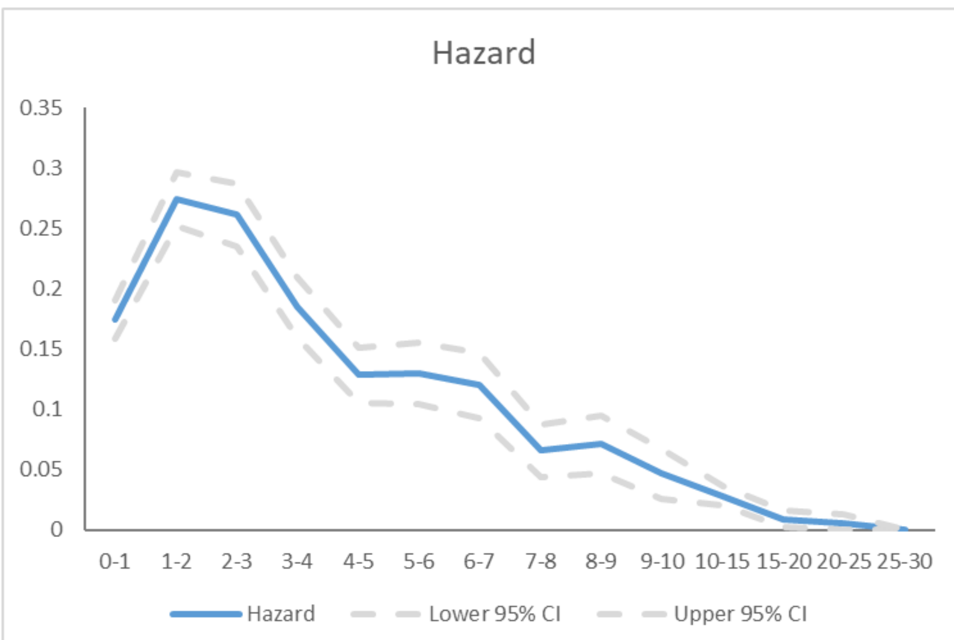

Figure 5: Hazard Function for Age at Second Born Child

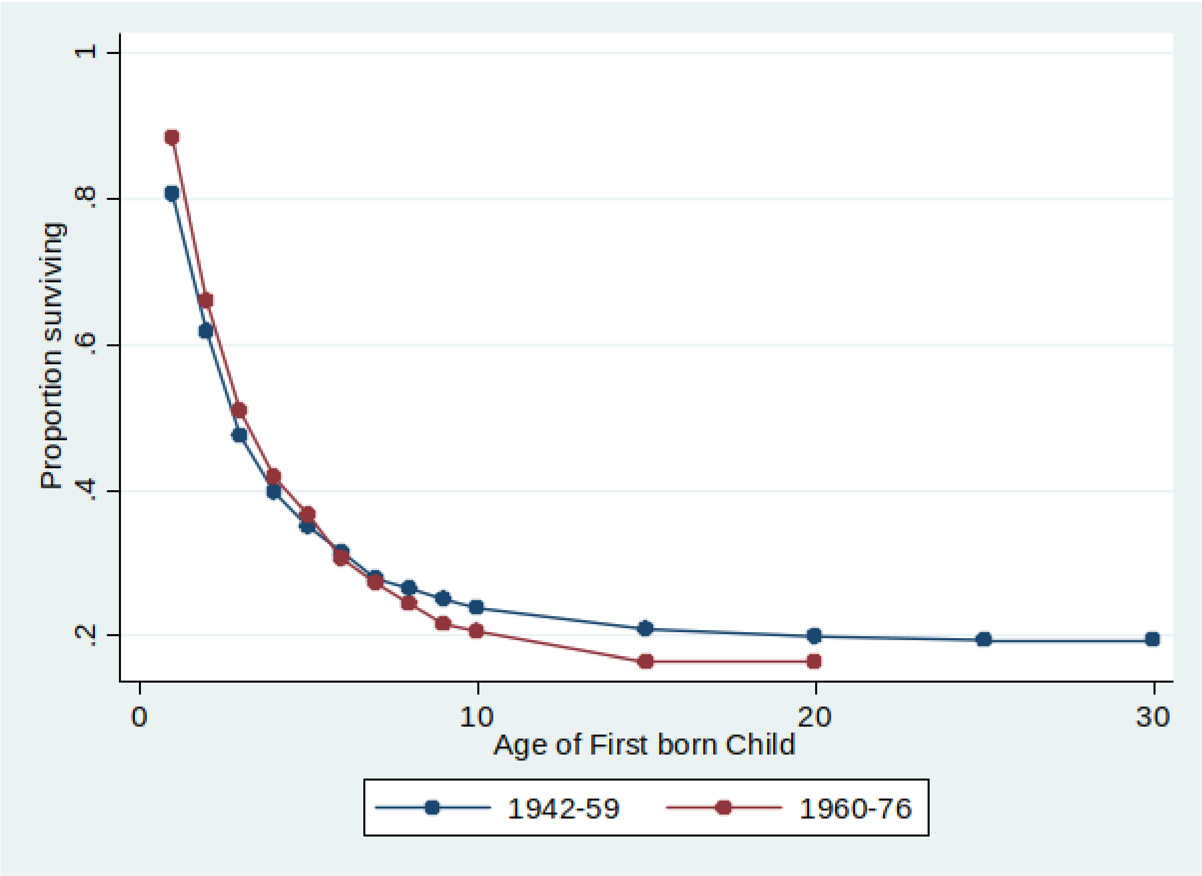

Figure 6: Survival Function for Age at Second Born Child by Cohort

Life table analysis code

```
* Life table analysis

* Ensure that Stata pays no attention to error message for a log file
capture log close

* Create a log file to allow you to make a full record of the session
 log using lifetable1.log, replace

* Load the data-set
use firstbirth.dta, clear

* Life table estimation
ltable b1dury0 birth, survival hazard intervals(1)

* Close the log file
log close

* Life table analysis

* Ensure that Stata pays no attention to error message for a log file
capture log close

* Create a log file to allow you to make a full record of the session
 log using lifetable2.log, replace

* Draw a graph for survival function by cohort
ltable b1dury0 birth, intervals(1) by(cohort) gr overlay ///
xtitle("Age at First Birth") ytitle("Proportion surviving") ///
saving("LT2", replace)

graph save Figure2.gph, replace

* Close the log file
log close
```

Discussion of Results

Figure 2 shows that the majority of persons had a first birth at age 27-28, the number of people having their first child after this age steadily increases, but then sharply drops off. Figure 5 compared with 2 shows a much sharper drop off for the second child. Likely due to the fact that people are more likely to want children closer together in age, and the limitations in having further children in older age.

Figure 3 shows that the first birth was typically earlier in 1942-1959, likely due to the post war boom in which global birth rates are known to have increased dramatically, before dropping off in more recent years (Sprague, 1988). Figure 6 indicates that more recently people are more likely to have children who are are closer together in age, likely a result of improvements in education and access to contraception, where it is far easier to choose when to have children in the modern society .

References

Alison Sprague. Post-War Fertility and Female Labour Force Participation Rates. *The Economic Journal*, 98(392):682–700, 1988. ISSN 0013-0133. doi: 10.2307/2233908.