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Modelling report [Cohort] from Longevitas (www.longevitas.co.uk)

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2. System details

Table 1. System parameters

Name	Value
Version and date	v2.472 2009-01-14
Mode	threaded
Threads	on
Symmetry	used
AIC multiplier	2
User	
Maximum iterations	200
Step maximum	0.1
Gradient tolerance	1e-10
ALF	0.0001
EPS	1e-10

Table 2. Environment and parameters

Parameter	Value
Decrement Modelled	DEATH
Model Description	Cohort
Generate Survival Curves	No
Per Member Files Include	All
Generate Rate Tables	Yes
Discard Exposure Date	Not set
Original File	realisticpostcodedata.csv
Tracking	2 6691 26413
Minimum Age	60
Maximum Age	95
Reject Beyond Age	105
Modelling Start Date	2000-01-01
Modelling End Date	2006-12-31
Exclude	EXCLUDE NONE
Pension Bands	20
Rate Table Projection	No - Static
Rate Table Start Year	2009
Rate Table Start Age	60
Rate Table Maximum Duration	0
Select Period Duration (years)	1
Select Period Category Width (years)	0
Spouse Benefit Percentage	50
Spouse Female Age Difference (years)	-3
Fixed Parameters	
Include Data Audit	NO
Generate R Integration File	NO
Perform Bootstrap Analysis	NO
Observation Weighting	equal
Simulated Annealing Runs	0
Simulated Annealing Changes	5
Optimisation Target Metric	AIC
Early Commencement Age	55
Late Commencement Age	75
Calendar Base Year	2000
Calendar Period Alignment	01
Calendar Slice Width	0.0000
Generate Kaplan Meier Curves	NO
Decrement Benefit Revaluation Pct	0
Benefit Type	annuity
Benefit Switch Age	65
Gradient Calculation Method	DERIVATIVES
Gradient Approximation Step	0.0001
Fitting Step Size	0.1
Model Time Type	Age

3. Model details

Table 3. Model overview

Name	Value or description
Mortality law	Perks
Model type	survival
Model terms	4
Parameters	6
Log-likelihood	-7081.66
Iterations taken	13
AIC	14175.3
BIC	14220
Age measured from	0
Duration measured from	0
Calendar time measured from	2000

Model is Age,Gender,Cohort.

All parameters in this model are free, i.e. they are the maximum-likelihood estimate in every case.

The functional form for the risk is:

$$\mu_{x,r,y} = \frac{e^{\alpha+\beta x+\gamma r+\delta y}}{1+e^{\alpha+\beta x+\gamma r+\delta y}}$$

where x is age, r is duration since inception and y is calendar time.

Table 4. Model terms and parameters

Term	Parameter	Fixed	Sig.	Estimate	Std. err.	Lives	Deaths	Exposure
Age	Age		***	0.110205	0.00626492	12720	1744	59263.6
Cohort	Cohort.2		*	-0.188137	0.0872254	5377	992	32777.6
	Cohort.3		**	-0.51636	0.166276	3953	123	17142.9
	Cohort.4			-0.282038	0.270922	2240	22	3983.17
Gender	Gender.M		***	0.35033	0.0619297	8129	1360	39144.1
Intercept	Intercept		***	-11.8339	0.547848	12720	1744	59263.6

• A new optimised factor named Cohort was created from BirthYear. The mapping is 1=(1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920) 2=(1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935) 3=(1936, 1937, 1938, 1939, 1940, 1941, 1942) 4=(1943, 1944, 1945, 1946)

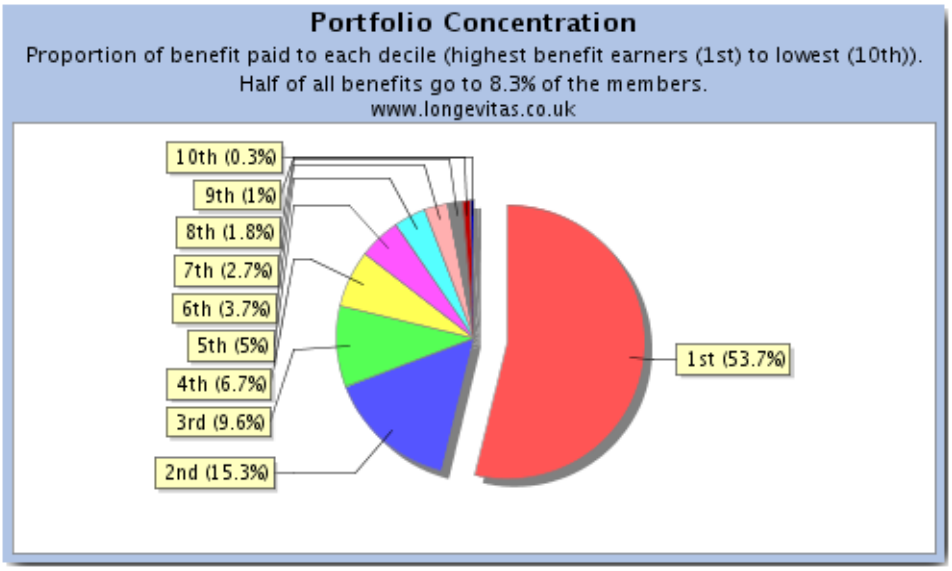
4. Data summary

Concentration of liabilities

Benefit amounts usually differ widely in size, with a large proportion of liabilities typically concentrated in a relatively small number of hands. One measure of inequality in income distribution is the Gini Index. It ranges from 0% (perfect equality) to 100% (one person has all the income). The CIA World Fact Book gave the UK as a whole a value of 36.8% in 2005, whereas the figure for this portfolio is 65.73%.

An alternative approach is to show the proportion of benefit amounts for each decile of lives as in Figure 1:

Figure 1. Concentration of liabilities



Geographic spread of liabilities

Figure 2 shows the geographic spread of lives and amounts for records with valid UK postcodes (data aggregated and plotted at postcode district level):

Figure 2. Geographical spread of liabilities by lives (left) and amounts (right)

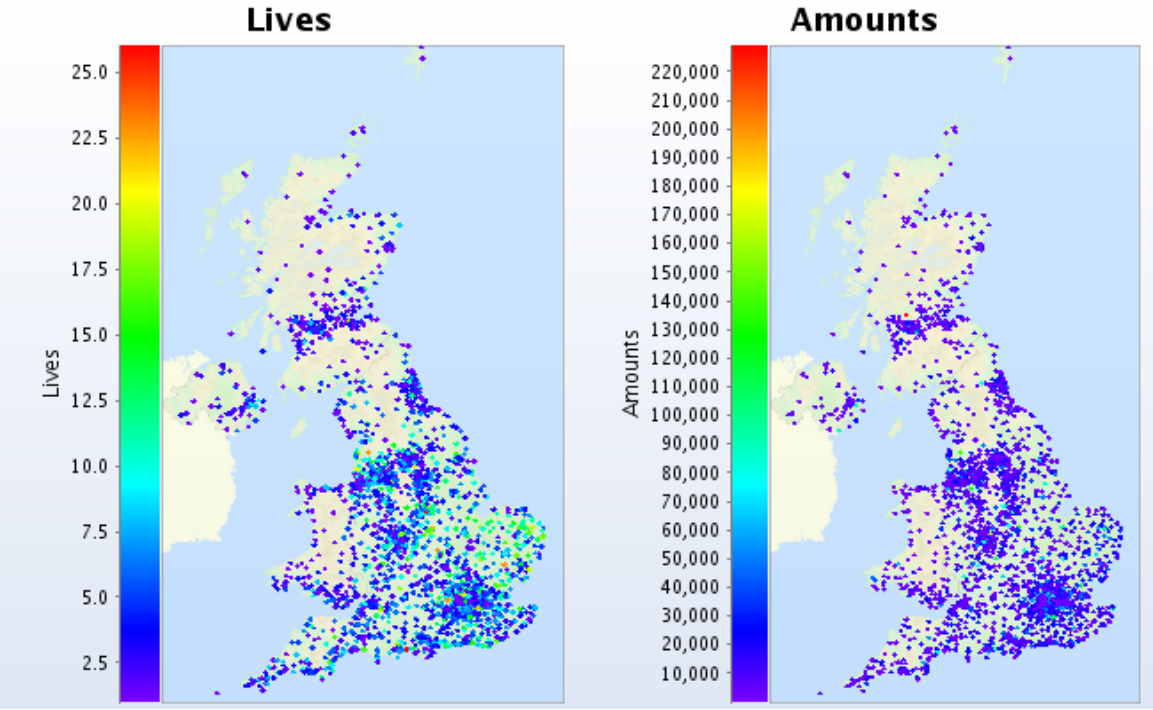


Table 5. Pension Bands

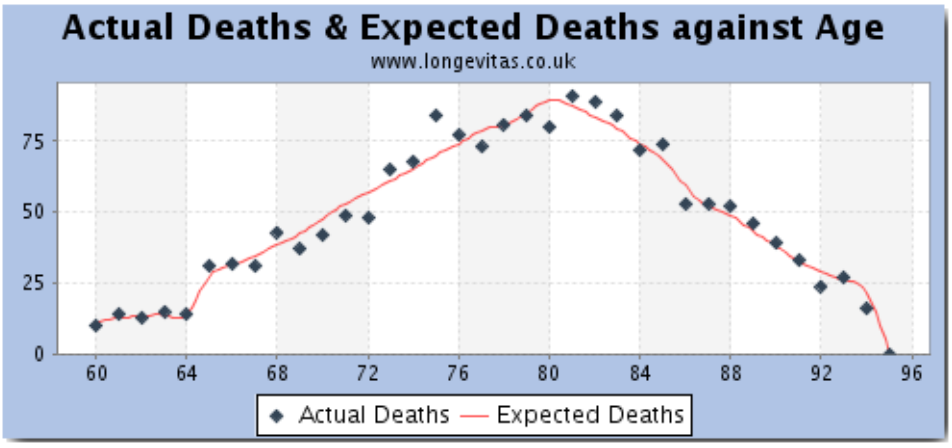
Band	From	To	Lives	Deaths	Exposure
S01	0	81.98	637	159	3199.81
S02	81.98	173.38	636	145	3020.87
S03	173.38	272.53	636	135	2896.31
S04	272.53	373.68	636	118	3020.23
S05	373.68	478.37	636	93	2941.19
S06	478.37	589.97	636	85	2845.42
S07	589.97	716.22	636	84	2903.69
S08	716.22	844.99	636	90	2800.25
S09	844.99	992.02	636	79	2723.77
S10	992.02	1151.86	636	47	2879.01
S11	1151.86	1331.57	637	69	2962.24
S12	1331.57	1549.15	635	78	2840.02
S13	1549.15	1808.06	637	65	2759
S14	1808.06	2137.39	635	70	2899.55
S15	2137.39	2579.90	636	70	2998.5
S16	2579.90	3155.04	637	64	3009.19
S17	3155.04	4049.16	635	80	2975.6
S18	4049.16	5673.02	636	70	3034.23
S19	5673.02	9676.08	636	77	3210.69
S20	9676.08	534951.29	635	66	3344.01

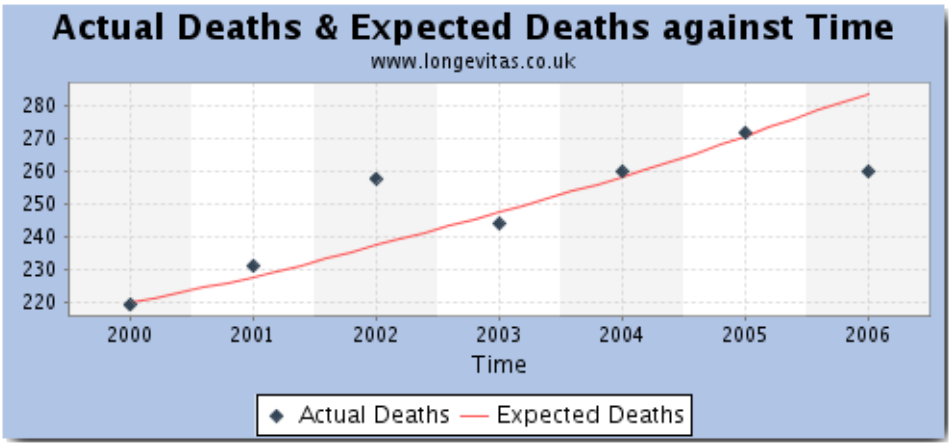
Table 6. Reserve Bands

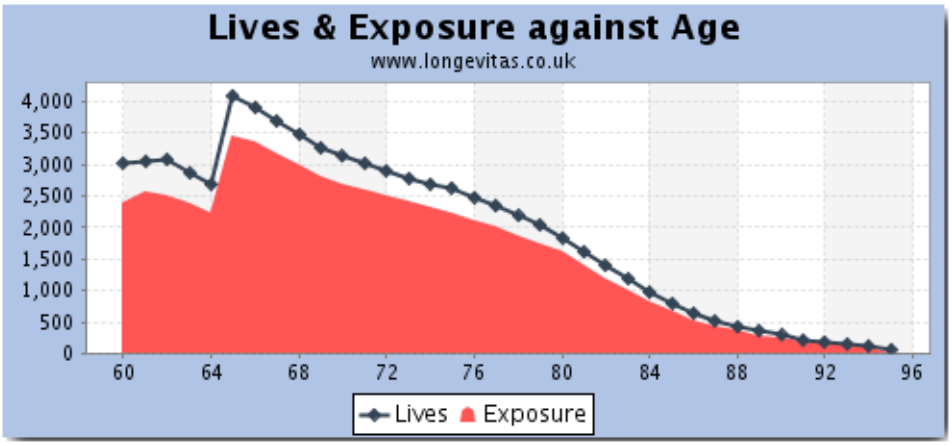
Band	From	To	Lives	Deaths	Exposure
S01	0	0.00	12720	1744	59263.6

Table 7. Data summary

Name	Value
Lives	12720
Deaths	1744
Exposure	59263.6
Lives under age 60	0
Lives over age 105	0







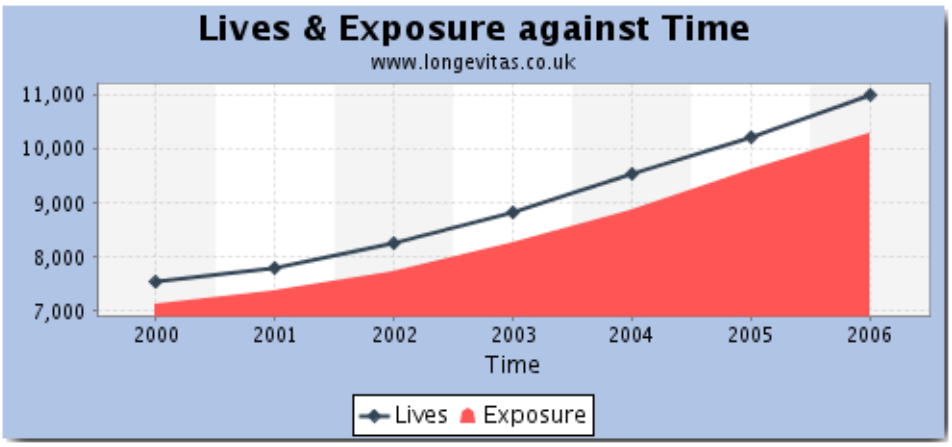


Table 8. Factor summary

Name	Levels	Type
BirthYear	42	multi-level factor
Cohort	4	multi-level factor
Gender	2	binary factor
ReserveSizeBand	1	degenerate factor
SizeBand	20	multi-level factor

Table 9. Factor-level details for ReserveSizeBand

Level	Lives	Exposure	Deaths	Baseline
S01	12720	59263.6	1744	Baseline

Table 10. Factor-level details for Gender

Level	Lives	Exposure	Deaths	Baseline
F	4591	20119.5	384	Baseline
M	8129	39144.1	1360	

Table 11. Factor-level details for Cohort

Level	Lives	Exposure	Deaths	Baseline
1	1150	5359.94	607	Baseline
2	5377	32777.6	992	
3	3953	17142.9	123	
4	2240	3983.17	22	

Table 12. Factor-level details for SizeBand

Level	Lives	Exposure	Deaths	Baseline	Level	Lives	Exposure	Deaths	Baseline
S01	637	3199.81	159	Baseline	S11	637	2962.24	69	
S02	636	3020.87	145		S12	635	2840.02	78	
S03	636	2896.31	135		S13	637	2759	65	
S04	636	3020.23	118		S14	635	2899.55	70	
S05	636	2941.19	93		S15	636	2998.5	70	
S06	636	2845.42	85		S16	637	3009.19	64	
S07	636	2903.69	84		S17	635	2975.6	80	
S08	636	2800.25	90		S18	636	3034.23	70	
S09	636	2723.77	79		S19	636	3210.69	77	
S10	636	2879.01	47		S20	635	3344.01	66	

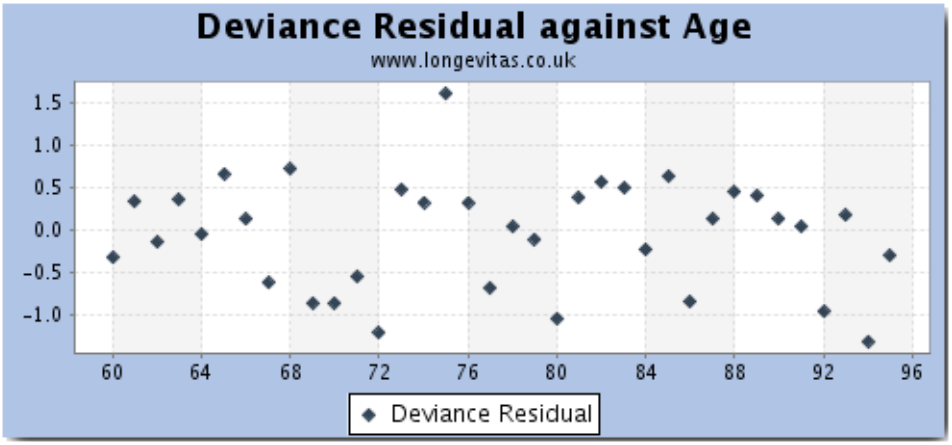
Table 13. Factor-level details for BirthYear

Level	Lives	Exposure	Deaths	Baseline	Level	Lives	Exposure	Deaths	Baseline
1905	7	3.45524	0	Baseline	1926	339	2058.45	81	
1906	12	14.9216	2		1927	341	2076.12	83	
1907	20	41.1645	6		1928	375	2389.06	58	
1908	20	53.5864	9		1929	368	2325.64	54	
1909	35	105.245	24		1930	384	2318.58	67	
1910	30	119.701	14		1931	427	2651.33	49	
1911	38	146.629	26		1932	410	2509.6	53	
1912	70	282.278	52		1933	399	2518.23	43	
1913	57	203.202	43		1934	465	2918.61	45	
1914	66	298.643	38		1935	453	2718.6	36	
1915	78	341.382	51		1936	491	2821.94	23	
1916	112	562.706	61		1937	547	2947.39	38	
1917	108	556.037	56		1938	574	2833.4	23	
1918	108	521.492	59		1939	627	2788.26	12	
1919	136	744.344	58		1940	619	2167.16	9	
1920	253	1365.15	108		1941	621	1849.11	9	
1921	224	1278.85	83		1942	474	1735.62	9	
1922	252	1441.9	83		1943	591	1692.84	11	
1923	309	1827.06	98		1944	652	1400.16	7	
1924	313	1861.04	82		1945	502	670.052	3	
1925	318	1884.49	77		1946	495	220.122	1	

Table 14. Residuals and badness-of-fit test results

Parameter	χ^2	df	p-value	Sig.
Age	14.5771	34	0.998538	
Age:Gender.F	42.4466	35	0.180826	
Age:Gender.M	17.0195	35	0.995466	
BirthYear	41.8712	41	0.432854	
Duration	42.1786	50	0.776213	
Duration:Gender.F	65.7014	46	0.0297216	*
Duration:Gender.M	35.4757	49	0.92618	
SizeBand	55.7784	19	1.76515e-05	***
Time	3.95059	6	0.683364	
Time:Gender.F	8.99214	6	0.17402	
Time:Gender.M	8.11002	6	0.230153	

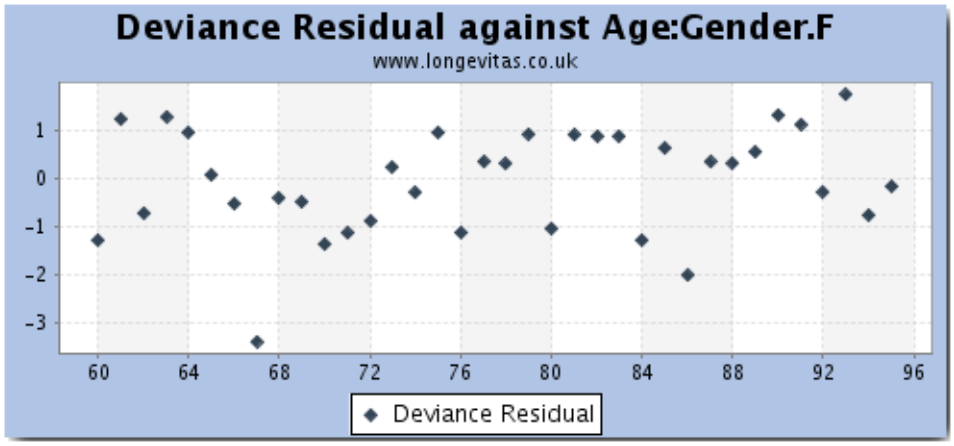
Table 15. Residuals by Age



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
60	3024	2391.2	10	11.0472	-0.320258	
61	3050	2546.51	14	12.7588	0.342066	
62	3076	2507.75	13	13.503	-0.137746	
63	2868	2371.65	15	13.6339	0.364034	
64	2694	2217.77	14	14.1691	-0.0450251	
65	4094	3452.04	31	27.4035	0.672773	
66	3909	3367.9	32	31.2623	0.131427	
67	3691	3175.1	31	34.5595	-0.616359	
68	3479	2988.99	43	38.4337	0.722655	
69	3262	2798.35	37	42.4125	-0.849778	
70	3131	2681.88	42	47.7474	-0.849348	
71	3008	2595.31	49	52.9397	-0.5484	
72	2905	2493.97	48	56.8475	-1.20605	
73	2781	2401.5	65	61.0951	0.494396	
74	2693	2305.62	68	65.2706	0.335525	
75	2631	2231.2	84	70.097	1.60978	
76	2483	2117.79	77	74.0912	0.335753	
77	2343	2026.02	73	78.8905	-0.671711	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
78	2181	1861.62	81	80.6145	0.0429008	
79	2034	1737.31	84	84.8896	-0.0967217	
80	1835	1612.7	80	89.5743	-1.03049	
81	1606	1392.75	91	87.3396	0.388986	
82	1389	1179.19	89	83.6779	0.575794	
83	1184	989.499	84	79.4532	0.50534	
84	972	813.473	72	73.9177	-0.224028	
85	798	665.019	74	68.6014	0.643523	
86	640	514.311	53	59.3394	-0.838302	
87	515	411.237	53	52.0141	0.136278	
88	423	352.428	52	48.7714	0.457337	
89	352	286.187	46	43.2932	0.407211	
90	291	231.051	39	38.1376	0.139118	
91	222	181.66	33	32.7487	0.0438639	
92	184	147.897	24	28.9935	-0.956104	
93	147	122.633	27	26.0863	0.177873	
94	114	93.8269	16	21.7839	-1.30122	
95	67	0.181806	0	0.044317	-0.297715	

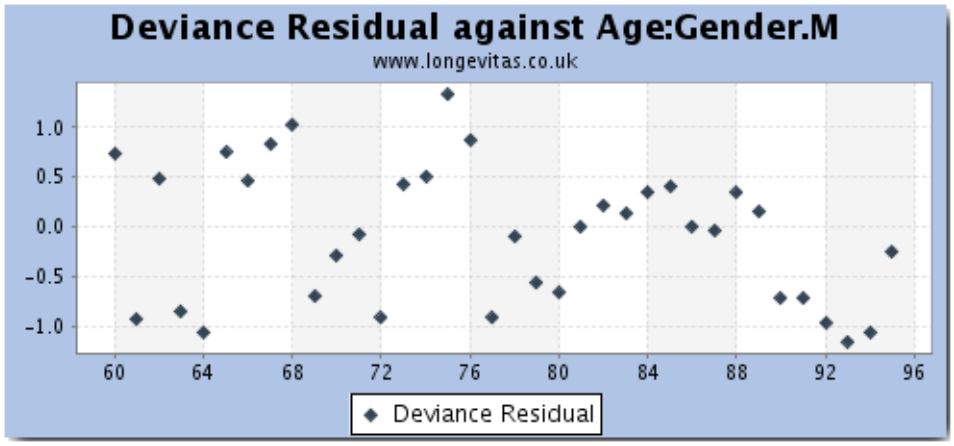
Table 16. Residuals by Age:Gender.F



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
60	1824	1458.7	3	5.81666	-1.28866	
61	1829	1530.06	10	6.60127	1.22841	
62	1779	1467.94	5	6.78172	-0.71799	
63	1608	1327.57	10	6.47527	1.28158	
64	1435	1196.13	9	6.4098	0.96371	
65	1476	1254.75	8	7.80803	0.0684213	
66	1351	1173.83	7	8.46973	-0.520788	
67	1210	1067.45	1	8.90494	-3.38181	***
68	1082	942.378	8	9.20002	-0.404741	
69	964	824.223	8	9.46656	-0.489833	
70	883	735.526	6	10.0096	-1.37033	
71	803	670.564	7	10.4791	-1.14437	
72	721	616.778	8	10.7478	-0.878325	
73	681	576.866	12	11.1963	0.237393	
74	643	555.869	11	12.0287	-0.300979	
75	646	555.489	17	13.3809	0.949148	
76	612	522.018	10	14.0019	-1.12767	
77	575	491.223	16	14.661	0.344567	

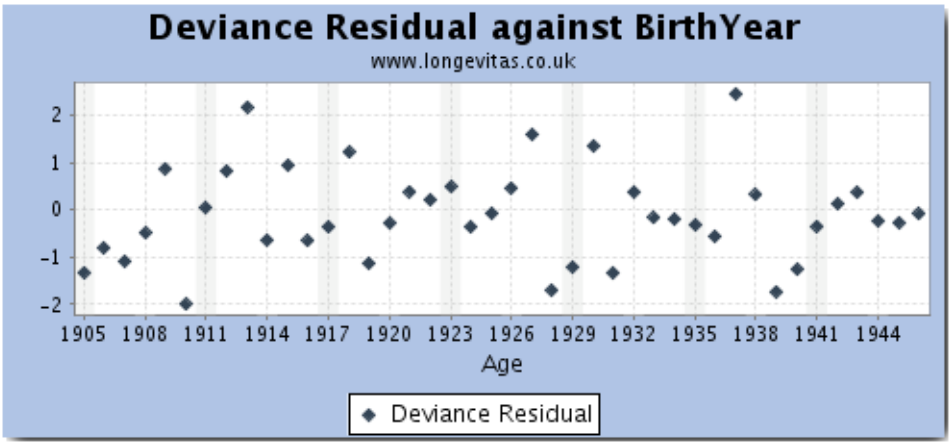
From	Lives	Exposure	Deaths	Expected	Residual	Sig.
78	526	446.11	16	14.8098	0.305254	
79	477	407.401	19	15.2306	0.929629	
80	421	374.548	12	15.9201	-1.02761	
81	375	319.059	19	15.3434	0.899689	
82	323	265.866	18	14.5218	0.879513	
83	282	232.943	18	14.5321	0.876698	
84	236	206.499	10	14.602	-1.27772	
85	204	169.563	16	13.6419	0.621259	
86	163	136.222	6	12.3856	-2.01838	*
87	143	117.465	13	11.8042	0.342421	
88	127	106.997	13	11.8687	0.323364	
89	112	91.1538	13	11.1365	0.543828	
90	101	77.6677	15	10.4442	1.32232	
91	78	63.1871	13	9.33741	1.13082	
92	66	54.3075	8	8.81331	-0.278344	
93	57	47.6558	14	8.4767	1.73263	.
94	41	35.4081	5	6.88094	-0.754125	
95	24	0.065124	0	0.0132556	-0.162823	

Table 17. Residuals by Age:Gender.M



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
60	1200	932.501	7	5.23056	0.73526	
61	1221	1016.45	4	6.15753	-0.929522	
62	1297	1039.82	8	6.72128	0.478714	
63	1260	1044.08	5	7.15866	-0.853504	
64	1259	1021.64	5	7.75935	-1.06023	
65	2618	2197.29	23	19.5955	0.748299	
66	2558	2194.07	25	22.7926	0.455197	
67	2481	2107.66	30	25.6546	0.83527	
68	2397	2046.61	35	29.2337	1.03404	
69	2298	1974.13	29	32.9459	-0.701912	
70	2248	1946.36	36	37.7378	-0.2851	
71	2205	1924.74	42	42.4606	-0.0708135	
72	2184	1877.19	40	46.0997	-0.919369	
73	2100	1824.64	53	49.8988	0.434589	
74	2050	1749.75	57	53.2419	0.509149	
75	1985	1675.71	67	56.716	1.32712	
76	1871	1595.77	67	60.0893	0.875183	
77	1768	1534.8	57	64.2295	-0.919836	
78	1655	1415.51	65	65.8047	-0.099397	
79	1557	1329.91	65	69.6589	-0.564615	
80	1414	1238.16	68	73.6541	-0.667533	
81	1231	1073.7	72	71.9962	0.000449802	
82	1066	913.324	71	69.1561	0.220754	
83	902	756.556	66	64.9211	0.133539	
84	736	606.974	62	59.3157	0.345959	
85	594	495.456	58	54.9595	0.406441	
86	477	378.089	47	46.9538	0.00673674	
87	372	293.771	40	40.2099	-0.0331315	
88	296	245.431	39	36.9028	0.342044	
89	240	195.033	33	32.1566	0.148081	
90	190	153.383	24	27.6935	-0.718392	
91	144	118.473	20	23.4112	-0.723273	
92	118	93.5897	16	20.1802	-0.965797	
93	90	74.9772	13	17.6096	-1.15253	
94	73	58.4188	11	14.903	-1.06081	
95	43	0.116682	0	0.0310614	-0.249244	

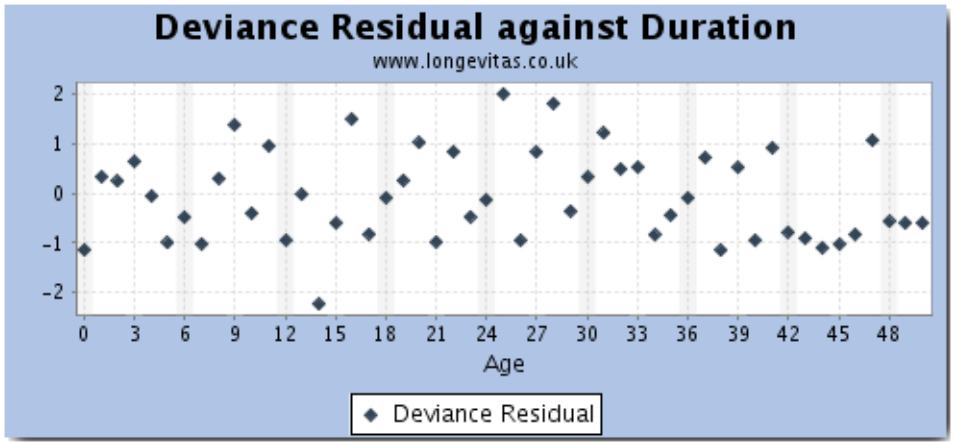
Table 18. Residuals by BirthYear



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
1905	7	3.45524	0	0.868144	-1.31768	
1906	12	14.9216	2	3.36533	-0.805695	
1907	20	41.1645	6	9.04304	-1.07854	
1908	20	53.5864	9	10.5536	-0.490754	
1909	35	105.245	24	19.9188	0.885604	
1910	30	119.701	14	22.8908	-2.00366	*
1911	38	146.629	26	25.7568	0.0478355	
1912	70	282.278	52	46.2579	0.827647	
1913	57	203.202	43	30.2192	2.18462	*
1914	66	298.643	38	42.007	-0.628488	
1915	78	341.382	51	44.5503	0.94429	
1916	112	562.706	61	66.2654	-0.655687	
1917	108	556.037	56	58.7706	-0.364302	
1918	108	521.492	59	50.0802	1.22555	
1919	136	744.344	58	67.0176	-1.12773	
1920	253	1365.15	108	110.997	-0.285724	
1921	224	1278.85	83	79.429	0.39774	
1922	252	1441.9	83	80.986	0.222876	
1923	309	1827.06	98	93.2335	0.489525	
1924	313	1861.04	82	85.3385	-0.363787	
1925	318	1884.49	77	77.6195	-0.0704098	

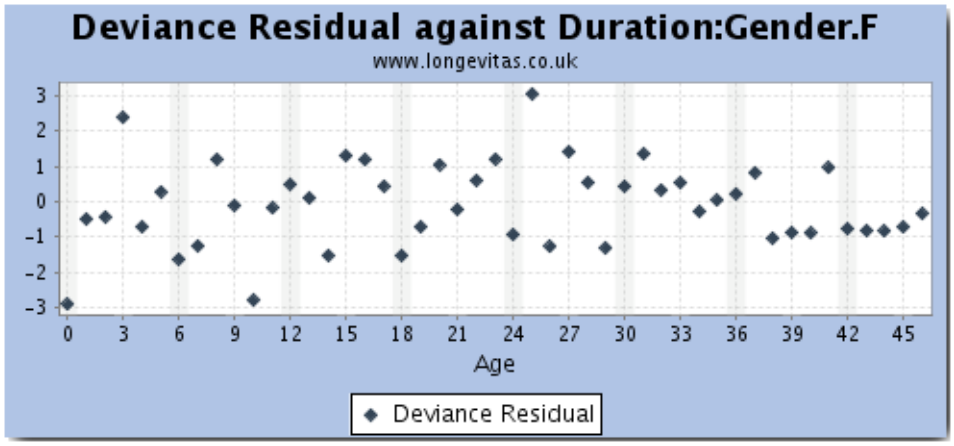
From	Lives	Exposure	Deaths	Expected	Residual	Sig.
1926	339	2058.45	81	76.7957	0.475477	
1927	341	2076.12	83	69.2573	1.60081	
1928	375	2389.06	58	71.9352	-1.70088	.
1929	368	2325.64	54	63.2975	-1.19913	
1930	384	2318.58	67	56.5074	1.35567	
1931	427	2651.33	49	58.9234	-1.33186	
1932	410	2509.6	53	50.2324	0.38699	
1933	399	2518.23	43	44.1152	-0.16862	
1934	465	2918.61	45	46.2845	-0.189693	
1935	453	2718.6	36	37.9122	-0.313233	
1936	491	2821.94	23	25.7767	-0.557196	
1937	547	2947.39	38	24.7144	2.47467	*
1938	574	2833.4	23	21.504	0.318972	
1939	627	2788.26	12	18.994	-1.72245	.
1940	619	2167.16	9	13.3437	-1.26438	
1941	621	1849.11	9	10.0423	-0.334863	
1942	474	1735.62	9	8.63837	0.122198	
1943	591	1692.84	11	9.82636	0.367298	
1944	652	1400.16	7	7.60501	-0.222399	
1945	502	670.052	3	3.47706	-0.262049	
1946	495	220.122	1	1.09227	-0.0895801	

Table 19. Residuals by Duration



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
0	5447	4631.41	29	35.624	-1.14719	
1	5198	4405.11	40	37.8979	0.338385	
2	4950	4190.63	43	41.4286	0.242619	
3	4663	3993.34	50	45.6482	0.634252	
4	4428	3760.78	49	49.3921	-0.0558666	
5	4122	3587.99	47	54.2135	-1.00272	
6	3980	3449.94	56	59.7144	-0.485784	
7	3806	3302.22	57	64.9636	-1.00933	
8	3627	3084.01	71	68.4346	0.308205	
9	3533	2931.56	86	73.7614	1.3881	
10	3210	2689.46	74	77.4163	-0.391189	
11	2930	2495.72	92	82.9909	0.971804	
12	2678	2342.53	80	88.7655	-0.946344	
13	2527	2164.02	92	92.2396	-0.0249594	
14	2315	1996.68	74	95.0504	-2.24726	*
15	2114	1842.94	93	98.9424	-0.603546	
16	1823	1534.54	106	91.2375	1.50642	
17	1537	1307.4	78	85.3818	-0.810823	
18	1345	1123.72	79	79.6641	-0.0745068	
19	1151	975.624	77	74.656	0.269881	
20	932	791.402	73	64.6189	1.02121	
21	735	608.068	47	53.9634	-0.96949	
22	555	459.122	49	43.2948	0.849007	
23	437	367.571	34	36.7902	-0.466022	
24	362	292.157	31	31.7284	-0.129819	
25	276	218.53	35	24.3309	2.02826	*
26	195	153.418	14	17.8994	-0.958599	
27	151	125.22	20	16.4898	0.83619	
28	128	101.519	22	14.4934	1.83035	.
29	99	81.162	11	12.1835	-0.344787	
30	78	51.2102	7	6.16684	0.328344	
31	56	46.284	9	5.8275	1.21592	
32	43	35.6845	6	4.86138	0.498001	
33	33	28.0577	5	3.91344	0.526394	
34	28	24.1072	2	3.44386	-0.844948	
35	18	12.8745	1	1.49194	-0.428635	
36	11	9.20162	1	1.09178	-0.0891154	
37	10	5.34848	1	0.439287	0.723726	
38	7	6.02464	0	0.665295	-1.15351	
39	8	5.85027	1	0.570272	0.513641	
40	5	5	0	0.457949	-0.957025	
41	5	3.47952	1	0.33379	0.928476	
42	3	3	0	0.299685	-0.77419	
43	5	3.66343	0	0.404807	-0.899785	
44	5	4.9154	0	0.588432	-1.08483	
45	4	4	0	0.5271	-1.02674	
46	4	2.41265	0	0.34417	-0.829663	
47	2	1.75188	1	0.271414	1.07287	
48	1	1	0	0.165763	-0.575783	
49	1	1	0	0.181567	-0.602606	
50	1	0.916898	0	0.181347	-0.602241	

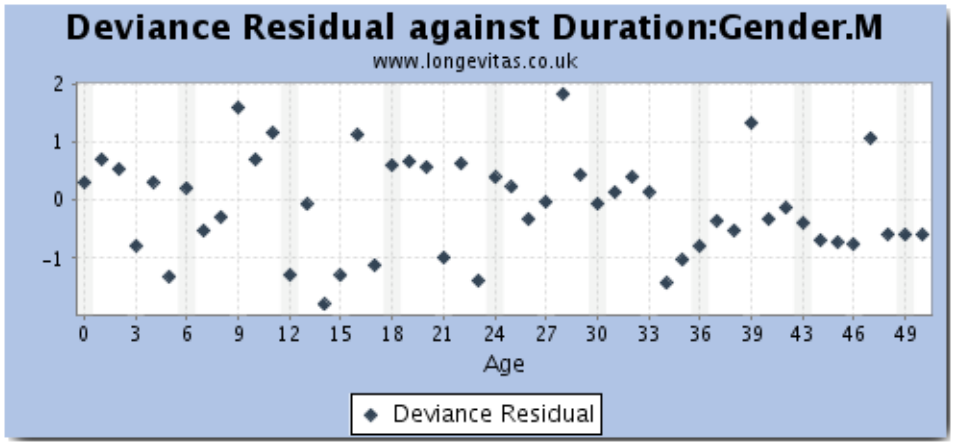
Table 20. Residuals by Duration:Gender.F



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
0	2301	1962.21	3	11.2024	-2.91543	**
1	2225	1891.14	10	11.6104	-0.484226	
2	2037	1714.75	10	11.4199	-0.429365	
3	1814	1530.52	20	11.1927	2.36731	*
4	1659	1380.3	9	11.3557	-0.725596	
5	1473	1263.99	13	11.999	0.285081	
6	1313	1137.82	7	12.2058	-1.62099	
7	1217	1070.33	9	13.2602	-1.24283	
8	1129	944.189	18	13.3678	1.20268	
9	1024	867.675	14	14.3798	-0.100603	
10	909	742.382	5	14.1463	-2.80935	**
11	772	644.768	14	14.7229	-0.189962	
12	663	573.882	17	15.0172	0.500985	
13	607	521.383	16	15.5845	0.104781	
14	566	482.873	10	15.6263	-1.52486	
15	533	460.047	22	16.4599	1.29803	
16	466	395.859	20	15.214	1.1699	
17	427	360.972	17	15.2582	0.437806	
18	392	336.835	10	15.6077	-1.52046	
19	362	314.151	13	15.8073	-0.728698	
20	326	282.311	19	14.7685	1.05396	
21	274	229.798	12	12.7914	-0.223616	
22	219	187.112	13	10.9131	0.613053	
23	187	163.735	14	9.96098	1.20526	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
24	157	132.913	6	8.61705	-0.943558	
25	132	105.756	17	7.27443	3.06752	**
26	96	78.0623	3	5.78689	-1.27745	
27	74	62.3367	9	5.37847	1.42257	
28	60	50.7386	6	4.76174	0.545194	
29	53	44.1834	2	4.46057	-1.30867	
30	53	38.3311	5	4.08604	0.436689	
31	43	34.5167	7	4.01802	1.34452	
32	33	27.115	4	3.37092	0.332728	
33	26	22.7812	4	3.05522	0.515732	
34	21	18.0257	2	2.42686	-0.282691	
35	13	8.94352	1	0.966313	0.0340726	
36	8	6.22068	1	0.783731	0.234181	
37	8	3.52153	1	0.38032	0.833141	
38	5	4.40739	0	0.535396	-1.03479	
39	6	3.96167	0	0.388074	-0.880993	
40	4	4	0	0.405263	-0.900292	
41	4	3.31231	1	0.324432	0.948801	
42	3	3	0	0.299685	-0.77419	
43	3	3	0	0.330382	-0.812874	
44	3	2.9154	0	0.353169	-0.840439	
45	2	2	0	0.267985	-0.7321	
46	2	0.412651	0	0.0591769	-0.344026	

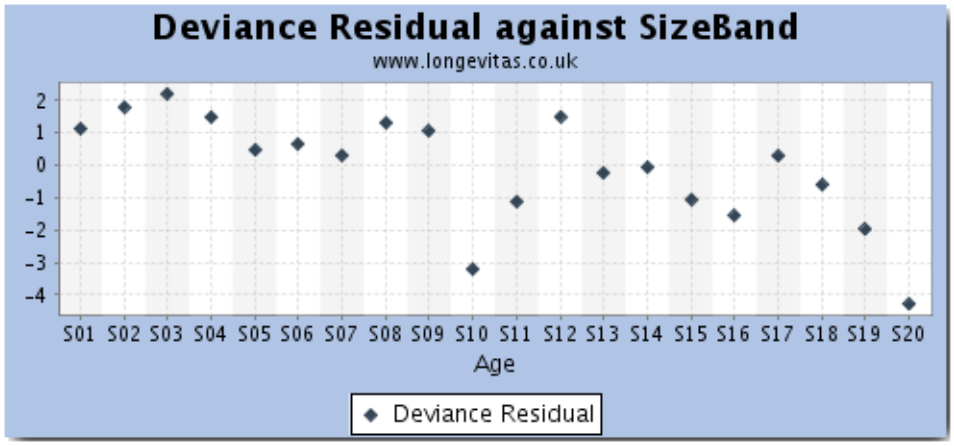
Table 21. Residuals by Duration:Gender.M



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
0	3146	2669.19	26	24.4216	0.316041	
1	2973	2513.97	30	26.2875	0.707983	
2	2913	2475.88	33	30.0087	0.537341	
3	2849	2462.82	30	34.4555	-0.776354	
4	2769	2380.48	40	38.0364	0.315704	
5	2649	2324.01	34	42.2144	-1.30903	
6	2667	2312.12	49	47.5085	0.215271	
7	2589	2231.89	48	51.7034	-0.521378	
8	2498	2139.82	53	55.0668	-0.280287	
9	2509	2063.88	72	59.3816	1.5841	
10	2301	1947.08	69	63.27	0.709883	
11	2158	1850.95	78	68.268	1.15141	
12	2015	1768.65	63	73.7483	-1.28401	
13	1920	1642.63	76	76.6551	-0.074928	
14	1749	1513.81	64	79.4241	-1.79182	.
15	1581	1382.89	71	82.4826	-1.2955	
16	1357	1138.68	86	76.0235	1.12046	
17	1110	946.424	61	70.1236	-1.11452	
18	953	786.886	69	64.0564	0.609978	
19	789	661.472	64	58.8488	0.66204	
20	606	509.091	54	49.8504	0.579838	
21	461	378.27	35	41.172	-0.987564	
22	336	272.009	36	32.3817	0.62453	
23	250	203.836	20	26.8292	-1.38133	
24	205	159.244	25	23.1114	0.387679	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
25	144	112.774	18	17.0565	0.2264	
26	99	75.356	11	12.1125	-0.324742	
27	77	62.883	11	11.1113	-0.0334519	
28	68	50.7808	16	9.73164	1.83681	.
29	46	36.9786	9	7.72292	0.447679	
30	25	12.8791	2	2.08081	-0.0563863	
31	13	11.7673	2	1.80948	0.139251	
32	10	8.56951	2	1.49046	0.396447	
33	7	5.27657	1	0.858217	0.149099	
34	7	6.08147	0	1.01701	-1.42619	
35	5	3.93102	0	0.52563	-1.02531	
36	3	2.98094	0	0.308051	-0.784922	
37	2	1.82695	0	0.0589665	-0.343414	
38	2	1.61725	0	0.129899	-0.509705	
39	2	1.8886	1	0.182198	1.33031	
40	1	1	0	0.0526855	-0.324609	
41	1	0.167204	0	0.00935776	-0.136805	
43	2	0.663433	0	0.0744245	-0.385809	
44	2	2	0	0.235264	-0.68595	
45	2	2	0	0.259115	-0.719882	
46	2	2	0	0.284993	-0.754975	
47	2	1.75188	1	0.271414	1.07287	
48	1	1	0	0.165763	-0.575783	
49	1	1	0	0.181567	-0.602606	
50	1	0.916898	0	0.181347	-0.602241	

Table 22. Residuals by SizeBand

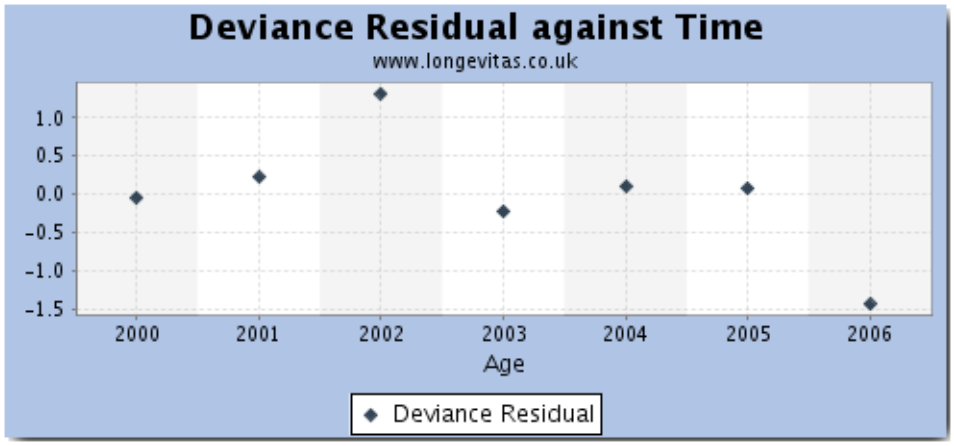


From	Lives	Exposure	Deaths	Expected	Residual	Sig.
S01	637	3199.81	159	145.045	1.14081	
S02	636	3020.87	145	124.233	1.81456	.
S03	636	2896.31	135	110.696	2.23241	*
S04	636	3020.23	118	102.589	1.48564	
S05	636	2941.19	93	88.5058	0.473753	
S06	636	2845.42	85	78.9638	0.67089	
S07	636	2903.69	84	80.9942	0.331952	
S08	636	2800.25	90	78.0001	1.32594	
S09	636	2723.77	79	69.9929	1.05468	
S10	636	2879.01	47	72.6558	-3.21972	**

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
S11	637	2962.24	69	78.574	-1.1032	
S12	635	2840.02	78	65.3677	1.51578	
S13	637	2759	65	66.8859	-0.231698	
S14	635	2899.55	70	70.6221	-0.0741329	
S15	636	2998.5	70	79.0975	-1.04353	
S16	637	3009.19	64	77.3185	-1.56159	
S17	635	2975.6	80	77.5616	0.275447	
S18	636	3034.23	70	75.2683	-0.614546	
S19	636	3210.69	77	95.7214	-1.98161	*
S20	635	3344.01	66	107.35	-4.30001	***

• The p-value of the X statistic suggests that the residuals are too large on average to be entirely random. This suggests that the model can be improved, possibly by (i) changing the model type, (ii) adding other risk factors, or (iii) working with a subset of the data

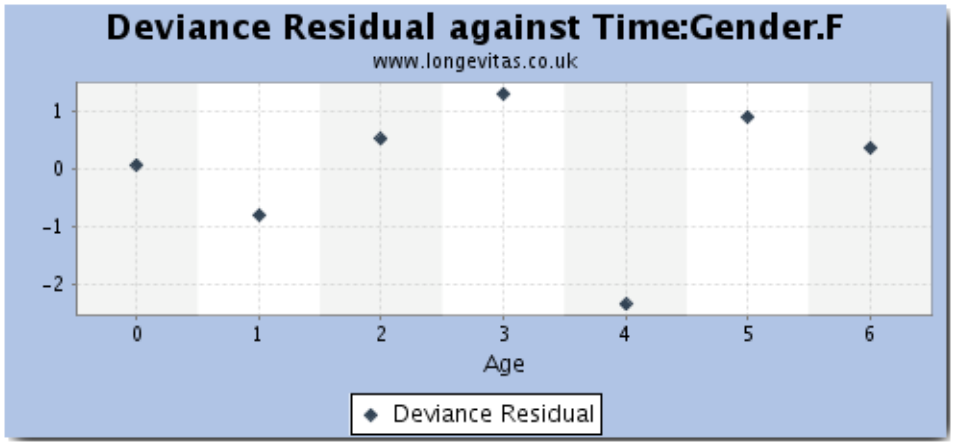
Table 23. Residuals by Time



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2000	7536	7107.54	219	219.605	-0.040871	
2001	7813	7366.44	231	227.673	0.219963	
2002	8249	7730.95	258	237.346	1.32185	
2003	8821	8274.73	244	247.629	-0.231158	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2004	9546	8877.74	260	258.362	0.101804	
2005	10239	9606.43	272	270.847	0.0699928	
2006	11023	10299.7	260	283.981	-1.4438	

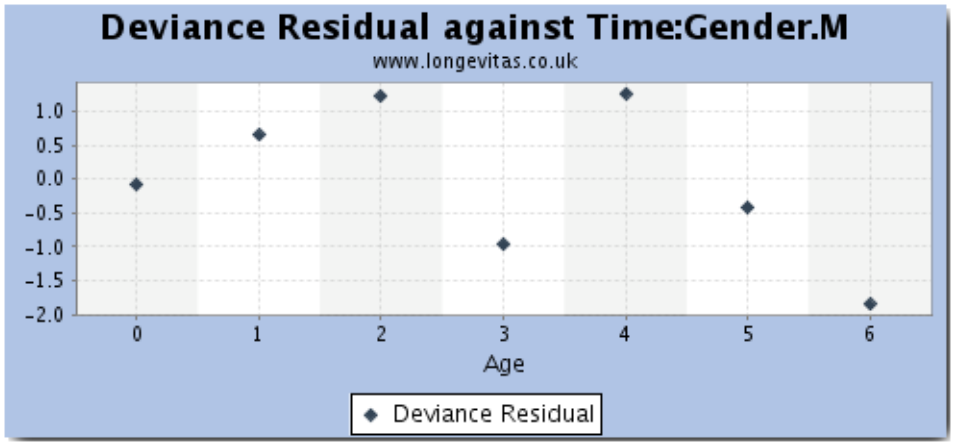
Table 24. Residuals by Time:Gender.F



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2000	2233	2093.06	47	46.5312	0.0686036	
2001	2415	2245.86	43	48.4225	-0.79452	
2002	2653	2459.21	55	51.3367	0.505377	
2003	2981	2755.6	63	53.2573	1.29715	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2004	3413	3129.41	40	56.6925	-2.3418	*
2005	3805	3546.34	68	60.8578	0.898447	
2006	4181	3890.01	68	65.104	0.356309	

Table 25. Residuals by Time:Gender.M



From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2000	5303	5014.49	172	173.074	-0.0817331	
2001	5398	5120.58	188	179.25	0.648306	
2002	5596	5271.74	203	186.01	1.22748	
2003	5840	5519.14	181	194.371	-0.970414	

From	Lives	Exposure	Deaths	Expected	Residual	Sig.
2004	6133	5748.33	220	201.669	1.27195	
2005	6434	6060.1	204	209.989	-0.415312	
2006	6842	6409.71	192	218.877	-1.85588	.