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Online Appendix

A Practitioner-Oriented Evaluation of Mortality Forecasting Methods: The Case of Australia*

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* This Online Appendix contains additional information regarding the article: https://www.comparativepopulationstudies.de/index.php/CPoS/article/view/635/434.

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Appendix A1: Summary of mortality projection models and key implementation details

Model	Package	overview	Key configurable parameters	assumptions	effects	selection	Handling of NAs, 0s and INF	Description
LC_D	demography	lca(HMD_data_BASE, series="male", max.age = max_age)	Base period selection method and properties; maximum age; coefficient scaling and adjustment method; method for calculating residuals; option to rescale bx and kt; interpolation option	Normal	No	Fixed period is default. Option to select base period using the "chooseperiod" parameter.	Default Interpolate=FALSE. If interpolate = TRUE, NA and zero values are replaced with estimates.	Standard Lee-Carter model
LC_Dc	demography	lca(HMD_data_BASE, series="male", max.age = max_age, chooseperiod = TRUE)	Base period selection method and properties; maximum age; coefficient scaling and adjustment method; method for calculating residuals; option to rescale bx and kt; interpolation option	Normal	No	Bai's method when chooseperiod= TRUE	Default Interpolate=FALSE. If interpolate = TRUE, NA and zero values are replaced with estimates.	Standard Lee-Carter model with optimal base period selection using Bai's method
Coherent FDM	demography	coherentfdm(HMD_data_BASE)	Number of basis functions for the geometric mean and ratio fitting. Other optional arguments passed to fdm function including method to use for principle components decomposition.	Normal	No	Fixed period	Errors on Inf; NA handled; zeros interpolated	Coherent functional data model for grouped demographic data, such as male and female
BMS	demography	bms(HMD_data_BASE, series="male", max.age = max_age)	Maximum age; method for calculating residuals; option to rescale bx and kt; interpolation option	Poisson	No	Booth-Maindonald-Smith method	Default Interpolate=FALSE. If interpolate = TRUE, NA and zero values are replaced with estimates.	Lee-Carter variant that uses Booth-Maindonald-Smith base period selection method and adjusts kt to better fit age-specific death rates
LC_S	StMoMo	LC <- lc() LCfit_male <- fit(LC, data= CountryData_male)	Link function options: Log (default), Logit, and Log-Gaussian; identifiability constraint type	Poisson (default), binomial, normal	No	Fixed period	Warnings issued but models implemented with non-positive exposures being zero-weighted	Lee-Carter model which assumes a Poisson distribution for deaths.
APC	StMoMo	APC <- apc() APCfit_male <- fit(APC, data= CountryData_male)	Link function - options are Log (default), Logit, and Log-Gaussian	Poisson	Yes	Fixed period	Warnings issued but models implemented with non-positive exposures being zero-weighted	Age-Period-Cohort model capturing age, period, and cohort effects.
Plat	StMoMo	PLAT <-plat() Platfit_male <- fit(PLAT, data= CountryData_male)	Link function - options are Log (default), Logit, and Log-Gaussian; option to include a parameter that models age-specific dynamics in mortality rates for younger ages (default is TRUE).	Poisson	Yes	Fixed period	Warnings issued but models implemented with non-positive exposures being zero-weighted	Extended Lee-Carter model with cohort effect.
CBD	StMoMo	CBD <- cbd() CBDfit_male <- fit(CBD, data=central2initial(CountryData_male))	Link function - options are Log (default), Logit, and Log-Gaussian	Poisson	No	Fixed period	Warnings issued but models implemented with non-positive exposures being zero-weighted	Cairns-Blake-Dowd model with focus on mortality trends for older ages.
EM	custom code	create_projections(for ecast_object, is_evaluation = 1)	smoothing parameters, max age, spline settings, trend settings	Normal	No	age and sex specific selection of optimal base period based on minimised R^2 for linear model	interpolate, based on surrounding values.	Custom Ediev-like mortality projection model implementing spline-based smoothing, optimal base period selection per age, and constraints to ensure male ASDRs are greater than or equal to female ASDRs, and that ASDRs do not decrease with age from age 15 years.

Notes: This table provides an overview of mortality projection models implemented in this study. The implementation overview describes each model setup, specifying data input and parameters. Key configurable parameters highlight primary adjustable elements – such as link functions, age limits, and interpolation choices – enabling customisation of mortality projection behaviours. Distribution assumptions indicate the statistical framework (e.g., normal or Poisson) used to model mortality rates. Cohort effects indicate whether the models account for cohort-based variations. While NA, INF, and zero values were addressed in data preparation, model-specific handling methods are noted for transparency. Note that in this study, `max.age` was set to 105.

Source: Authors' synthesis based on *Hyndman* (2023), *Villegas et al.* (2018), *Ediev* (2008), and the authors' code.

Appendix B1: Average absolute errors in age-specific mortality rates for males for 10-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	**0.0022**	0.0056	0.0055	0.0024	0.0023	0.0023	0.0031	0.0139	0.0036	0.0031	0.0024	0.0025
2	0.0001	0.0005	0.0006	**0.0001**	0.0002	0.0002	0.0011	0.0010	0.0006	0.0003	0.0005	0.0003
3	**0.0001**	0.0004	0.0004	0.0001	0.0002	0.0002	0.0004	0.0006	0.0002	0.0002	0.0002	0.0002
4	0.0001	0.0003	0.0003	**0.0001**	0.0001	0.0001	0.0002	0.0004	0.0001	0.0001	0.0001	0.0001
5	0.0001	0.0003	0.0003	**0.0001**	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001
6	**0.0000**	0.0002	0.0002	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
7	0.0001	0.0002	0.0002	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
8	**0.0001**	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
9	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
10	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001
11	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001
12	0.0000	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001
13	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0001	0.0001	0.0000	**0.0000**	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
15	0.0001	0.0002	0.0002	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
16	0.0001	0.0002	0.0002	0.0001	**0.0001**	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
17	0.0002	0.0002	0.0002	0.0002	0.0001	**0.0001**	0.0003	0.0002	0.0002	0.0001	0.0002	0.0001
18	0.0002	**0.0002**	0.0003	0.0003	0.0002	0.0003	0.0005	0.0006	0.0004	0.0002	0.0004	0.0003
19	0.0004	**0.0003**	0.0004	0.0005	0.0003	0.0004	0.0008	0.0009	0.0007	0.0003	0.0005	0.0004
20	**0.0004**	0.0004	0.0006	0.0006	0.0005	0.0005	0.0008	0.0009	0.0007	0.0005	0.0005	0.0005
21	**0.0003**	0.0004	0.0005	0.0006	0.0004	0.0004	0.0009	0.0009	0.0007	0.0004	0.0006	0.0005
22	**0.0003**	0.0004	0.0004	0.0005	0.0004	0.0003	0.0007	0.0007	0.0006	0.0004	0.0005	0.0004
23	**0.0002**	0.0004	0.0003	0.0003	0.0003	0.0002	0.0006	0.0005	0.0005	0.0003	0.0004	0.0004
24	**0.0002**	0.0005	0.0003	0.0003	0.0004	0.0003	0.0006	0.0004	0.0004	0.0004	0.0004	0.0004
25	**0.0002**	0.0005	0.0003	0.0003	0.0003	0.0003	0.0006	0.0003	0.0004	0.0003	0.0004	0.0004
26	**0.0002**	0.0005	0.0003	0.0004	0.0003	0.0004	0.0006	0.0004	0.0004	0.0004	0.0004	0.0004
27	**0.0002**	0.0006	0.0003	0.0004	0.0004	0.0004	0.0005	0.0003	0.0003	0.0004	0.0004	0.0004
28	**0.0002**	0.0006	0.0003	0.0004	0.0004	0.0004	0.0005	0.0005	0.0003	0.0004	0.0004	0.0004
29	0.0002	0.0005	0.0003	0.0004	0.0004	0.0004	0.0004	0.0005	**0.0002**	0.0004	0.0003	0.0004
30	0.0003	0.0007	0.0004	0.0004	0.0003	0.0004	0.0004	0.0006	**0.0002**	0.0005	0.0003	0.0004
31	**0.0002**	0.0006	0.0004	0.0004	0.0003	0.0004	0.0004	0.0007	0.0003	0.0004	0.0003	0.0003
32	**0.0002**	0.0006	0.0004	0.0003	0.0003	0.0004	0.0003	0.0007	0.0002	0.0004	0.0003	0.0003
33	**0.0003**	0.0007	0.0005	0.0004	0.0004	0.0004	0.0004	0.0009	0.0003	0.0005	0.0004	0.0004
34	**0.0002**	0.0006	0.0003	0.0003	0.0002	0.0004	0.0003	0.0010	0.0003	0.0004	0.0002	0.0003
35	**0.0002**	0.0006	0.0004	0.0003	0.0003	0.0004	0.0002	0.0010	0.0003	0.0004	0.0002	0.0003
36	**0.0003**	0.0008	0.0005	0.0004	0.0004	0.0005	0.0003	0.0011	0.0003	0.0005	0.0003	0.0004
37	**0.0002**	0.0007	0.0005	0.0004	0.0004	0.0004	0.0003	0.0013	0.0004	0.0005	0.0003	0.0003
38	**0.0002**	0.0006	0.0004	0.0003	0.0003	0.0003	0.0003	0.0015	0.0003	0.0004	0.0002	0.0002
39	**0.0002**	0.0007	0.0005	0.0003	0.0003	0.0004	0.0003	0.0017	0.0005	0.0005	0.0002	0.0003
40	**0.0004**	0.0008	0.0007	0.0005	0.0005	0.0005	0.0004	0.0017	0.0005	0.0006	0.0004	0.0004
41	0.0002	0.0008	0.0005	0.0003	0.0004	0.0004	0.0003	0.0019	0.0005	0.0005	**0.0002**	0.0003
42	0.0004	0.0008	0.0006	**0.0003**	0.0004	0.0004	0.0005	0.0022	0.0004	0.0005	0.0004	0.0004
43	0.0006	0.0010	0.0008	0.0006	0.0007	0.0006	0.0006	0.0019	0.0008	0.0007	**0.0005**	0.0006
44	0.0005	0.0008	0.0008	0.0005	0.0006	0.0006	0.0006	0.0022	0.0005	0.0005	**0.0005**	0.0005
45	0.0005	0.0007	0.0008	**0.0003**	0.0004	0.0004	0.0005	0.0027	0.0007	0.0004	0.0004	0.0004
46	0.0006	0.0008	0.0009	0.0005	0.0006	0.0005	**0.0005**	0.0027	0.0009	0.0005	0.0005	0.0005
47	0.0006	0.0006	0.0009	0.0005	0.0005	0.0005	0.0006	0.0029	0.0007	**0.0005**	0.0006	0.0005
48	0.0006	0.0007	0.0008	0.0007	0.0007	0.0007	0.0008	0.0030	0.0009	**0.0006**	0.0008	0.0007
49	0.0009	0.0008	0.0011	0.0007	0.0008	0.0007	0.0009	0.0033	0.0011	**0.0007**	0.0009	0.0008
50	0.0010	**0.0008**	0.0011	0.0010	0.0010	0.0011	0.0013	0.0032	0.0016	0.0009	0.0013	0.0011
51	0.0009	0.0011	0.0012	0.0011	0.0010	0.0011	0.0012	0.0032	0.0012	**0.0009**	0.0012	0.0010
52	0.0009	**0.0009**	0.0010	0.0010	0.0009	0.0012	0.0016	0.0038	0.0014	0.0009	0.0013	0.0011
53	0.0012	**0.0011**	0.0016	0.0013	0.0013	0.0016	0.0017	0.0040	0.0017	0.0012	0.0016	0.0013
54	0.0014	0.0014	0.0015	0.0015	0.0016	0.0018	0.0017	0.0040	0.0018	0.0015	0.0017	**0.0014**
55	**0.0014**	0.0016	0.0016	0.0017	0.0016	0.0020	0.0021	0.0040	0.0022	0.0016	0.0021	0.0018
56	0.0017	0.0016	0.0017	0.0016	0.0016	0.0020	0.0019	0.0047	0.0019	0.0016	0.0018	**0.0015**
57	0.0020	0.0020	**0.0019**	0.0024	0.0020	0.0025	0.0027	0.0044	0.0027	0.0021	0.0026	0.0023
58	0.0019	0.0022	**0.0017**	0.0023	0.0021	0.0026	0.0026	0.0046	0.0028	0.0022	0.0026	0.0023
59	0.0023	0.0028	**0.0021**	0.0026	0.0027	0.0032	0.0030	0.0047	0.0032	0.0026	0.0030	0.0026
60	0.0022	0.0033	**0.0020**	0.0031	0.0028	0.0035	0.0033	0.0044	0.0034	0.0031	0.0034	0.0031
61	**0.0026**	0.0032	0.0028	0.0036	0.0034	0.0039	0.0034	0.0049	0.0035	0.0034	0.0036	0.0033

Appendix B1: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
62	0.0034	0.0049	**0.0027**	0.0031	0.0038	0.0046	0.0031	0.0063	0.0033	0.0039	0.0033	0.0030
63	0.0037	0.0052	**0.0036**	0.0040	0.0046	0.0054	0.0041	0.0059	0.0043	0.0046	0.0042	0.0039
64	**0.0033**	0.0046	0.0033	0.0037	0.0042	0.0050	0.0039	0.0055	0.0041	0.0041	0.0041	0.0036
65	**0.0032**	0.0050	0.0032	0.0044	0.0043	0.0051	0.0043	0.0055	0.0046	0.0044	0.0046	0.0042
66	0.0037	0.0049	**0.0037**	0.0052	0.0048	0.0056	0.0050	0.0060	0.0054	0.0050	0.0053	0.0048
67	0.0039	0.0054	**0.0030**	0.0043	0.0045	0.0053	0.0040	0.0066	0.0044	0.0045	0.0045	0.0041
68	0.0045	0.0073	**0.0039**	0.0062	0.0059	0.0073	0.0054	0.0072	0.0060	0.0065	0.0062	0.0059
69	0.0051	0.0076	**0.0049**	0.0056	0.0066	0.0077	0.0055	0.0078	0.0062	0.0064	0.0061	0.0057
70	**0.0053**	0.0097	0.0054	0.0063	0.0076	0.0091	0.0058	0.0080	0.0064	0.0078	0.0067	0.0065
71	0.0061	0.0073	0.0056	0.0060	0.0069	0.0082	**0.0049**	0.0087	0.0064	0.0067	0.0065	0.0061
72	0.0074	0.0103	**0.0044**	0.0066	0.0071	0.0088	0.0048	0.0097	0.0057	0.0080	0.0064	0.0064
73	0.0059	0.0091	**0.0050**	0.0074	0.0075	0.0092	0.0058	0.0081	0.0072	0.0080	0.0073	0.0070
74	0.0086	0.0118	**0.0068**	0.0083	0.0101	0.0118	0.0082	0.0107	0.0101	0.0100	0.0100	0.0094
75	0.0079	0.0113	**0.0064**	0.0079	0.0097	0.0113	0.0072	0.0099	0.0093	0.0096	0.0093	0.0087
76	0.0093	0.0104	**0.0080**	0.0093	0.0096	0.0116	0.0096	0.0112	0.0120	0.0097	0.0111	0.0100
77	0.0107	0.0127	**0.0082**	0.0109	0.0117	0.0139	0.0107	0.0129	0.0132	0.0118	0.0122	0.0110
78	0.0102	0.0129	0.0095	0.0086	0.0109	0.0130	**0.0071**	0.0123	0.0096	0.0108	0.0099	0.0097
79	0.0110	0.0135	0.0111	**0.0099**	0.0128	0.0149	0.0115	0.0125	0.0144	0.0121	0.0136	0.0119
80	0.0102	0.0148	0.0105	**0.0101**	0.0131	0.0151	0.0138	0.0117	0.0167	0.0127	0.0152	0.0131
81	0.0089	0.0080	0.0097	**0.0072**	0.0085	0.0108	0.0130	0.0103	0.0167	0.0077	0.0135	0.0106
82	0.0140	0.0157	0.0102	0.0096	0.0121	0.0145	**0.0087**	0.0148	0.0094	0.0125	0.0099	0.0109
83	0.0127	0.0129	0.0121	**0.0103**	0.0125	0.0145	0.0108	0.0128	0.0150	0.0119	0.0133	0.0123
84	0.0162	0.0205	0.0164	**0.0140**	0.0188	0.0202	0.0152	0.0152	0.0201	0.0177	0.0185	0.0172
85	0.0086	0.0103	0.0093	**0.0085**	0.0131	0.0121	0.0178	0.0148	0.0182	0.0107	0.0158	0.0118
86	0.0146	0.0117	0.0134	**0.0101**	0.0145	0.0150	0.0212	0.0129	0.0229	0.0119	0.0182	0.0151
87	0.0143	0.0184	0.0166	**0.0122**	0.0203	0.0190	0.0238	0.0174	0.0246	0.0167	0.0220	0.0172
88	0.0219	0.0295	0.0242	0.0203	0.0318	0.0297	0.0293	**0.0199**	0.0295	0.0272	0.0292	0.0257
89	0.0239	0.0287	0.0245	0.0195	0.0306	0.0263	0.0265	**0.0170**	0.0283	0.0249	0.0242	0.0227
90	0.0247	0.0263	0.0248	0.0218	0.0234	0.0258	0.0253	**0.0203**	0.0302	0.0238	0.0248	0.0224
91	0.0159	0.0185	0.0192	**0.0158**	0.0185	0.0170	0.0370	0.0203	0.0265	0.0165	0.0211	0.0171
92	0.0180	0.0370	**0.0152**	0.0190	0.0264	0.0273	0.0307	0.0215	0.0263	0.0272	0.0198	0.0182
93	0.0210	0.0256	0.0142	**0.0120**	0.0208	0.0186	0.0294	0.0327	0.0321	0.0160	0.0228	0.0201
94	0.0444	0.0742	0.0406	0.0363	0.0512	0.0503	0.0408	**0.0345**	0.0360	0.0535	0.0364	0.0404
95	0.0375	0.0636	0.0528	0.0597	0.0629	0.0517	0.0591	0.0301	**0.0287**	0.0596	0.0465	0.0483
96	0.0436	0.0535	0.0468	0.0478	0.0556	0.0431	0.0492	0.0381	**0.0273**	0.0509	0.0369	0.0386
97	0.0509	0.0946	**0.0424**	0.0694	0.0728	0.0731	0.0690	0.0778	0.0914	0.0772	0.0779	0.0739
98	0.0795	0.0714	0.0648	0.0344	0.0521	0.0388	0.0474	0.0336	0.0340	0.0422	**0.0261**	0.0322
99	0.1080	0.1752	0.1043	0.0757	0.1558	0.1372	0.0726	0.0529	**0.0313**	0.1269	0.0726	0.0771
100	0.1275	0.3010	0.1310	0.0752	0.0973	0.1107	**0.0648**	0.0733	0.1201	0.1523	0.0832	0.1117
101	0.1954	0.1460	0.2023	0.2040	0.1281	0.1208	0.1332	0.0894	**0.0600**	0.1512	0.1034	0.1406
102	0.1884	0.9870	0.6373	0.2977	0.6360	0.3983	0.1670	0.1114	0.1518	0.5615	**0.1108**	0.2305
103	0.2510	0.7841	0.5684	0.3207	0.6141	0.3713	0.2021	0.2021	0.1843	0.5294	**0.1803**	0.2769
104	0.2593	0.6796	0.6600	0.3904	0.6663	0.4819	0.2427	0.2398	**0.2243**	0.5787	0.2313	0.3048
105	0.2771	0.6487	0.4789	0.3406	0.6347	0.4833	0.3205	0.3251	0.3016	0.5413	**0.2515**	0.2694
105+	**0.1602**	1.1032	0.4358	0.3060	0.7848	0.8433	0.2287	0.2544	0.2890	0.6748	0.2361	0.2395

Notes: The table above presents the average absolute errors of the forecast ASDRs for males aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 10-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix B2: Average absolute errors in age-specific mortality rates for females for 10-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	0.0016	0.0027	0.0020	**0.0014**	0.0017	0.0021	0.0016	0.0110	0.0028	0.0018	0.0019	0.0017
2	**0.0001**	0.0004	0.0003	0.0002	0.0003	0.0003	0.0008	0.0010	0.0003	0.0003	0.0003	0.0002
3	0.0001	0.0002	0.0002	**0.0001**	0.0002	0.0002	0.0003	0.0005	0.0002	0.0001	0.0001	0.0001
4	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001
5	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001
6	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0000	0.0000	**0.0000**
8	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000
9	0.0000	0.0001	0.0001	0.0000	**0.0000**	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000
10	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	**0.0000**	0.0001	0.0001	0.0000	0.0000	0.0000
11	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0001	0.0001	0.0000	0.0000	0.0000
12	0.0000	0.0001	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000
13	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001
16	0.0000	0.0001	0.0001	**0.0000**	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
17	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
18	0.0001	0.0002	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0001
19	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0003	0.0001	0.0002	0.0002	0.0002
20	**0.0001**	0.0002	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002
21	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	**0.0001**	0.0001	0.0002	0.0002
22	0.0001	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001
23	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	**0.0001**	0.0001	0.0001	0.0001
24	**0.0001**	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
25	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	**0.0001**	0.0001
26	0.0001	0.0002	0.0001	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
27	0.0001	0.0002	0.0001	0.0002	**0.0001**	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002
28	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0001	0.0001
29	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	**0.0001**	0.0002	0.0001	0.0002	0.0001	0.0001
30	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	**0.0001**	0.0003	0.0002	0.0002	0.0001	0.0001
31	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	**0.0001**	0.0003	0.0002	0.0001	0.0001	0.0001
32	0.0001	0.0002	0.0002	0.0001	0.0001	0.0002	**0.0001**	0.0003	0.0002	0.0001	0.0001	0.0001
33	0.0002	0.0003	0.0002	0.0002	**0.0002**	0.0002	0.0002	0.0004	0.0003	0.0002	0.0002	0.0002
34	0.0001	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0001	0.0004	0.0002	0.0002	0.0001	0.0001
35	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	**0.0001**	0.0004	0.0003	0.0002	0.0002	0.0002
36	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0003	0.0002	**0.0002**	0.0002
37	0.0002	0.0003	0.0003	0.0002	0.0002	0.0003	0.0002	0.0004	0.0003	0.0002	**0.0002**	0.0002
38	0.0001	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0006	0.0002	0.0002	**0.0001**	0.0001
39	0.0003	0.0004	0.0003	0.0003	0.0003	0.0004	0.0003	0.0006	0.0005	0.0004	**0.0003**	0.0003
40	**0.0002**	0.0004	0.0003	0.0002	0.0003	0.0003	0.0003	0.0006	0.0003	0.0002	0.0002	0.0002
41	**0.0001**	0.0003	0.0002	0.0002	0.0002	0.0002	0.0004	0.0007	0.0003	0.0002	0.0002	0.0002
42	0.0002	0.0003	0.0002	0.0002	0.0002	**0.0002**	0.0005	0.0008	0.0004	0.0002	0.0003	0.0002
43	**0.0003**	0.0003	0.0004	0.0003	0.0003	0.0003	0.0005	0.0008	0.0005	0.0003	0.0003	0.0003
44	0.0003	0.0004	0.0004	0.0004	0.0004	0.0003	0.0005	0.0010	0.0005	0.0004	0.0003	**0.0003**
45	0.0003	0.0003	0.0004	0.0003	0.0003	0.0003	0.0006	0.0011	0.0003	0.0003	**0.0002**	0.0002
46	0.0003	0.0004	0.0004	0.0004	0.0004	**0.0003**	0.0006	0.0012	0.0006	0.0003	0.0004	0.0004
47	0.0003	0.0002	0.0003	0.0003	0.0002	**0.0002**	0.0008	0.0012	0.0005	0.0002	0.0003	0.0002
48	0.0004	0.0004	0.0005	0.0004	0.0004	**0.0003**	0.0009	0.0012	0.0006	0.0004	0.0004	0.0003
49	0.0004	0.0004	0.0004	0.0005	**0.0003**	0.0004	0.0009	0.0015	0.0007	0.0004	0.0005	0.0004
50	0.0006	**0.0005**	0.0005	0.0007	0.0005	0.0006	0.0009	0.0015	0.0009	0.0005	0.0006	0.0005
51	0.0006	0.0004	0.0005	0.0006	**0.0004**	0.0005	0.0009	0.0017	0.0009	0.0005	0.0005	0.0005
52	0.0007	0.0006	0.0006	0.0007	0.0005	0.0006	0.0012	0.0020	0.0008	0.0006	**0.0005**	0.0005
53	0.0008	**0.0007**	0.0009	0.0010	0.0007	0.0008	0.0011	0.0020	0.0014	0.0008	0.0007	0.0008
54	0.0007	0.0008	0.0008	0.0010	**0.0007**	0.0008	0.0011	0.0022	0.0014	0.0008	0.0007	0.0008
55	0.0008	0.0008	0.0008	0.0012	0.0008	0.0009	0.0011	0.0026	0.0013	0.0009	**0.0007**	0.0008
56	0.0011	0.0007	0.0009	0.0011	0.0008	0.0009	0.0013	0.0030	0.0011	0.0009	**0.0006**	0.0008
57	0.0009	0.0006	0.0009	0.0010	0.0007	0.0008	0.0015	0.0028	0.0011	0.0007	**0.0006**	0.0007
58	0.0012	0.0010	0.0010	0.0014	0.0009	0.0011	0.0017	0.0032	0.0011	0.0011	**0.0008**	0.0009
59	0.0013	0.0010	0.0011	0.0015	0.0011	0.0011	0.0013	0.0038	0.0012	0.0011	**0.0008**	0.0010
60	0.0011	0.0009	0.0010	0.0015	0.0008	0.0011	0.0017	0.0037	0.0010	0.0011	**0.0007**	0.0009
61	0.0014	0.0012	0.0012	0.0015	**0.0011**	0.0013	0.0012	0.0040	0.0014	0.0012	0.0011	0.0012

Appendix B2: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
62	0.0019	0.0016	0.0015	0.0021	0.0013	0.0017	0.0018	0.0052	0.0011	0.0017	**0.0011**	0.0013
63	0.0016	0.0017	0.0017	0.0024	0.0015	0.0019	0.0013	0.0050	0.0012	0.0019	**0.0011**	0.0014
64	0.0016	0.0015	0.0016	0.0024	0.0014	0.0017	**0.0012**	0.0052	0.0013	0.0018	0.0012	0.0015
65	0.0019	0.0017	0.0017	0.0029	0.0016	0.0019	0.0014	0.0061	0.0013	0.0020	**0.0013**	0.0016
66	0.0017	0.0016	0.0015	0.0024	**0.0013**	0.0016	0.0014	0.0056	0.0016	0.0016	0.0014	0.0015
67	0.0022	0.0018	0.0018	0.0028	0.0016	0.0020	0.0018	0.0068	0.0015	0.0021	**0.0014**	0.0016
68	0.0020	0.0016	0.0016	0.0034	**0.0014**	0.0018	0.0018	0.0074	0.0016	0.0020	0.0014	0.0016
69	0.0023	0.0021	0.0018	0.0042	**0.0016**	0.0024	0.0018	0.0077	0.0018	0.0025	0.0018	0.0021
70	0.0029	0.0034	0.0027	0.0051	0.0027	0.0035	0.0019	0.0079	**0.0018**	0.0035	0.0020	0.0026
71	0.0040	0.0039	0.0038	0.0051	0.0036	0.0042	**0.0028**	0.0074	0.0028	0.0041	0.0030	0.0036
72	0.0048	0.0039	0.0029	0.0056	0.0030	0.0040	0.0030	0.0104	0.0031	0.0040	**0.0027**	0.0035
73	0.0040	0.0035	0.0029	0.0062	**0.0028**	0.0038	0.0028	0.0087	0.0030	0.0040	0.0028	0.0035
74	0.0053	0.0053	0.0048	0.0082	0.0049	0.0056	0.0042	0.0094	**0.0040**	0.0057	0.0043	0.0050
75	0.0057	0.0061	0.0051	0.0083	0.0051	0.0061	0.0044	0.0090	**0.0043**	0.0060	0.0045	0.0054
76	0.0062	0.0061	0.0051	0.0081	0.0047	0.0064	0.0054	0.0096	**0.0043**	0.0063	0.0052	0.0059
77	0.0068	0.0071	0.0062	0.0089	0.0055	0.0073	0.0066	0.0104	**0.0052**	0.0070	0.0061	0.0068
78	0.0068	0.0066	0.0059	0.0104	0.0066	0.0067	**0.0047**	0.0113	0.0048	0.0074	0.0049	0.0056
79	0.0068	0.0070	0.0062	0.0115	0.0056	0.0073	0.0059	0.0109	**0.0052**	0.0074	0.0055	0.0066
80	0.0069	0.0096	**0.0065**	0.0130	0.0074	0.0092	0.0081	0.0109	0.0073	0.0096	0.0073	0.0081
81	0.0073	0.0075	0.0066	0.0102	**0.0057**	0.0081	0.0078	0.0110	0.0074	0.0076	0.0065	0.0073
82	0.0095	0.0100	0.0066	0.0120	0.0068	0.0090	0.0054	0.0123	0.0095	0.0096	**0.0038**	0.0060
83	0.0086	0.0096	0.0067	0.0133	0.0074	0.0093	**0.0052**	0.0104	0.0072	0.0101	0.0052	0.0067
84	0.0099	0.0142	0.0103	0.0193	0.0111	0.0130	0.0057	0.0099	0.0073	0.0149	**0.0051**	0.0085
85	0.0111	0.0145	0.0098	0.0181	0.0104	0.0138	0.0100	0.0128	0.0115	0.0143	**0.0090**	0.0109
86	0.0086	0.0123	0.0094	0.0163	0.0095	0.0117	0.0067	0.0116	0.0099	0.0124	**0.0058**	0.0072
87	0.0127	0.0175	0.0152	0.0224	0.0169	0.0165	0.0133	**0.0121**	0.0161	0.0179	0.0127	0.0135
88	0.0090	0.0119	0.0119	0.0205	0.0106	0.0115	0.0104	0.0136	0.0136	0.0136	0.0087	**0.0082**
89	0.0113	0.0162	0.0209	0.0229	0.0179	0.0161	0.0156	**0.0112**	0.0189	0.0183	0.0137	0.0130
90	0.0162	0.0366	0.0204	0.0327	0.0297	0.0272	0.0154	**0.0121**	0.0197	0.0324	0.0149	0.0170
91	**0.0075**	0.0191	0.0226	0.0206	0.0240	0.0177	0.0156	0.0206	0.0192	0.0188	0.0150	0.0127
92	0.0111	0.0300	0.0171	0.0258	0.0210	0.0189	0.0301	0.0213	0.0365	0.0238	0.0201	**0.0095**
93	**0.0090**	0.0352	0.0188	0.0261	0.0304	0.0207	0.0331	0.0308	0.0374	0.0260	0.0231	0.0131
94	**0.0126**	0.0415	0.0249	0.0408	0.0298	0.0267	0.0206	0.0217	0.0260	0.0361	0.0141	0.0171
95	**0.0156**	0.0626	0.0395	0.0423	0.0550	0.0385	0.0326	0.0345	0.0344	0.0456	0.0275	0.0216
96	**0.0236**	0.0598	0.0374	0.0488	0.0576	0.0410	0.0317	0.0309	0.0322	0.0489	0.0321	0.0307
97	0.0385	0.0161	0.0202	0.0248	0.0251	**0.0158**	0.0446	0.0406	0.0618	0.0194	0.0370	0.0333
98	0.0426	0.0302	**0.0258**	0.0479	0.0292	0.0281	0.0371	0.0499	0.0387	0.0350	0.0316	0.0357
99	0.0780	0.0545	0.0690	0.1033	0.0599	0.0614	0.0763	**0.0496**	0.0693	0.0702	0.0683	0.0683
100	0.1001	0.1788	0.1242	0.1626	0.1420	0.1224	0.0657	**0.0353**	0.0529	0.1611	0.0760	0.0957
101	0.1363	0.2557	0.0879	0.1520	0.2342	0.1302	0.0828	**0.0679**	0.1085	0.2039	0.0970	0.1043
102	0.1735	0.2554	0.2322	0.3559	0.2591	0.1553	0.1218	**0.0920**	0.1274	0.2697	0.1324	0.1576
103	0.1866	0.1991	0.2335	0.3550	0.2362	0.1657	0.1486	**0.0983**	0.1557	0.2633	0.1567	0.1887
104	0.1748	0.3245	0.3400	0.4378	0.3376	0.2487	0.2086	**0.0930**	0.1973	0.3500	0.2169	0.2575
105	0.2080	0.3004	0.2620	0.4270	0.3311	0.2570	0.2049	**0.1348**	0.2122	0.3528	0.2247	0.2450
105+	0.2721	0.3550	0.3660	0.4762	0.3982	0.5112	0.2668	**0.2301**	0.2599	0.3784	0.3451	0.3170

Notes: The table above presents the average absolute errors of the forecast ASDRs for females aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 10-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix B3: Average absolute errors in age-specific mortality rates for males for 20-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	**0.0022**	0.0041	0.0043	0.0025	0.0024	0.0024	0.0047	0.0104	0.0033	0.0025	0.0027	0.0024
2	**0.0001**	0.0004	0.0006	0.0002	0.0002	0.0003	0.0012	0.0007	0.0003	0.0003	0.0005	0.0003
3	**0.0000**	0.0002	0.0003	0.0001	0.0001	0.0001	0.0005	0.0004	0.0001	0.0001	0.0002	0.0001
4	0.0001	0.0002	0.0003	0.0001	**0.0001**	0.0001	0.0003	0.0003	0.0001	0.0001	0.0001	0.0001
5	0.0001	0.0001	0.0002	**0.0000**	0.0000	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
6	**0.0000**	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
7	0.0001	0.0001	0.0002	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
8	0.0001	0.0001	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000
9	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
10	0.0000	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000
11	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000
12	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001	0.0001
13	0.0001	0.0001	0.0002	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0002	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
16	0.0001	0.0001	0.0002	0.0001	0.0001	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
17	0.0002	0.0002	0.0002	0.0002	0.0001	**0.0001**	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001
18	0.0003	0.0004	0.0005	0.0004	0.0003	0.0004	0.0006	0.0006	0.0004	0.0004	0.0004	**0.0003**
19	0.0004	0.0005	0.0006	0.0006	**0.0004**	0.0006	0.0008	0.0009	0.0006	0.0005	0.0004	0.0005
20	0.0005	0.0006	0.0008	0.0007	0.0006	0.0007	0.0007	0.0008	0.0005	0.0006	**0.0005**	0.0005
21	0.0005	0.0005	0.0007	0.0007	0.0005	0.0006	0.0008	0.0008	**0.0005**	0.0005	0.0005	0.0005
22	0.0005	0.0006	0.0007	0.0007	0.0005	0.0006	0.0008	0.0008	0.0005	0.0006	**0.0005**	0.0005
23	0.0004	0.0004	0.0005	0.0006	0.0005	**0.0004**	0.0007	0.0006	0.0004	0.0005	0.0004	0.0004
24	**0.0004**	0.0005	0.0006	0.0006	0.0006	0.0005	0.0007	0.0005	0.0004	0.0006	0.0005	0.0005
25	0.0003	0.0004	0.0005	0.0005	0.0005	0.0004	0.0006	0.0004	**0.0003**	0.0005	0.0004	0.0004
26	0.0004	0.0006	0.0005	0.0006	0.0006	0.0005	0.0007	0.0004	**0.0004**	0.0006	0.0005	0.0005
27	0.0003	0.0005	0.0005	0.0005	0.0006	0.0004	0.0006	**0.0002**	0.0002	0.0005	0.0004	0.0004
28	0.0003	0.0006	0.0004	0.0005	0.0006	0.0004	0.0006	**0.0002**	0.0003	0.0006	0.0004	0.0004
29	0.0004	0.0006	0.0005	0.0006	0.0006	0.0005	0.0006	**0.0002**	0.0002	0.0006	0.0004	0.0004
30	0.0003	0.0006	0.0004	0.0005	0.0006	0.0005	0.0006	0.0003	**0.0002**	0.0005	0.0004	0.0004
31	0.0003	0.0006	0.0004	0.0005	0.0006	0.0005	0.0006	0.0003	**0.0002**	0.0005	0.0004	0.0004
32	0.0002	0.0006	0.0003	0.0005	0.0004	0.0005	0.0006	0.0004	**0.0002**	0.0005	0.0004	0.0004
33	**0.0003**	0.0006	0.0004	0.0005	0.0004	0.0005	0.0006	0.0005	0.0003	0.0005	0.0004	0.0004
34	**0.0002**	0.0006	0.0004	0.0004	0.0003	0.0004	0.0005	0.0006	0.0003	0.0004	0.0003	0.0003
35	**0.0002**	0.0006	0.0004	0.0004	0.0003	0.0004	0.0005	0.0007	0.0002	0.0004	0.0003	0.0003
36	0.0003	0.0007	0.0005	0.0005	0.0005	0.0006	0.0006	0.0007	**0.0002**	0.0006	0.0004	0.0004
37	**0.0003**	0.0008	0.0006	0.0005	0.0005	0.0005	0.0005	0.0009	0.0004	0.0006	0.0003	0.0004
38	**0.0003**	0.0007	0.0005	0.0005	0.0005	0.0005	0.0005	0.0010	0.0004	0.0006	0.0004	0.0004
39	**0.0003**	0.0007	0.0006	0.0005	0.0004	0.0005	0.0004	0.0011	0.0006	0.0005	0.0003	0.0003
40	**0.0004**	0.0009	0.0007	0.0005	0.0006	0.0006	0.0005	0.0013	0.0006	0.0007	0.0004	0.0005
41	0.0004	0.0009	0.0007	0.0004	0.0005	0.0006	0.0004	0.0015	0.0007	0.0006	**0.0003**	0.0004
42	0.0004	0.0007	0.0005	**0.0002**	0.0003	0.0003	0.0005	0.0018	0.0008	0.0004	0.0003	0.0003
43	0.0006	0.0010	0.0008	0.0005	0.0007	0.0006	0.0005	0.0017	0.0010	0.0007	**0.0005**	0.0005
44	0.0008	0.0011	0.0011	**0.0007**	0.0009	0.0008	0.0008	0.0018	0.0010	0.0008	0.0008	0.0008
45	0.0006	0.0008	0.0008	**0.0004**	0.0005	0.0004	0.0006	0.0023	0.0012	0.0005	0.0005	0.0004
46	0.0010	0.0013	0.0012	0.0008	0.0010	0.0009	0.0008	0.0023	0.0016	0.0009	**0.0008**	0.0008
47	0.0011	0.0010	0.0013	**0.0009**	0.0011	0.0010	0.0010	0.0025	0.0015	0.0009	0.0009	0.0009
48	0.0011	0.0011	0.0014	**0.0010**	0.0013	0.0011	0.0011	0.0027	0.0019	0.0011	0.0011	0.0011
49	0.0010	0.0009	0.0012	**0.0009**	0.0011	0.0010	0.0011	0.0031	0.0023	0.0009	0.0013	0.0011
50	0.0015	**0.0013**	0.0017	0.0014	0.0016	0.0015	0.0016	0.0032	0.0029	0.0014	0.0017	0.0015
51	0.0015	0.0016	0.0018	0.0016	0.0017	0.0016	0.0015	0.0033	0.0029	0.0015	0.0016	**0.0015**
52	0.0014	0.0015	0.0017	**0.0014**	0.0018	0.0018	0.0017	0.0040	0.0028	0.0015	0.0017	0.0015
53	0.0017	**0.0016**	0.0020	0.0019	0.0021	0.0022	0.0019	0.0043	0.0039	0.0018	0.0024	0.0020
54	**0.0019**	0.0021	0.0021	0.0021	0.0024	0.0026	0.0020	0.0044	0.0041	0.0021	0.0026	0.0023
55	**0.0022**	0.0025	0.0024	0.0025	0.0028	0.0030	0.0025	0.0048	0.0045	0.0025	0.0030	0.0026
56	**0.0022**	0.0024	0.0023	0.0024	0.0027	0.0029	0.0025	0.0053	0.0040	0.0024	0.0027	0.0024
57	**0.0030**	0.0033	0.0032	0.0034	0.0036	0.0039	0.0031	0.0057	0.0051	0.0034	0.0037	0.0033
58	**0.0029**	0.0040	0.0033	0.0037	0.0038	0.0044	0.0032	0.0062	0.0049	0.0038	0.0036	0.0034
59	**0.0035**	0.0049	0.0039	0.0044	0.0046	0.0053	0.0039	0.0066	0.0058	0.0046	0.0044	0.0041

Appendix B3: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
60	**0.0036**	0.0062	0.0046	0.0050	0.0055	0.0062	0.0042	0.0070	0.0060	0.0055	0.0049	0.0046
61	**0.0042**	0.0044	0.0043	0.0046	0.0046	0.0054	0.0045	0.0078	0.0063	0.0045	0.0048	0.0044
62	0.0052	0.0082	0.0052	0.0054	0.0066	0.0075	**0.0044**	0.0090	0.0055	0.0064	0.0049	0.0050
63	**0.0054**	0.0082	0.0059	0.0066	0.0072	0.0082	0.0057	0.0091	0.0072	0.0073	0.0063	0.0062
64	**0.0055**	0.0082	0.0066	0.0065	0.0074	0.0083	0.0057	0.0097	0.0075	0.0072	0.0064	0.0062
65	**0.0062**	0.0096	0.0074	0.0074	0.0086	0.0096	0.0064	0.0107	0.0076	0.0084	0.0069	0.0068
66	**0.0068**	0.0089	0.0077	0.0079	0.0086	0.0098	0.0069	0.0109	0.0089	0.0085	0.0077	0.0074
67	0.0069	0.0101	0.0067	0.0074	0.0086	0.0098	**0.0066**	0.0127	0.0080	0.0087	0.0071	0.0069
68	0.0080	0.0132	0.0088	0.0099	0.0112	0.0130	**0.0079**	0.0135	0.0096	0.0115	0.0090	0.0091
69	0.0088	0.0134	0.0102	0.0099	0.0118	0.0132	**0.0083**	0.0150	0.0102	0.0117	0.0095	0.0095
70	**0.0095**	0.0166	0.0106	0.0112	0.0133	0.0151	0.0098	0.0150	0.0117	0.0137	0.0107	0.0106
71	0.0105	0.0123	0.0094	0.0102	0.0115	0.0131	**0.0085**	0.0163	0.0104	0.0114	0.0095	0.0096
72	0.0121	0.0184	0.0107	0.0118	0.0139	0.0165	**0.0090**	0.0208	0.0113	0.0147	0.0108	0.0106
73	0.0121	0.0175	0.0121	0.0129	0.0150	0.0173	**0.0105**	0.0199	0.0132	0.0151	0.0122	0.0120
74	0.0148	0.0205	0.0141	0.0151	0.0177	0.0201	**0.0115**	0.0223	0.0147	0.0178	0.0141	0.0145
75	0.0154	0.0215	0.0146	0.0159	0.0188	0.0211	**0.0109**	0.0238	0.0144	0.0187	0.0145	0.0150
76	0.0165	0.0190	0.0154	0.0159	0.0177	0.0208	**0.0113**	0.0246	0.0156	0.0175	0.0152	0.0152
77	0.0187	0.0231	0.0177	0.0184	0.0213	0.0245	**0.0135**	0.0255	0.0182	0.0209	0.0181	0.0180
78	0.0172	0.0215	0.0163	0.0155	0.0183	0.0210	**0.0103**	0.0307	0.0154	0.0184	0.0138	0.0149
79	0.0183	0.0227	0.0181	0.0187	0.0212	0.0242	**0.0136**	0.0308	0.0195	0.0208	0.0176	0.0176
80	0.0172	0.0250	0.0195	0.0187	0.0220	0.0247	**0.0138**	0.0335	0.0193	0.0219	0.0191	0.0187
81	0.0177	0.0172	0.0166	0.0161	0.0167	0.0199	**0.0110**	0.0361	0.0191	0.0167	0.0159	0.0158
82	0.0185	0.0268	0.0186	0.0178	0.0214	0.0251	**0.0073**	0.0442	0.0148	0.0220	0.0138	0.0154
83	0.0176	0.0219	0.0197	0.0180	0.0207	0.0238	**0.0098**	0.0421	0.0209	0.0202	0.0163	0.0166
84	0.0195	0.0317	0.0212	0.0213	0.0282	0.0277	**0.0146**	0.0449	0.0208	0.0265	0.0208	0.0209
85	**0.0177**	0.0248	0.0225	0.0209	0.0265	0.0256	0.0195	0.0465	0.0296	0.0241	0.0248	0.0222
86	0.0179	0.0204	0.0234	**0.0162**	0.0225	0.0223	0.0174	0.0492	0.0277	0.0197	0.0225	0.0199
87	**0.0198**	0.0340	0.0292	0.0242	0.0335	0.0333	0.0256	0.0525	0.0365	0.0306	0.0318	0.0280
88	0.0304	0.0439	0.0341	0.0301	0.0451	0.0431	**0.0291**	0.0648	0.0393	0.0397	0.0368	0.0344
89	0.0260	0.0431	0.0310	0.0259	0.0399	0.0390	**0.0212**	0.0627	0.0290	0.0363	0.0284	0.0283
90	**0.0240**	0.0430	0.0298	0.0358	0.0378	0.0418	0.0271	0.0642	0.0372	0.0389	0.0346	0.0330
91	0.0272	0.0200	0.0282	**0.0195**	0.0244	0.0217	0.0447	0.0696	0.0482	0.0207	0.0346	0.0289
92	0.0283	0.0587	0.0258	0.0291	0.0422	0.0401	0.0285	0.0711	0.0200	0.0433	**0.0175**	0.0245
93	0.0356	0.0534	0.0434	0.0289	0.0448	0.0363	0.0359	0.0673	0.0305	0.0382	**0.0223**	0.0264
94	**0.0236**	0.0997	0.0498	0.0517	0.0781	0.0726	0.0320	0.0774	0.0359	0.0716	0.0349	0.0380
95	0.0539	0.0803	0.0717	0.0660	0.0686	0.0582	0.0704	0.1002	**0.0424**	0.0663	0.0456	0.0480
96	0.0616	0.0765	0.0706	0.0670	0.0701	0.0522	0.0716	0.0940	**0.0346**	0.0639	0.0472	0.0502
97	**0.0542**	0.1253	0.0771	0.0869	0.1220	0.0993	0.0834	0.0898	0.0934	0.1033	0.0758	0.0762
98	0.0870	0.1163	0.0888	**0.0301**	0.0948	0.0719	0.0533	0.1195	0.0316	0.0779	0.0352	0.0483
99	0.1330	0.2703	0.1381	0.0946	0.2213	0.1993	0.0874	0.1191	**0.0767**	0.1829	0.0973	0.1048
100	0.1254	0.4353	0.2107	0.1066	0.2406	0.1538	0.1021	0.0935	0.1168	0.2314	**0.0768**	0.1203
101	0.2567	0.2059	0.3093	0.3035	0.2188	0.1663	0.1614	0.1451	**0.1098**	0.2281	0.1312	0.1987
102	0.2690	1.9219	1.2420	0.5362	1.2961	0.7871	0.1444	0.1404	**0.0931**	1.1872	0.2745	0.4470
103	0.3438	1.3791	1.1172	0.5626	1.1649	0.6300	0.2254	0.2141	**0.1577**	0.9630	0.2965	0.4076
104	0.3463	1.0972	1.2234	0.6294	1.0227	0.7304	0.2549	0.2287	**0.1709**	0.8645	0.3529	0.4142
105	0.2838	0.9533	0.8380	0.5645	0.9186	0.7025	0.3230	0.2438	**0.2173**	0.7649	0.3379	0.3600
105+	0.2190	1.9496	0.7614	0.5483	1.3554	1.5775	0.2733	**0.1284**	0.2247	1.1516	0.4514	0.3651

Notes: The table above presents the average absolute errors of the forecast ASDRs for males aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 20-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix B4: Average absolute errors in age-specific mortality rates for females for 20-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	0.0018	0.0022	0.0018	0.0016	0.0017	0.0017	0.0022	0.0081	0.0034	**0.0015**	0.0017	0.0015
2	**0.0001**	0.0003	0.0002	0.0001	0.0001	0.0002	0.0008	0.0007	0.0002	0.0002	0.0002	0.0001
3	0.0001	0.0002	0.0002	**0.0001**	0.0001	0.0001	0.0003	0.0004	0.0001	0.0001	0.0001	0.0001
4	**0.0001**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001
5	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
6	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001	0.0002	0.0001	0.0000	0.0000	**0.0000**
7	0.0000	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000
8	0.0000	0.0001	0.0000	0.0000	**0.0000**	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	**0.0000**	0.0001	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0001	0.0000	0.0000	0.0000	0.0000
12	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
13	**0.0000**	0.0001	0.0000	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000
14	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	**0.0000**	0.0001
16	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000
17	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
18	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0003	**0.0001**	0.0002	0.0001	0.0001
19	0.0002	0.0003	0.0003	0.0002	0.0003	0.0002	0.0002	0.0003	**0.0001**	0.0002	0.0001	0.0002
20	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	**0.0001**	0.0001
21	0.0002	0.0003	0.0002	0.0001	0.0002	0.0003	0.0002	0.0003	0.0002	0.0002	**0.0001**	0.0001
22	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0003	0.0002	**0.0000**	0.0001
23	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	**0.0001**
24	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0003	0.0001	0.0001	**0.0000**
25	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0003	0.0002	0.0001	**0.0001**
26	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0003	0.0002	0.0001	**0.0001**
27	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0003	0.0001	0.0000	**0.0000**
28	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	**0.0001**	0.0001	0.0003	0.0002	0.0001	0.0001
29	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0004	0.0002	0.0001	**0.0000**
30	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0004	0.0001	0.0001	**0.0001**
31	0.0002	0.0003	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0004	0.0001	**0.0001**	0.0001
32	0.0001	0.0002	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0003	0.0001	**0.0000**	0.0000
33	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0001	0.0002	0.0004	0.0002	0.0001	0.0001
34	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	**0.0001**	0.0001
35	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0003	0.0004	0.0002	0.0001	0.0001
36	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0003	0.0004	0.0002	0.0001	0.0001
37	0.0003	0.0004	0.0003	**0.0002**	0.0003	0.0003	0.0003	0.0002	0.0005	0.0003	0.0002	0.0002
38	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0003	0.0002	0.0004	0.0005	0.0002	0.0002	0.0002
39	**0.0002**	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0007	0.0003	0.0003	0.0002
40	0.0003	0.0005	0.0004	**0.0002**	0.0004	0.0004	0.0004	0.0004	0.0007	0.0004	0.0003	0.0003
41	**0.0002**	0.0004	0.0003	0.0002	0.0003	0.0003	0.0004	0.0005	0.0006	0.0003	0.0003	0.0002
42	**0.0002**	0.0004	0.0003	0.0002	0.0003	0.0003	0.0005	0.0006	0.0007	0.0003	0.0003	0.0003
43	**0.0002**	0.0003	0.0003	0.0004	0.0003	0.0003	0.0004	0.0006	0.0009	0.0003	0.0004	0.0003
44	0.0002	0.0003	0.0003	0.0004	0.0003	**0.0002**	0.0005	0.0007	0.0009	0.0003	0.0004	0.0004
45	0.0002	0.0004	0.0003	**0.0002**	0.0003	0.0002	0.0006	0.0008	0.0008	0.0002	0.0003	0.0002
46	0.0003	0.0004	0.0004	0.0004	0.0004	**0.0003**	0.0006	0.0009	0.0010	0.0003	0.0005	0.0004
47	0.0003	0.0003	0.0003	0.0004	0.0003	**0.0003**	0.0009	0.0009	0.0009	0.0003	0.0004	0.0003
48	0.0003	**0.0003**	0.0003	0.0005	0.0003	0.0003	0.0009	0.0010	0.0011	0.0003	0.0005	0.0004
49	**0.0003**	0.0003	0.0004	0.0006	0.0004	0.0005	0.0009	0.0013	0.0014	0.0004	0.0006	0.0005
50	0.0005	**0.0005**	0.0007	0.0009	0.0007	0.0007	0.0010	0.0013	0.0017	0.0007	0.0008	0.0006
51	0.0004	**0.0004**	0.0005	0.0007	0.0005	0.0005	0.0011	0.0014	0.0016	0.0005	0.0007	0.0005
52	**0.0004**	0.0004	0.0004	0.0009	0.0005	0.0006	0.0014	0.0017	0.0016	0.0006	0.0007	0.0005
53	0.0007	**0.0005**	0.0006	0.0009	0.0007	0.0007	0.0015	0.0017	0.0022	0.0006	0.0010	0.0008
54	0.0006	0.0005	**0.0004**	0.0013	0.0006	0.0007	0.0015	0.0020	0.0022	0.0008	0.0008	0.0007
55	**0.0006**	0.0008	0.0008	0.0016	0.0009	0.0011	0.0014	0.0025	0.0023	0.0011	0.0009	0.0008
56	0.0007	**0.0006**	0.0006	0.0012	0.0008	0.0008	0.0019	0.0028	0.0016	0.0007	0.0008	0.0007
57	0.0008	0.0008	**0.0007**	0.0014	0.0007	0.0010	0.0020	0.0029	0.0018	0.0009	0.0011	0.0009
58	**0.0009**	0.0010	0.0010	0.0016	0.0010	0.0013	0.0023	0.0033	0.0017	0.0012	0.0011	0.0010
59	0.0009	**0.0008**	0.0009	0.0022	0.0009	0.0011	0.0020	0.0039	0.0018	0.0013	0.0010	0.0009

Appendix B4: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
60	**0.0010**	0.0012	0.0010	0.0025	0.0011	0.0015	0.0024	0.0042	0.0016	0.0015	0.0012	0.0010
61	0.0013	0.0013	0.0013	0.0022	0.0013	0.0017	0.0020	0.0049	0.0019	0.0016	0.0013	**0.0013**
62	0.0014	0.0015	0.0012	0.0030	0.0011	0.0017	0.0027	0.0056	0.0013	0.0019	**0.0010**	0.0010
63	0.0013	0.0017	0.0014	0.0036	0.0016	0.0020	0.0023	0.0060	0.0016	0.0023	**0.0012**	0.0013
64	**0.0013**	0.0017	0.0017	0.0037	0.0017	0.0022	0.0023	0.0064	0.0018	0.0023	0.0013	0.0014
65	0.0019	0.0021	0.0020	0.0045	0.0021	0.0026	0.0022	0.0077	0.0017	0.0029	**0.0012**	0.0016
66	0.0017	0.0020	0.0018	0.0042	0.0020	0.0026	0.0021	0.0079	0.0018	0.0024	**0.0013**	0.0017
67	0.0019	0.0022	0.0020	0.0045	0.0021	0.0027	0.0030	0.0090	0.0012	0.0027	**0.0011**	0.0015
68	0.0023	0.0024	0.0023	0.0056	0.0024	0.0029	0.0025	0.0102	0.0012	0.0035	**0.0011**	0.0017
69	0.0026	0.0033	0.0027	0.0069	0.0030	0.0039	0.0021	0.0114	0.0017	0.0044	**0.0015**	0.0024
70	0.0025	0.0049	0.0034	0.0083	0.0043	0.0051	0.0022	0.0119	**0.0014**	0.0058	0.0016	0.0028
71	0.0027	0.0039	0.0027	0.0066	0.0035	0.0045	0.0026	0.0119	**0.0019**	0.0044	0.0023	0.0030
72	0.0047	0.0054	0.0033	0.0087	0.0043	0.0053	0.0034	0.0151	0.0022	0.0061	**0.0018**	0.0028
73	0.0045	0.0055	0.0045	0.0100	0.0047	0.0062	0.0024	0.0154	**0.0017**	0.0067	0.0024	0.0036
74	0.0055	0.0076	0.0060	0.0122	0.0061	0.0080	0.0019	0.0169	**0.0018**	0.0087	0.0031	0.0050
75	0.0058	0.0085	0.0059	0.0133	0.0067	0.0087	0.0024	0.0179	**0.0020**	0.0095	0.0037	0.0054
76	0.0058	0.0070	0.0051	0.0123	0.0058	0.0077	0.0025	0.0191	**0.0020**	0.0083	0.0037	0.0051
77	0.0064	0.0095	0.0083	0.0147	0.0074	0.0101	0.0043	0.0212	**0.0031**	0.0105	0.0054	0.0067
78	0.0082	0.0111	0.0076	0.0165	0.0089	0.0109	0.0025	0.0247	**0.0020**	0.0122	0.0033	0.0068
79	0.0069	0.0106	0.0098	0.0181	0.0085	0.0115	0.0039	0.0251	**0.0023**	0.0124	0.0050	0.0072
80	0.0062	0.0149	0.0087	0.0206	0.0112	0.0138	0.0054	0.0255	**0.0037**	0.0156	0.0060	0.0079
81	0.0072	0.0109	0.0110	0.0173	0.0084	0.0125	0.0061	0.0275	**0.0048**	0.0122	0.0054	0.0075
82	0.0115	0.0173	0.0123	0.0205	0.0127	0.0156	0.0081	0.0321	0.0118	0.0168	**0.0041**	0.0065
83	0.0110	0.0171	0.0127	0.0224	0.0137	0.0164	0.0055	0.0315	0.0096	0.0177	**0.0033**	0.0082
84	0.0141	0.0221	0.0167	0.0296	0.0175	0.0201	0.0056	0.0345	0.0092	0.0231	**0.0045**	0.0118
85	0.0115	0.0231	0.0167	0.0282	0.0177	0.0218	0.0089	0.0321	0.0114	0.0228	**0.0070**	0.0109
86	0.0134	0.0220	0.0177	0.0275	0.0171	0.0206	0.0076	0.0348	0.0145	0.0220	**0.0055**	0.0100
87	0.0111	0.0256	0.0197	0.0330	0.0213	0.0237	0.0121	0.0341	0.0154	0.0262	**0.0093**	0.0116
88	0.0162	0.0216	0.0205	0.0335	0.0192	0.0205	0.0117	0.0413	0.0201	0.0237	**0.0097**	0.0111
89	0.0164	0.0251	0.0308	0.0356	0.0265	0.0239	0.0149	0.0439	0.0259	0.0266	**0.0147**	0.0164
90	0.0151	0.0482	0.0233	0.0454	0.0389	0.0352	**0.0134**	0.0450	0.0280	0.0433	0.0136	0.0179
91	**0.0153**	0.0316	0.0351	0.0340	0.0376	0.0284	0.0247	0.0453	0.0291	0.0305	0.0231	0.0212
92	0.0205	0.0515	0.0364	0.0488	0.0431	0.0366	0.0240	0.0519	0.0504	0.0442	**0.0166**	0.0186
93	**0.0126**	0.0593	0.0347	0.0488	0.0529	0.0401	0.0276	0.0452	0.0566	0.0480	0.0208	0.0195
94	**0.0215**	0.0632	0.0505	0.0683	0.0585	0.0432	0.0291	0.0576	0.0525	0.0581	0.0280	0.0309
95	**0.0183**	0.0906	0.0595	0.0659	0.0842	0.0587	0.0360	0.0527	0.0650	0.0694	0.0336	0.0331
96	**0.0274**	0.0819	0.0542	0.0759	0.0855	0.0595	0.0376	0.0617	0.0672	0.0731	0.0412	0.0424
97	0.0278	**0.0228**	0.0334	0.0396	0.0346	0.0243	0.0452	0.0471	0.0907	0.0277	0.0429	0.0229
98	**0.0435**	0.0471	0.0546	0.0798	0.0589	0.0445	0.0594	0.0680	0.0691	0.0581	0.0486	0.0465
99	0.0799	0.0631	0.0849	0.1250	0.0714	0.0714	0.0841	**0.0583**	0.1086	0.0865	0.0752	0.0800
100	0.0783	0.2213	0.1841	0.2651	0.2152	0.1616	**0.0647**	0.1061	0.0750	0.2339	0.0823	0.1252
101	0.1063	0.3786	0.0600	0.2085	0.3545	0.1715	0.0772	**0.0541**	0.1327	0.2835	0.0896	0.1313
102	0.0986	0.3516	0.3508	0.6331	0.3850	0.2010	0.1325	**0.0845**	0.1448	0.4233	0.1189	0.2278
103	0.1049	0.2373	0.3556	0.5290	0.2845	0.1700	0.1235	**0.0868**	0.1606	0.3503	0.1424	0.2196
104	0.1443	0.3376	0.4915	0.5877	0.3975	0.2673	0.1828	**0.1360**	0.2196	0.4337	0.2065	0.2799
105	0.1111	0.3227	0.2787	0.5450	0.3611	0.1898	0.1620	**0.0595**	0.1716	0.4096	0.1638	0.2461
105+	0.1636	0.4013	0.2920	0.7125	0.4881	0.5098	0.2301	**0.1436**	0.2059	0.5340	0.2624	0.2987

Notes: The table above presents the average absolute errors of the forecast ASDRs for females aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 20-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix B5: Average absolute errors in age-specific mortality rates for males for 30-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	**0.0013**	0.0037	0.0061	0.0018	0.0018	0.0015	0.0069	0.0068	0.0023	0.0021	0.0021	0.0018
2	0.0001	0.0003	0.0006	**0.0001**	0.0001	0.0002	0.0013	0.0005	0.0002	0.0002	0.0005	0.0003
3	0.0001	0.0002	0.0004	**0.0000**	0.0001	0.0001	0.0006	0.0003	0.0001	0.0001	0.0002	0.0001
4	0.0001	0.0001	0.0003	0.0001	**0.0001**	0.0001	0.0004	0.0002	0.0001	0.0001	0.0001	0.0001
5	0.0001	0.0001	0.0002	**0.0000**	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001
6	0.0001	0.0001	0.0002	0.0000	0.0001	0.0001	0.0002	0.0001	**0.0000**	0.0001	0.0001	0.0001
7	**0.0000**	0.0001	0.0002	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
8	0.0001	0.0001	0.0002	**0.0000**	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
9	**0.0000**	0.0001	0.0002	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
10	0.0001	0.0001	0.0002	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
11	0.0000	0.0001	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000
12	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0000
13	0.0001	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0001	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0000
15	**0.0001**	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
16	0.0001	0.0001	0.0002	0.0001	**0.0000**	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001
17	0.0002	0.0001	0.0003	0.0001	0.0001	**0.0000**	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
18	0.0003	0.0003	0.0005	0.0004	0.0003	0.0004	0.0004	0.0006	0.0004	0.0003	0.0003	**0.0003**
19	0.0004	0.0005	0.0006	0.0006	0.0004	0.0006	0.0005	0.0007	0.0004	0.0005	**0.0003**	0.0004
20	0.0005	0.0006	0.0009	0.0007	0.0005	0.0007	0.0005	0.0007	**0.0004**	0.0006	0.0004	0.0004
21	0.0005	0.0006	0.0008	0.0007	0.0005	0.0006	0.0005	0.0007	**0.0004**	0.0006	0.0004	0.0005
22	0.0005	0.0005	0.0007	0.0006	0.0005	0.0005	0.0005	0.0006	0.0004	0.0005	**0.0003**	0.0004
23	0.0005	0.0004	0.0007	0.0006	0.0005	0.0004	0.0005	0.0006	**0.0003**	0.0004	0.0003	0.0004
24	0.0004	0.0004	0.0007	0.0005	0.0005	0.0004	0.0005	0.0005	**0.0002**	0.0004	0.0003	0.0003
25	0.0004	0.0004	0.0006	0.0005	0.0004	0.0003	0.0005	0.0004	**0.0002**	0.0004	0.0003	0.0003
26	0.0005	0.0005	0.0005	0.0006	0.0006	0.0004	0.0006	0.0004	**0.0002**	0.0005	0.0004	0.0004
27	0.0004	0.0006	0.0006	0.0005	0.0006	0.0004	0.0005	0.0003	**0.0002**	0.0005	0.0004	0.0004
28	0.0004	0.0006	0.0006	0.0006	0.0007	0.0005	0.0006	0.0003	**0.0002**	0.0006	0.0004	0.0004
29	0.0004	0.0006	0.0005	0.0006	0.0006	0.0005	0.0006	0.0003	**0.0002**	0.0005	0.0004	0.0004
30	0.0003	0.0006	0.0004	0.0006	0.0006	0.0005	0.0006	**0.0002**	0.0002	0.0005	0.0004	0.0004
31	0.0003	0.0006	0.0004	0.0006	0.0006	0.0005	0.0006	**0.0002**	0.0003	0.0005	0.0004	0.0004
32	0.0003	0.0006	0.0003	0.0005	0.0004	0.0005	0.0006	**0.0002**	0.0003	0.0005	0.0004	0.0004
33	0.0003	0.0006	0.0004	0.0006	0.0004	0.0005	0.0006	**0.0002**	0.0003	0.0005	0.0004	0.0004
34	**0.0002**	0.0005	0.0003	0.0004	0.0005	0.0004	0.0005	0.0003	0.0004	0.0004	0.0003	0.0003
35	**0.0002**	0.0005	0.0004	0.0004	0.0003	0.0004	0.0005	0.0004	0.0004	0.0004	0.0002	0.0003
36	**0.0003**	0.0007	0.0005	0.0005	0.0005	0.0006	0.0006	0.0005	0.0004	0.0006	0.0003	0.0004
37	**0.0002**	0.0006	0.0004	0.0005	0.0005	0.0005	0.0006	0.0007	0.0005	0.0005	0.0003	0.0003
38	**0.0002**	0.0005	0.0004	0.0004	0.0004	0.0004	0.0006	0.0007	0.0006	0.0004	0.0002	0.0003
39	**0.0003**	0.0007	0.0006	0.0005	0.0004	0.0005	0.0005	0.0009	0.0008	0.0005	0.0003	0.0003
40	0.0002	0.0006	0.0005	0.0003	0.0003	0.0003	0.0005	0.0011	0.0008	0.0004	**0.0002**	0.0002
41	0.0004	0.0009	0.0007	0.0005	0.0005	0.0006	0.0007	0.0011	0.0009	0.0006	**0.0004**	0.0004
42	0.0004	0.0006	0.0007	**0.0002**	0.0004	0.0003	0.0006	0.0015	0.0009	0.0003	0.0003	0.0003
43	0.0005	0.0008	0.0008	0.0004	0.0006	0.0005	0.0007	0.0015	0.0011	0.0006	0.0005	**0.0004**
44	0.0005	0.0008	0.0009	**0.0004**	0.0006	0.0005	0.0009	0.0017	0.0010	0.0005	0.0005	0.0005
45	0.0005	0.0006	0.0010	**0.0003**	0.0004	0.0003	0.0008	0.0020	0.0013	0.0003	0.0004	0.0004
46	0.0008	0.0010	0.0011	**0.0005**	0.0007	0.0006	0.0008	0.0022	0.0018	0.0006	0.0008	0.0007
47	0.0009	0.0008	0.0012	**0.0007**	0.0009	0.0008	0.0010	0.0024	0.0017	0.0007	0.0009	0.0008
48	0.0010	0.0010	0.0015	**0.0008**	0.0012	0.0010	0.0010	0.0027	0.0023	0.0010	0.0011	0.0010
49	0.0010	0.0010	0.0018	0.0009	0.0012	0.0009	**0.0007**	0.0031	0.0030	0.0010	0.0012	0.0011
50	0.0014	0.0014	0.0023	0.0014	0.0019	0.0016	**0.0010**	0.0035	0.0035	0.0015	0.0017	0.0016
51	0.0015	0.0013	0.0019	0.0014	0.0015	0.0014	**0.0010**	0.0037	0.0041	0.0013	0.0018	0.0015
52	0.0018	0.0023	0.0028	0.0018	0.0027	0.0025	**0.0013**	0.0043	0.0039	0.0022	0.0020	0.0019
53	0.0022	0.0023	0.0032	0.0021	0.0030	0.0028	**0.0012**	0.0048	0.0058	0.0024	0.0027	0.0023
54	0.0025	0.0029	0.0033	0.0025	0.0034	0.0034	**0.0013**	0.0052	0.0062	0.0028	0.0029	0.0026
55	0.0029	0.0035	0.0040	0.0029	0.0041	0.0040	**0.0017**	0.0058	0.0067	0.0033	0.0033	0.0030
56	0.0033	0.0034	0.0037	0.0029	0.0038	0.0039	**0.0017**	0.0064	0.0061	0.0032	0.0033	0.0030
57	0.0041	0.0042	0.0046	0.0036	0.0048	0.0048	**0.0021**	0.0073	0.0076	0.0040	0.0039	0.0037
58	0.0045	0.0059	0.0051	0.0044	0.0060	0.0063	**0.0024**	0.0079	0.0072	0.0053	0.0042	0.0042
59	0.0052	0.0072	0.0063	0.0052	0.0072	0.0077	**0.0028**	0.0089	0.0088	0.0064	0.0053	0.0052
60	0.0056	0.0091	0.0072	0.0060	0.0087	0.0091	**0.0030**	0.0095	0.0086	0.0078	0.0057	0.0057

Appendix B5: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
61	0.0066	0.0054	0.0066	0.0051	0.0059	0.0063	**0.0030**	0.0108	0.0097	0.0053	0.0057	0.0053
62	0.0077	0.0121	0.0085	0.0073	0.0105	0.0113	**0.0032**	0.0122	0.0079	0.0099	0.0059	0.0066
63	0.0085	0.0123	0.0098	0.0082	0.0113	0.0121	**0.0041**	0.0135	0.0101	0.0106	0.0073	0.0077
64	0.0089	0.0124	0.0105	0.0082	0.0117	0.0124	**0.0045**	0.0145	0.0109	0.0107	0.0076	0.0080
65	0.0098	0.0145	0.0118	0.0094	0.0134	0.0144	**0.0052**	0.0162	0.0116	0.0124	0.0087	0.0090
66	0.0103	0.0128	0.0129	0.0090	0.0124	0.0137	**0.0054**	0.0177	0.0133	0.0113	0.0091	0.0091
67	0.0110	0.0158	0.0117	0.0095	0.0140	0.0151	**0.0059**	0.0197	0.0111	0.0131	0.0088	0.0090
68	0.0121	0.0192	0.0141	0.0119	0.0168	0.0184	**0.0066**	0.0222	0.0131	0.0159	0.0107	0.0111
69	0.0131	0.0208	0.0170	0.0128	0.0188	0.0204	**0.0074**	0.0247	0.0140	0.0175	0.0115	0.0122
70	0.0134	0.0254	0.0184	0.0155	0.0216	0.0237	**0.0088**	0.0264	0.0155	0.0208	0.0131	0.0136
71	0.0147	0.0181	0.0163	0.0133	0.0170	0.0190	**0.0078**	0.0291	0.0151	0.0161	0.0116	0.0124
72	0.0179	0.0267	0.0178	0.0161	0.0213	0.0242	**0.0090**	0.0335	0.0143	0.0214	0.0135	0.0142
73	0.0183	0.0261	0.0195	0.0169	0.0230	0.0254	**0.0110**	0.0353	0.0174	0.0220	0.0154	0.0157
74	0.0212	0.0298	0.0239	0.0203	0.0265	0.0295	**0.0102**	0.0400	0.0197	0.0255	0.0174	0.0188
75	0.0229	0.0330	0.0252	0.0230	0.0297	0.0324	**0.0115**	0.0440	0.0208	0.0286	0.0189	0.0206
76	0.0232	0.0253	0.0229	0.0191	0.0233	0.0271	**0.0116**	0.0475	0.0221	0.0226	0.0176	0.0186
77	0.0239	0.0302	0.0249	0.0217	0.0276	0.0307	**0.0127**	0.0523	0.0243	0.0265	0.0200	0.0210
78	0.0249	0.0335	0.0265	0.0230	0.0295	0.0324	**0.0129**	0.0579	0.0218	0.0287	0.0185	0.0209
79	0.0244	0.0346	0.0314	0.0246	0.0323	0.0357	**0.0144**	0.0626	0.0267	0.0305	0.0228	0.0233
80	0.0244	0.0406	0.0343	0.0292	0.0367	0.0395	**0.0145**	0.0677	0.0295	0.0355	0.0258	0.0264
81	0.0247	0.0260	0.0308	0.0230	0.0254	0.0295	**0.0141**	0.0730	0.0293	0.0248	0.0216	0.0216
82	0.0296	0.0405	0.0321	0.0286	0.0338	0.0374	**0.0121**	0.0830	0.0240	0.0343	0.0194	0.0229
83	0.0292	0.0360	0.0317	0.0297	0.0336	0.0364	**0.0123**	0.0877	0.0304	0.0331	0.0236	0.0258
84	0.0323	0.0530	0.0378	0.0369	0.0481	0.0473	**0.0135**	0.0961	0.0375	0.0460	0.0304	0.0332
85	0.0313	0.0415	0.0382	0.0359	0.0423	0.0415	**0.0145**	0.1008	0.0399	0.0399	0.0320	0.0326
86	0.0338	0.0385	0.0420	0.0324	0.0397	0.0398	**0.0138**	0.1094	0.0429	0.0369	0.0313	0.0318
87	0.0365	0.0546	0.0483	0.0415	0.0528	0.0527	**0.0199**	0.1184	0.0502	0.0496	0.0403	0.0401
88	0.0465	0.0646	0.0519	0.0464	0.0650	0.0628	**0.0226**	0.1354	0.0550	0.0587	0.0458	0.0465
89	0.0453	0.0691	0.0482	0.0464	0.0643	0.0634	**0.0158**	0.1422	0.0502	0.0599	0.0400	0.0435
90	0.0445	0.0699	0.0523	0.0605	0.0626	0.0680	**0.0236**	0.1508	0.0590	0.0643	0.0478	0.0501
91	0.0384	0.0327	0.0365	0.0322	0.0376	0.0348	**0.0282**	0.1564	0.0541	0.0342	0.0363	0.0355
92	0.0403	0.0972	0.0556	0.0604	0.0770	0.0743	**0.0240**	0.1727	0.0480	0.0782	0.0339	0.0434
93	0.0374	0.0925	0.0788	0.0571	0.0724	0.0709	**0.0268**	0.1790	0.0485	0.0740	0.0362	0.0436
94	0.0416	0.1397	0.0777	0.0709	0.1027	0.1066	**0.0283**	0.1883	0.0565	0.1044	0.0492	0.0556
95	0.0542	0.1072	0.0717	0.0793	0.0855	0.0795	**0.0452**	0.2154	0.0503	0.0907	0.0456	0.0568
96	0.0585	0.1110	0.0679	0.0648	0.0883	0.0776	0.0502	0.2224	0.0584	0.0874	**0.0471**	0.0516
97	0.0694	0.1368	0.0860	0.0768	0.1242	0.1040	0.0673	0.2421	0.0730	0.1000	**0.0644**	0.0690
98	0.0937	0.1541	0.1146	0.0490	0.1303	0.0968	0.0571	0.2581	0.0689	0.1062	**0.0416**	0.0559
99	0.1038	0.3440	0.1340	0.1044	0.2850	0.2569	**0.0528**	0.2564	0.0790	0.2294	0.1036	0.1103
100	0.1625	0.6662	0.2994	0.1826	0.3930	0.2453	0.1295	0.2765	0.1130	0.3888	**0.0918**	0.1785
101	0.1777	0.1987	0.3448	0.3229	0.2328	0.1482	0.1038	0.2838	**0.0793**	0.2281	0.0813	0.1498
102	0.2216	3.5171	2.1847	0.7745	2.5697	1.4762	0.1148	0.3293	**0.1046**	2.2495	0.4339	0.8326
103	0.2952	2.2914	1.7344	0.7054	2.0199	0.9470	0.1885	0.4182	**0.1632**	1.6210	0.3654	0.6391
104	0.2928	1.7224	1.7484	0.7525	1.5815	1.1349	0.2020	0.4451	**0.1786**	1.3124	0.4340	0.5510
105	0.2806	1.4468	1.0429	0.6518	1.3763	1.0743	**0.2173**	0.4468	0.2214	1.1420	0.4386	0.4971
105+	**0.1485**	3.2291	1.0347	0.6969	2.2325	2.8813	0.1820	0.2778	0.2391	1.9466	0.8614	0.7062

Notes: The table above presents the average absolute errors of the forecast ASDRs for males aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 30-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix B6: Average absolute errors in age-specific mortality rates for females for 30-year forecast horizons

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
1	0.0012	0.0015	0.0014	0.0013	0.0011	0.0011	0.0030	0.0055	0.0027	0.0010	0.0010	**0.0009**
2	0.0001	0.0002	0.0002	**0.0001**	0.0001	0.0002	0.0008	0.0005	0.0001	0.0002	0.0002	0.0001
3	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0004	0.0002	0.0001	0.0001	0.0001	0.0001
4	0.0000	0.0001	0.0000	0.0001	0.0000	0.0000	0.0003	0.0001	**0.0000**	0.0000	0.0001	0.0001
5	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001	0.0000	0.0001	0.0000
6	0.0000	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	**0.0000**	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	**0.0000**	0.0000	0.0000
9	0.0000	0.0000	0.0001	0.0000	0.0000	**0.0000**	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	**0.0000**	0.0000	0.0000
11	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
12	**0.0000**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000
13	0.0000	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	**0.0000**	0.0000
14	0.0000	0.0001	0.0001	0.0000	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0000	0.0000	0.0000
15	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0001	0.0000
16	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000
17	0.0001	0.0001	0.0001	**0.0000**	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0000	0.0001
18	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003	**0.0000**	0.0001	0.0001	0.0001
19	0.0002	0.0003	0.0003	0.0002	0.0003	0.0002	0.0002	0.0003	**0.0001**	0.0002	0.0001	0.0002
20	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	**0.0000**	0.0001
21	0.0002	0.0003	0.0003	0.0001	0.0003	0.0003	0.0002	0.0003	0.0001	0.0002	**0.0001**	0.0001
22	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	**0.0001**	0.0002	0.0003	0.0002	0.0001	0.0001
23	0.0002	0.0003	0.0002	0.0001	0.0003	0.0002	0.0001	0.0002	0.0003	0.0002	**0.0000**	0.0001
24	0.0001	0.0002	0.0001	**0.0001**	0.0001	0.0002	0.0001	0.0001	0.0005	0.0001	0.0001	0.0001
25	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0005	0.0002	0.0001	**0.0001**
26	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0006	0.0002	0.0001	**0.0001**
27	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	**0.0001**	0.0001	0.0007	0.0001	0.0002	0.0001
28	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0007	0.0002	0.0001	**0.0000**
29	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0009	0.0002	0.0002	**0.0001**
30	0.0002	0.0002	0.0002	**0.0001**	0.0001	0.0002	0.0001	0.0001	0.0010	0.0001	0.0002	0.0001
31	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0011	0.0002	0.0002	**0.0001**
32	0.0002	0.0002	0.0002	**0.0001**	0.0001	0.0002	0.0001	0.0001	0.0009	0.0001	0.0002	0.0001
33	0.0002	0.0002	0.0002	**0.0001**	0.0002	0.0002	0.0001	0.0001	0.0009	0.0002	0.0002	0.0001
34	0.0002	0.0003	0.0002	0.0001	0.0002	0.0003	0.0002	0.0001	0.0009	0.0002	0.0001	**0.0001**
35	0.0002	0.0003	0.0001	**0.0001**	0.0002	0.0002	0.0002	0.0002	0.0010	0.0002	0.0002	0.0001
36	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0009	0.0002	0.0002	**0.0001**
37	0.0002	0.0003	0.0001	**0.0001**	0.0002	0.0002	0.0002	0.0002	0.0010	0.0002	0.0002	0.0001
38	0.0002	0.0003	0.0001	**0.0001**	0.0002	0.0002	0.0003	0.0003	0.0010	0.0002	0.0002	0.0001
39	0.0002	0.0003	0.0002	**0.0001**	0.0002	0.0002	0.0002	0.0004	0.0013	0.0002	0.0003	0.0002
40	0.0002	0.0003	0.0003	**0.0001**	0.0002	0.0002	0.0003	0.0003	0.0013	0.0002	0.0002	0.0001
41	**0.0001**	0.0003	0.0002	0.0001	0.0002	0.0002	0.0003	0.0004	0.0013	0.0002	0.0003	0.0002
42	**0.0001**	0.0002	0.0001	0.0002	0.0002	0.0002	0.0005	0.0005	0.0012	0.0002	0.0003	0.0002
43	**0.0001**	0.0002	0.0003	0.0003	0.0002	0.0002	0.0004	0.0005	0.0017	0.0002	0.0004	0.0003
44	0.0002	0.0002	0.0003	0.0003	0.0002	**0.0002**	0.0005	0.0006	0.0016	0.0002	0.0004	0.0003
45	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.0006	0.0006	0.0016	**0.0002**	0.0003	0.0002
46	0.0003	0.0003	0.0003	0.0004	0.0003	0.0003	0.0006	0.0008	0.0020	**0.0003**	0.0005	0.0004
47	**0.0003**	0.0003	0.0003	0.0005	0.0003	0.0003	0.0008	0.0008	0.0020	0.0003	0.0005	0.0004
48	0.0004	**0.0003**	0.0006	0.0006	0.0005	0.0004	0.0008	0.0009	0.0024	0.0005	0.0007	0.0005
49	0.0005	**0.0004**	0.0006	0.0008	0.0006	0.0005	0.0007	0.0011	0.0031	0.0006	0.0009	0.0007
50	**0.0005**	0.0007	0.0008	0.0012	0.0009	0.0008	0.0008	0.0013	0.0037	0.0009	0.0012	0.0010
51	0.0006	**0.0004**	0.0006	0.0008	0.0006	0.0005	0.0010	0.0014	0.0038	0.0005	0.0011	0.0008
52	0.0008	**0.0007**	0.0008	0.0014	0.0009	0.0009	0.0011	0.0017	0.0037	0.0010	0.0012	0.0010
53	0.0007	**0.0006**	0.0011	0.0014	0.0008	0.0008	0.0012	0.0018	0.0049	0.0009	0.0015	0.0012
54	0.0009	0.0009	**0.0009**	0.0017	0.0011	0.0011	0.0013	0.0021	0.0050	0.0012	0.0016	0.0014
55	**0.0010**	0.0012	0.0013	0.0021	0.0014	0.0014	0.0013	0.0025	0.0051	0.0015	0.0017	0.0016
56	0.0010	**0.0008**	0.0011	0.0017	0.0011	0.0011	0.0017	0.0028	0.0038	0.0011	0.0011	0.0011
57	0.0010	**0.0010**	0.0013	0.0021	0.0011	0.0013	0.0017	0.0032	0.0041	0.0013	0.0012	0.0013
58	0.0013	0.0012	0.0013	0.0025	0.0014	0.0015	0.0019	0.0036	0.0037	0.0017	**0.0012**	0.0013
59	**0.0013**	0.0014	0.0015	0.0031	0.0015	0.0017	0.0018	0.0044	0.0043	0.0020	0.0014	0.0017
60	0.0015	0.0018	0.0017	0.0036	0.0018	0.0021	0.0021	0.0048	0.0038	0.0024	**0.0013**	0.0017

Appendix B6: Continuation

Age	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
61	0.0019	0.0019	0.0021	0.0032	0.0021	0.0023	0.0019	0.0057	0.0040	0.0023	**0.0015**	0.0018
62	0.0022	0.0024	0.0021	0.0044	0.0022	0.0027	0.0025	0.0065	0.0028	0.0029	**0.0012**	0.0018
63	0.0022	0.0027	0.0023	0.0051	0.0026	0.0030	0.0024	0.0072	0.0037	0.0034	**0.0014**	0.0022
64	0.0023	0.0026	0.0027	0.0053	0.0027	0.0030	0.0025	0.0079	0.0037	0.0035	**0.0015**	0.0023
65	0.0030	0.0033	0.0030	0.0062	0.0032	0.0037	0.0024	0.0094	0.0037	0.0042	**0.0017**	0.0027
66	0.0030	0.0029	0.0030	0.0061	0.0029	0.0035	0.0025	0.0103	0.0039	0.0039	**0.0017**	0.0027
67	0.0033	0.0036	0.0033	0.0069	0.0034	0.0040	0.0032	0.0117	0.0026	0.0046	**0.0015**	0.0026
68	0.0036	0.0039	0.0034	0.0078	0.0037	0.0044	0.0031	0.0131	0.0029	0.0052	**0.0017**	0.0031
69	0.0043	0.0051	0.0043	0.0096	0.0047	0.0056	0.0027	0.0150	0.0036	0.0064	**0.0022**	0.0039
70	0.0045	0.0074	0.0055	0.0118	0.0066	0.0075	0.0032	0.0164	0.0030	0.0086	**0.0024**	0.0047
71	0.0049	0.0066	0.0059	0.0107	0.0060	0.0071	0.0031	0.0179	0.0031	0.0078	**0.0024**	0.0044
72	0.0067	0.0084	0.0059	0.0127	0.0071	0.0082	0.0041	0.0209	0.0021	0.0094	**0.0019**	0.0050
73	0.0071	0.0085	0.0073	0.0141	0.0074	0.0091	0.0032	0.0225	0.0030	0.0100	**0.0029**	0.0058
74	0.0085	0.0112	0.0093	0.0170	0.0096	0.0115	**0.0027**	0.0253	0.0038	0.0125	0.0043	0.0076
75	0.0095	0.0130	0.0100	0.0191	0.0111	0.0130	**0.0027**	0.0282	0.0038	0.0143	0.0045	0.0085
76	0.0100	0.0115	0.0093	0.0179	0.0103	0.0121	**0.0025**	0.0309	0.0033	0.0131	0.0044	0.0081
77	0.0114	0.0150	0.0139	0.0215	0.0132	0.0155	**0.0026**	0.0352	0.0038	0.0163	0.0061	0.0101
78	0.0123	0.0165	0.0122	0.0232	0.0138	0.0160	**0.0031**	0.0393	0.0036	0.0178	0.0048	0.0101
79	0.0124	0.0163	0.0154	0.0254	0.0138	0.0170	**0.0024**	0.0428	0.0033	0.0184	0.0058	0.0109
80	0.0120	0.0225	0.0149	0.0297	0.0181	0.0208	0.0038	0.0458	**0.0038**	0.0234	0.0066	0.0126
81	0.0135	0.0184	0.0187	0.0259	0.0151	0.0201	**0.0054**	0.0505	0.0058	0.0198	0.0064	0.0113
82	0.0163	0.0261	0.0200	0.0303	0.0204	0.0238	0.0082	0.0561	0.0095	0.0256	**0.0026**	0.0110
83	0.0173	0.0262	0.0208	0.0328	0.0218	0.0250	0.0068	0.0600	0.0081	0.0270	**0.0042**	0.0127
84	0.0197	0.0309	0.0243	0.0404	0.0252	0.0281	0.0068	0.0656	0.0091	0.0322	**0.0056**	0.0157
85	0.0204	0.0351	0.0274	0.0414	0.0282	0.0333	**0.0066**	0.0702	0.0110	0.0347	0.0089	0.0171
86	0.0216	0.0335	0.0284	0.0403	0.0266	0.0315	**0.0078**	0.0760	0.0144	0.0335	0.0079	0.0156
87	0.0219	0.0394	0.0322	0.0490	0.0332	0.0368	**0.0092**	0.0819	0.0190	0.0403	0.0113	0.0186
88	0.0243	0.0321	0.0292	0.0468	0.0255	0.0303	0.0121	0.0910	0.0249	0.0346	**0.0096**	0.0149
89	0.0238	0.0360	0.0379	0.0498	0.0313	0.0341	0.0165	0.0979	0.0338	0.0380	**0.0132**	0.0164
90	0.0229	0.0652	0.0324	0.0633	0.0512	0.0489	0.0181	0.1053	0.0360	0.0597	**0.0161**	0.0210
91	0.0227	0.0450	0.0405	0.0479	0.0438	0.0396	**0.0194**	0.1125	0.0430	0.0417	0.0203	0.0203
92	0.0240	0.0727	0.0478	0.0712	0.0570	0.0542	0.0298	0.1243	0.0611	0.0645	0.0235	**0.0225**
93	**0.0216**	0.0874	0.0479	0.0760	0.0729	0.0636	0.0281	0.1300	0.0664	0.0742	0.0260	0.0268
94	**0.0253**	0.0821	0.0603	0.0928	0.0714	0.0569	0.0267	0.1440	0.0695	0.0774	0.0269	0.0325
95	**0.0268**	0.1258	0.0744	0.0942	0.1089	0.0859	0.0367	0.1527	0.0832	0.1003	0.0379	0.0380
96	**0.0326**	0.1032	0.0649	0.0948	0.1075	0.0710	0.0451	0.1617	0.0966	0.0895	0.0482	0.0473
97	0.0418	0.0346	0.0248	0.0595	0.0381	**0.0239**	0.0479	0.1697	0.1111	0.0364	0.0464	0.0271
98	**0.0503**	0.0642	0.0789	0.1106	0.0842	0.0651	0.0581	0.2029	0.1067	0.0799	0.0648	0.0608
99	0.0821	**0.0457**	0.0740	0.1441	0.0559	0.0639	0.0737	0.1941	0.1415	0.0770	0.0829	0.0765
100	0.1077	0.2932	0.2510	0.3573	0.2952	0.2083	**0.0953**	0.2567	0.1172	0.3014	0.1253	0.1646
101	0.1169	0.5859	0.0837	0.2756	0.5121	0.2265	**0.0741**	0.2273	0.1683	0.4275	0.1253	0.1673
102	0.1559	0.5226	0.5459	1.0393	0.5221	0.2589	**0.1212**	0.2698	0.2123	0.6395	0.1660	0.3210
103	0.1761	0.2854	0.4887	0.7563	0.3403	0.2021	**0.1457**	0.2761	0.2492	0.4607	0.1903	0.2807
104	0.1912	0.3929	0.6445	0.7489	0.4353	0.2656	**0.1510**	0.3055	0.2723	0.5076	0.2127	0.2899
105	0.1549	0.3726	0.3760	0.7073	0.4160	0.2177	**0.1509**	0.2972	0.2656	0.4987	0.2002	0.2873
105+	**0.1370**	0.5134	0.4863	1.0097	0.6100	0.7308	0.2147	0.3100	0.2987	0.7029	0.4056	0.4169

Notes: The table above presents the average absolute errors of the forecast ASDRs for females aged 0 to 105+, where the average is the mean of the errors in the age-specific mortality rates across the five forecasts, where each forecast has a different jump-off year. The average errors above are for a 30-year forecast horizon. The bolded values represent the top model for a specific age and the values in red represent worst performing models for a specific age.

Source: Authors' calculations using *HMD data* (2023).

Appendix C1: Mean absolute percentage error of forecast age-specific death rates across ages 0-105 for males

Jump-off		*demography*				*StMoMo*				*ensemble models*		
year	EM	LC_D	LC_Dc	C FDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						Point forecast errors after 1 year						
1950	**8.95**	11.77	13.17	11.21	12.17	11.92	11.71	41.75	11.27	11.61	10.59	9.84
1960	7.72	12.84	13.21	8.61	10.73	10.26	12.16	38.57	10.45	10.26	8.76	**7.63**
1970	11.57	18.30	22.44	**9.81**	12.12	11.59	17.32	43.56	16.41	12.83	14.26	13.45
1980	9.00	42.16	10.37	**8.82**	18.35	15.57	13.09	33.10	12.25	20.63	11.40	11.40
1990	13.55	30.46	11.22	13.38	**10.67**	19.23	17.23	30.97	13.52	13.37	13.12	11.66
mean	**10.16**	23.11	14.08	10.37	12.81	13.72	14.30	37.59	12.78	13.74	11.63	10.80
						Point forecast errors after 10 years						
1950	13.51	21.02	22.66	16.93	21.56	20.10	17.37	34.27	**13.18**	19.60	13.53	13.66
1960	**15.23**	25.95	24.84	19.11	20.56	19.40	22.99	28.99	16.67	21.76	16.95	17.49
1970	21.30	32.23	46.74	**18.44**	24.98	22.96	28.03	50.42	34.19	24.84	27.60	25.92
1980	22.27	59.30	21.90	23.36	37.13	31.85	**21.50**	41.22	25.80	37.07	22.97	23.15
1990	16.49	42.26	17.13	24.28	**14.99**	32.04	27.27	39.79	26.71	23.08	24.72	21.60
mean	**17.76**	36.15	26.65	20.42	23.84	25.27	23.43	38.94	23.31	25.27	21.15	20.36
						Point forecast errors after 20 years						
1950	23.93	38.84	37.99	32.04	40.29	36.32	31.16	31.63	**16.80**	36.77	25.01	26.32
1960	**19.77**	49.78	44.63	29.55	40.71	35.35	31.30	43.81	21.15	39.71	19.83	22.43
1970	39.51	56.83	85.22	**37.08**	49.53	46.51	43.76	77.65	57.12	47.21	47.54	45.33
1980	37.10	73.22	40.59	40.92	55.25	48.99	**33.96**	58.08	45.04	53.01	38.30	36.21
1990	**26.33**	56.11	31.61	34.88	29.32	43.67	32.76	51.10	41.74	32.42	30.62	27.54
mean	**29.33**	54.96	48.01	34.90	43.02	42.17	34.59	52.45	36.37	41.83	32.26	31.57
						Point forecast errors after 30 years						
1950	34.25	88.35	90.32	50.00	91.86	74.36	39.86	65.71	**21.96**	76.62	33.53	38.90
1960	**32.83**	83.45	71.85	48.14	71.15	63.17	38.41	74.13	42.50	67.40	37.57	40.69
1970	56.10	79.35	130.46	**53.47**	69.79	67.61	56.62	106.99	87.27	66.64	64.96	62.41
1980	56.94	101.82	62.12	54.28	81.68	71.75	**40.34**	82.22	61.12	74.46	49.92	50.72
1990	**30.15**	68.86	37.40	37.24	35.33	52.24	47.96	68.93	67.11	36.83	46.19	39.27
mean	**42.05**	84.37	78.43	48.62	69.96	65.82	44.64	79.60	55.99	64.39	46.43	46.40
						Cumulative forecast errors after 30 years, averaged over the five forecasts						
TOT[d]	**726.3**	1470.3	1218.5	854.9	1097.9	1092.8	865.1	1477.2	919.6	1072.6	821.0	803.0
						Average forecast errors after 30 years, averaged over the five forecasts						
Av[m]	**24.2**	49.0	40.6	28.5	36.6	36.4	28.8	49.2	30.7	35.8	27.4	26.8

Notes: Point forecast errors refer to the percentage difference between the actual and forecast values for specific years. Mean absolute percentage errors in forecast age-specific death rates should be interpreted with caution. Mortality rates are generally very low at younger and middle ages compared to older ages, which can result in higher percentage errors, even for small absolute differences. Point errors are reported for 1-, 10-, 20-, and 30-year forecast horizons, for each jump-off year and averaged across jump-off years. The TOT metric is the average of the cumulative percentage errors over the 30-year forecast horizon, for the five evaluated forecasts for the five jump-off years. The Av metric is equal to the TOT metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.

Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the *demography* package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C2: Mean absolute percentage error of forecast age-specific death rates across ages 0-105 for females

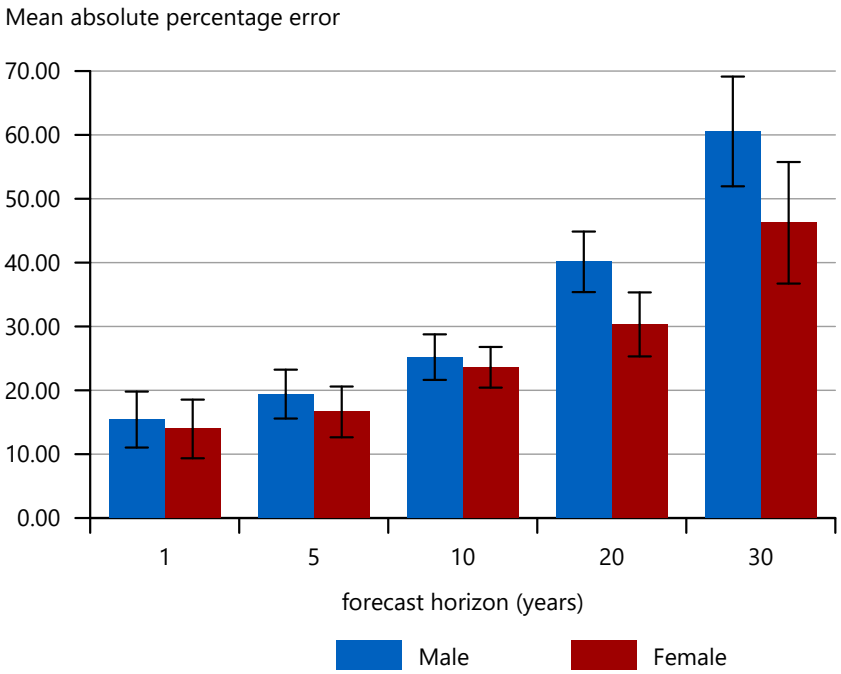
Jump-off			*demography*				*StMoMo*			*ensemble models*		
year	EM	LC_D	LC_Dc	CFDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						1-year forecast horizon						
1950	9.51	9.44	9.77	9.63	9.35	9.60	11.47	44.35	10.34	9.14	9.40	**8.63**
1960	9.79	13.30	12.36	10.51	10.58	9.48	9.35	48.17	8.57	10.39	**7.34**	7.74
1970	**11.71**	12.56	12.19	13.19	13.37	12.88	18.26	42.90	14.04	12.91	13.96	12.78
1980	**9.23**	24.44	10.00	12.08	9.96	16.46	13.90	30.91	12.04	11.31	10.77	9.79
1990	11.35	19.81	10.25	11.12	**10.20**	15.54	14.05	29.51	13.12	11.12	11.32	10.42
mean	10.32	15.91	10.91	11.31	10.69	12.79	13.41	39.17	11.62	10.97	10.56	**9.87**
						10-year forecast horizon						
1950	**19.70**	27.08	27.14	38.40	26.91	26.88	21.92	42.53	20.31	29.79	20.94	23.27
1960	22.09	26.63	25.35	**15.17**	19.66	18.54	23.61	27.83	17.13	20.13	17.32	17.47
1970	**21.21**	26.27	25.27	32.08	27.87	26.29	27.09	53.40	35.18	28.37	25.54	25.22
1980	14.09	27.70	13.59	22.45	13.63	21.35	18.29	32.79	28.60	15.97	12.27	**11.99**
1990	**13.98**	28.98	14.39	17.99	15.03	25.74	22.63	37.45	27.50	18.18	16.64	14.94
mean	**18.21**	27.33	21.15	25.22	20.62	23.76	22.71	38.80	25.74	22.49	18.54	18.58
						20-year forecast horizon						
1950	16.68	27.07	27.83	28.04	26.24	23.84	23.11	36.60	**13.49**	25.82	14.67	15.28
1960	20.09	35.07	31.17	35.52	31.56	27.12	28.53	48.92	22.23	33.29	**14.05**	17.18
1970	**28.35**	37.86	35.45	44.92	38.94	36.71	29.00	69.20	66.65	39.84	33.39	32.45
1980	24.56	38.55	21.63	35.55	20.94	33.16	29.01	46.45	51.13	26.77	**18.65**	20.64
1990	**15.51**	34.08	18.64	25.31	19.89	29.92	28.47	46.54	59.35	21.32	20.68	16.52
mean	21.04	34.53	26.94	33.86	27.51	30.15	27.62	49.54	42.57	29.41	**20.29**	20.41
						30-year forecast horizon						
1950	34.44	51.23	54.08	69.41	50.62	46.38	30.27	80.87	43.05	55.86	**25.09**	35.29
1960	24.01	43.76	39.43	51.86	41.84	35.85	37.33	68.70	49.00	44.77	**16.11**	19.45
1970	38.90	48.84	47.38	57.68	49.85	47.45	**32.51**	92.07	115.24	51.67	48.72	43.06
1980	28.95	45.04	28.69	45.75	**26.11**	39.13	36.13	63.26	108.38	30.62	34.59	27.95
1990	**27.77**	43.60	32.82	36.09	34.47	39.93	51.73	64.56	107.80	32.06	38.71	28.20
mean	30.81	46.50	40.48	52.16	40.58	41.75	37.59	73.89	84.70	43.00	32.64	**30.79**
						Cumulative forecast errors after 30 years, averaged over the five forecasts						
TOT[d]	566.9	902.9	711.4	883.1	711.8	775.0	731.7	1426.1	1139.3	757.8	561.8	**553.3**
						Average forecast errors after 30 years, averaged over the five forecasts						
Av[m]	18.9	30.1	23.7	29.4	23.7	25.8	24.4	47.5	38.0	25.3	18.7	**18.4**

Notes: Point forecast errors refer to the percentage difference between the actual and forecast values for specific years. Mean absolute percentage errors in forecast age-specific death rates should be interpreted with caution. Mortality rates are generally very low at younger and middle ages compared to older ages, which can result in higher percentage errors, even for small absolute differences. Point errors are reported for 1-, 10-, 20-, and 30-year forecast horizons, for each jump-off year and averaged across jump-off years. The TOT metric is the average of the cumulative percentage errors over the 30-year forecast horizon, for the five evaluated forecasts for the five jump-off years. The Av metric is equal to the TOT metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.

Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the `demography` package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C3: Mean absolute percentage error in forecasted age-specific death rates, averaged across models and jump-off years, by forecast horizon



Notes: The figure presents mean absolute percentage error in forecasted age-specific death rates over all ages, averaged across jump-off years and across models. Mean absolute percentage errors in forecast age-specific death rates should be interpreted with caution, as low mortality rates at younger and middle ages can result in higher percentage errors, even for small absolute differences. Error bars represent 95% confidence intervals of the model errors

Source: Authors' calculations using *HMD data* (2023).

Appendix C4: Absolute percentage error for forecasted life expectancy at birth for males

Jump-off		*demography*						*StMoMo*			*combinations*		
year	Actual	EM	LC_D	LC_Dc	C FDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						1-year forecast horizon							
1950	66.08	0.91	0.72	0.87	1.28	0.87	0.94	1.12	**0.63**	1.06	0.96	1.04	1.02
1960	68.04	0.36	0.51	0.58	0.41	0.16	0.13	0.45	0.20	0.21	**0.02**	0.17	0.07
1970	68.25	0.85	1.83	2.10	**0.35**	0.52	0.54	0.47	1.27	1.04	0.90	0.69	0.92
1980	71.30	0.37	1.57	**0.03**	0.63	1.62	1.13	0.34	0.03	0.15	0.26	0.33	0.14
1990	74.48	1.03	0.60	0.33	0.89	0.26	0.95	**0.11**	0.30	0.53	0.19	0.54	0.40
	mean	0.70	1.05	0.78	0.71	0.69	0.74	0.50	0.49	0.60	**0.47**	0.55	0.51
						10-year forecast horizon							
1950	67.95	0.09	0.09	0.64	1.07	**0.04**	0.15	1.29	1.08	0.80	0.34	0.74	0.59
1960	67.43	2.49	2.97	2.69	2.69	2.30	2.35	4.34	**1.66**	3.23	2.65	3.28	3.12
1970	71.09	3.40	4.59	5.95	2.50	3.35	3.37	**2.15**	4.59	3.74	3.49	3.10	3.29
1980	73.98	2.49	1.23	2.23	2.96	4.18	3.60	**0.75**	2.84	2.42	2.82	2.30	2.00
1990	76.95	1.50	1.48	1.06	2.25	**0.34**	2.81	0.58	2.74	2.45	1.40	1.99	1.68
	mean	1.99	2.07	2.52	2.29	2.04	2.46	**1.82**	2.58	2.53	2.14	2.28	2.14
						20-year forecast horizon							
1950	67.43	2.49	2.39	1.29	3.84	2.52	2.65	5.84	**0.42**	3.79	2.91	4.03	3.62
1960	71.09	1.01	1.07	1.60	0.58	1.67	1.59	2.39	2.89	0.84	1.11	**0.14**	0.31
1970	73.98	5.82	7.27	9.58	4.65	6.13	6.15	**3.33**	7.86	7.02	6.04	5.57	5.67
1980	76.95	4.78	4.27	4.60	5.13	6.99	6.30	**1.68**	5.98	5.20	5.50	4.52	4.29
1990	79.80	2.47	3.90	2.20	3.62	0.97	5.01	1.07	5.59	4.87	2.93	3.81	3.30
	mean	3.31	3.78	3.85	3.56	3.65	4.34	**2.86**	4.55	4.34	3.70	3.61	3.44
						30-year forecast horizon							
1950	71.09	1.29	1.62	3.05	0.02	1.52	1.37	4.23	4.36	0.37	1.07	0.60	**0.02**
1960	73.98	3.39	4.00	4.69	2.88	4.53	4.43	**1.77**	6.26	4.80	3.82	2.81	2.89
1970	76.95	8.36	10.00	13.03	6.99	8.96	8.98	**4.38**	11.12	10.91	8.68	8.31	8.28
1980	79.80	6.86	7.07	6.74	7.17	9.58	8.80	**2.16**	8.91	8.01	7.99	6.61	6.43
1990	81.62	2.40	5.06	2.24	3.76	0.66	5.97	**0.10**	7.21	6.17	3.34	4.48	3.78
	mean	4.46	5.55	5.95	4.17	5.05	5.91	**2.53**	7.57	6.05	4.98	4.56	4.28
						Cumulative forecast errors after 30 years, averaged over the five forecasts							
	$TOT^{e(0)}$	73.5	85.7	91.8	79.5	80.7	96.5	**60.0**	108.1	98.7	81.1	82.3	77.0
						Average forecast errors after 30 years, averaged over the five forecasts							
	Av^{m}	2.45	2.86	3.06	2.65	2.69	3.22	**2.00**	3.60	3.29	2.70	2.74	2.57

Notes: Actual life expectancies are presented in the second column from the left. If the jump-off year is 1970 and the forecast horizon is 10 years, the relevant cell will show the estimated life expectancy at birth for 1980. The 12 rightmost columns present the absolute percentage error in years of the life expectancy forecasts for the 12 evaluated models for each of the evaluated jump-off years and forecast horizons. The mean of the absolute percentage errors across jump-off years for each evaluated forecast horizon are also presented. The TOT metric is the average of the cumulative percentage errors over the 30-year forecast horizon, for the five evaluated forecasts for the five jump-off years. The Av metric is equal to the TOT

metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.
Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the `demography` package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C5: Absolute percentage error for forecasted life expectancy at birth for females

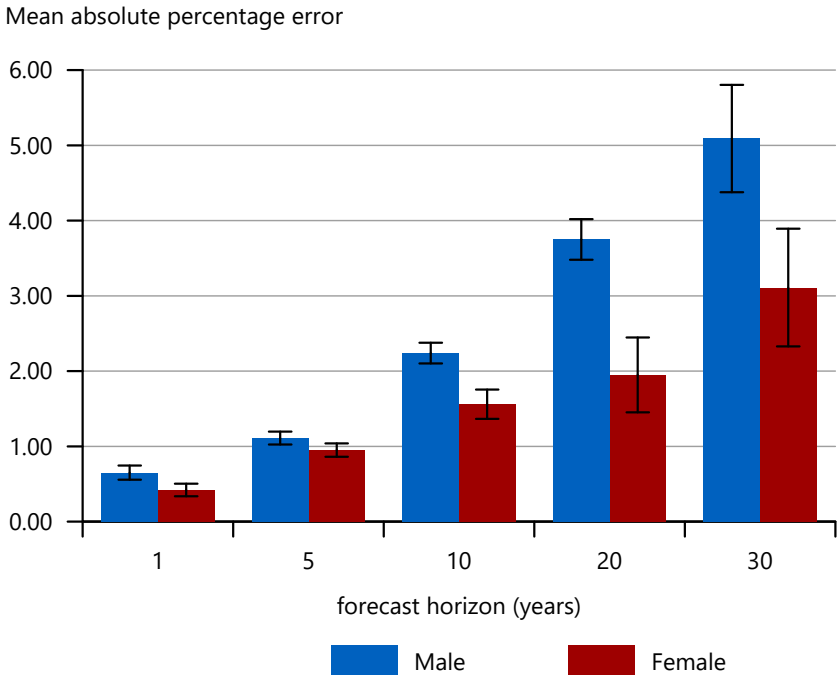
		demography					*StMoMo*				*combinations*		
Jump-off year	Actual	EM	LC_D	LC_Dc	C FDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						1-year forecast horizon							
1950	71.59	0.32	0.52	0.56	0.24	0.39	0.43	0.25	0.27	0.53	**0.22**	0.40	0.27
1960	74.51	0.55	0.21	**0.13**	1.00	0.75	0.66	0.18	0.71	0.31	0.51	0.39	0.37
1970	74.89	0.56	0.54	0.74	0.94	0.82	0.76	**0.24**	1.10	0.71	0.77	0.57	0.60
1980	78.43	0.31	0.70	0.10	1.10	0.08	0.28	0.22	0.03	**0.01**	0.17	0.02	0.11
1990	80.50	0.74	0.26	0.20	0.63	0.17	0.36	**0.01**	0.17	0.18	0.18	0.19	0.27
	mean	0.50	0.45	0.34	0.78	0.44	0.50	**0.18**	0.46	0.35	0.37	0.32	0.32
						10-year forecast horizon							
1950	74.05	1.24	0.77	0.97	2.40	0.88	0.81	0.17	2.32	**0.10**	1.36	0.37	0.96
1960	74.17	2.61	2.49	2.38	0.55	1.54	1.68	3.34	**0.53**	2.96	1.52	2.62	2.35
1970	78.22	2.92	3.30	3.47	4.21	3.55	3.45	**1.86**	4.78	2.65	3.69	2.69	3.02
1980	80.15	0.87	**0.01**	0.38	2.63	0.16	0.82	0.90	1.51	0.46	0.98	0.12	0.52
1990	82.27	0.60	0.48	0.15	1.54	0.16	0.96	0.62	1.78	**0.04**	0.64	0.17	0.46
	mean	1.65	1.41	1.47	2.27	1.26	1.54	1.38	2.18	1.24	1.64	**1.19**	1.46
						20-year forecast horizon							
1950	74.17	0.24	0.88	0.48	1.06	0.79	0.90	3.15	2.06	1.97	**0.19**	1.96	0.96
1960	78.22	0.17	1.22	1.33	3.57	2.11	1.92	1.54	4.15	**0.08**	2.32	0.23	0.82
1970	80.15	3.39	4.23	4.31	5.58	4.45	4.30	**1.00**	6.69	3.18	4.76	2.97	3.62
1980	82.27	1.86	1.16	1.05	4.25	0.63	1.83	1.61	3.58	**0.04**	2.12	0.31	1.42
1990	84.20	0.60	1.36	**0.23**	2.26	0.32	1.68	1.54	3.59	0.61	1.16	0.43	0.83
	mean	1.25	1.77	1.48	3.34	1.66	2.13	1.77	4.01	**1.18**	2.11	1.18	1.53
						30-year forecast horizon							
1950	78.22	3.64	2.95	3.48	5.01	3.03	2.89	1.44	6.99	2.13	3.68	**1.37**	2.67
1960	80.15	**0.37**	2.29	2.38	4.99	3.14	2.89	2.96	6.15	0.76	3.50	0.56	1.46
1970	82.27	4.22	5.51	5.46	7.23	5.71	5.51	**0.08**	8.88	5.48	6.16	4.05	4.86
1980	84.20	2.67	2.19	1.55	5.62	**0.95**	2.69	2.79	5.47	1.76	3.11	1.07	2.49
1990	85.69	0.30	1.82	**0.03**	2.49	0.79	2.00	3.16	4.95	1.94	1.29	0.71	1.07
	mean	2.24	2.95	2.58	5.07	2.72	3.20	2.09	6.49	2.41	3.55	**1.55**	2.51
						Cumulative forecast errors after 30 years, averaged over the five forecasts							
	TOT	39.6	44.2	40.6	84.6	40.4	48.5	42.8	96.1	33.7	53.3	**28.2**	38.1
						Average forecast errors after 30 years, averaged over the five forecasts							
	Av^m	1.32	1.47	1.35	2.82	1.35	1.62	1.43	3.20	1.12	1.78	**0.94**	1.27

Notes: Actual life expectancies are presented in the second column from the left. If the jump-off year is 1970 and the forecast horizon is 10 years, the relevant cell will show the estimated life expectancy at birth for 1980. The 12 rightmost columns present the absolute percentage error in years of the life expectancy forecasts for the 12 evaluated models for each of the evaluated jump-off years and forecast horizons. The mean of the absolute percentage errors across jump-off years for each evaluated forecast horizon are also presented. The TOT metric is the average of the cumulative percentage errors over the 30-year forecast horizon, for

the five evaluated forecasts for the five jump-off years. The Av metric is equal to the TOT metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.
Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the `demography` package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C6: Mean absolute percentage error in forecasted life expectancy at birth, averaged across models and jump-off years, by forecast horizon



Notes: This figure visualises the mean absolute percentage error in forecasted life expectancy at birth, which has been averaged across jump-off years and then across models. Error bars represent 95% confidence intervals of the model errors.

Source: Authors' calculations using *HMD data* (2023).

Appendix C7: Absolute percentage error for forecasted life expectancy at age 65 for males

Jump-off		*demography*						*StMoMo*			*combinations*		
year	Actual	EM	LC_D	LC_Dc	C FDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						1-year forecast horizon							
1950	12.10	1.82	1.68	0.96	2.54	1.67	1.75	**0.35**	10.22	0.86	1.96	0.98	1.44
1960	12.60	1.48	2.13	2.56	2.11	2.10	1.93	2.03	6.65	**0.54**	2.12	1.52	1.68
1970	12.47	2.69	1.33	0.98	**0.47**	1.46	1.52	4.87	2.24	3.03	1.09	3.19	2.53
1980	13.84	0.29	5.67	0.28	1.23	7.94	6.13	1.13	3.12	**0.21**	5.05	2.42	1.68
1990	15.45	3.06	4.74	0.94	1.76	**0.85**	5.36	1.61	1.29	1.35	2.49	2.81	2.53
	mean	1.87	3.11	**1.14**	1.62	2.80	3.34	2.00	4.70	1.20	2.54	2.18	1.97
						10-year forecast horizon							
1950	12.51	1.69	1.86	3.04	0.94	1.88	1.68	**0.18**	1.95	1.53	0.95	1.14	0.88
1960	11.98	4.77	2.82	**2.14**	4.68	2.86	3.19	8.51	5.61	9.56	3.45	7.01	6.01
1970	13.76	11.37	10.65	10.24	**8.00**	10.79	10.83	8.81	12.34	8.31	9.83	9.35	9.47
1980	15.22	6.11	13.35	5.98	9.28	15.71	13.51	**4.20**	9.03	6.40	12.87	8.19	7.98
1990	17.05	5.71	11.51	4.17	6.78	**2.47**	11.72	4.08	9.70	10.26	7.08	8.85	7.80
	mean	5.93	8.04	**5.11**	5.93	6.74	8.19	5.16	7.72	7.21	6.84	6.91	6.43
						20-year forecast horizon							
1950	11.98	3.38	2.18	**0.40**	6.42	2.16	2.51	13.20	6.08	7.11	3.56	7.48	6.36
1960	13.76	7.23	10.55	11.36	6.79	10.50	10.07	4.80	13.58	2.33	9.31	**1.37**	3.80
1970	15.22	19.07	19.33	18.87	15.08	19.49	19.50	**10.69**	25.27	14.61	18.02	15.05	15.86
1980	17.05	13.27	21.82	12.77	16.70	24.21	21.70	**7.80**	21.34	15.64	21.04	15.41	15.31
1990	19.01	9.45	18.50	8.20	11.35	**5.21**	18.33	5.42	20.38	18.89	12.07	14.83	13.19
	mean	10.48	14.48	10.32	11.27	12.31	14.42	**8.38**	17.33	11.71	12.80	10.83	10.91
						30-year forecast horizon							
1950	13.76	8.91	11.26	13.28	6.51	11.28	10.86	11.56	24.51	1.73	9.73	**1.03**	3.89
1960	15.22	14.60	19.23	20.16	14.01	19.17	18.65	5.86	26.29	**4.61**	17.53	6.88	10.18
1970	17.05	26.86	28.10	27.58	22.72	28.26	28.26	**13.79**	36.90	25.59	26.44	22.95	23.69
1980	19.01	19.68	29.17	18.81	23.17	31.55	28.80	**9.30**	31.54	24.53	28.14	21.72	21.75
1990	20.57	11.05	22.71	9.91	13.24	5.99	22.22	**3.17**	27.56	25.31	14.62	18.42	16.21
	mean	16.22	22.09	17.95	15.93	19.25	21.76	**8.74**	29.36	16.35	19.29	14.20	15.14
						Cumulative forecast errors after 30 years, averaged over the five forecasts							
	TOT	235.9	340.2	244.1	240.8	289.2	339.2	**177.2**	409.4	259.2	290.4	241.0	238.9
						Average forecast errors after 30 years, averaged over the five forecasts							
	Av^m	7.86	11.34	8.14	8.03	9.64	11.31	**5.91**	13.65	8.64	9.68	8.03	7.96

Notes: Actual life expectancies are presented in the second column from the left. If the jump-off year is 1970 and the forecast horizon is 10 years, then the relevant cell will show the estimated life expectancy at birth for 1980. The 12 rightmost columns present the absolute error in years of the life expectancy forecasts for the 12 evaluated models for each of the evaluated jump-off years and forecast horizons. The mean of the absolute errors across jump-off years for each evaluated forecast horizon are also presented. TOT is the average cumulative error over the five 30-year forecasts and is presented at the bottom of the table. The Av metric is equal to the TOT metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.

Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the `demography` package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C8: Absolute percentage error for forecasted life expectancy at age 65 for females

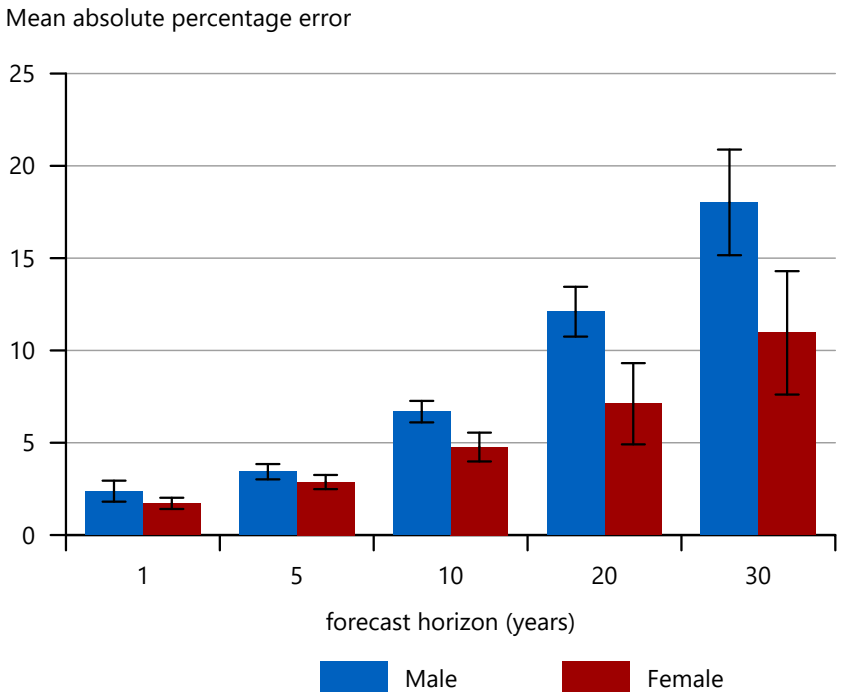
Jump-off		*demography*						*StMoMo*			*combinations*		
year	Actual	EM	LC_D	LC_Dc	C FDM	BMS	LC_S	APC	CBD	Plat	D	S	U
						1-year forecast horizon							
1950	14.66	0.74	0.48	0.37	0.42	0.39	0.52	1.29	6.78	0.81	**0.15**	0.87	0.57
1960	15.92	1.28	2.33	2.12	3.42	3.44	3.02	1.39	3.59	**0.39**	3.07	1.62	1.78
1970	16.17	2.00	2.91	2.45	3.16	3.28	2.87	3.54	**1.01**	1.75	3.11	2.73	2.69
1980	18.12	0.69	1.82	0.32	3.39	0.36	2.81	0.97	**0.27**	0.65	1.66	1.07	1.28
1990	19.32	2.37	1.67	0.38	1.99	0.34	2.23	1.03	1.38	**0.15**	1.35	1.05	1.40
	mean	1.42	1.84	1.13	2.48	1.56	2.29	1.64	2.61	**0.75**	1.87	1.47	1.55
						10-year forecast horizon							
1950	15.76	5.18	4.97	5.33	7.79	5.05	4.80	**1.66**	7.66	1.79	5.95	2.79	4.35
1960	15.71	4.86	1.38	1.69	1.98	**0.07**	0.76	5.91	0.42	8.20	0.19	4.80	3.48
1970	18.02	8.55	10.93	9.86	12.64	11.28	10.69	8.32	14.57	**4.14**	11.62	7.87	9.07
1980	19.08	2.13	3.61	**0.29**	8.30	0.89	4.24	1.35	6.90	5.98	3.87	0.73	1.72
1990	20.57	2.70	4.37	0.79	5.20	**0.05**	4.55	0.55	8.29	3.57	3.30	0.35	1.85
	mean	4.68	5.05	3.59	7.18	3.47	5.01	3.56	7.57	4.74	4.99	**3.31**	4.09
						20-year forecast horizon							
1950	15.71	3.71	3.05	3.72	6.97	3.15	2.74	5.95	13.99	4.14	4.42	2.24	**1.04**
1960	18.02	3.58	9.32	8.97	13.96	10.63	9.78	**1.13**	16.28	2.38	11.34	2.61	5.29
1970	19.08	9.91	13.89	12.17	16.88	14.23	13.44	4.63	22.49	**0.43**	15.02	6.77	9.76
1980	20.57	5.67	7.45	1.88	13.77	**0.74**	7.68	3.70	15.15	9.46	7.75	0.82	3.95
1990	21.92	2.89	6.89	1.11	7.33	**0.31**	6.66	4.00	14.76	7.15	4.86	0.73	1.94
	mean	5.15	8.12	5.57	11.78	5.81	8.06	3.88	16.53	4.71	8.68	**2.63**	4.40
						30-year forecast horizon							
1950	18.02	14.98	14.07	14.90	18.33	14.15	13.66	**2.24**	29.87	4.16	15.56	5.82	10.65
1960	19.08	4.08	12.29	11.87	18.13	13.67	12.63	7.88	24.11	5.01	14.76	**1.26**	5.85
1970	20.57	12.94	18.32	16.05	22.28	18.64	17.68	0.57	30.73	**0.51**	19.78	7.37	12.21
1980	21.92	8.12	10.27	3.15	17.85	1.52	10.08	8.38	21.61	12.77	10.59	**1.47**	5.54
1990	23.21	3.05	9.02	1.29	8.82	**0.75**	8.39	9.08	20.22	8.54	6.11	1.35	2.25
	mean	8.64	12.79	9.45	17.08	9.75	12.49	5.63	25.31	6.20	13.36	**3.46**	7.30
						Cumulative forecast errors after 30 years, averaged over the five forecasts							
	TOT	138.6	200.9	143.4	291.2	157.3	201.8	102.9	381.1	128.7	213.9	**72.6**	118.9
						Average forecast errors after 30 years, averaged over the five forecasts							
	Av^m	4.62	6.70	4.78	9.71	5.24	6.73	3.43	12.70	4.29	7.13	**2.42**	3.96

Notes: Actual life expectancies are presented in the second column from the left. If the jump-off year is 1970 and the forecast horizon is 10 years, then the relevant cell will show the estimated life expectancy at birth for 1980. The 12 rightmost columns present the absolute error in years of the life expectancy forecasts for the 12 evaluated models for each of the evaluated jump-off years and forecast horizons. The mean of the absolute errors across jump-off years for each evaluated forecast horizon are also presented. TOT is the average cumulative error over the five 30-year forecasts and is presented at the bottom of the table. The Av metric is equal to the TOT metric divided by the forecast horizon, providing a central measure of error across the forecast horizon.

Abbreviations: EM – extrapolative smoothing model, LC_D – Lee-Carter model from the `demography` package, LC_Dc Lee-Carter model from the `demography` package with automated base period selection, CFDM – coherent functional demographic model, LC_S – the `StMoMo` implementation of the Lee-Carter model, APC – Age-period-cohort model, CBD – Cairns-Blake-Dowd model, Plat – Plat model, D – demography ensemble, StMoMo ensemble, U – unique ensemble.

Source: Authors' calculations using *HMD data* (2023).

Appendix C9: Mean absolute percentage error in forecasted life expectancy at age 65, averaged across models and jump-off years, by forecast horizon



Notes: This figure visualises the mean absolute percentage error in forecasted life expectancy at age 65, which has been averaged across jump-off years and then across models. Error bars represent 95% confidence intervals of the model errors.

Source: Authors' calculations using *HMD data* (2023).

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