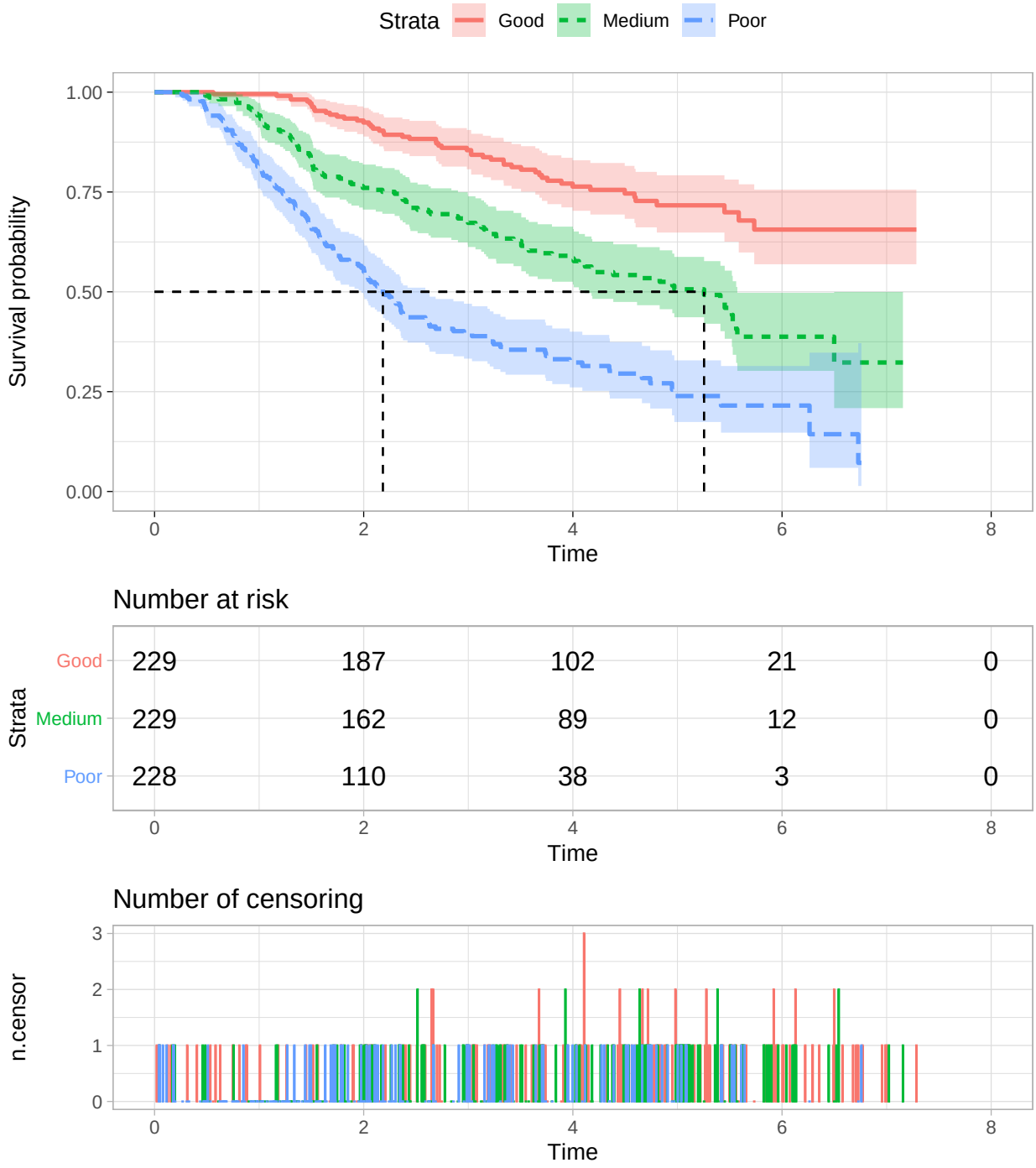
PERSUADE OUTPUT

Authors

Contents

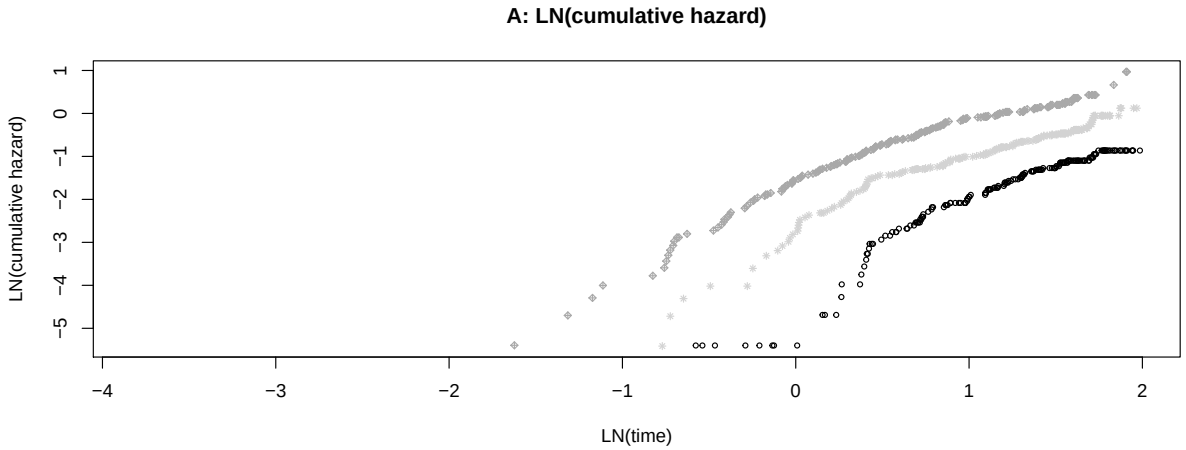
2020-07-06

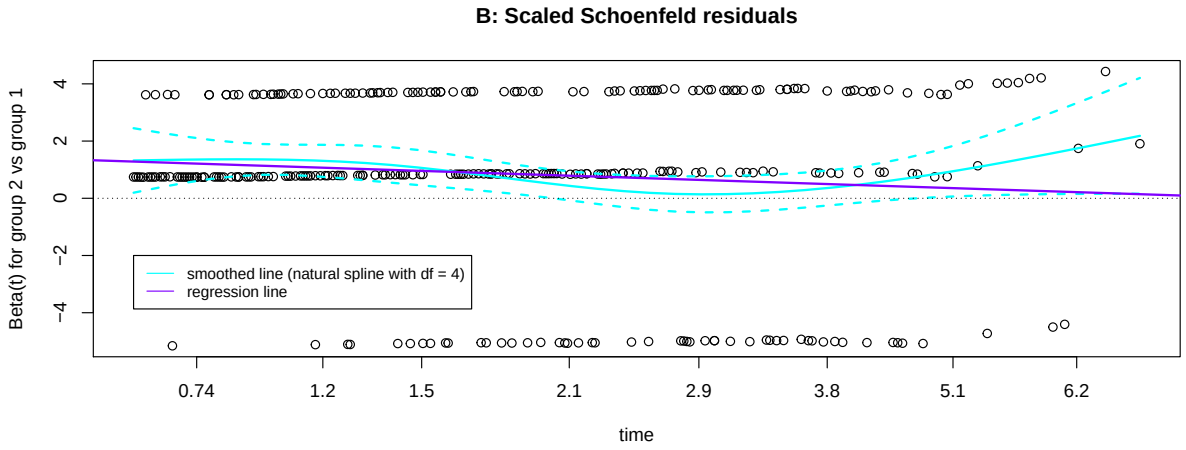
Kaplan-Meier

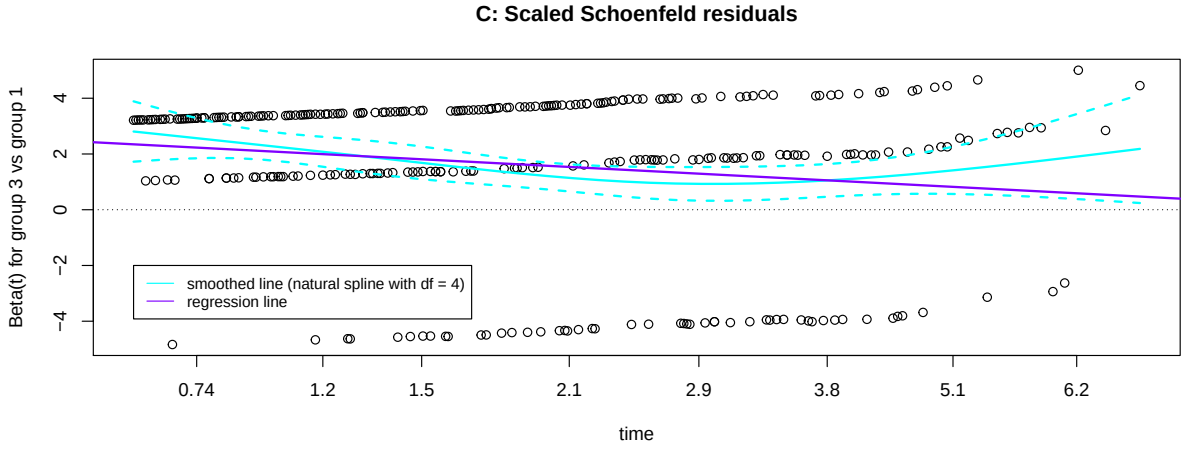


Stratified models?

Should stratified parametric survival models be used?

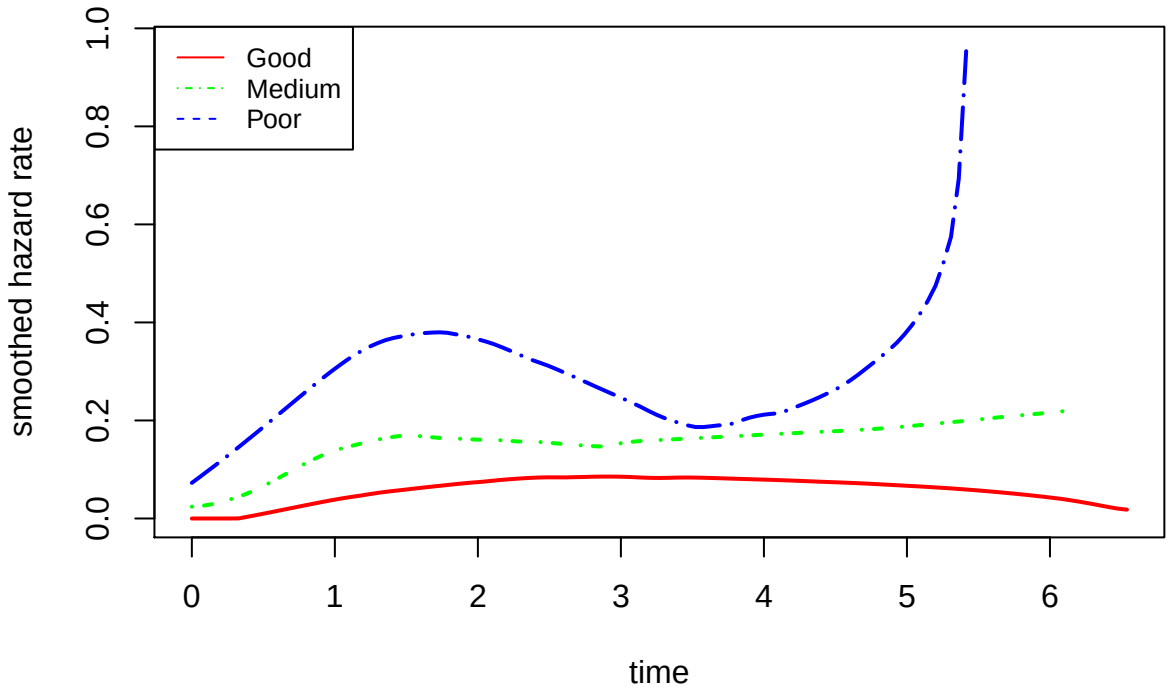






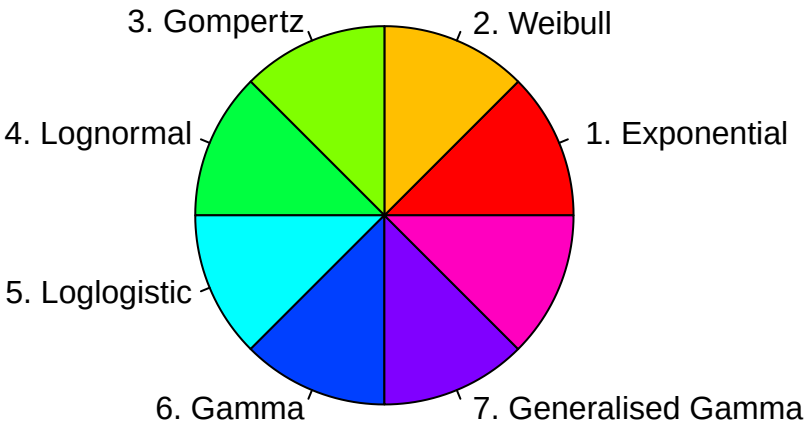
Monotonic hazard models?

Should parametric survival models assuming a monotonic hazard rate (i.e. exponential, Weibull, Gompertz) be used?



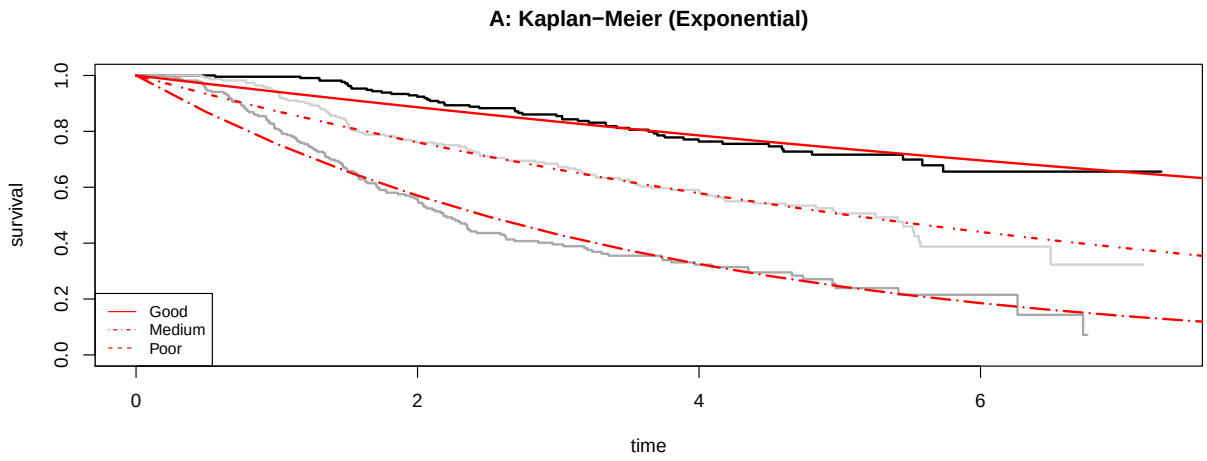
Standard parametric models?

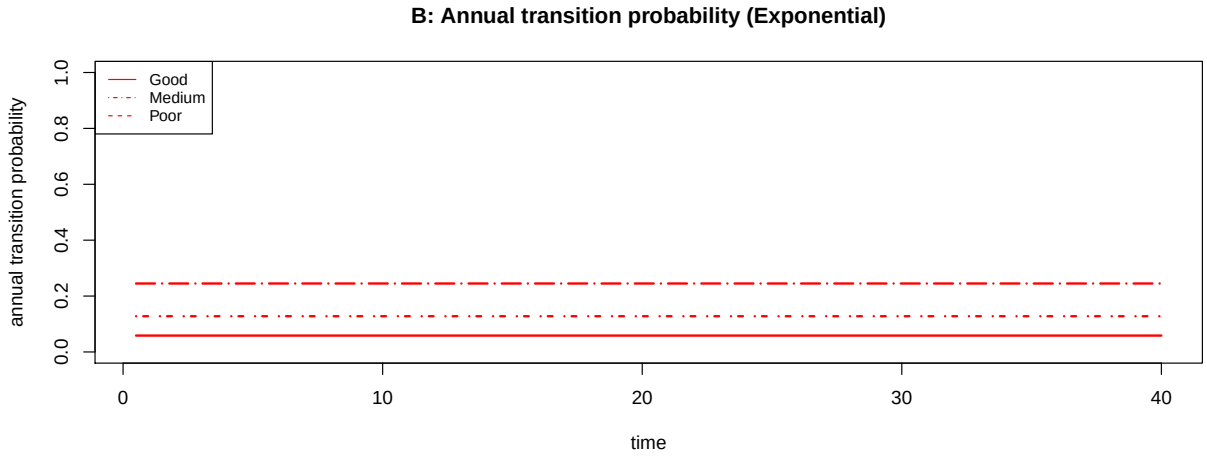
Do standard parametric models provide an appropriate fit to the data?

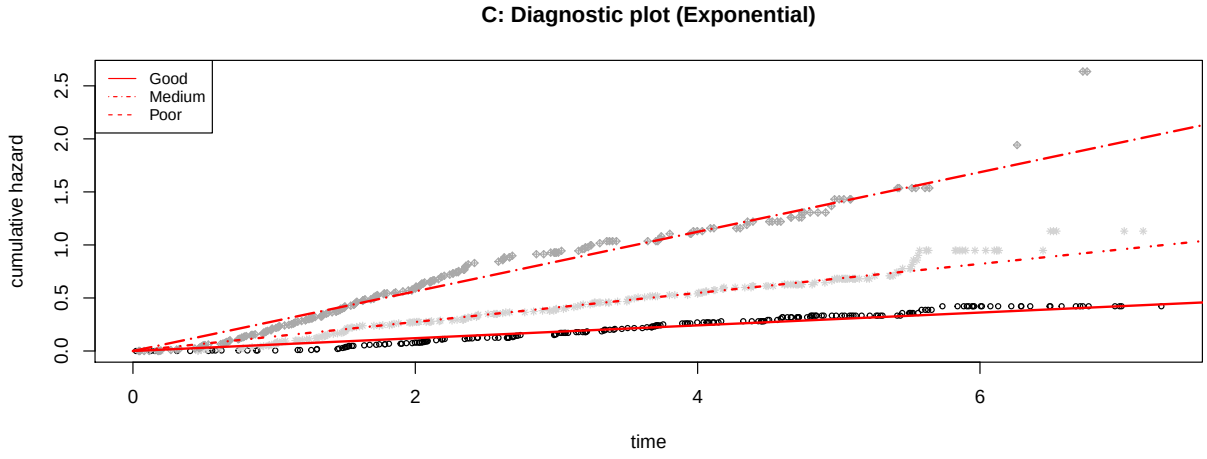


Model	AIC	BIC
7. Generalised Gamma	1589.049	1629.826
4. Lognormal	1592.880	1620.066
5. Loglogistic	1609.294	1636.479
6. Gamma	1621.982	1649.167
2. Weibull	1632.618	1659.803
3. Gompertz	1660.954	1688.140
1. Exponential	1668.212	1681.805

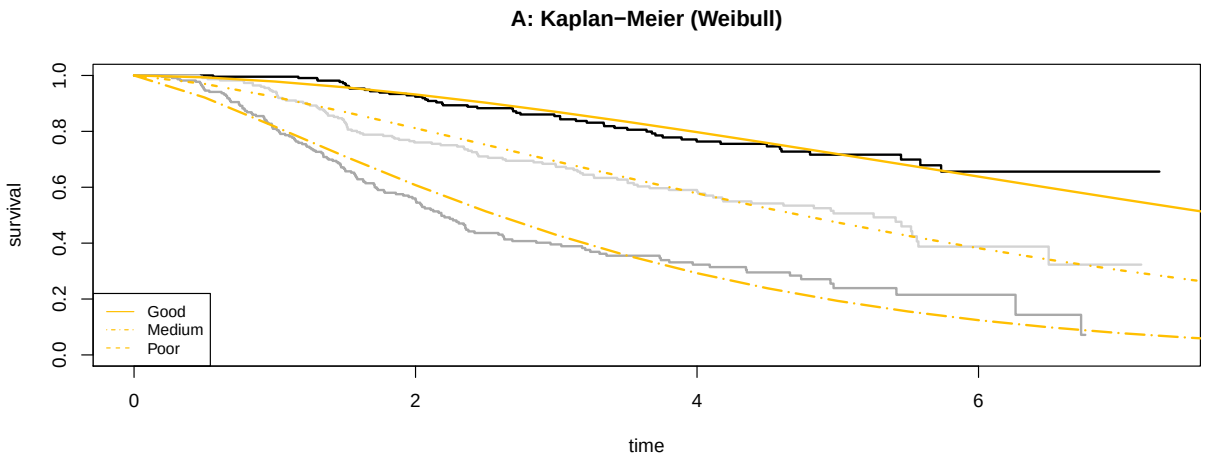
Exponential

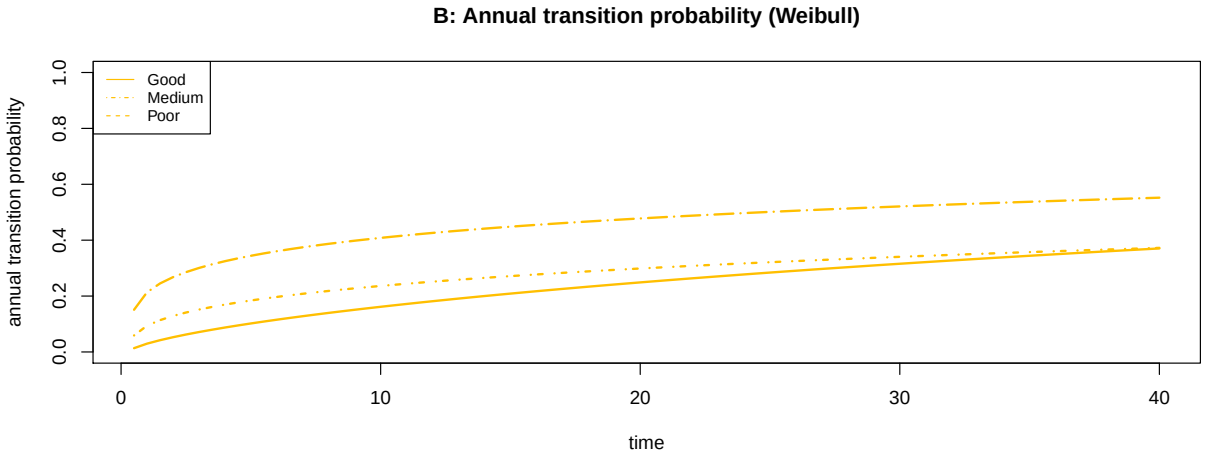


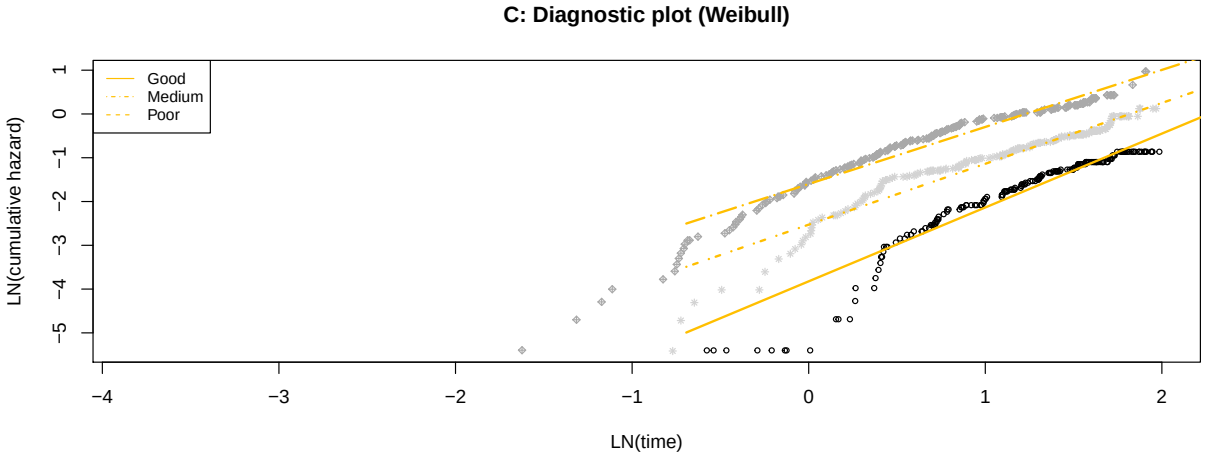




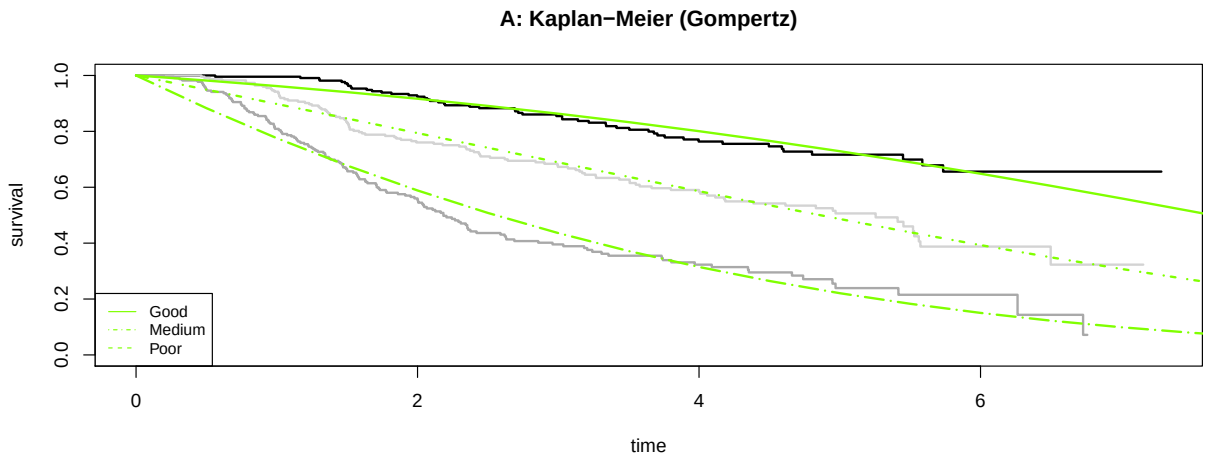
Weibull

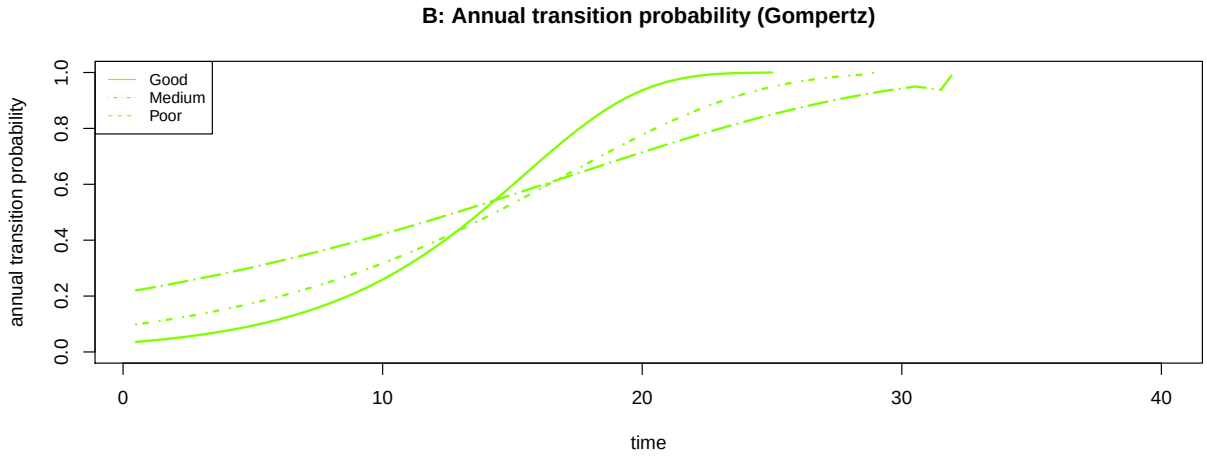

A: Kaplan−Meier (Weibull)
survival
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
2
4
6
time

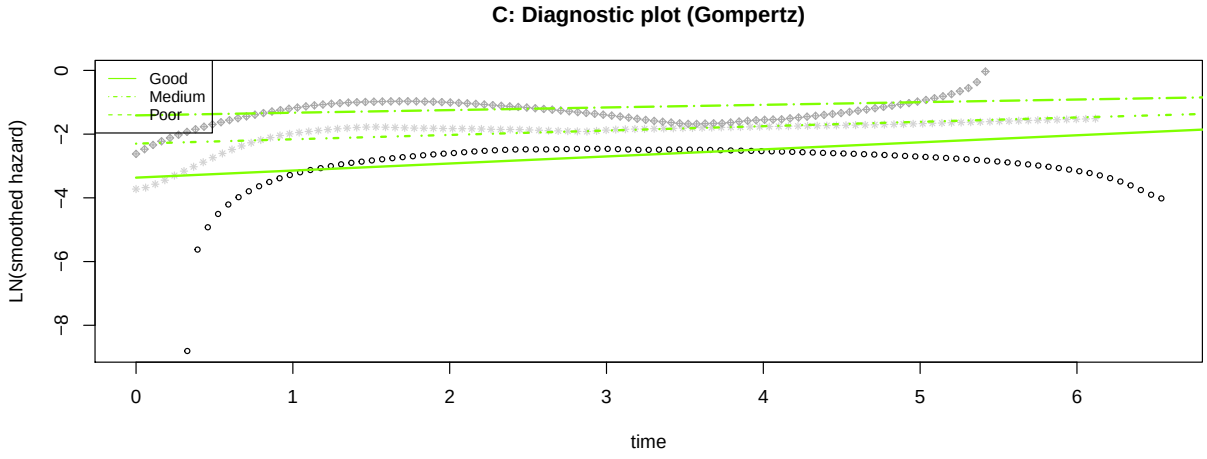

B: Annual transition probability (Weibull)
annual transition probability
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
10
20
30
40
time


C: Diagnostic plot (Weibull)
LN(cumulative hazard)
−5
−4
−3
−2
−1
0
1
Good
Medium
Poor
−4
−3
−2
−1
0
1
2
LN(time)

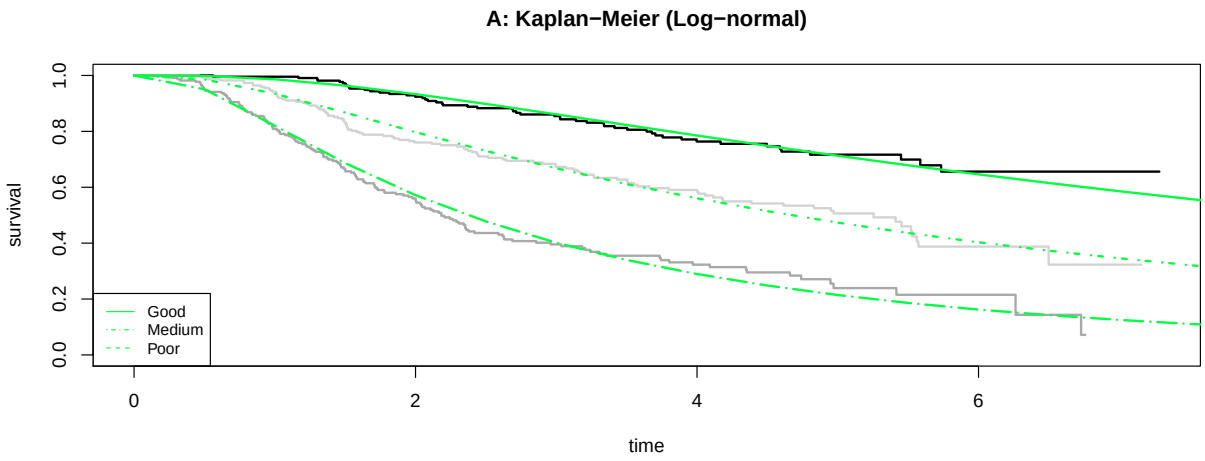
Gompertz

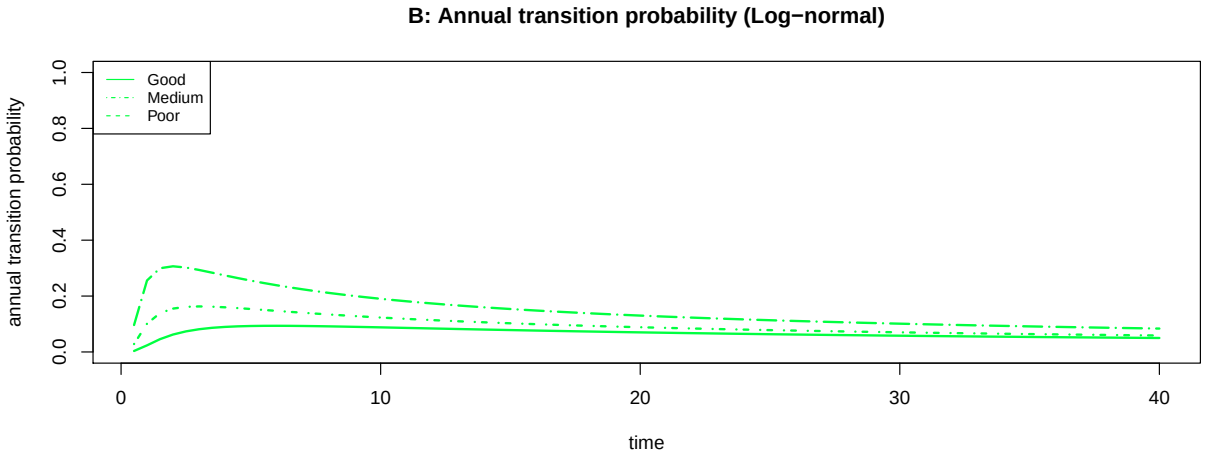

A: Kaplan−Meier (Gompertz)
survival
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
2
4
6
time

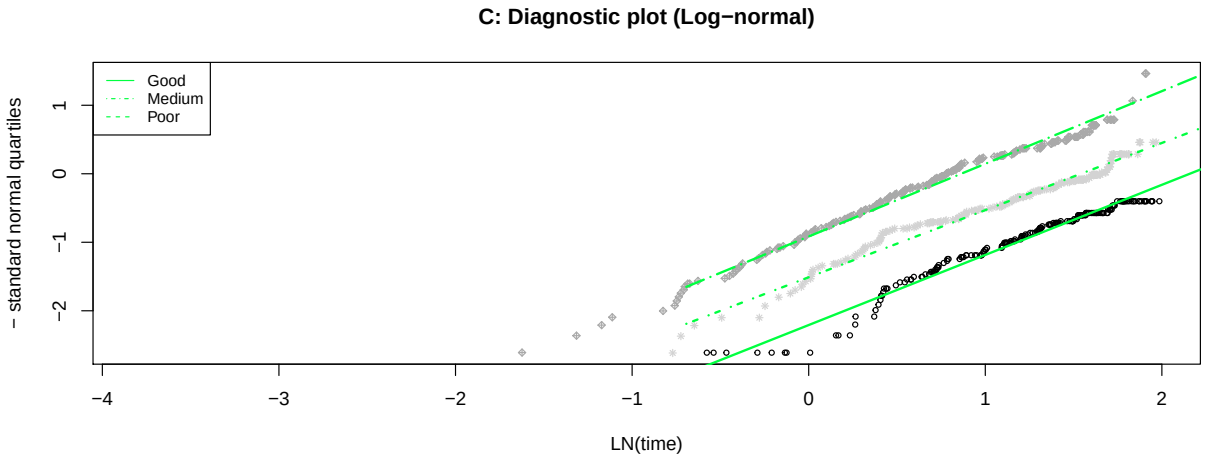

B: Annual transition probability (Gompertz)
annual transition probability
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
10
20
30
40
time


C: Diagnostic plot (Gompertz)
LN(smoothed hazard)
0
−2
−4
−6
−8
Good
Medium
Poor
0
1
2
3
4
5
6
time

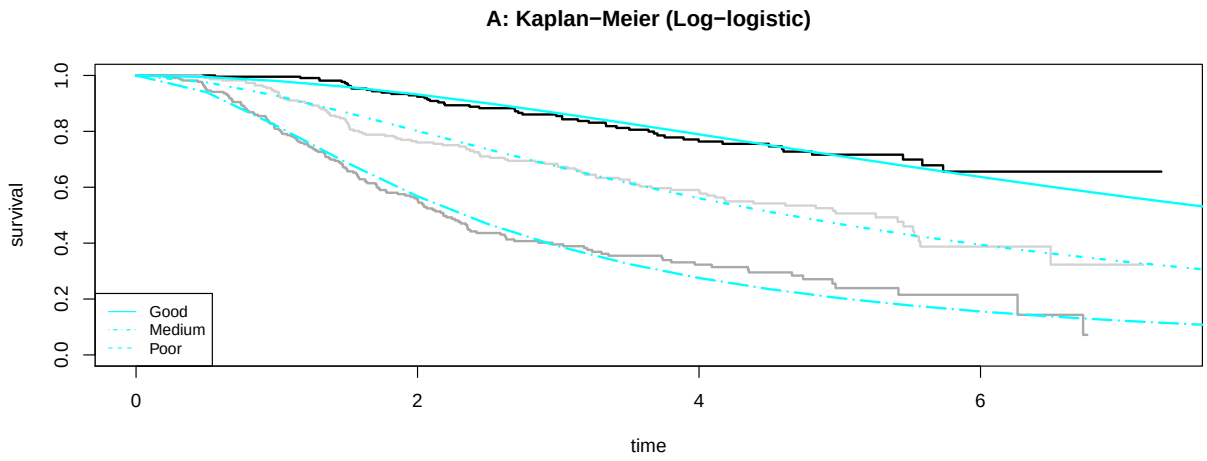
Lognormal

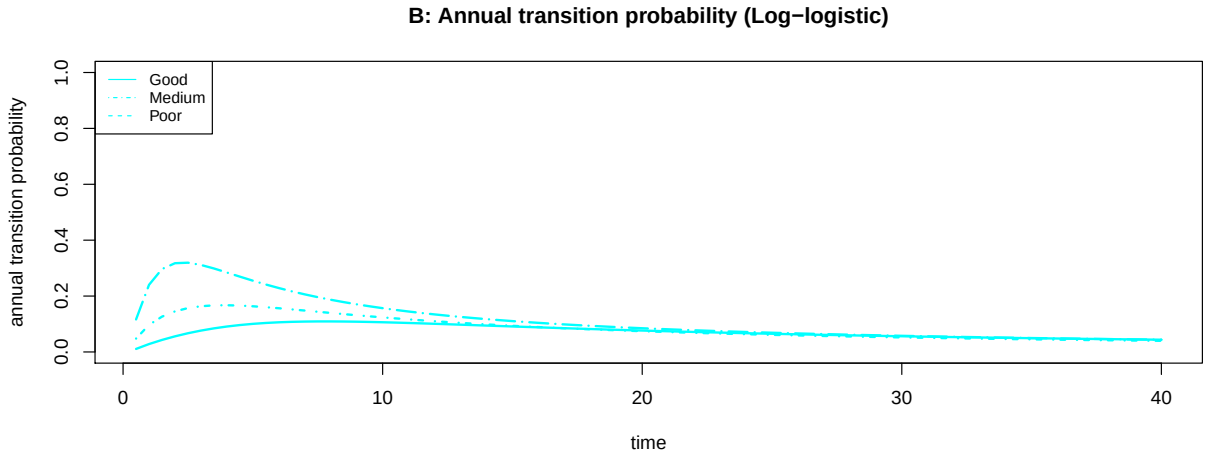

A: Kaplan−Meier (Log−normal)
survival
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
2
4
6
time

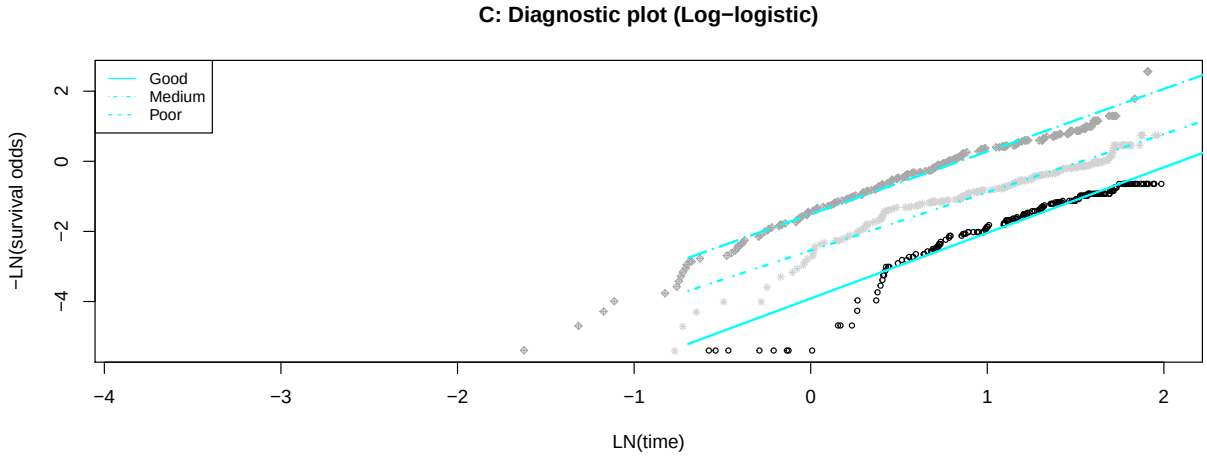

B: Annual transition probability (Log−normal)
annual transition probability
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
10
20
30
40
time


C: Diagnostic plot (Log−normal)
− standard normal quartiles
−2
−1
0
1
Good
Medium
Poor
−4
−3
−2
−1
0
1
2
LN(time)

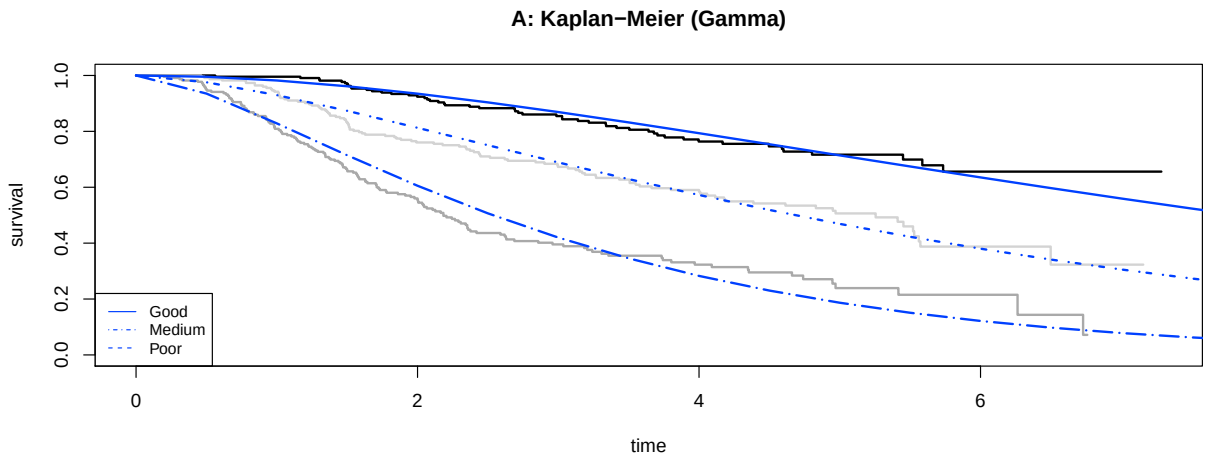
Loglogistic

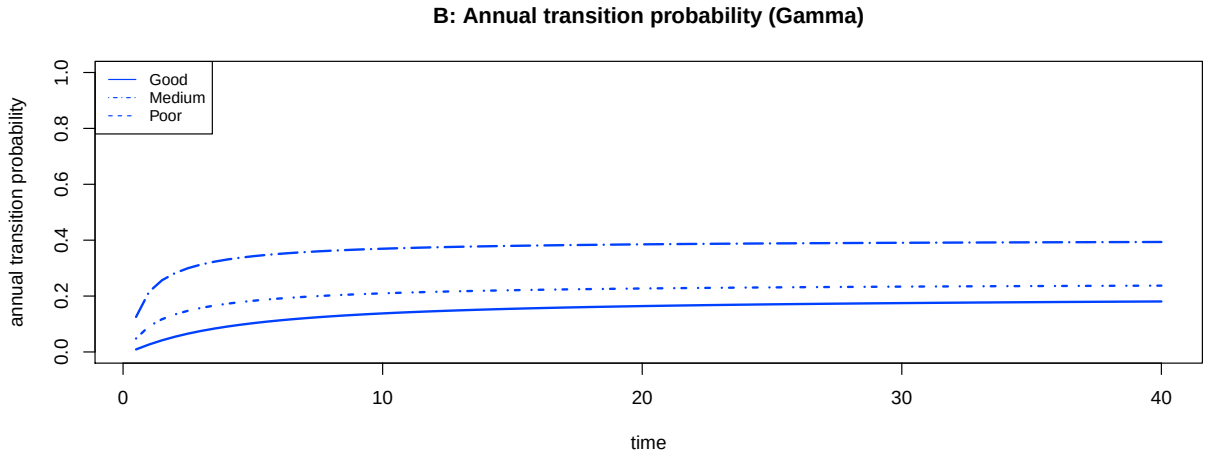


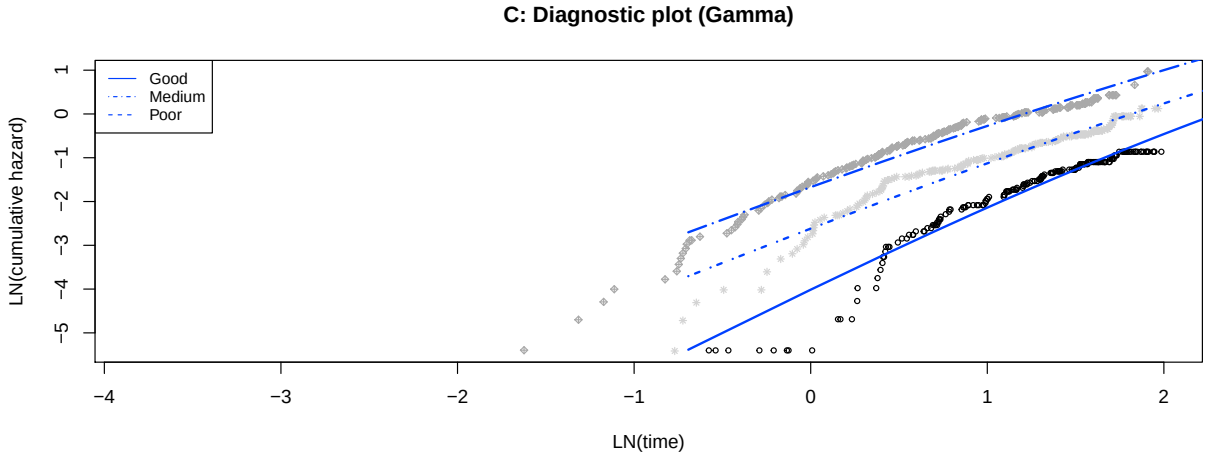




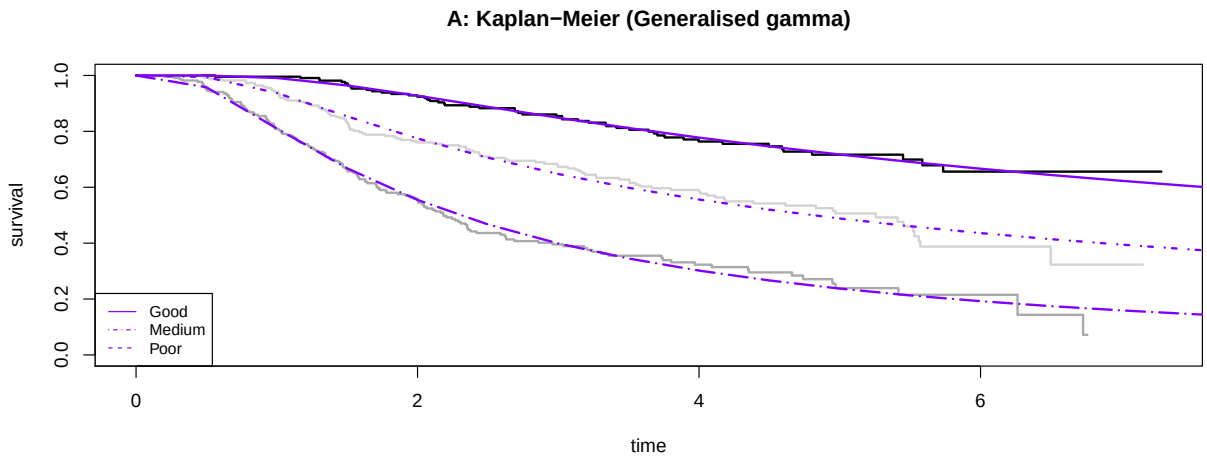
Gamma

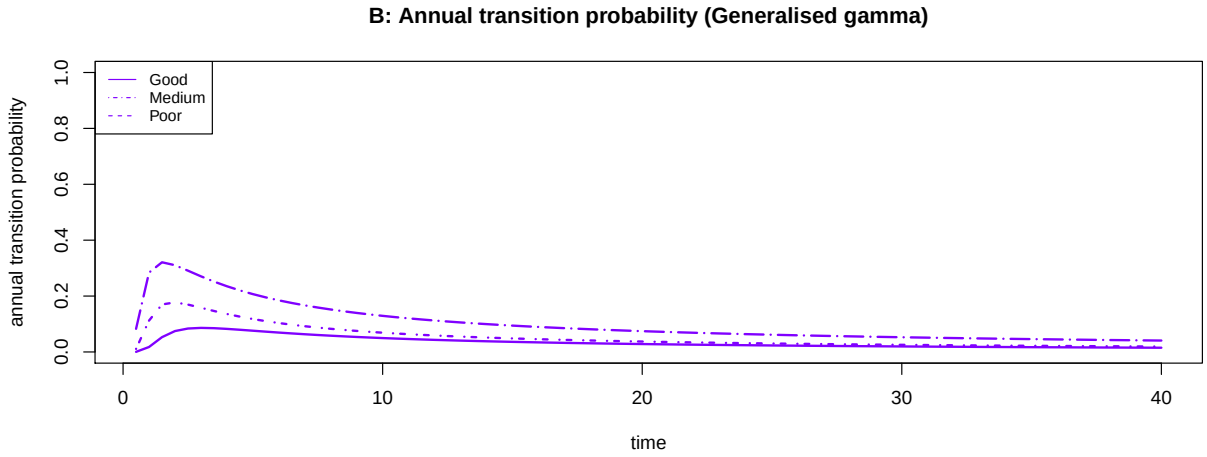

A: Kaplan−Meier (Gamma)
survival
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
2
4
6
time

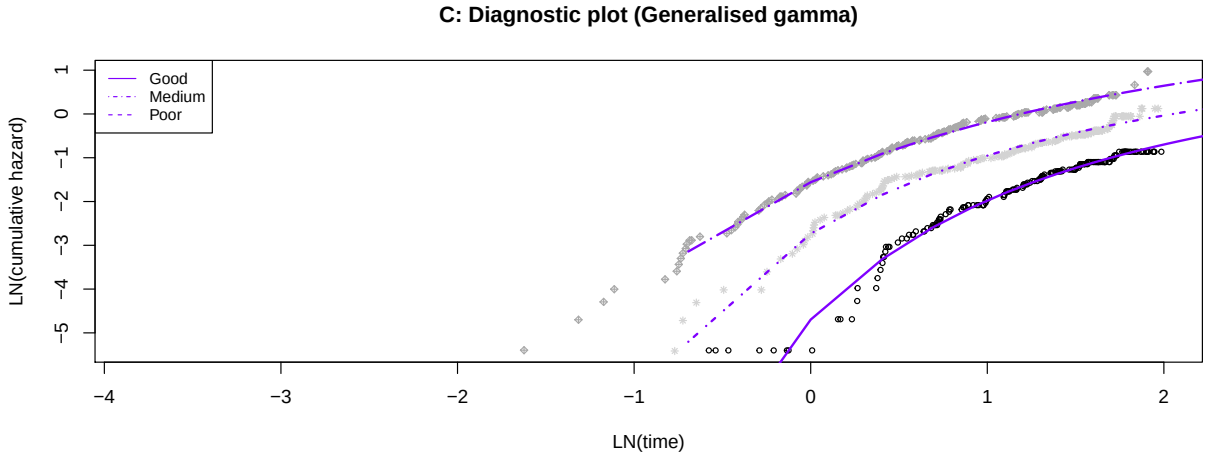

B: Annual transition probability (Gamma)
annual transition probability
0.0
0.2
0.4
0.6
0.8
1.0
Good
Medium
Poor
0
10
20
30
40
time


C: Diagnostic plot (Gamma)
LN(cumulative hazard)
−5
−4
−3
−2
−1
0
1
Good
Medium
Poor
−4
−3
−2
−1
0
1
2
LN(time)

Generalised Gamma

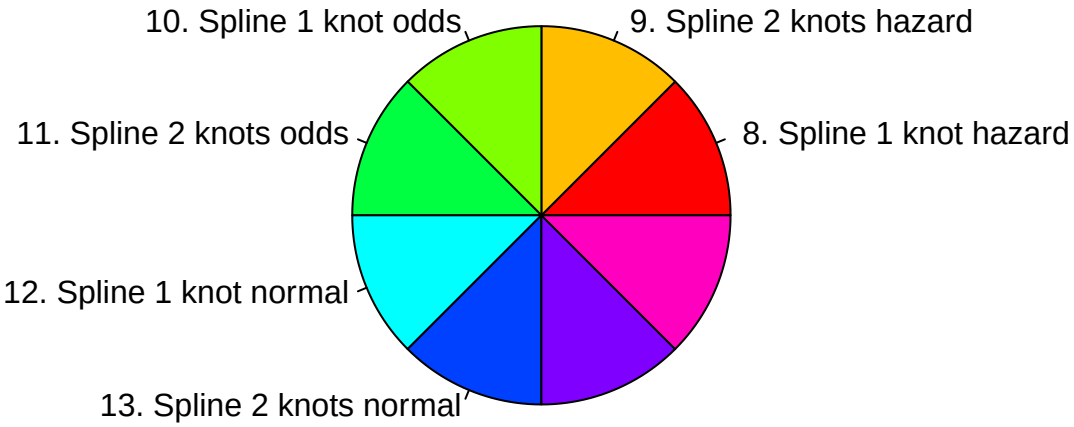






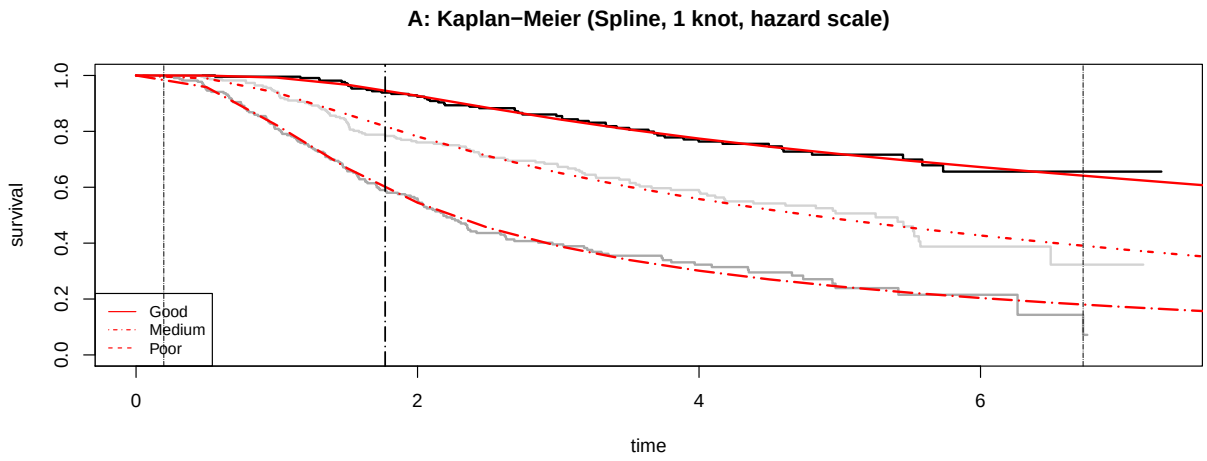
Parametric spline models?

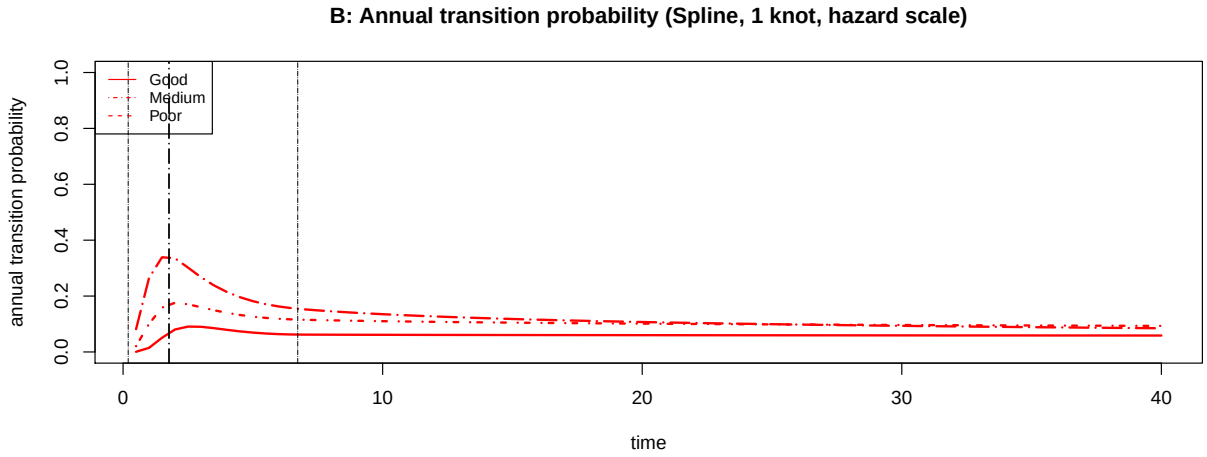
If standard parametric models are not appropriate, are spline models a more appropriate fit to the data?

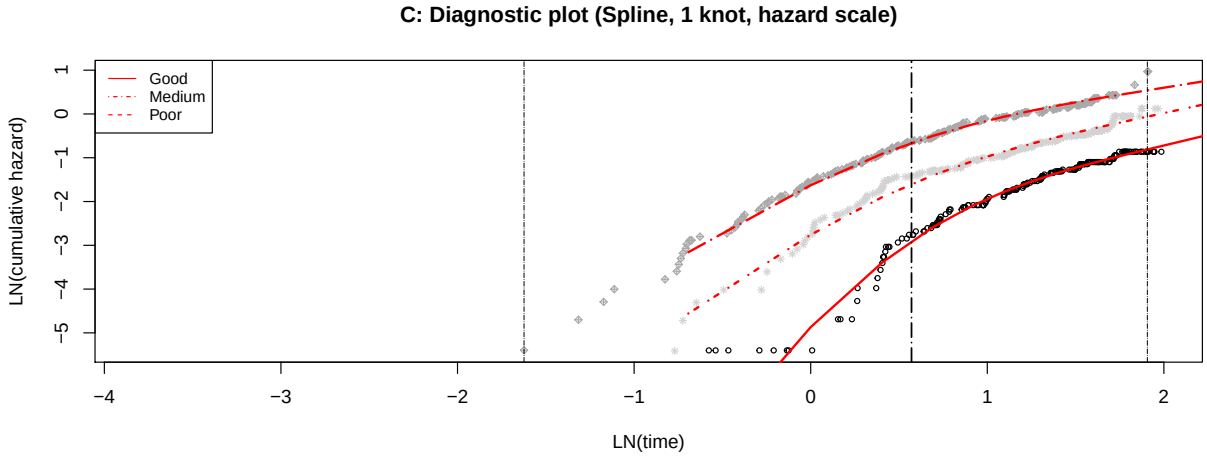


Model	AIC	BIC
9. Spline 2 knots hazard	1585.894	1640.264
11. Spline 2 knots odds	1587.289	1641.659
12. Spline 1 knot normal	1587.682	1628.460
13. Spline 2 knots normal	1588.343	1642.714
7. Generalised Gamma	1589.049	1629.826
8. Spline 1 knot hazard	1589.327	1630.105
10. Spline 1 knot odds	1590.221	1630.999
4. Lognormal	1592.880	1620.066
5. Loglogistic	1609.294	1636.479
6. Gamma	1621.982	1649.167
2. Weibull	1632.618	1659.803
3. Gompertz	1660.954	1688.140
1. Exponential	1668.212	1681.805

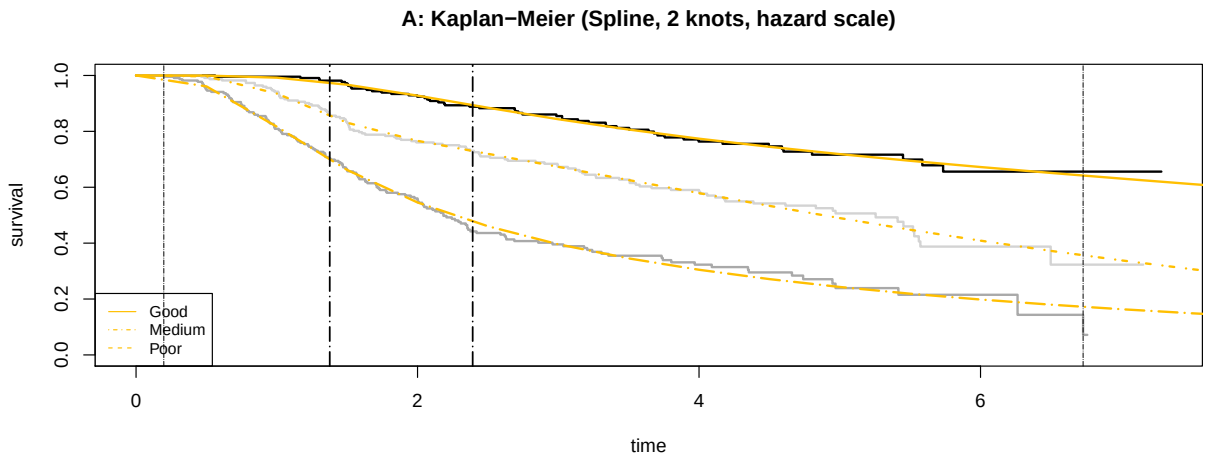
Spline hazard 1 knot

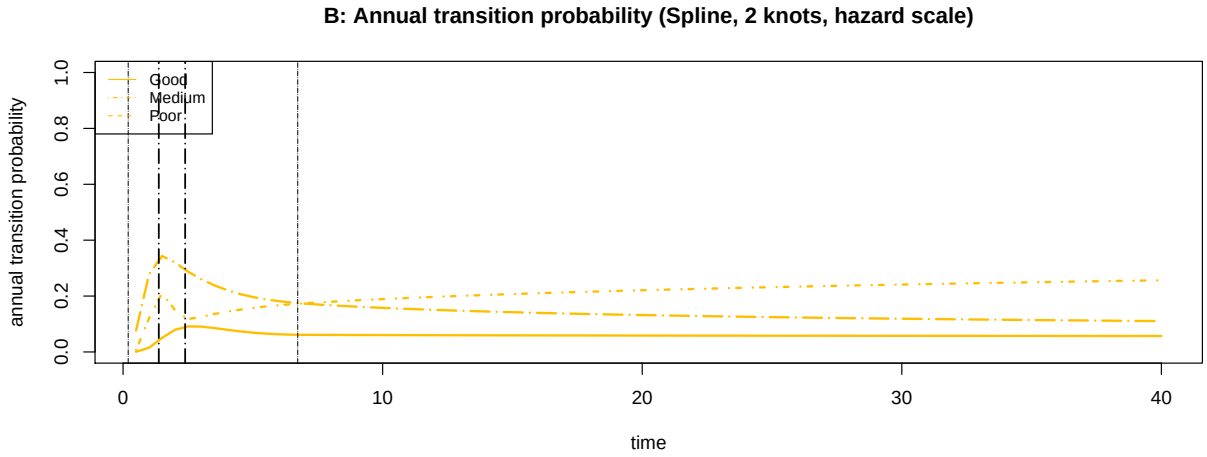


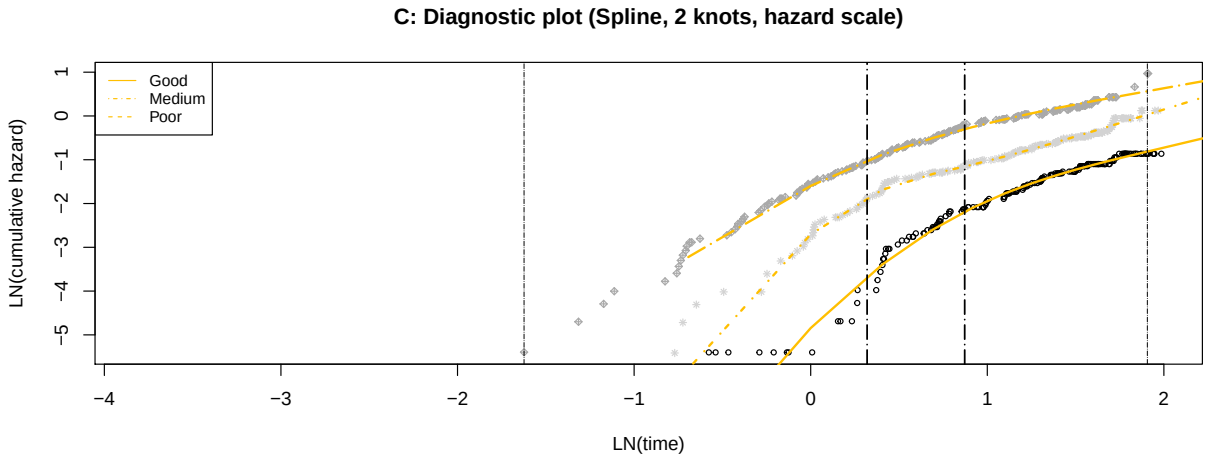




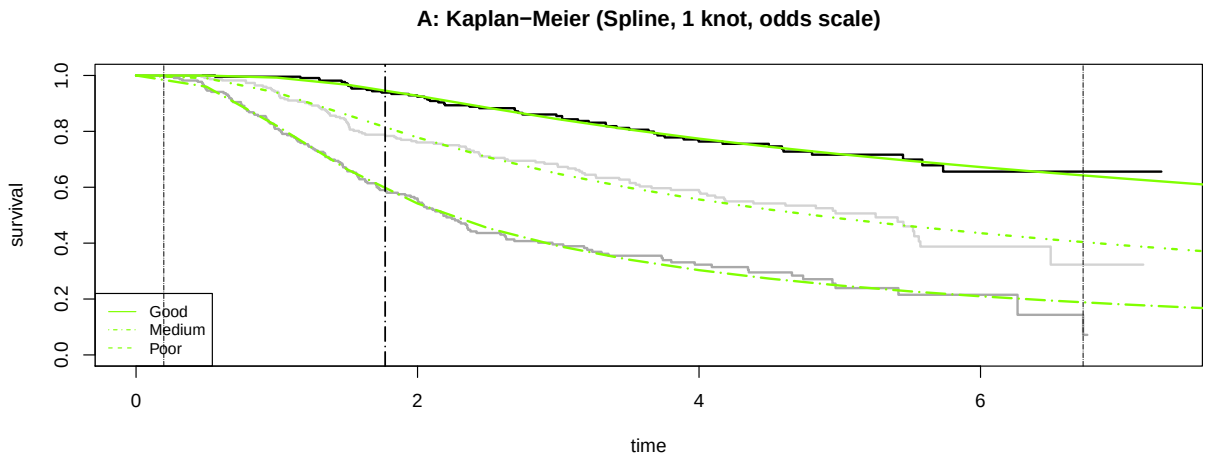
Spline hazard 2 knots

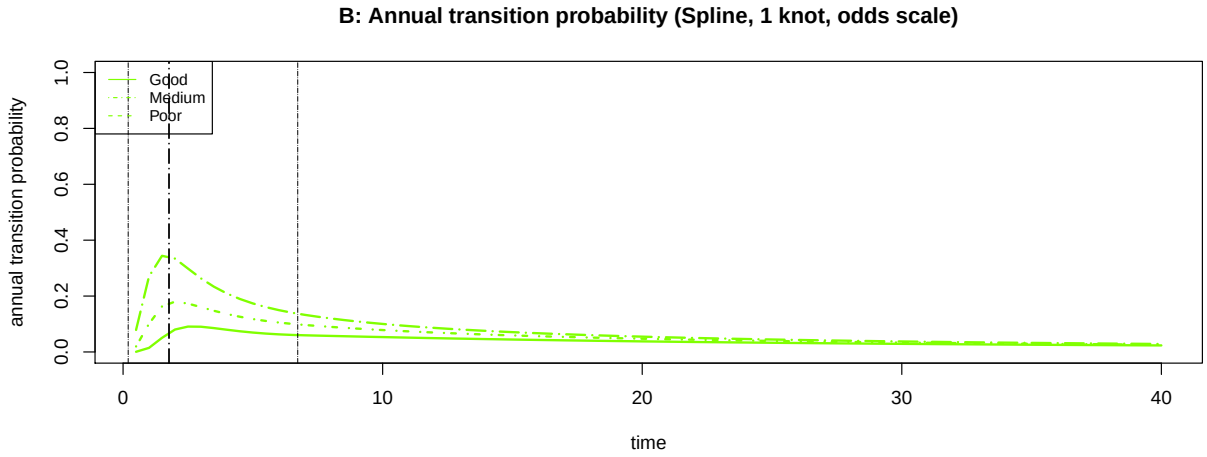


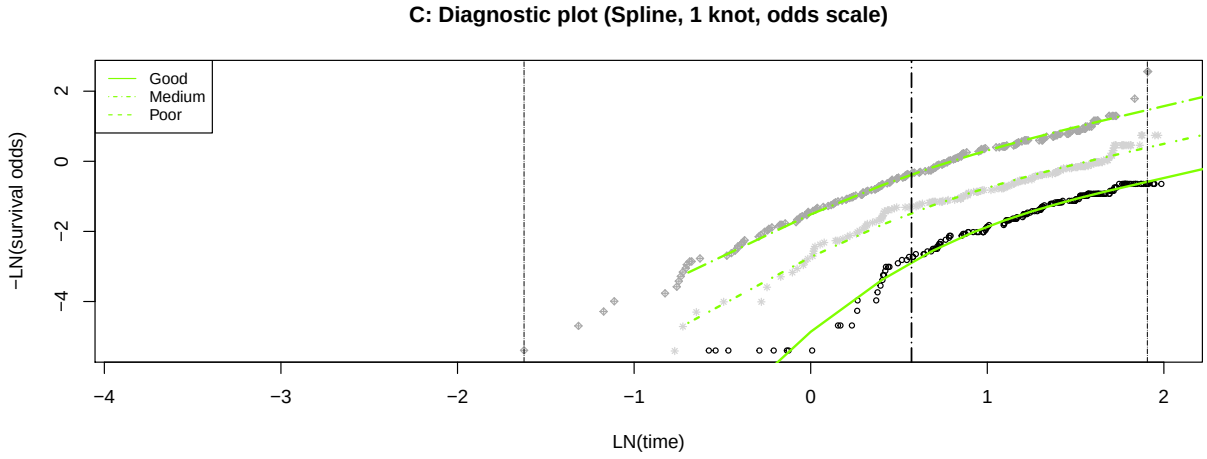




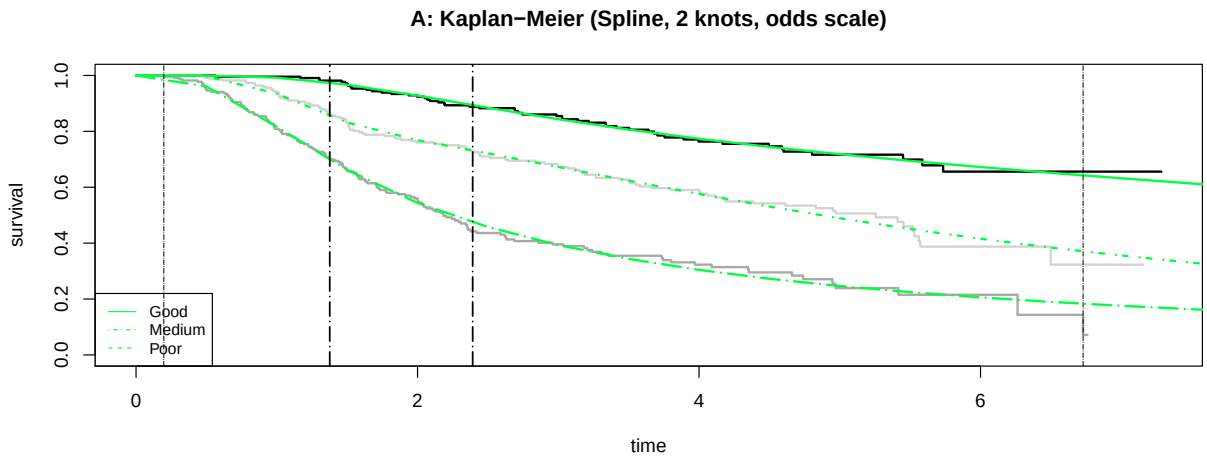
Spline odds 1 knot

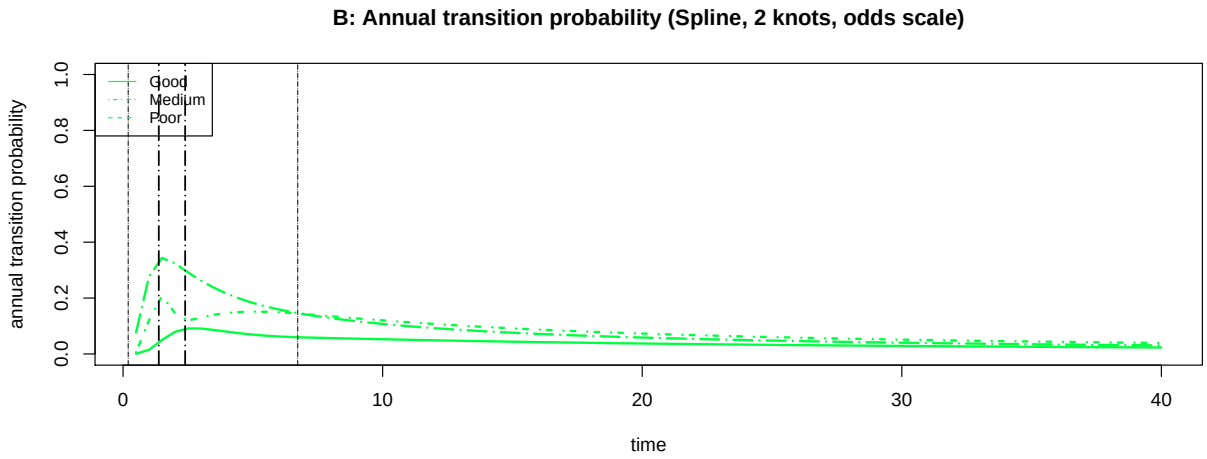


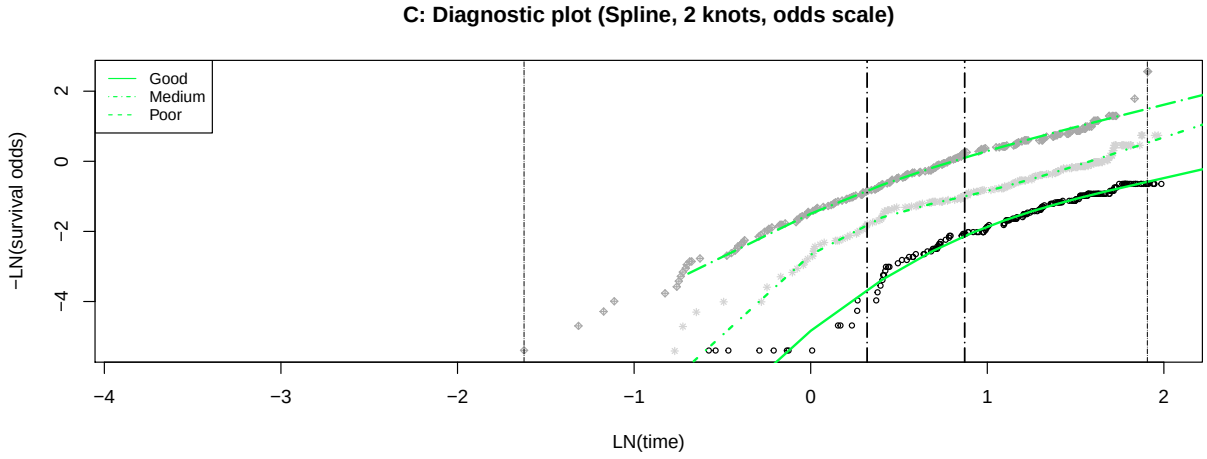




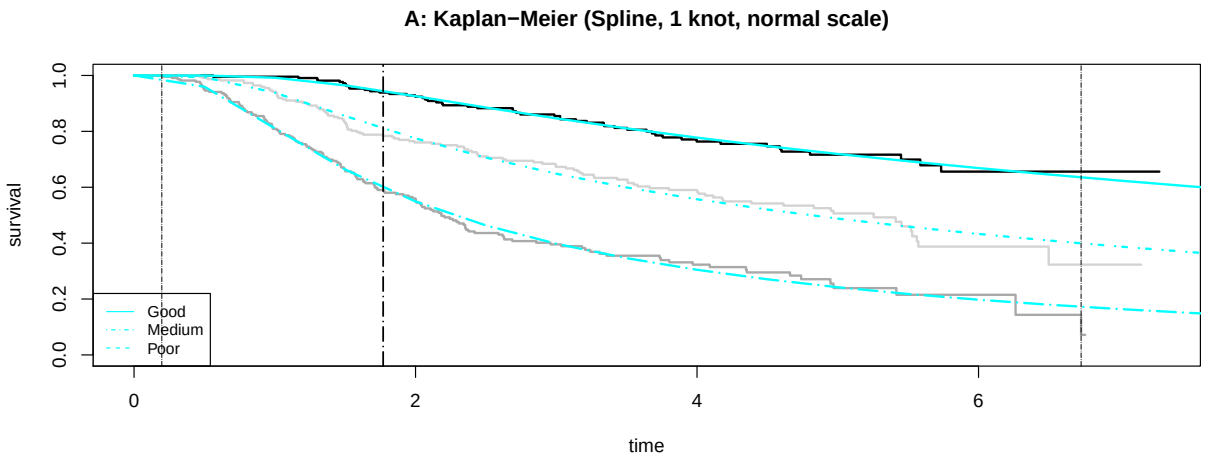
Spline odds 2 knots

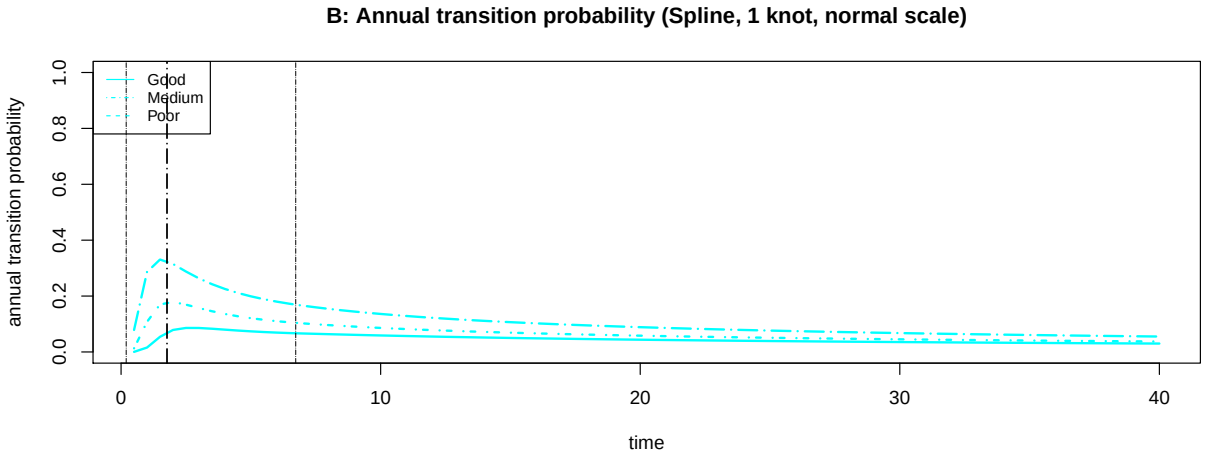


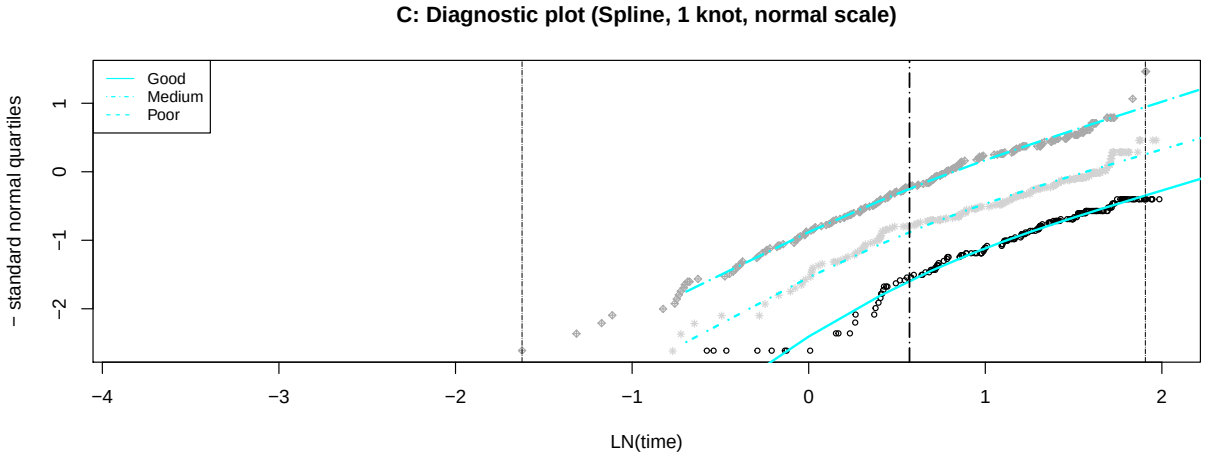




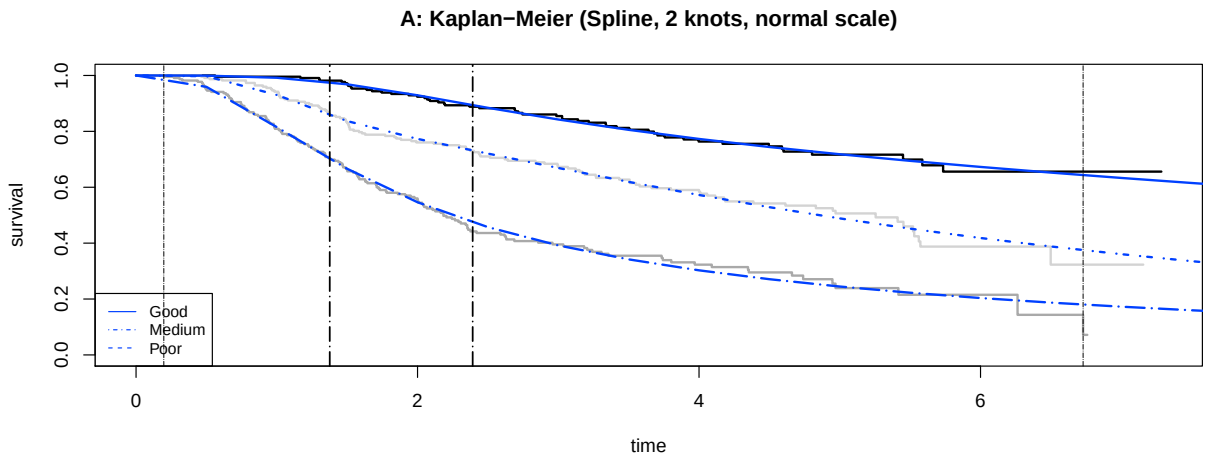
Spline normal 1 knot

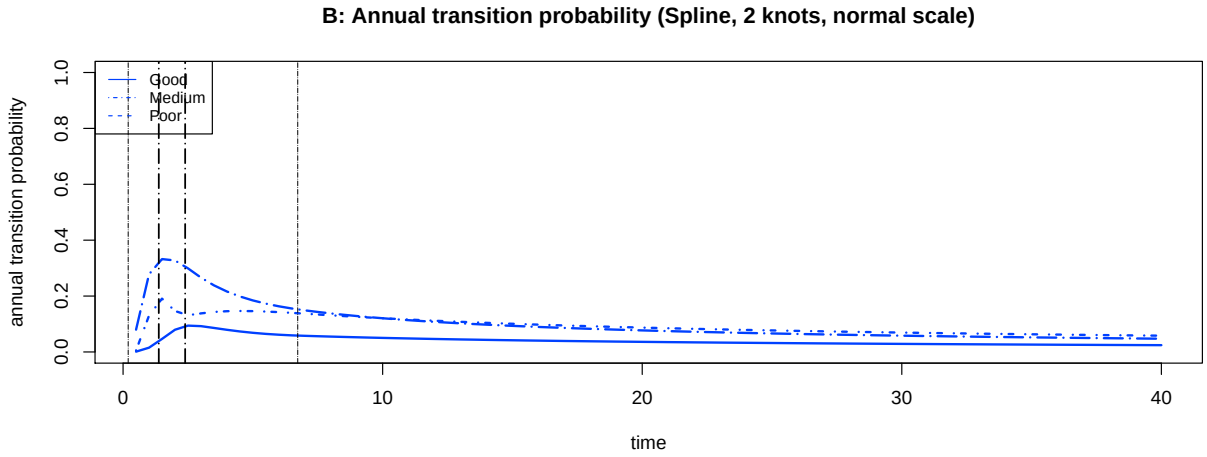


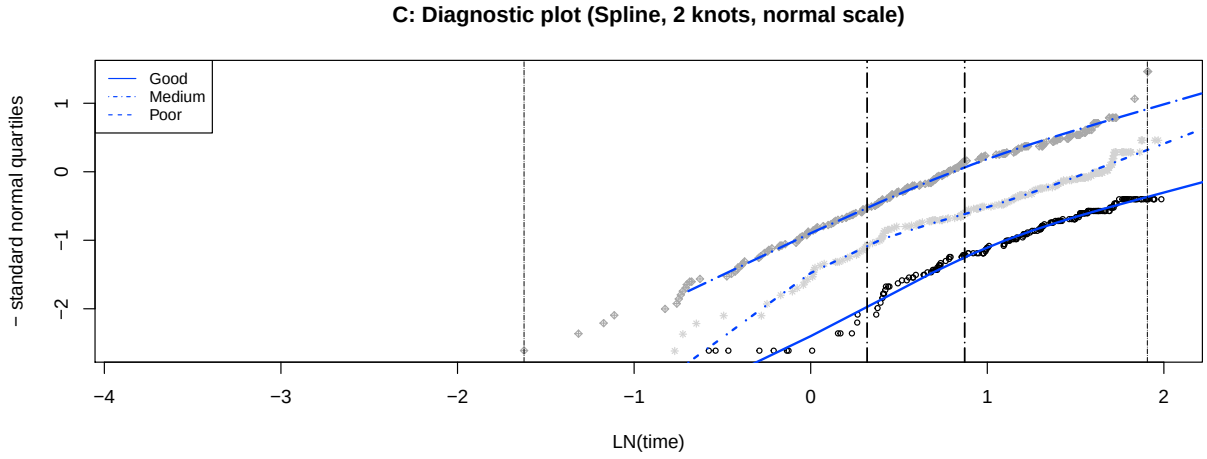




Spline normal 2 knots



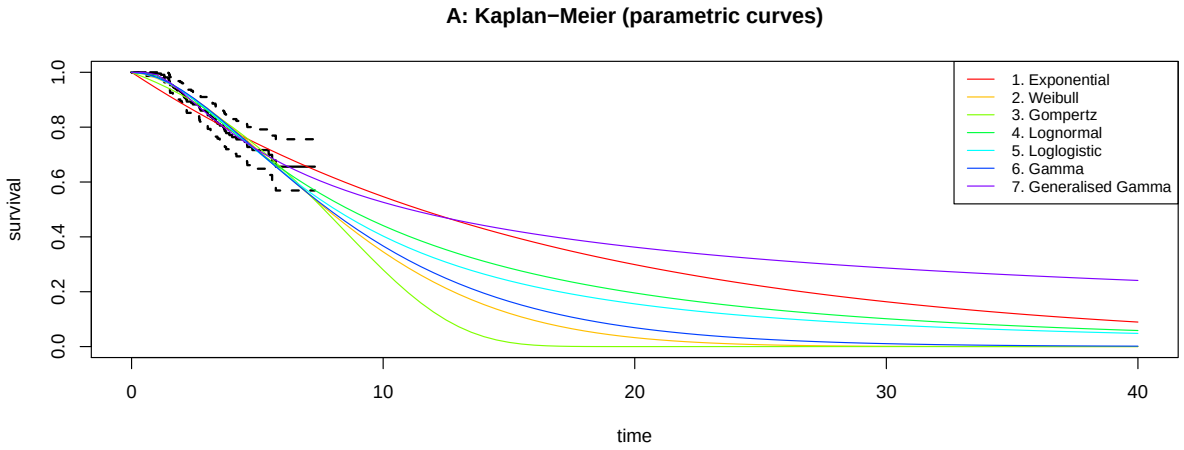


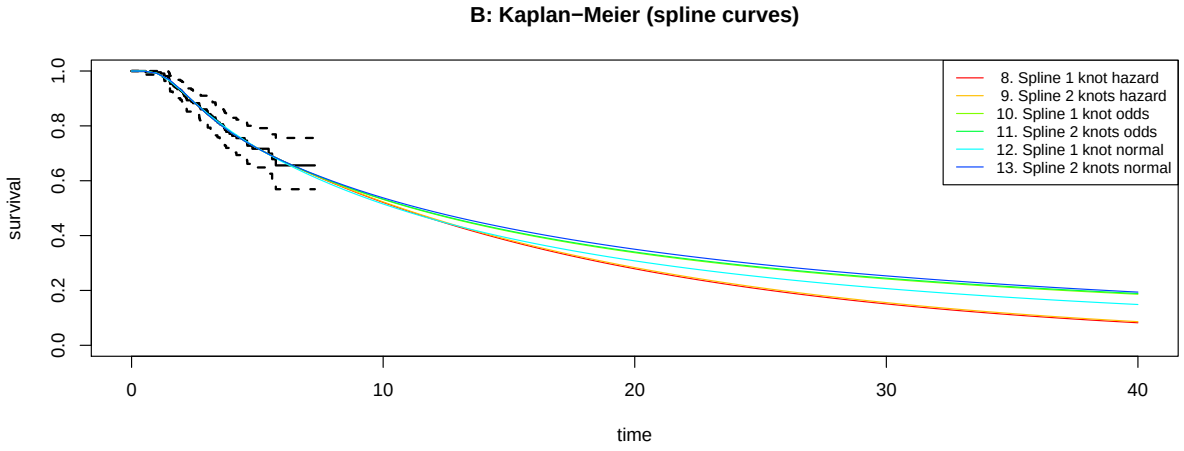


Validity of long-term extrapolation?

What model(s) is/are more appropriate for long-term extrapolation? Are/is the selected model(s) plausible in comparison with general population mortality?

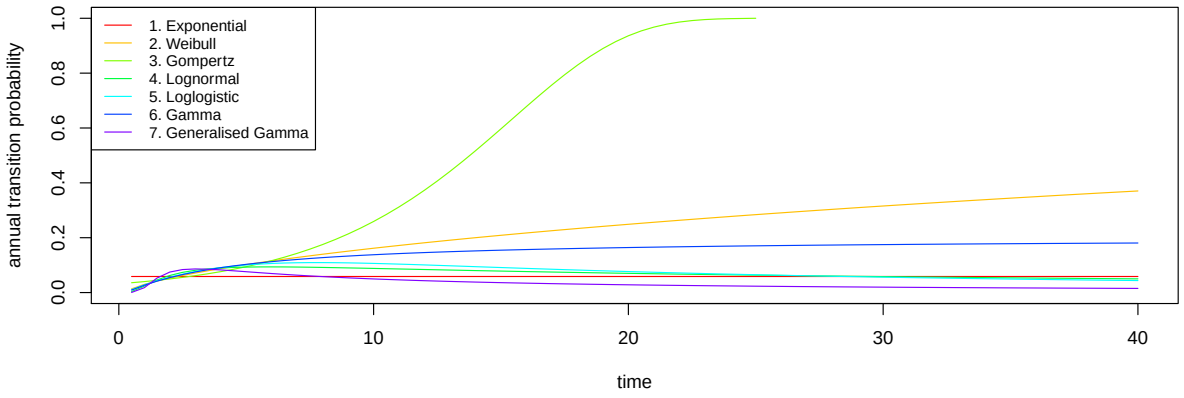
Group Good



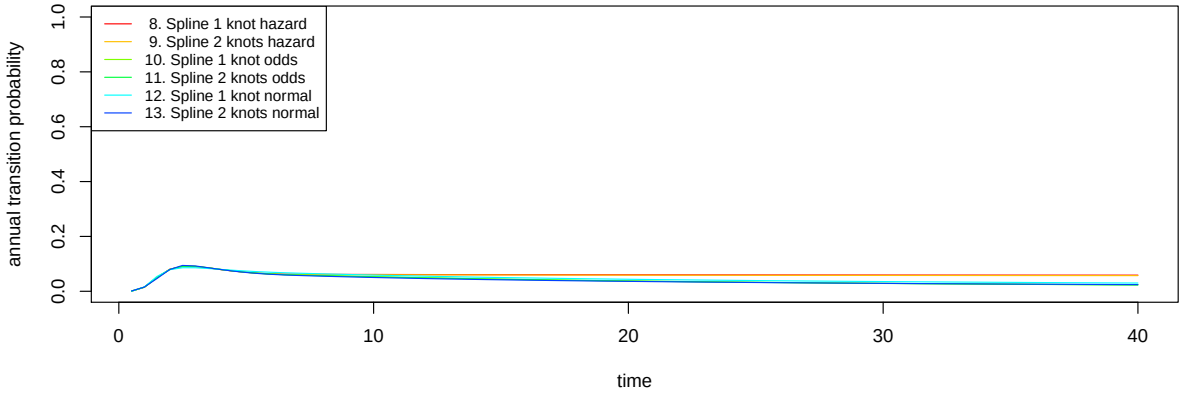


	T= 0	T= 1	T= 2	T= 3	T= 4	T= 5	T= 10	T= 15	T= 20	T= 25	T= 30	T= 35
1. Exponential	1	0.941	0.886	0.834	0.785	0.739	0.547	0.404	0.299	0.221	0.163	0.121
2. Weibull	1	0.978	0.932	0.870	0.797	0.719	0.345	0.122	0.033	0.007	0.001	0.000
3. Gompertz	1	0.962	0.917	0.863	0.801	0.729	0.280	0.015	0.000	0.000	0.000	0.000
4. Lognormal	1	0.986	0.933	0.861	0.785	0.713	0.441	0.287	0.196	0.139	0.102	0.076
5. Loglogistic	1	0.980	0.932	0.865	0.789	0.712	0.403	0.240	0.156	0.108	0.080	0.061
6. Gamma	1	0.982	0.935	0.869	0.793	0.714	0.367	0.165	0.069	0.027	0.011	0.004
7. Generalised Gamma	1	0.991	0.928	0.849	0.778	0.717	0.526	0.425	0.362	0.319	0.286	0.261
8. Spline 1 knot hazard	1	0.992	0.927	0.843	0.774	0.719	0.521	0.381	0.279	0.205	0.151	0.111
9. Spline 2 knots hazard	1	0.992	0.928	0.843	0.774	0.719	0.523	0.384	0.283	0.210	0.156	0.116
10. Spline 1 knot odds	1	0.992	0.927	0.843	0.774	0.718	0.532	0.415	0.338	0.283	0.242	0.211
11. Spline 2 knots odds	1	0.992	0.928	0.843	0.774	0.718	0.533	0.418	0.340	0.285	0.245	0.213
12. Spline 1 knot normal	1	0.992	0.926	0.847	0.778	0.719	0.515	0.391	0.308	0.250	0.207	0.174
13. Spline 2 knots normal	1	0.992	0.929	0.842	0.773	0.718	0.538	0.426	0.350	0.295	0.253	0.220

C: Annual transition probability (parametric curves)

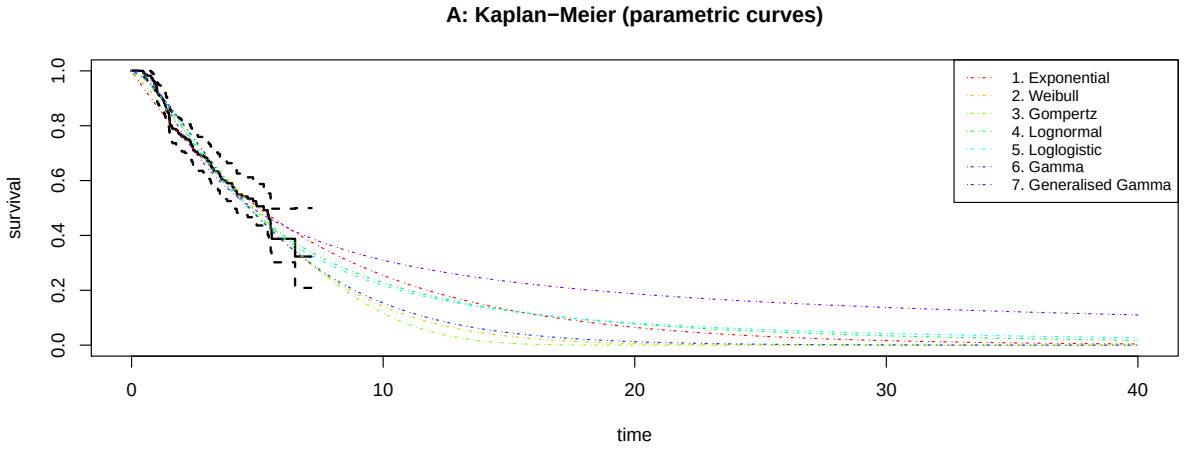


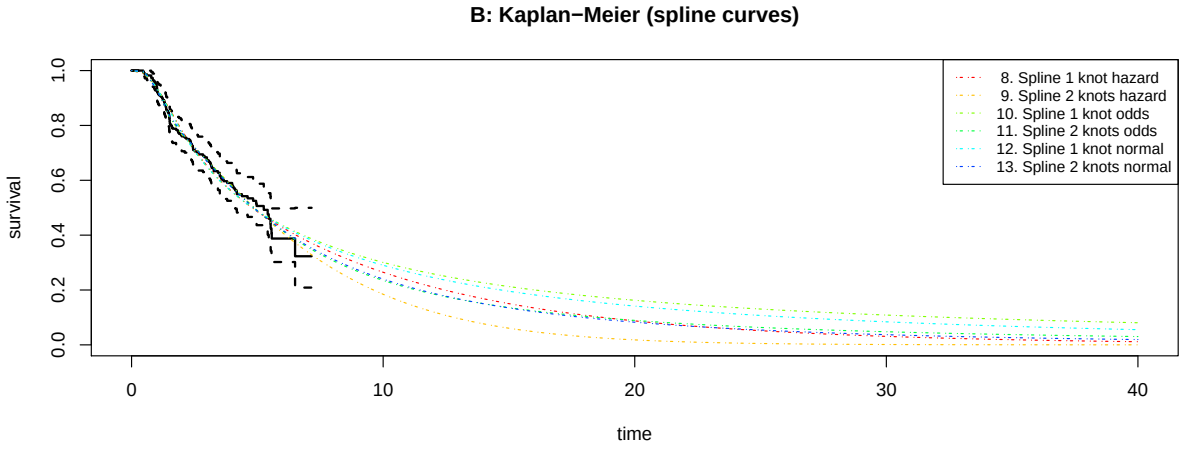
D: Annual transition probability (spline curves)



	Min	Q1	Median	Q3	Max
1. Exponential	0.0585969	0.0585969	0.0585969	0.0585969	0.0585969
2. Weibull	0.0134926	0.1641610	0.2507474	0.3170860	0.3704265
3. Gompertz	0.0358674	0.1289836	0.4243279	0.8897705	1.0000000
4. Lognormal	0.0035242	0.0564742	0.0669435	0.0816466	0.0935926
5. Loglogistic	0.0108361	0.0535545	0.0698593	0.0936004	0.1092076
6. Gamma	0.0091337	0.1390115	0.1644832	0.1750177	0.1806585
7. Generalised Gamma	0.0003592	0.0189735	0.0268357	0.0454799	0.0860838
8. Spline 1 knot hazard	0.0006045	0.0592047	0.0598816	0.0610069	0.0907018
9. Spline 2 knots hazard	0.0006430	0.0576382	0.0585136	0.0599758	0.0911975
10. Spline 1 knot odds	0.0006235	0.0281280	0.0364731	0.0503972	0.0907451
11. Spline 2 knots odds	0.0006730	0.0277991	0.0360401	0.0499037	0.0912259
12. Spline 1 knot normal	0.0003052	0.0345981	0.0424906	0.0555438	0.0858716
13. Spline 2 knots normal	0.0011199	0.0281489	0.0349746	0.0469783	0.0942191

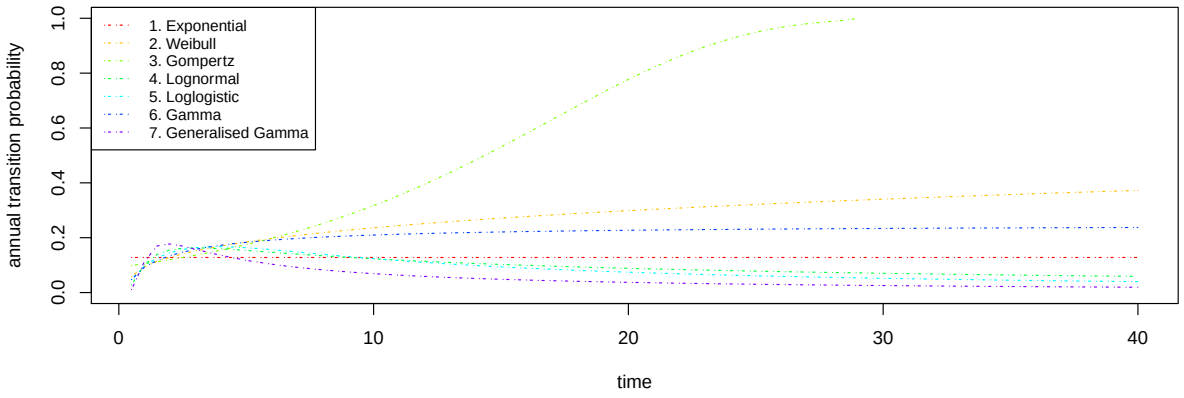
Group Medium



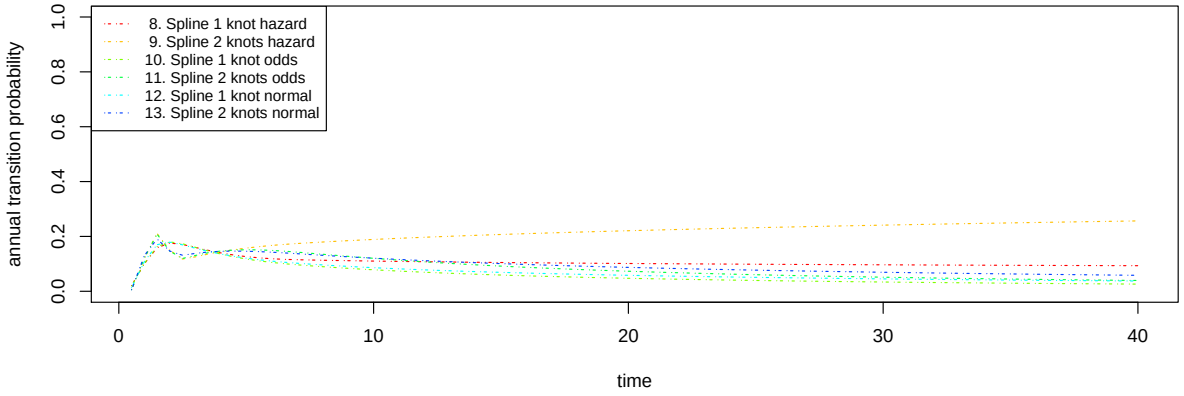


	T= 0	T= 1	T= 2	T= 3	T= 4	T= 5	T= 10	T= 15	T= 20	T= 25	T= 30	T= 35
1. Exponential	1	0.872	0.761	0.663	0.578	0.505	0.255	0.128	0.065	0.033	0.016	0.008
2. Weibull	1	0.923	0.811	0.693	0.578	0.474	0.141	0.032	0.006	0.001	0.000	0.000
3. Gompertz	1	0.898	0.794	0.689	0.586	0.486	0.117	0.007	0.000	0.000	0.000	0.000
4. Lognormal	1	0.935	0.797	0.668	0.560	0.473	0.228	0.126	0.077	0.050	0.034	0.024
5. Loglogistic	1	0.927	0.801	0.673	0.561	0.468	0.218	0.124	0.081	0.057	0.043	0.034
6. Gamma	1	0.930	0.813	0.689	0.572	0.469	0.154	0.045	0.013	0.003	0.001	0.000
7. Generalised Gamma	1	0.937	0.774	0.648	0.556	0.488	0.310	0.232	0.187	0.158	0.138	0.122
8. Spline 1 knot hazard	1	0.939	0.782	0.652	0.558	0.486	0.265	0.150	0.087	0.052	0.031	0.019
9. Spline 2 knots hazard	1	0.935	0.766	0.673	0.579	0.490	0.184	0.061	0.018	0.005	0.001	0.000
10. Spline 1 knot odds	1	0.939	0.778	0.648	0.556	0.489	0.301	0.213	0.162	0.131	0.109	0.093
11. Spline 2 knots odds	1	0.935	0.769	0.673	0.576	0.489	0.235	0.136	0.089	0.063	0.048	0.037
12. Spline 1 knot normal	1	0.938	0.775	0.648	0.557	0.488	0.290	0.195	0.141	0.107	0.084	0.067
13. Spline 2 knots normal	1	0.930	0.773	0.669	0.572	0.489	0.240	0.135	0.083	0.054	0.037	0.026

C: Annual transition probability (parametric curves)

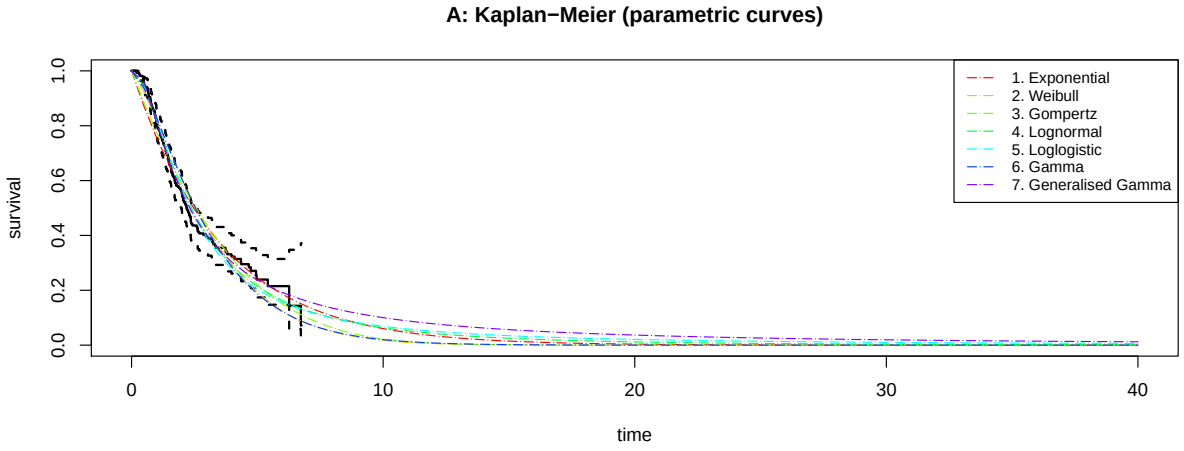


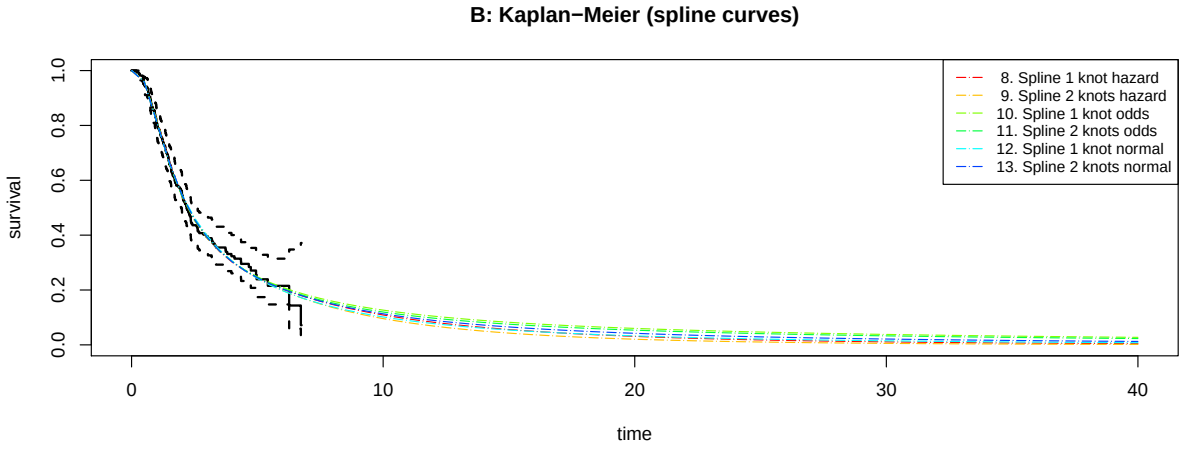
D: Annual transition probability (spline curves)



	Min	Q1	Median	Q3	Max
1. Exponential	0.1278820	0.1278820	0.1278820	0.1278820	0.1278820
2. Weibull	0.0591011	0.2381968	0.2998605	0.3413129	0.3724339
3. Gompertz	0.0986811	0.2373335	0.5186913	0.8609606	1.0000000
4. Lognormal	0.0282952	0.0692226	0.0866936	0.1171810	0.1629587
5. Loglogistic	0.0398205	0.0508351	0.0719824	0.1148545	0.1671681
6. Gamma	0.0480016	0.2105085	0.2273394	0.2338781	0.2372976
7. Generalised Gamma	0.0109341	0.0249143	0.0360207	0.0648290	0.1772175
8. Spline 1 knot hazard	0.0207293	0.0962139	0.1005759	0.1085803	0.1758852
9. Spline 2 knots hazard	0.0061802	0.1921445	0.2213455	0.2415959	0.2565416
10. Spline 1 knot odds	0.0196172	0.0330411	0.0459973	0.0747733	0.1799958
11. Spline 2 knots odds	0.0057632	0.0502183	0.0708612	0.1151671	0.2083176
12. Spline 1 knot normal	0.0128862	0.0444913	0.0569747	0.0828185	0.1788613
13. Spline 2 knots normal	0.0053472	0.0683352	0.0854055	0.1171708	0.1907920

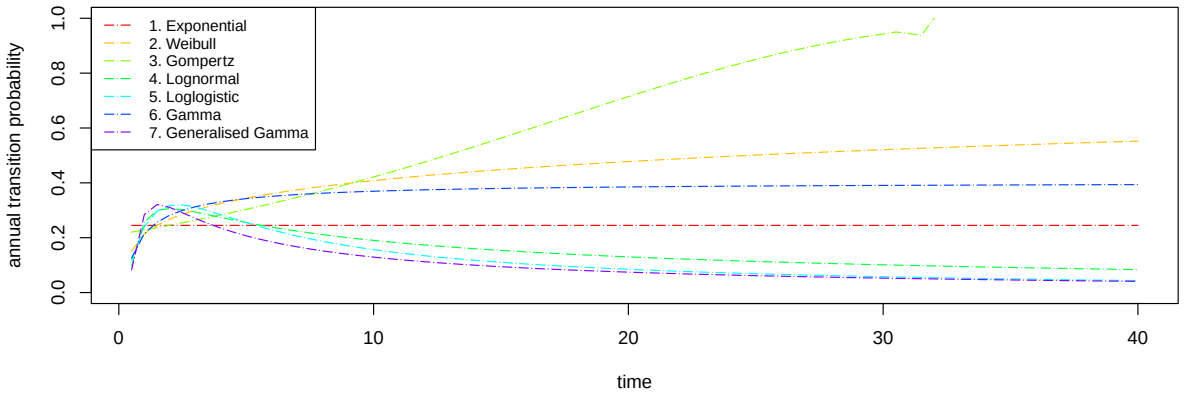
Group Poor



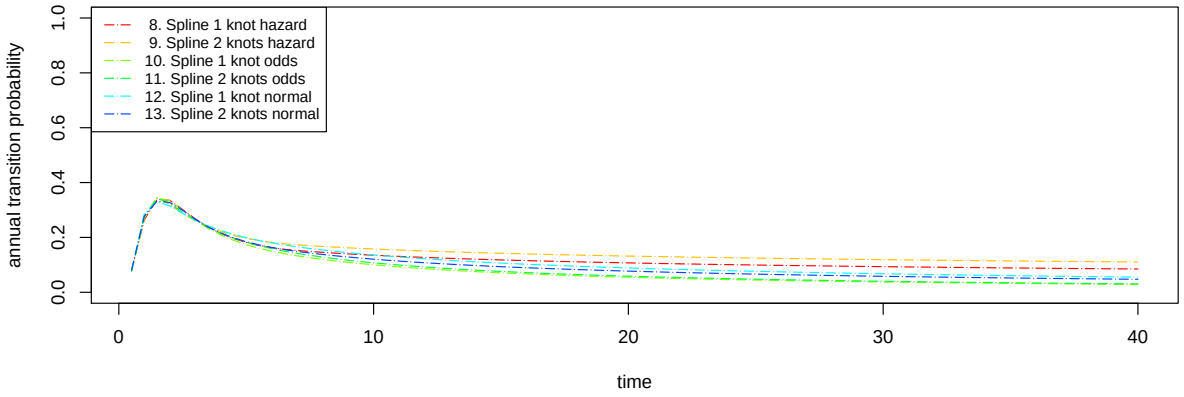


	T= 0	T= 1	T= 2	T= 3	T= 4	T= 5	T= 10	T= 15	T= 20	T= 25	T= 30	T= 35
1. Exponential	1	0.755	0.570	0.430	0.325	0.245	0.060	0.015	0.004	0.001	0.000	0.000
2. Weibull	1	0.817	0.608	0.430	0.292	0.193	0.017	0.001	0.000	0.000	0.000	0.000
3. Gompertz	1	0.776	0.588	0.436	0.315	0.221	0.022	0.001	0.000	0.000	0.000	0.000
4. Lognormal	1	0.820	0.572	0.401	0.289	0.214	0.063	0.025	0.012	0.006	0.004	0.002
5. Loglogistic	1	0.819	0.568	0.389	0.275	0.203	0.069	0.034	0.021	0.014	0.010	0.008
6. Gamma	1	0.829	0.605	0.420	0.283	0.187	0.020	0.002	0.000	0.000	0.000	0.000
7. Generalised Gamma	1	0.810	0.555	0.399	0.302	0.237	0.100	0.057	0.037	0.026	0.019	0.015
8. Spline 1 knot hazard	1	0.822	0.545	0.390	0.301	0.244	0.109	0.056	0.031	0.018	0.011	0.007
9. Spline 2 knots hazard	1	0.817	0.546	0.396	0.305	0.243	0.096	0.043	0.021	0.010	0.005	0.003
10. Spline 1 knot odds	1	0.820	0.542	0.390	0.303	0.248	0.127	0.082	0.060	0.047	0.038	0.032
11. Spline 2 knots odds	1	0.817	0.544	0.393	0.304	0.246	0.120	0.075	0.054	0.041	0.033	0.027
12. Spline 1 knot normal	1	0.811	0.549	0.398	0.305	0.242	0.102	0.054	0.033	0.021	0.015	0.011
13. Spline 2 knots normal	1	0.815	0.546	0.392	0.303	0.245	0.113	0.065	0.042	0.029	0.021	0.016

C: Annual transition probability (parametric curves)



D: Annual transition probability (spline curves)



	Min	Q1	Median	Q3	Max
1. Exponential	0.2449482	0.2449482	0.2449482	0.2449482	0.2449482
2. Weibull	0.1510049	0.4105396	0.4790497	0.5216154	0.5520052
3. Gompertz	0.2203222	0.3769816	0.6007991	0.8316903	1.0000000
4. Lognormal	0.0836825	0.0995548	0.1272985	0.1834832	0.3065423
5. Loglogistic	0.0437409	0.0573187	0.0838677	0.1475772	0.3193673
6. Gamma	0.1253666	0.3701740	0.3852505	0.3907361	0.3935243
7. Generalised Gamma	0.0407810	0.0522176	0.0736609	0.1223572	0.3209103
8. Spline 1 knot hazard	0.0815213	0.0926812	0.1057981	0.1319033	0.3389077
9. Spline 2 knots hazard	0.0766259	0.1181717	0.1307978	0.1549084	0.3434543
10. Spline 1 knot odds	0.0285342	0.0372365	0.0541059	0.0944228	0.3440970
11. Spline 2 knots odds	0.0305654	0.0399116	0.0580356	0.1012316	0.3435620
12. Spline 1 knot normal	0.0552128	0.0671541	0.0865712	0.1304175	0.3307356
13. Spline 2 knots normal	0.0473655	0.0578940	0.0764795	0.1153902	0.3323350

Session information

```
## R version 4.0.1 (2020-06-06)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 18362)
##
## Matrix products: default
##
## Random number generation:
##  RNG:     Mersenne-Twister
##  Normal:  Inversion
##  Sample:  Rejection
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] kableExtra_1.1.0   knitr_1.28         summarytools_0.9.6 data.table_1.12.8
##  [5] survminer_0.4.7    ggpubr_0.3.0       muhaz_1.2.6.1      flexsurv_1.1.1
##  [9] rms_6.0-0          SparseM_1.78       Hmisc_4.4-0        ggplot2_3.3.2
## [13] Formula_1.2-3      survival_3.2-3     lattice_0.20-41
##
## loaded via a namespace (and not attached):
##   [1] TH.data_1.0-10      colorspace_1.4-1    ggsignif_0.6.0
##   [4] pryr_0.1.4          ellipsis_0.3.1      rio_0.5.16
##   [7] htmlTable_1.13.3    base64enc_0.1-3     rstudioapi_0.11
##  [10] farver_2.0.3        MatrixModels_0.4-1  mvtnorm_1.1-1
##  [13] lubridate_1.7.9     xml2_1.3.2          codetools_0.2-16
##  [16] splines_4.0.1       broom_0.5.6         km.ci_0.5-2
##  [19] cluster_2.1.0       png_0.1-7           readr_1.3.1
##  [22] compiler_4.0.1      httr_1.4.1          backports_1.1.7
##  [25] Matrix_1.2-18       acepack_1.4.1       htmltools_0.4.0
##  [28] quantreg_5.55       tools_4.0.1         gtable_0.3.0
##  [31] glue_1.4.1          dplyr_1.0.0         Rcpp_1.0.4.6
##  [34] carData_3.0-4       cellranger_1.1.0    vctrs_0.3.0
##  [37] nlme_3.1-148        xfun_0.14           stringr_1.4.0
##  [40] openxlsx_4.1.5      rvest_0.3.5         lifecycle_0.2.0
##  [43] rstatix_0.5.0       polspline_1.1.19    MASS_7.3-51.6
##  [46] zoo_1.8-8           scales_1.1.1        hms_0.5.3
##  [49] sandwich_2.5-1      RColorBrewer_1.1-2  yaml_2.2.1
##  [52] curl_4.3            gridExtra_2.3       KMsurv_0.1-5
##  [55] pander_0.6.3        rpart_4.1-15        latticeExtra_0.6-29
##  [58] stringi_1.4.6       checkmate_2.0.0     zip_2.0.4
##  [61] rlang_0.4.6         pkgconfig_2.0.3     matrixStats_0.56.0
##  [64] evaluate_0.14       purrr_0.3.4         rapportools_1.0
##  [67] htmlwidgets_1.5.1   labeling_0.3        tidyselect_1.1.0
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##  [73] R6_2.4.1            magick_2.3          generics_0.0.2
##  [76] multcomp_1.4-13     pillar_1.4.4        haven_2.3.1
##  [79] foreign_0.8-80      withr_2.2.0         abind_1.4-5
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##  [88] rmarkdown_2.2       jpeg_0.1-8.1        grid_4.0.1
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##  [97] munsell_0.5.0       viridisLite_0.3.0   tcltk_4.0.1
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