

6.4 Failure times data

This dataset gives the failure times of the air conditional system of an airplane which was studied by [1]. This dataset consists of 30 observations. To access the data, please follow the instructions in the “Declarations” section.

Table 1 shows the estimated parameters and the goodness-of-fit statistics. We can conclude that the Type-2 Gumbel Weibull-exponential distribution has a better performance than any other distributions since it has the smallest values for all goodness-of-fit statistics and the highest p-value in the K-S test. The K-M survival curve, the theoretical and ECDF, and TTT scaled are displayed in Fig. 2. The convergence of the fitted empirical and theoretical plots suggests that our model accurately represents the given data. Additionally, the TTT scaled plot clearly suggests that the model is suitable for a monotonic hazard rate structure.

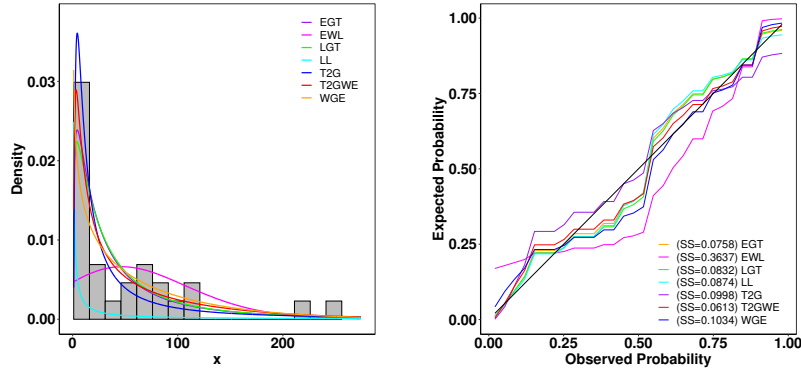


Figure 1: left) Fitted density superposed on the histogram and observed probability for the Failure times data. right) Expected probability plots for the Failure times data.

Table 1: MLEs and Goodness-of-Fit Statistics for Failure times Data

Model	Estimates (SE)				Statistics								
	α	β	γ	-	$-2 \log L$	AIC	CAIC	BIC	HQIC	W*	A*	K-S	p-value
T2GWE	0.7459 (0.3619)	0.5245 (0.1129)	0.0241 (0.0117)	-	302.0708	308.0708	308.9938	312.2743	309.4155	0.0659	0.4019	0.1159	0.815
EGT	α 35.7830 (75.1284)	ϕ 0.2196 (0.1125)	θ 8.3451 (1.7363)	-	303.058	309.058	309.9811	313.2616	310.4028	0.0765	0.4200	0.1145	0.8265
WGE	α 3.0211 (1.5390)	θ 0.7532 (0.1108)	γ 0.0035 (0.0016)	-	304.683	310.6831	311.6061	314.8867	312.0278	0.1136	0.6867	0.1594	0.4309
LGT	α 9.2323 (13.8921)	β 0.0208 (0.0442)	θ 10.5484 (2.0673)	k 0.1442 (0.0613)	303.1716	311.1715	312.7715	316.7763	312.9645	0.0827	0.4432	0.1261	0.7265
T2G	α 6.9657 (1.8021)	ν 0.7232 (0.0927)	-	-	310.4426	314.4426	314.887	317.245	315.3391	0.1046	0.7601	0.1590	0.4338
EWL	α 4.4909 (0.9253)	β 0.0950 (0.4669)	λ 0.0365 (0.1793)	θ 159.8407 (150.2679)	333.844	341.8439	343.4439	347.4487	343.637	0.3684	2.3318	0.2436	0.0569
LL	α 29.4019 (7.3002)	β 1.2992 (0.1936)	-	-	304.5894	308.5895	309.0339	311.3918	309.486	0.0921	0.4966	0.1213	0.7696

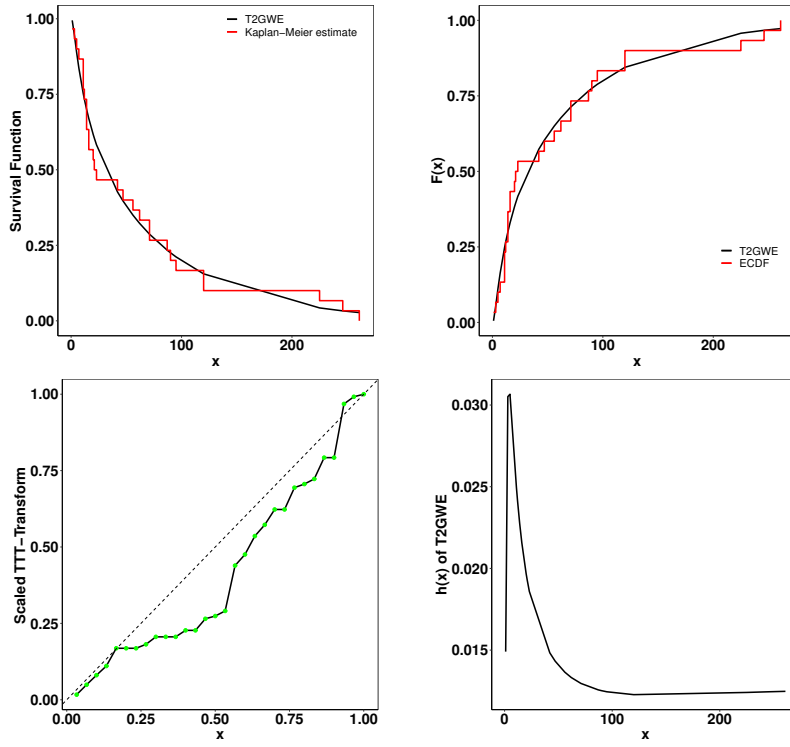


Figure 2: Fitted K-M survival curve, theoretical and ECDF functions, the TTT statistics, and the hrf for the Failure times data.

References

- [1] R. D. Gupta and D. Kundu, “Exponentiated exponential family: an alternative to gamma and weibull distributions,” *Biometrical Journal: Journal of Mathematical Methods in Biosciences*, vol. 43, no. 1, pp. 117–130, 2001.