

A revisit of robust inference in the Cox model

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"Robust" inference for the Cox model commonly refers to the use of the Lin and Wei (1989) sandwich variance estimator (LW) in conjunction with the partial likelihood estimator. It usually means that under certain misspecifications of the Cox model, e.g. covariate omission or slight deviations from the proportional hazards assumption, the test size is better preserved. In modern robustness theory a testing procedure must be stable in a neighbourhood of the assumed model both under the null and alternative to be declared robust. This property is usually required to deal with outliers, e.g. abnormal long-term survivors, a common and particularly harmful type of contamination in that setting. We examine the properties of the LW approach under that paradigm and draw a link with a robust estimator (RE) and related Wald test that emerged over the years from the work of Bednarski and colleagues - see for instance Bednarski (1999). We show that, at least literally, the asymptotic variance for RE is a generalisation of the LW formula and compare it to the LW approach in the exact same setting. We also show that the results are contrasted in terms of robust testing in the more modern sense of the word. Only the Wald test based on RE can maintain its level if the neighbourhood shrinks as the sample size increases. Our work provides some new insight into the nature of robust inference in the Cox model, and the types of contamination the proposed procedures can and cannot deal with.

References

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- [2] Lin DY, Wei LJ (1989) The robust inference for the Cox proportional hazard model. *Journal of the American Statistical Association*, 84:1074-1078