Approximate Inferences Using the Sandwich Variance Estimator in Generalized Estimating Equations

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February 29, 2000

Summary

The generalized estimating equation (GEE) approach is widely used in regression analyses with correlated response data. An attractive point of GEE is that the resulting regression coefficient estimator is consistent and asymptotically normal if the regression function is correctly specified. Furthermore, the variance of the regression coefficient estimator can be consistently estimated by the so-called sandwich covariance estimator. However, it has been noted in the literature that for small samples the sandwich estimator is not efficient and using it in the asymptotic Wald chi-square test can lead to inflated Type I errors. Here we propose using an approximate $t$ or $F$ test that takes account of the variability of the sandwich estimator. Through a simulation study, it is found that the proposed new tests have Type I errors closer to the nominal levels than does the Wald chi-square test.

Key words: F-test; GEE; Robust variance estimator; $t$-test; Wald chi-square test; $z$-test.