RECENT ADVANCES IN EMPIRICAL LIKELIHOOD APPROACHES UNDER COMPLEX SAMPLING

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The approach proposed by Berger and De La Riva Torres (2016) gives design-consistent estimators of parameters which are solutions of estimating equations (e.g. averages, totals, quantiles, correlation, (non)linear regression parameters). It can be used to construct confidence intervals without variance estimates. These confidence intervals are not based on the normality of the point estimator. Linearisation (e.g. Binder, 1983; Deville, 1999), re-sampling (jackknife or bootstrap) (e.g. Rao *et al.*, 1992) or joint-inclusion probabilities are not necessary, even when the parameter of interest is not linear. Berger and De La Riva Torres's (2016) approach gives consistent confidence intervals even when the sampling distribution is skewed (e.g. with domains or with outlying values), or when linearisation gives biased variance estimates. The proposed approach can be used to estimate generalised regression parameters (e.g. logistic regression) and to test if they are significant, under a design-based approach (Oguz-Alper and Berger, 2014, 2015). The population level information is naturally taken into account, without the need of a calibration distance function (e.g. Deville and Särndal, 1992). The empirical likelihood approach is a design-based approach. A super-population model is not necessary. The empirical likelihood approach proposed by Berger and De La Riva Torres (2016) is different from the pseudoempirical likelihood approach (Chen and Sitter, 1999). The empirical likelihood approach of Berger and De La Riva Torres (2016) will be presented. Extensions to non-response (Berger, 2015) and nuisance parameters will be also covered (Oguz-Alper and Berger, 2014, 2015).

References

Berger, Y. G. (2015) Empirical likelihood confidence intervals in the presence of unit non-response. *60th session of International Statistical Institute, Rio de Janeiro, Brasil*, 3pp.

Berger, Y. G. and De La Riva Torres, O. (2016) An empirical likelihood approach for inference under complex sampling design. *To appear in the Journal of the Royal Statistical Society, Series B*, 22pp. URL `http://dx.doi.org/10.1111/rssb.12115`.

Binder, D. A. (1983) On the variance of asymptotically normal estimators from complex surveys. *International Statistical Review*, **51**, 279–292.

Chen, J. and Sitter, R. R. (1999) A pseudo empirical likelihood approach to the effective use of auxiliary information in complex surveys. *Statistica Sinica*, **9**, 385–406.

Deville, J. C. (1999) Variance estimation for complex statistics and estimators: linearization and residual techniques. *Survey Methodology*, **25**, 193–203.

Deville, J. C. and Särndal, C. E. (1992) Calibration estimators in survey sampling. *Journal of the American Statistical Association*, **87**, 376–382.

Oguz-Alper, M. and Berger, Y. G. (2014) Empirical likelihood confidence intervals and significance test for regression parameters under complex sampling designs. *Proceedings of the Survey Research Method Section of the American Statistical Association, Joint Statistical Meeting, Boston*, 10pp.

Oguz-Alper, M. and Berger, Y. G. (2015) *Profile empirical likelihood in the presence of nuisance parameters and population level information under unequal probability sampling.* Southampton: Southampton Statistical Sciences Research Institute `http://eprints.soton.ac.uk/376699`.

Rao, J. N. K., Wu, C. F. J. and Yue, K. (1992) Some recent work on resampling methods for complex surveys. *Survey Methodology*, **18**, 209–217.