

Comment on Article by Berger, Bernardo, and Sun*

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Congratulations to the authors on this important paper that leads the way in selecting an objective overall prior for estimation. The paper is very enjoyable to read.

The authors provide three possible approaches one could use to find an overall objective prior suitable for use when there is interest in simultaneous estimation of several parameters. They illustrate the approaches in several examples, and give a comprehensive evaluation of the resulting priors. The proposed new approaches are very carefully thought out, and hold much promise for the development of a single overall objective prior in many more models. This is a very interesting paper and is likely to, and hopefully will, spur increased research in this new development to find overall objective priors for estimation.

Selection of good objective priors is very important in the practice of Bayesian analysis since, often, there is little or no prior information available for at least some of the parameters, especially in complex models with large number of parameters. Use of diffuse priors is not always good or optimal. The reference prior approach has been very successful in providing a way to get objective priors for estimation in numerous standard and non-standard models. It was introduced in Bernardo (1979) to derive a non-informative prior for estimation of a scalar parameter. In simple terms, the reference prior is the prior that maximizes, in an asymptotic sense, the missing information in a prior measured by the Kullback–Leibler distance between the prior and the posterior distribution. The approach gave good priors in the one-parameter case, but did not easily extend to multi-parameter cases. A series of influential articles beginning with Berger and Bernardo (1989, 1992), and later by Berger, Bernardo and Sun extended the reference prior approach to multi-parameter problems, and formalized the approach, e.g., see Berger et al. (2009, 2012), Sun and Berger (1998), and Berger and Sun (2008). It is reasonable to say that the reference prior approach is the best formal approach to obtain an objective prior for estimation.

The literature is now filled with reference priors for several standard and non-standard models, ready for use when objective Bayesian estimation is desired. The reference prior approach has often been found to have the virtue of giving good priors when the conventional choices fail, for example, due to the behavior of the likelihood in the tail. One case in point is in spatial modeling, see Berger et al. (2001). How this is achieved seems to be a mystery to me. In this paper too, for the multinomial example using the hierarchical approach, the reference prior for the hyper parameter turned out to be a proper prior to compensate for the slow decay of likelihood in the tail. However, one runs into difficulty in implementing the reference prior approach when there are

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