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Rejoinder

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I would like express my deep thanks to the Editor-in-Chief of *Bayesian Analysis*, Dr. Brad Carlin, for organizing these extensive discussions of my work on the Bayesian generalized method of moments (GMM). I am also grateful to the outstanding discussants: Drs. Ming-Hui Chen and Sungduk Kim, and Dr. Ciprian Crainiceanu for their insightful and stimulating comments on my article. In response to the suggestions from the discussants, I present some related computational issues, and also numerically examine the Bayesian GMM in the context of the least squares estimation and quantile regression. Many distributions are characterized by only the first and second moments, based on which the likelihood can be completely recovered. The Bayesian GMM is a robust, general and widely applicable approach, especially when there is not enough information to derive the likelihood.

1 Computational Issues

In the Bayesian GMM, the posterior distribution of the model parameters is quite complicated, and typically is not log-concave. Thus, I agree with Drs. Chen and Kim that the convergence of the Metropolis algorithm may be slow. In the frequentist GMM (Hansen 1982), $\widehat{\boldsymbol{\beta}}$ is computed via a two-stage iterative procedure by inserting the estimator obtained from the previous step, say $k-1$, into the covariance matrix, such that at the kth step, minimizing

$$Q_n^{(k)}(\boldsymbol{\beta}) = \mathbf{U}_n^T(\boldsymbol{\beta})\boldsymbol{\Sigma}_n^{-1}(\widehat{\boldsymbol{\beta}}^{(k-1)})\mathbf{U}_n(\boldsymbol{\beta})$$

with respect to $\boldsymbol{\beta}$ is much easier. A more efficient Markov chain Monte Carlo (MCMC) algorithm along the line of the two-stage iterative procedure is currently under development.

The Bayesian GMM is based on the moment conditions, instead of the likelihood, which can be applied as long as the moments are correctly specified. However, finding the correct moments is more difficult for longitudinal or clustered data because of the existing correlations, and is particularly challenging when the underlying correlation structure is complicated, as shown in the numerical studies by Drs. Chen and Kim. Although the Bayesian GMM with a working independence model is able to provide valid inferences, it may be less efficient, as in the case of the generalized estimating equation (GEE). Through personal communications with Drs. Chen and Kim, we agree that greater caution is required when selecting the appropriate moments. In some circumstances, the concatenated moments may have redundant information that would cause singularity of the covariance matrix. To resolve this, one can either delete the redundant rows or simply use the Moore-Penrose generalized inverse matrix when the

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