DONALD A. PIERCE[1]

Oregon State University

As I understand Section 5, it provides strong evidence that the χ^2 statistic is a suitable measure of overdispersion only when its approximate effect is to increase $V(\mathbf{x})$ to $(1+c)V(\mathbf{x})$. This is an important result which is helpful in judging the general usefulness of such methodology, which I will make some attempt to do here. From the viewpoint of models for overdispersion that appeal to me, I will question the appropriateness of using χ^2 as a measure of overdispersion in contingency tables when the marginal totals are quite heterogeneous, as in Table 2 of this paper.

The authors are careful to point out that this is being suggested only for a rough preliminary analysis. In view of this, I am probably scrutinizing the method rather severely. My aim is not to be critical of their results, but rather to complement them with a way of thinking about the "roughness" question.

Two-stage models, such as that described near (4.15), are very appealing to me. Since these are only mentioned in the preliminary heuristics, I may be putting more emphasis on such a formulation than the authors intend. However, it is hard for me to get down to what overdispersion really means without explicit models such as this. Further, I believe that they are not necessarily Bayesian in nature, any more than is the ordinary randomized block model. It may be helpful to emphasize briefly the approximate connection between the results of Section 5 and the two-stage models. If overdispersion is thought of as the result of a random perturbation on the mean parameter, as exemplified by the discussion near (4.15), and if its marginal result is to rescale $V(\mathbf{x})$, as noted by (5.23), then the covariance matrix of the perturbation in the mean parameter must also be a multiple of $V(\mathbf{x})$.

For the contingency table case, the implicit assumption in measuring overdispersion by χ^2 is given by (4.15); that $\boldsymbol{\pi}$ is randomly perturbed from $\hat{\boldsymbol{\pi}}$, with covariance matrix Σ. Here Σ is the covariance matrix of the Fisher-Yates distribution of $\mathbf{x}$ given the marginal totals. Consider a case where the marginal totals are as in Table 1 of this comment, which is not intended to be special other than that the totals are quite heterogeneous. The nonparenthetical cell entries are $\hat{\pi}_{ij}$ and the parenthetical ones are the variance elements of Σ.

In my judgement this is a strange enough model for dispersion in $\boldsymbol{\pi}$ to warrant concern. The (1, 2) and (2, 1) elements have the same $\hat{\pi}_{ij}$ but very different variances. The (2, 1) and (2, 2) elements have the same variance but very different $\hat{\pi}_{ij}$. There is, of course, no theoretical reason for a simple model for the coefficient of variation of π, but for a rough and ready model I think that assuming it to be constant would have considerable merit. Unfortunately, this would apparently lead to a more complex analysis.

Another example, which requires a generalization of the analysis of Section 5 which the authors might or might not endorse, is given by a typical binomial

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