



## Missing values of MDIST and CHIPCT

The level-2 residual file contains, among others, the two statistics

- CHIPCT: the expected values of the order statistics for a sample of size  $J$  selected from a population that is distributed  $\chi^2_{(v)}$ , and
- MDIST: If we model  $q$  level-1 coefficients, mdist would be the Mahalanobis distance (*i.e.*, the standardized squared distance of a unit from the center of a  $v$ -dimensional distribution, where  $v$  is the number of random effects per unit). Essentially, MDIST provides a single, summary measure of the distance of a unit's EB estimates,  $\beta_{qj}^*$ , from its “fitted value,”  $\hat{\gamma}_{q0} + \sum \hat{\gamma}_{q0} W_{sj}$ .

In general, MDIST can be set to missing for one of two reasons:

- The first is if the quantity  $(\tau - \sigma^2) \times \text{inv}[C_j]$  (using the notation of chapter 14 in Raudenbush & Bryk, Sage, 2002) is not positive-definite.
- This is nowhere near as likely as the second reason, which is if  $n(j) - r \leq 0$ , where  $n(j)$  is the NJ column, and  $r$  is the number of random effects.

If the MDIST column is missing, the CHIPCT column is necessarily missing. Also note that in the weighted case, a number of things in the level-2 residual file are set to missing: CHIPCT, MDIST, LNTOTVAR, OLSRSVAR, MDSRVAR, and all the OLS residuals.