
**Multivariate generalized linear mixed
models for continuous bounded
outcomes: Analyzing the body fat
percentage data**

Supplementary Material

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Web Appendix A

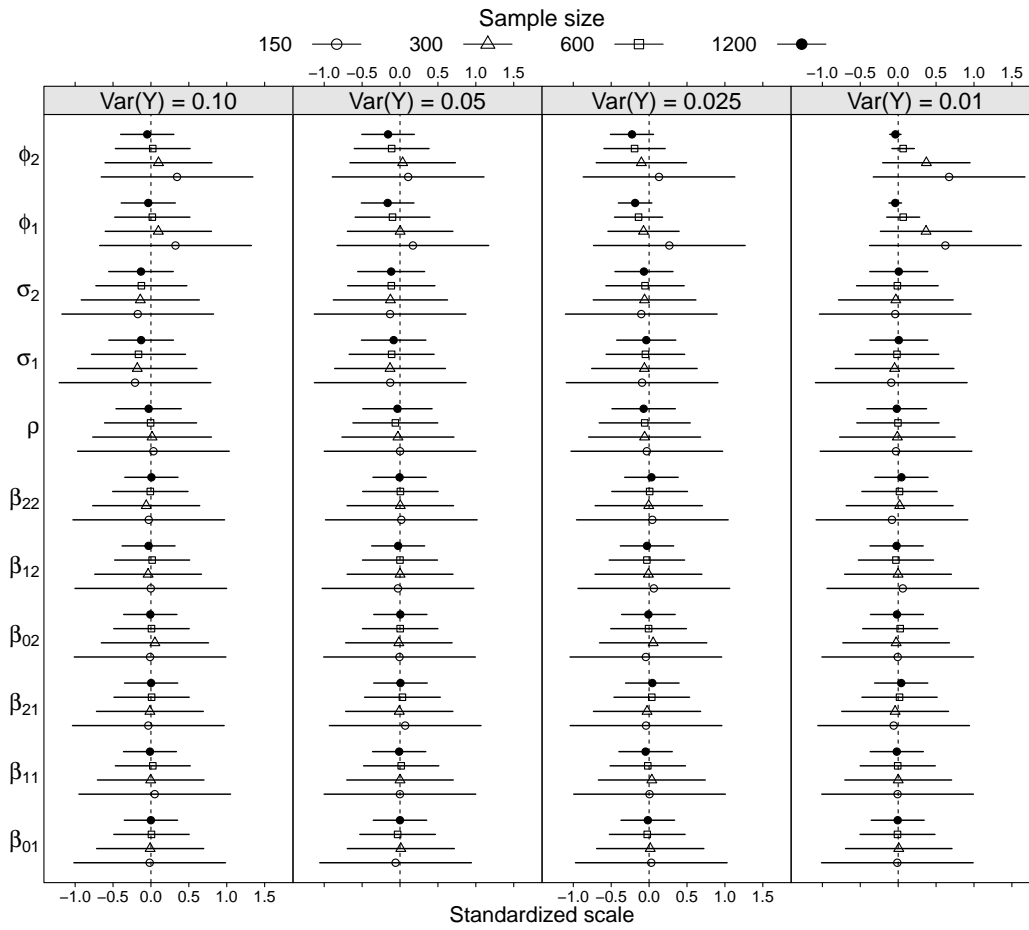


Figure 1: Average bias and intervals on a standardized scale by sample size and variance levels - Beta distribution ($\rho = -0.5$).

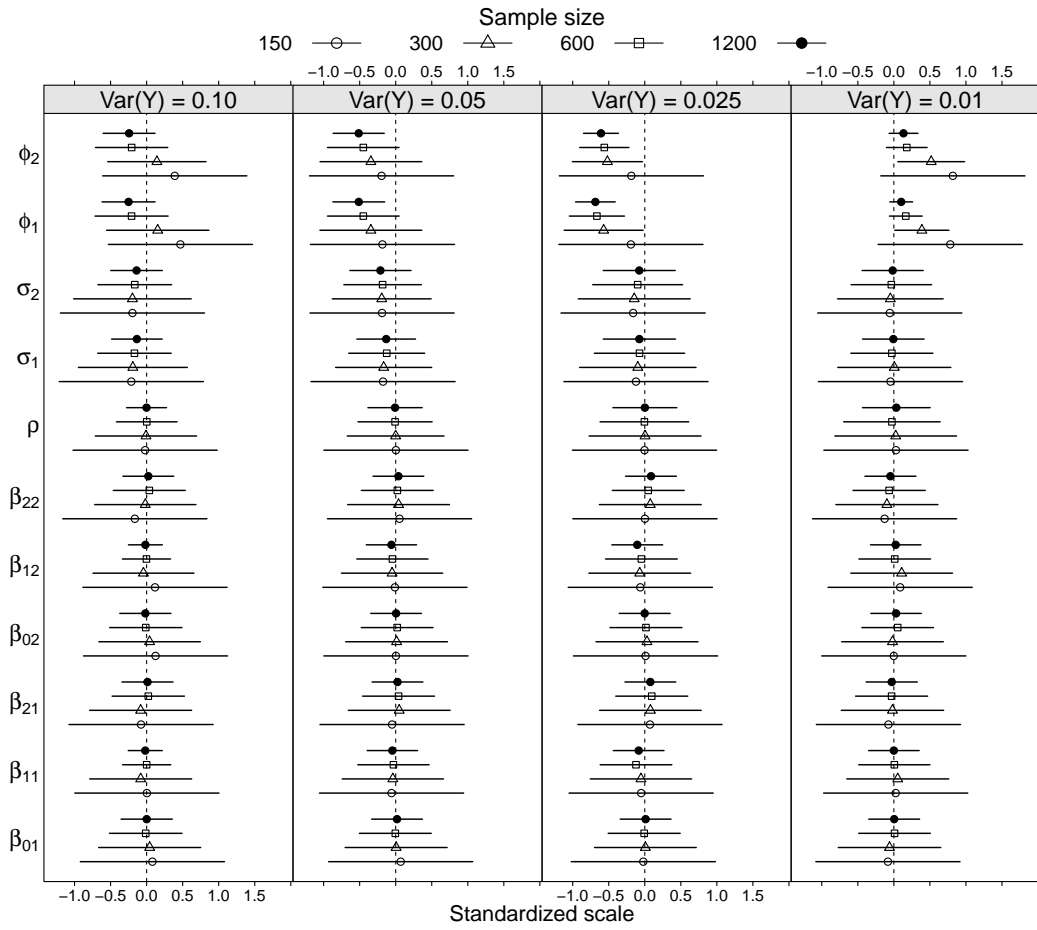


Figure 2: Average bias and intervals on a standardized scale by sample size and variance levels - Beta distribution ($\rho = 0.0$).

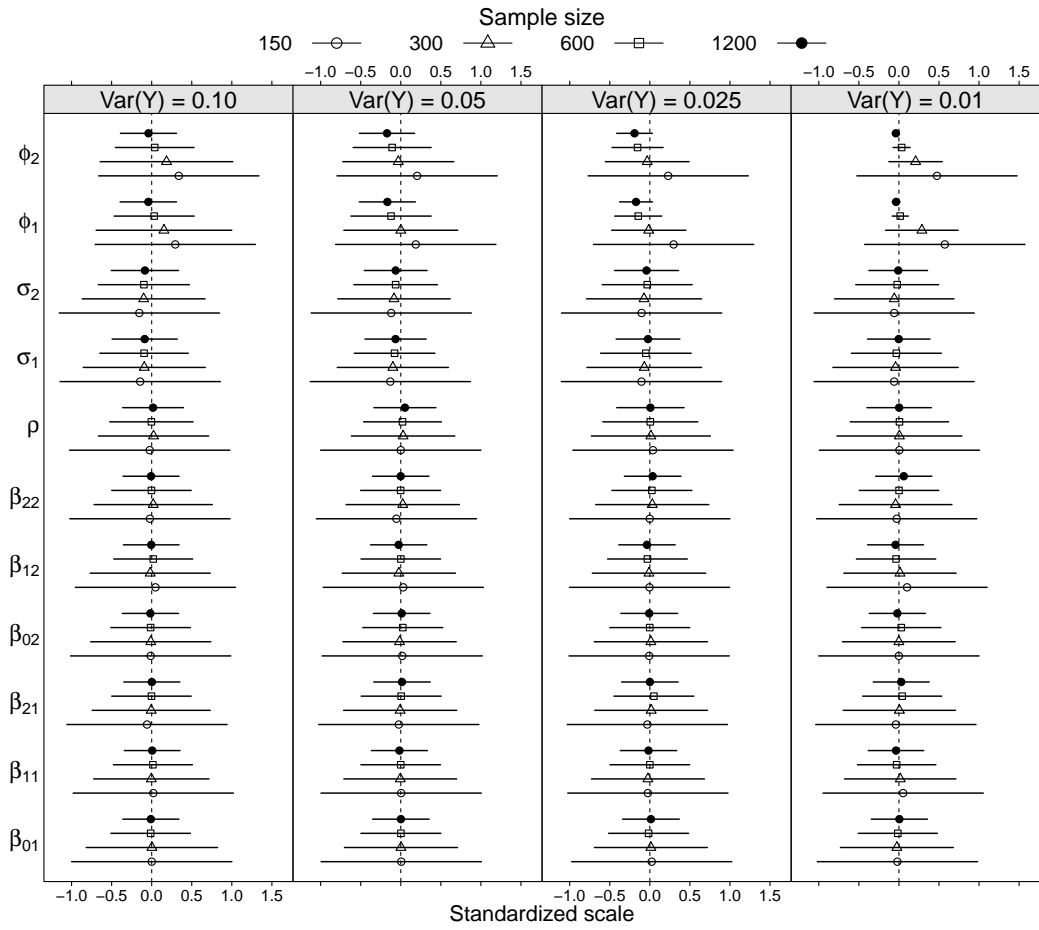


Figure 3: Average bias and intervals on a standardized scale by sample size and variance levels - Beta distribution ($\rho = 0.5$).

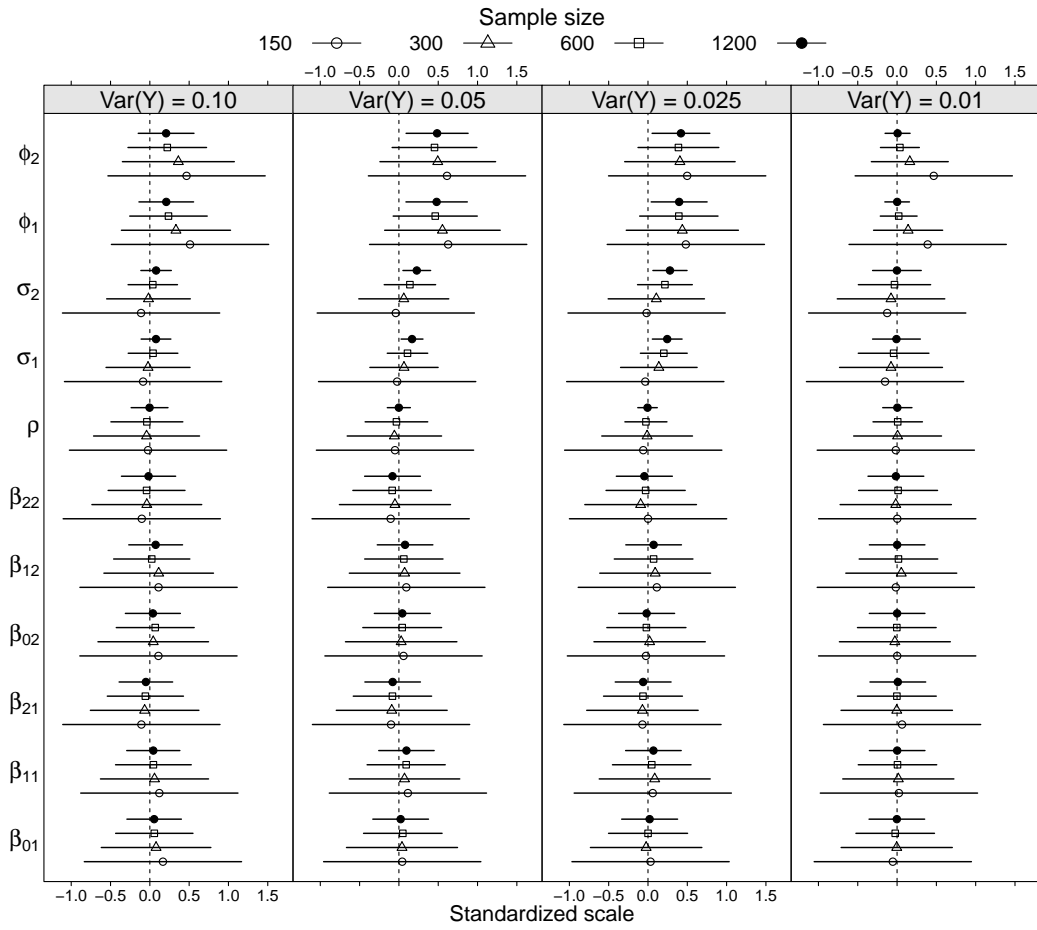


Figure 4: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma distribution ($\rho = -0.5$).

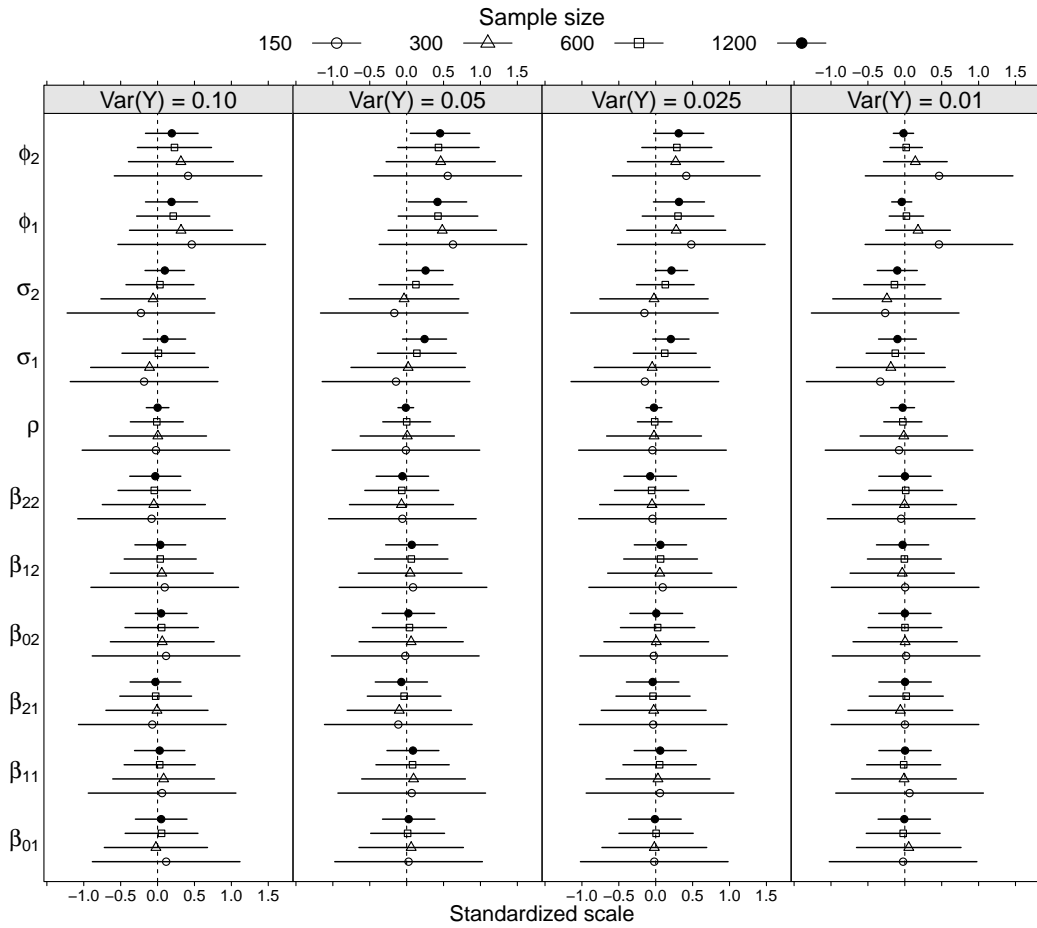


Figure 5: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma distribution ($\rho = 0.0$).

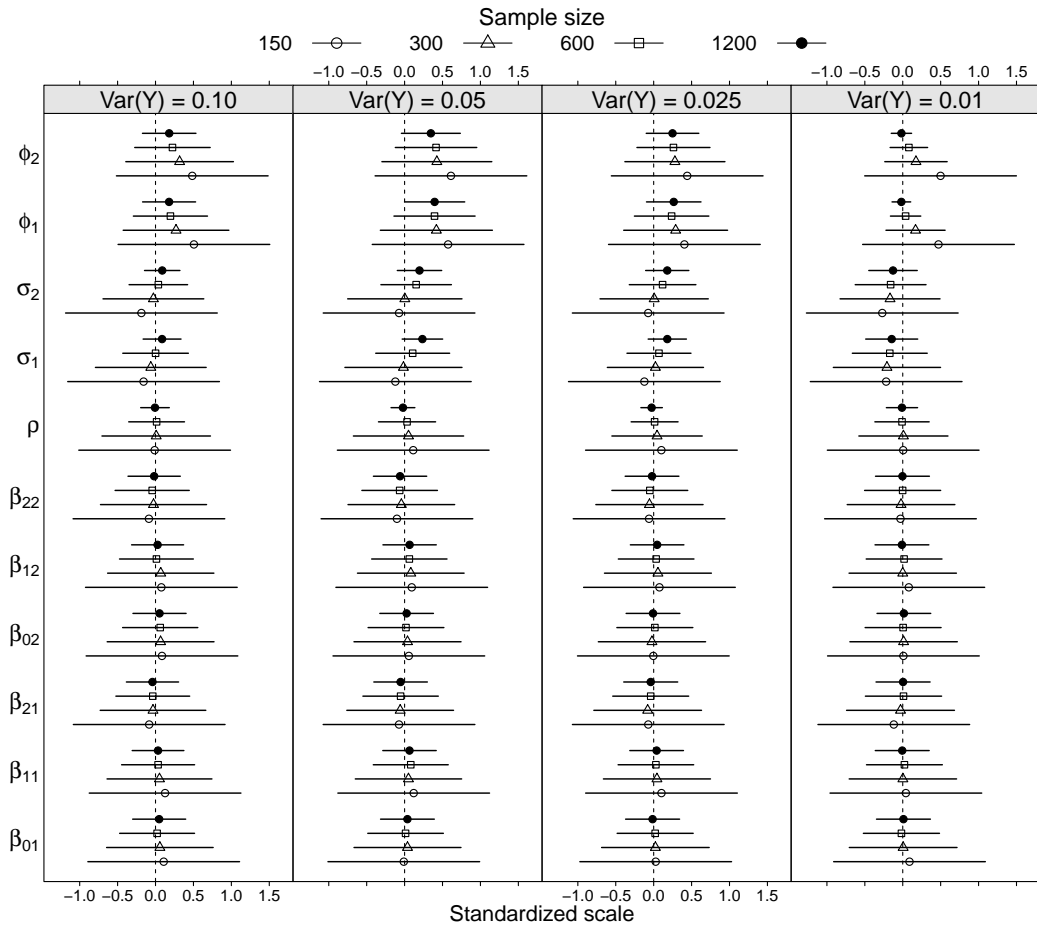


Figure 6: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma distribution ($\rho = 0.5$).

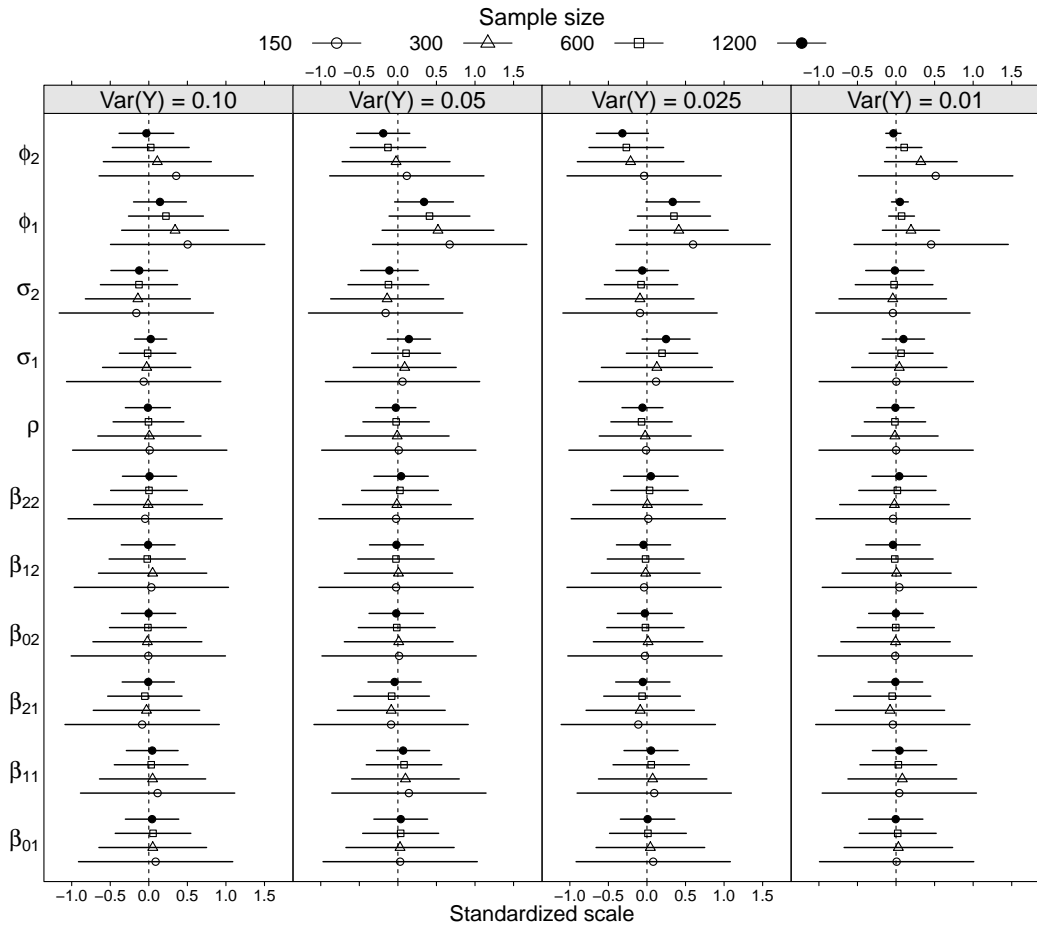


Figure 7: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma and beta distributions ($\rho = -0.5$).

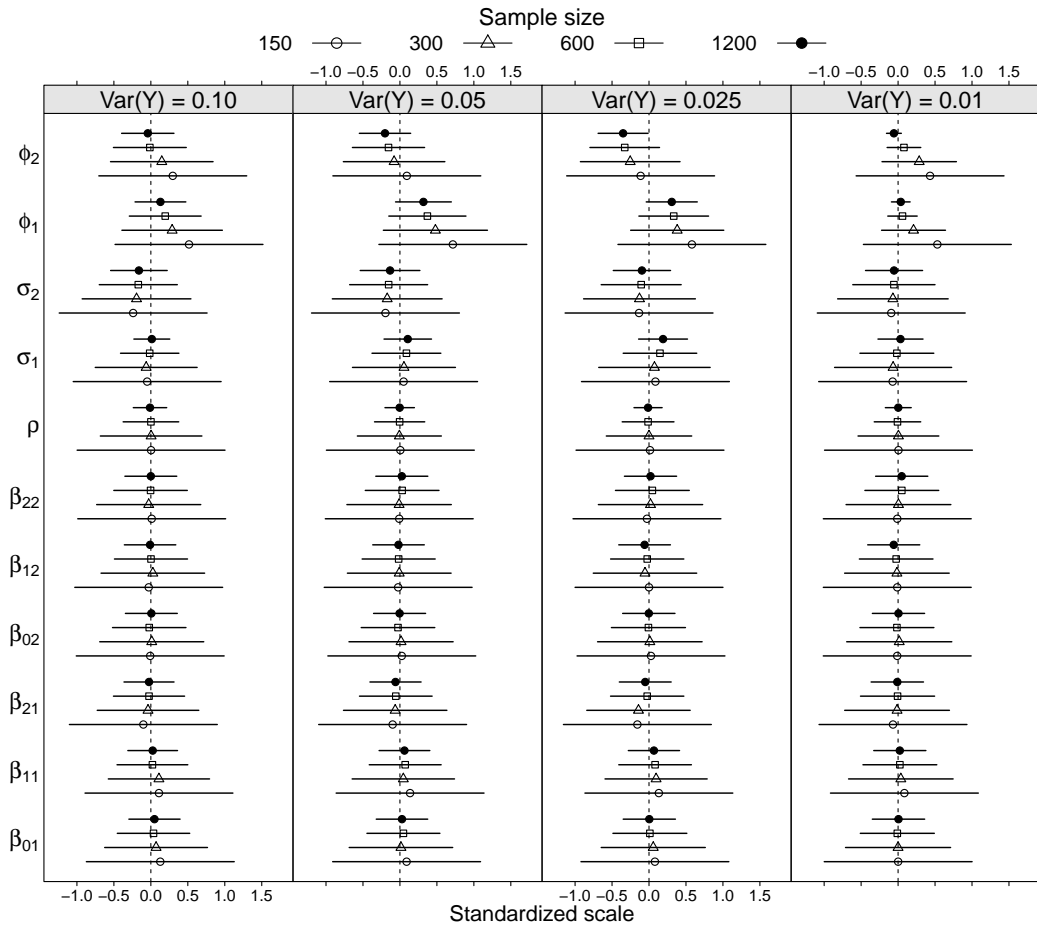


Figure 8: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma and beta distributions ($\rho = 0.0$).

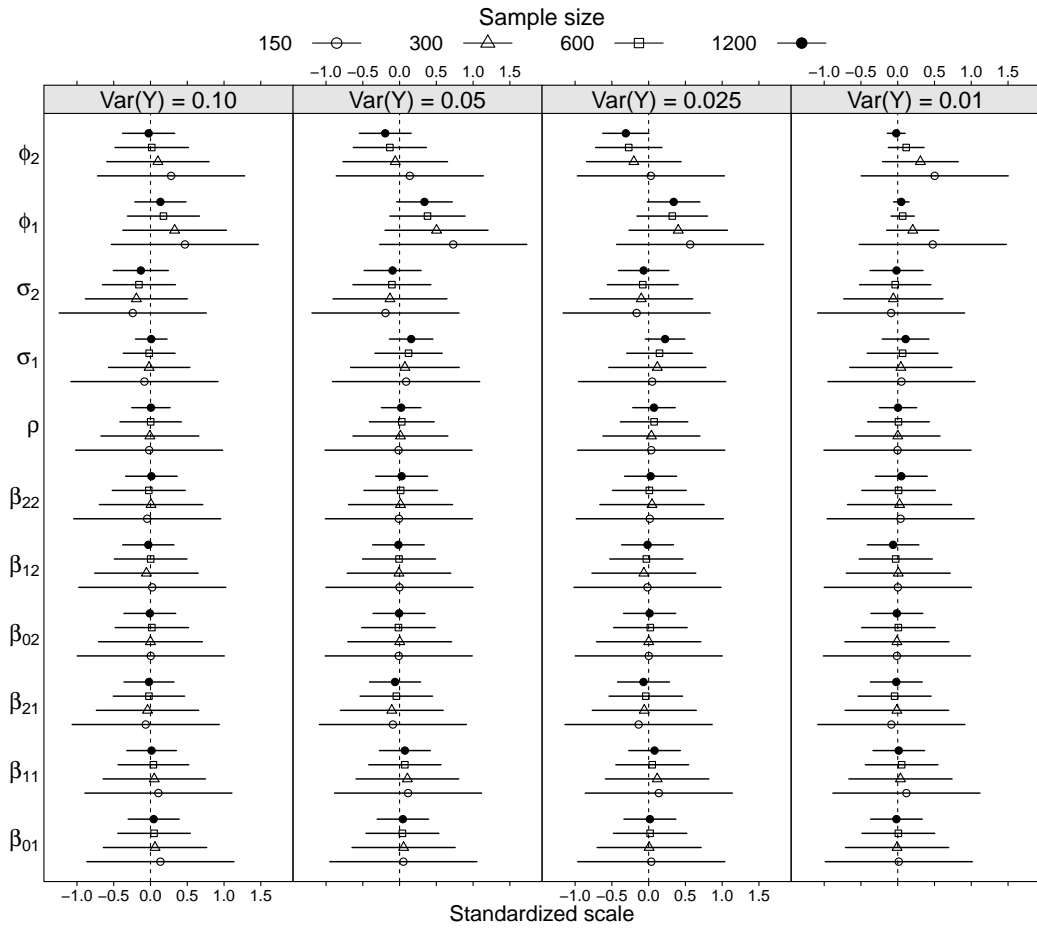


Figure 9: Average bias and intervals on a standardized scale by sample size and variance levels - Unit gamma and beta distributions ($\rho = 0.5$).

Web Appendix B

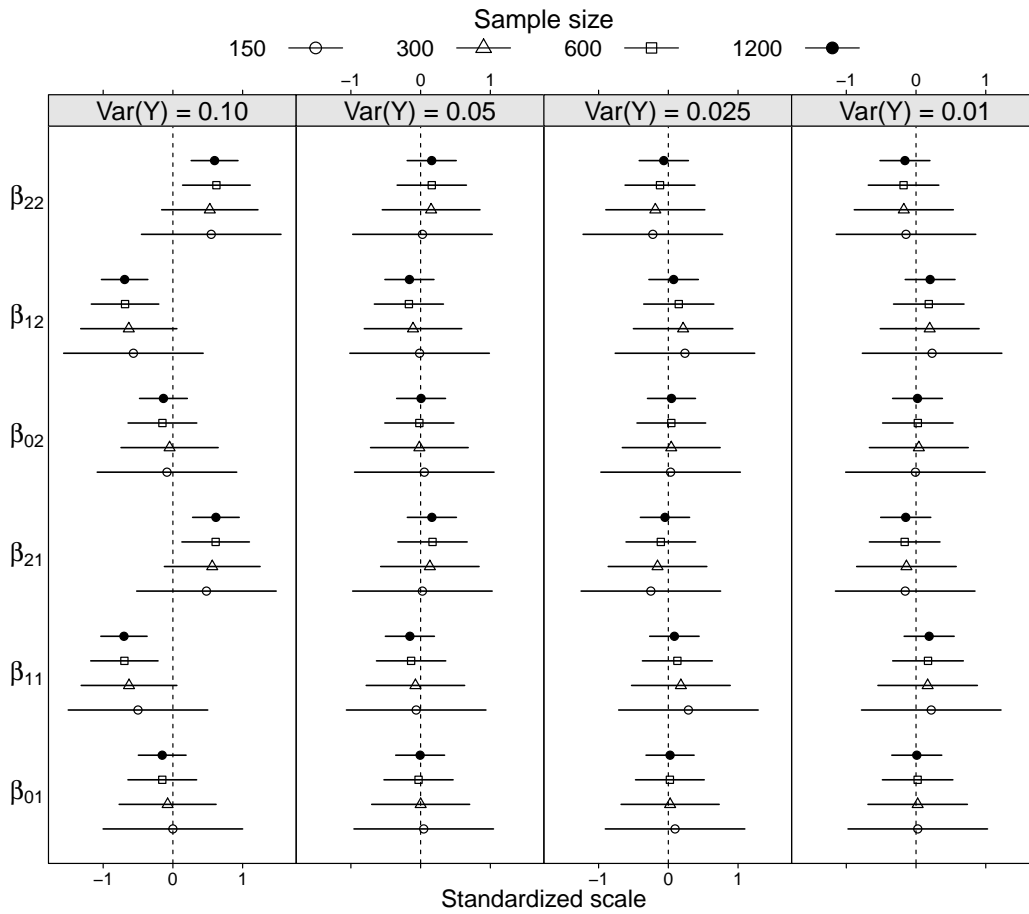


Figure 10: Average bias and intervals on a standardized scale by sample size and variance levels - with data simulated by the bivariate beta distribution ($\rho = 0.5$) and estimated by the MGLMM unit gamma.

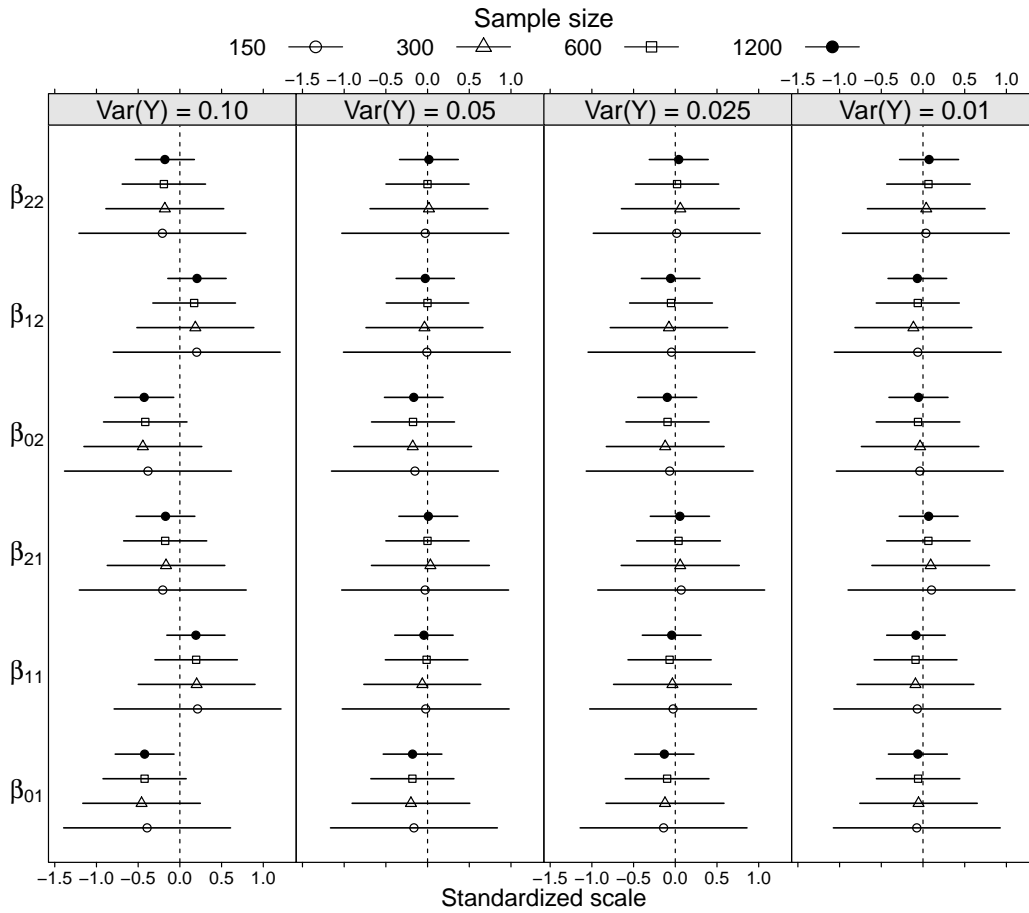


Figure 11: Average bias and intervals on a standardized scale by sample size and variance levels - with data simulated by the bivariate unit gamma distribution ($\rho = 0.5$) and estimated by the MGLMM beta.

Web Appendix C

Table 1: Maximized log-likelihood values ($\log\text{Lik}$) for univariate regression models fitted by distributions and response variables.

Distributions	Response variables				
	Arms	Legs	Trunk	Android	Gynoid
Beta	460.74	426.41	445.46	382.79	442.80
Unit gamma	460.51	423.81	448.75	387.91	442.78

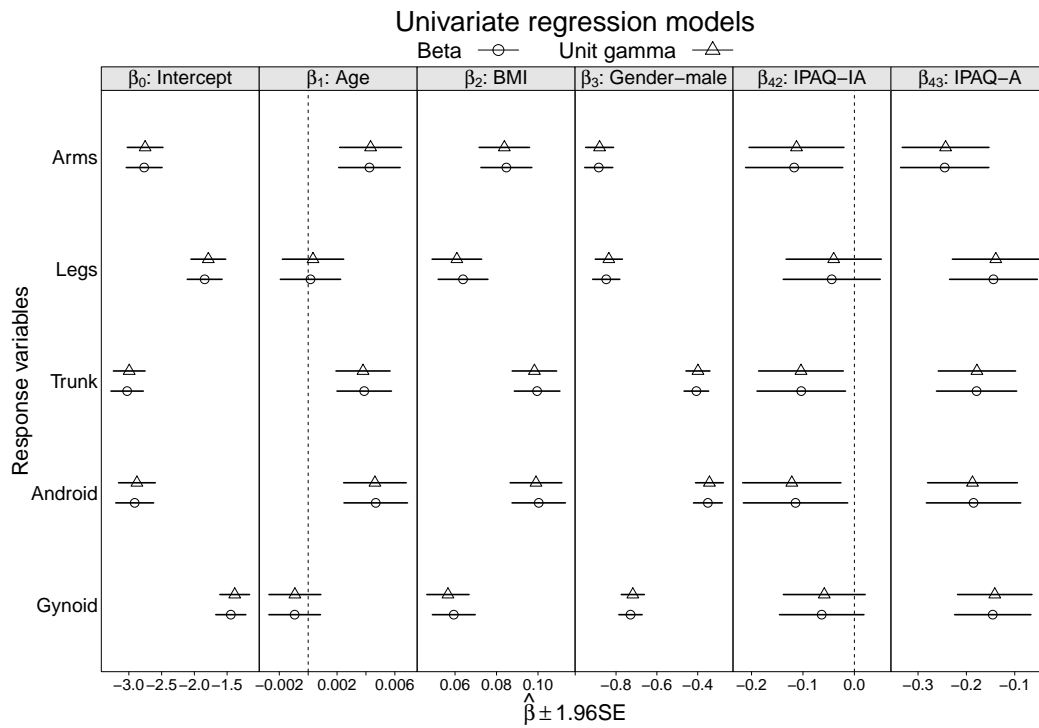


Figure 12: Parameter estimates and 95% confidence intervals for the univariate regression models by response variables and distributions.

Web Appendix D

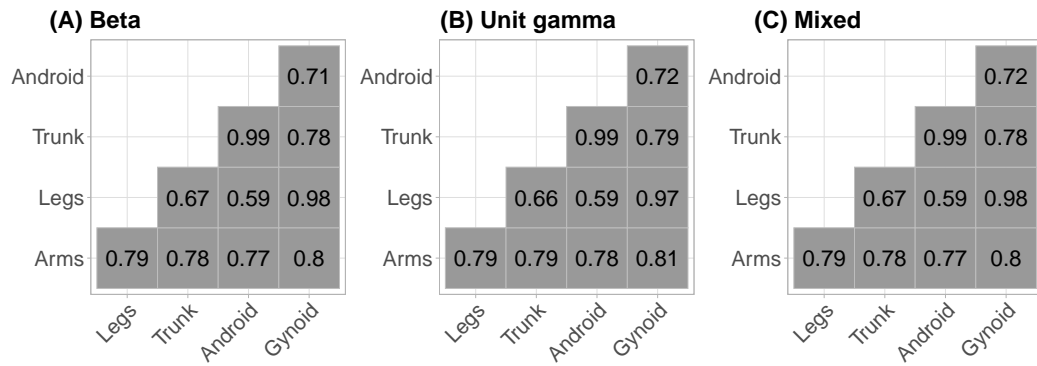


Figure 13: Correlation matrix between the response variables for the MGLMM by distributions.

Web Appendix E

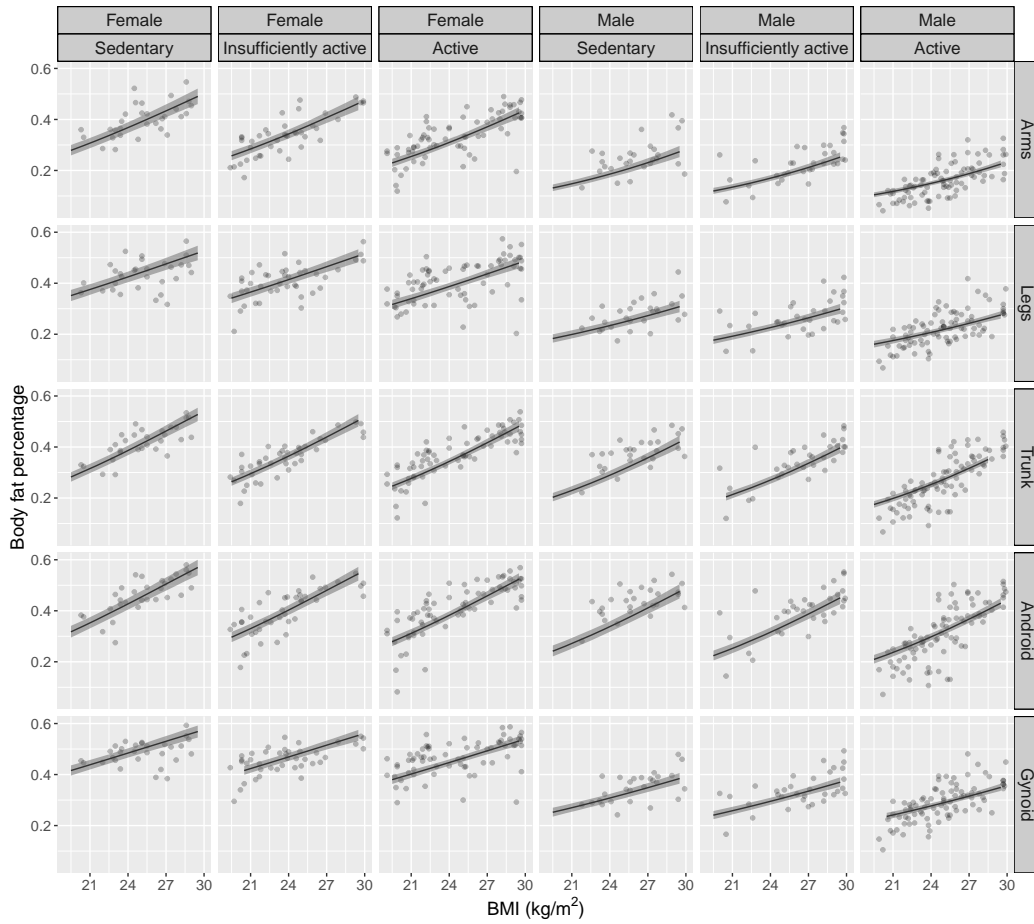


Figure 14: Curves of fitted values with 95% confidence intervals by gender, IPAQ and BMI for the MGLMM unit gamma by response variables.