

Figure 1: Comparison between NUTS and our samplers for IRT model with identity covariance matrix: The x-axis in each plot corresponds to the desired accept probability  $\delta$  of the primal-dual averaging algorithm. The y-axis is the minimum ESS per gradient for each parameter group. ESS of samples of NUTS, eHMC, eHMCq and eHMCu is estimated by `ess` of R package `mcmcse`.

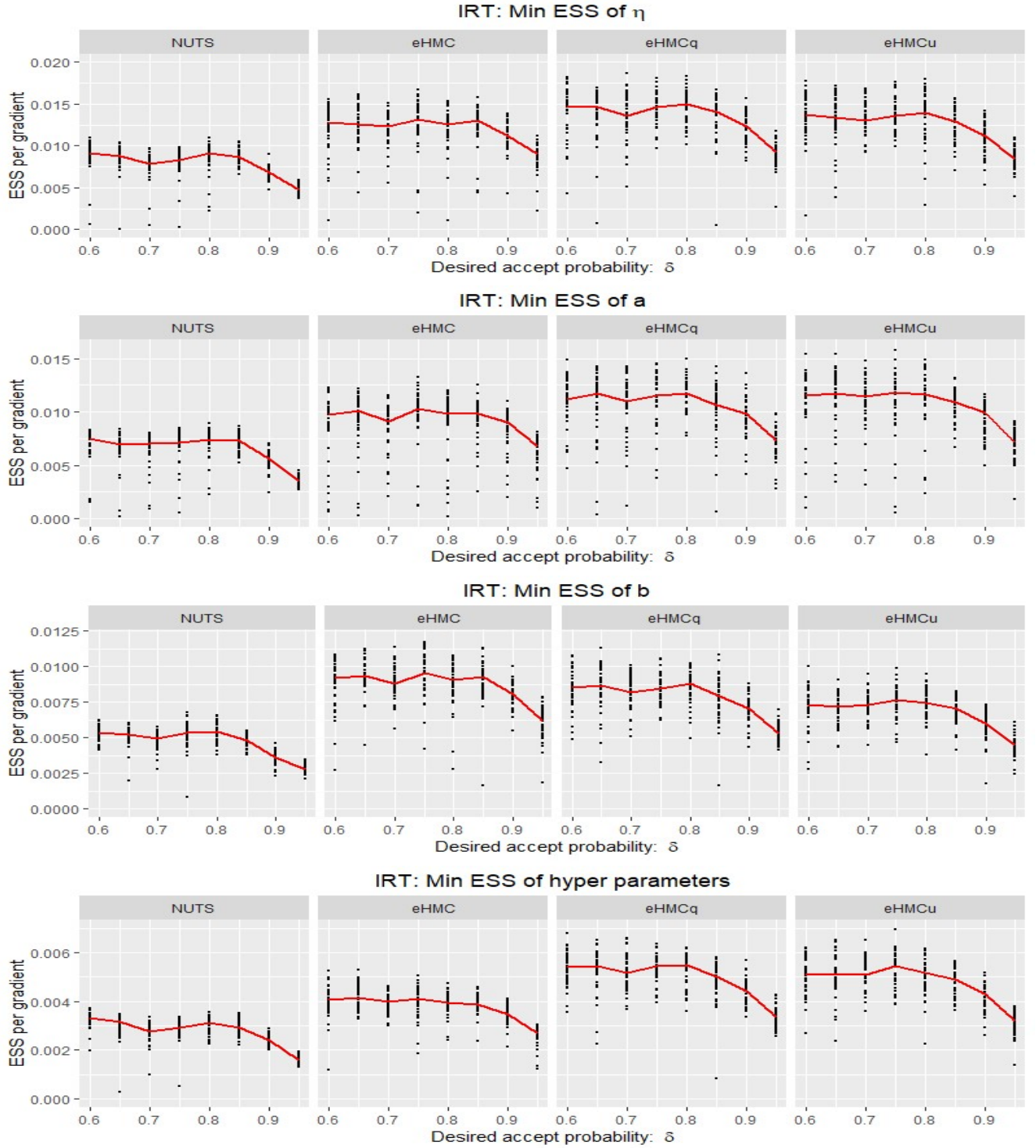


Figure 2: Comparison between NUTS and our samplers for IRT model with identity covariance matrix: The x-axis in each plot corresponds to the desired accept probability  $\delta$  of the primal-dual averaging algorithm. The y-axis is the minimum ESS per gradient for each parameter group. ESS of samples of NUTS, eHMC, eHMCq and eHMCu is estimated by `effectiveSize` of R package `coda`.

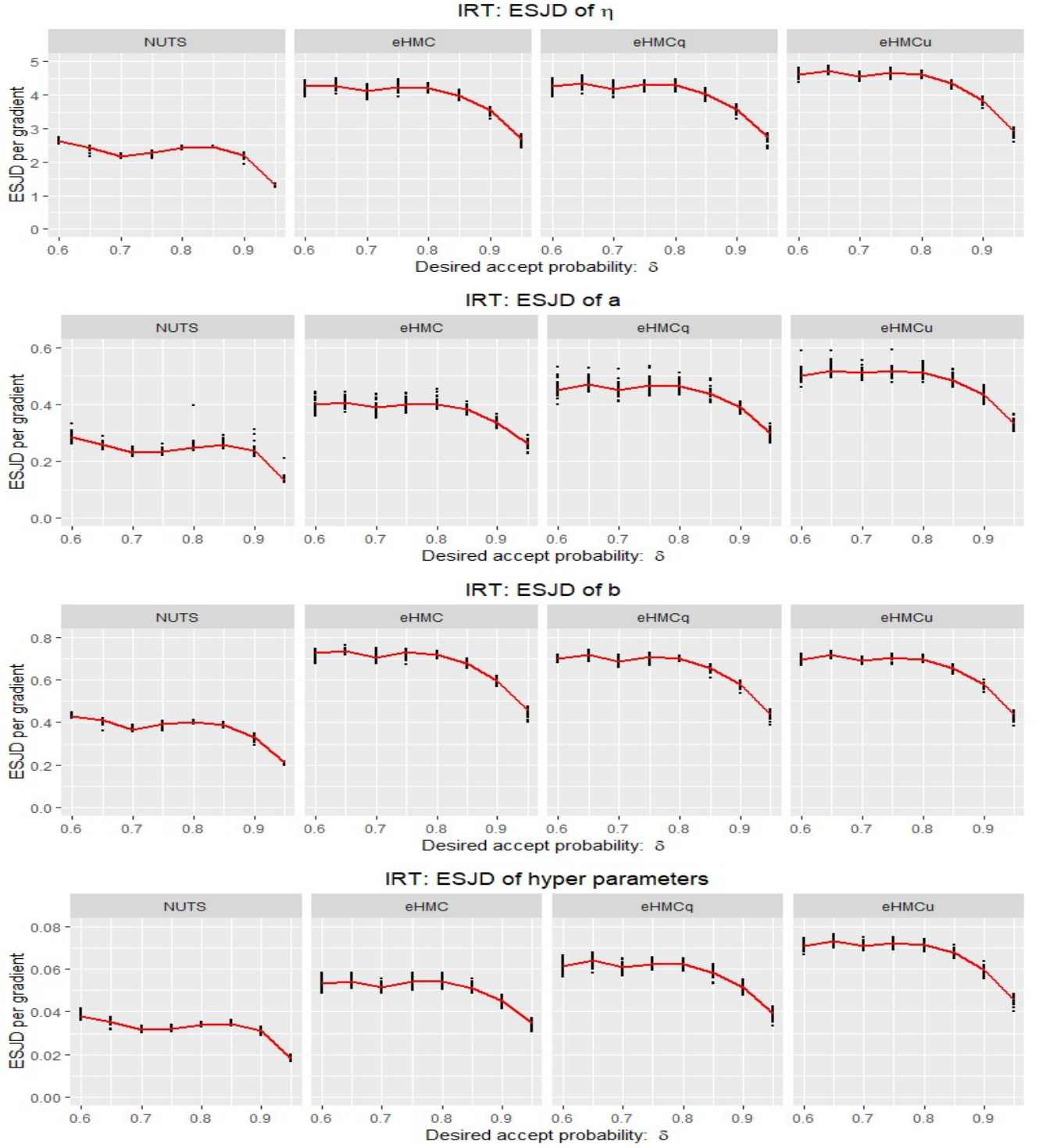


Figure 3: Comparison between NUTS and our samplers for IRT model with identity covariance matrix: The x-axis in each plot corresponds to the desired accept probability  $\delta$  of the primal-dual averaging algorithm. The y-axis is the ESJD per gradient for each parameter group.