Model Fit - Bootstrap simulations of Negative Binomial Distribution

January 16, 2019

Contents

1 Description

We can also use bootstrap to check the fitness of the model. Considering negative binomial distribution as the alternative model, we generated $S = 10,000$ datasets $\boldsymbol{X}^k$, i.e., $\boldsymbol{X}^k \sim NB(r, q)$ for $k = 1, 2, \ldots, S$. In each simulation step, we implemented a bootstrap step where $B = 2000$ parametric bootstrap samples were generated from $\hat{\boldsymbol{\theta}} = \arg\max_{\boldsymbol{\theta}} L(\boldsymbol{\theta}\,|\boldsymbol{X}^k)$ and the bootstrap bias-corrected MLE was derived.

2 Bias of $\hat{\lambda}$

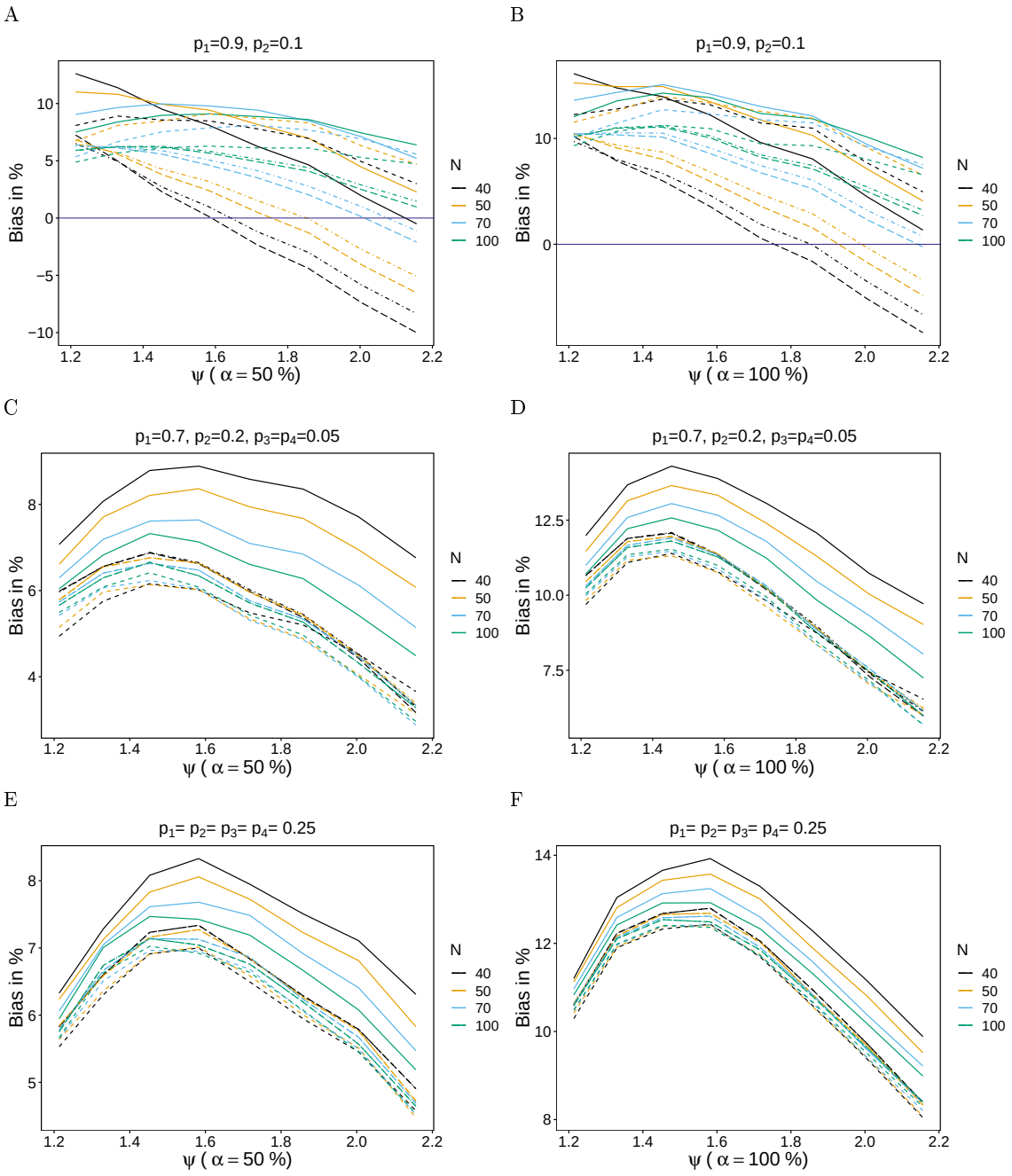

Figure 1: **Bias in % of different versions of bias-corrected MLE under conditional negative binomial model**. The figure shows the bias in % of different versions of bias-corrected MLE of mean MOI parameter along with MLE of $\psi = \frac{\lambda}{1-e^{-\lambda}}$ for different lineage frequency distributions under conditional negative binomial model. The simulated data is from conditional negative binomial model whereas the estimations are from conditional Poisson model. Each plot carries different levels of dispersion determined by α, i.e., the data is generated with $\sigma^{2(CNB)} = (1+\alpha/100)\mu^{(CNB)}$. Different colors correspond to different sample sizes N. The solid, long-dashed, dot-dashed and dashed lines correspond to MLE, TBCMLE (theoretical bias-corrected MLE), HBCMLE (heuristic bias-corrected MLE) and PBBCMLE (parametric bootstrap bias-corrected MLE), respectively.

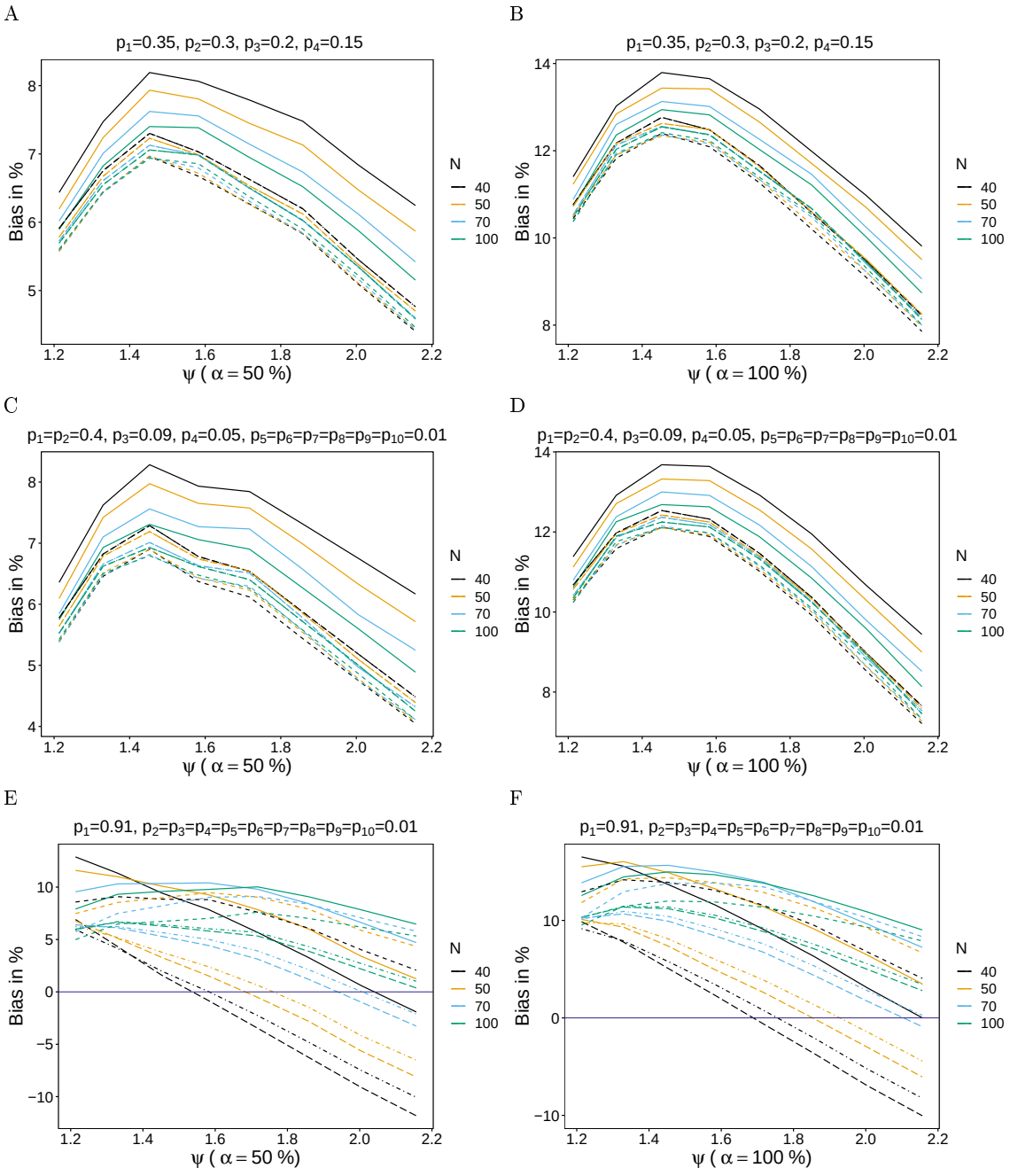

Figure 2: Same as Figure 1.

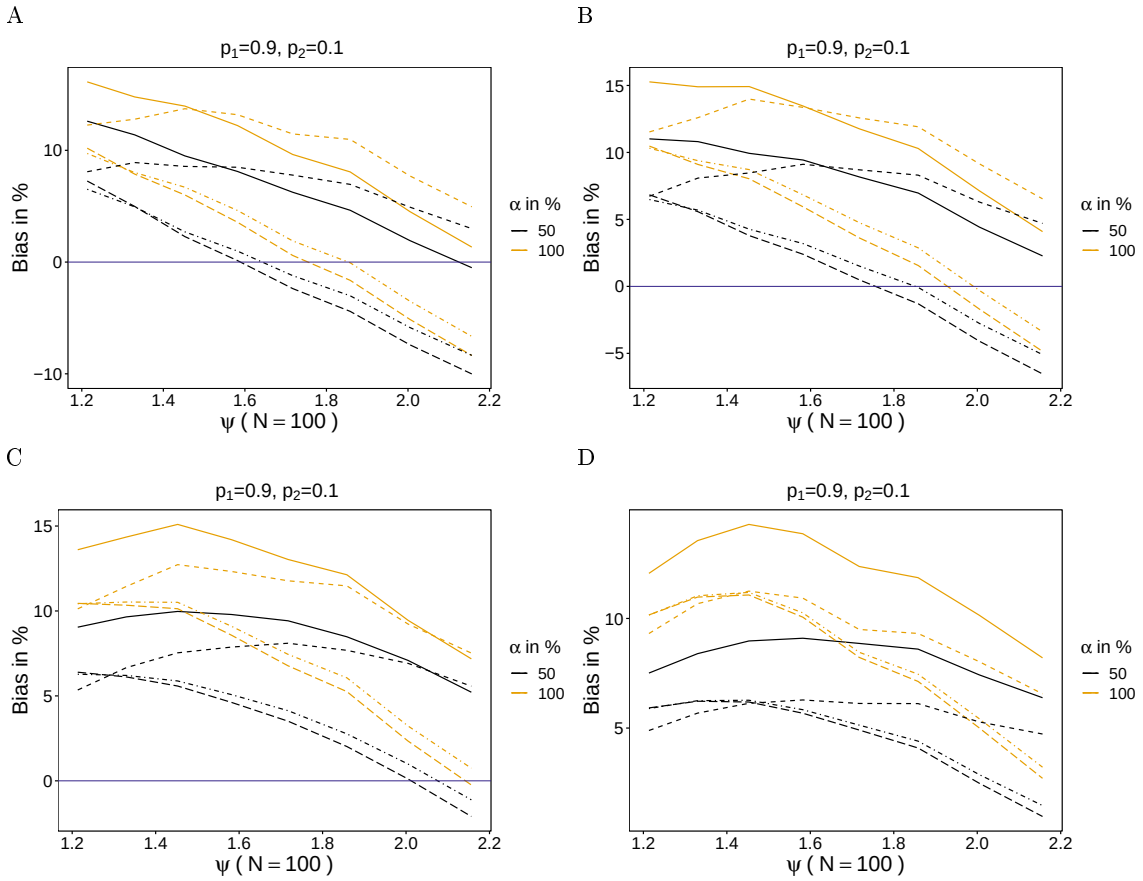

Figure 3: **Bias of bias-corrected MLE under conditional negative binomial model**. Same as Figure 1 but every plot corresponds to a fixed sample size N. Colored lines correspond to different levels of dispersion.

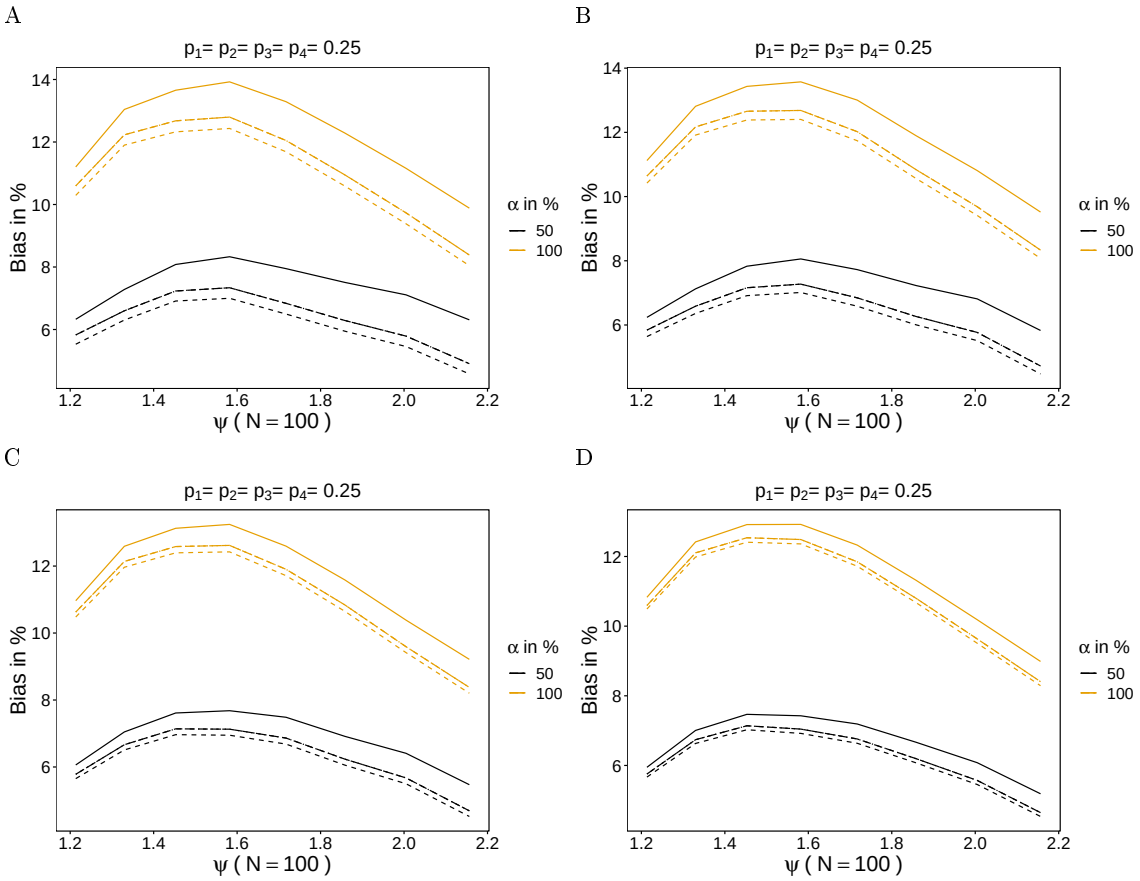

Figure 4: Same as Figure 3.

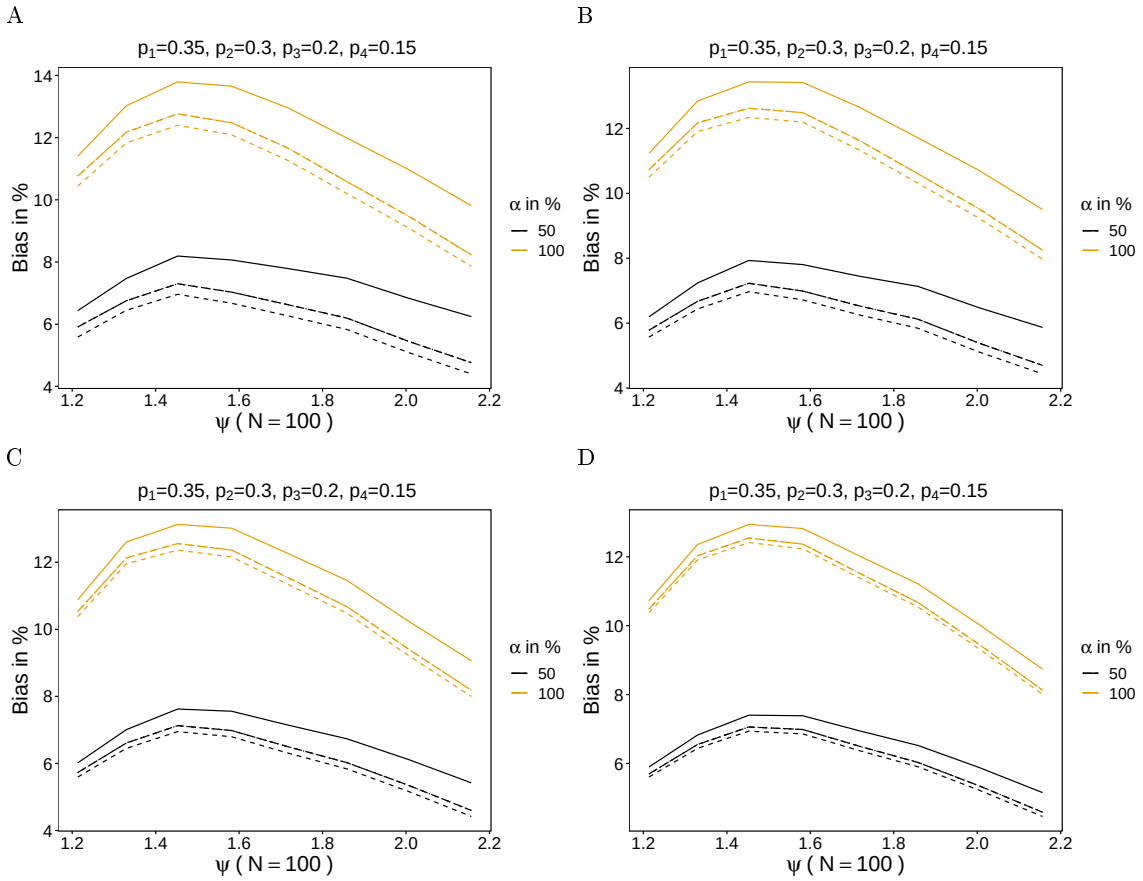

Figure 5: Same as Figure 3.

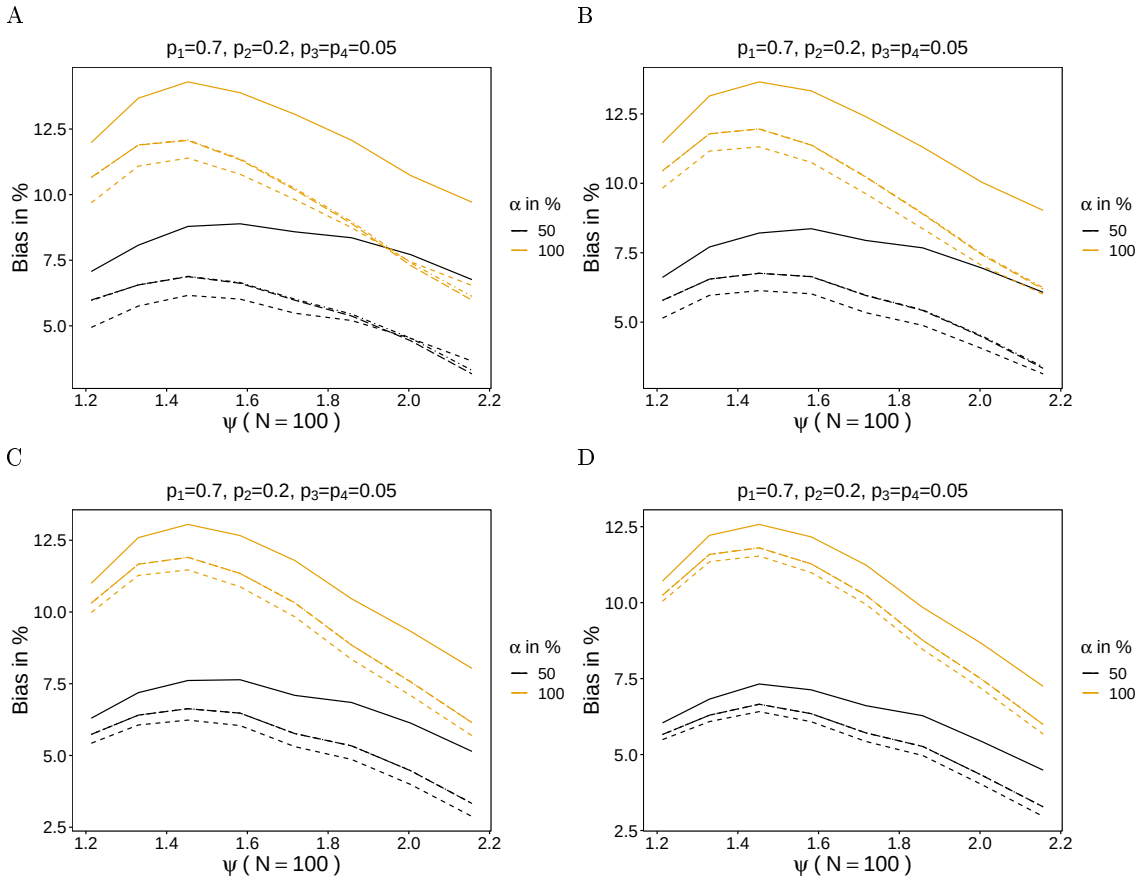

Figure 6: Same as Figure 3.

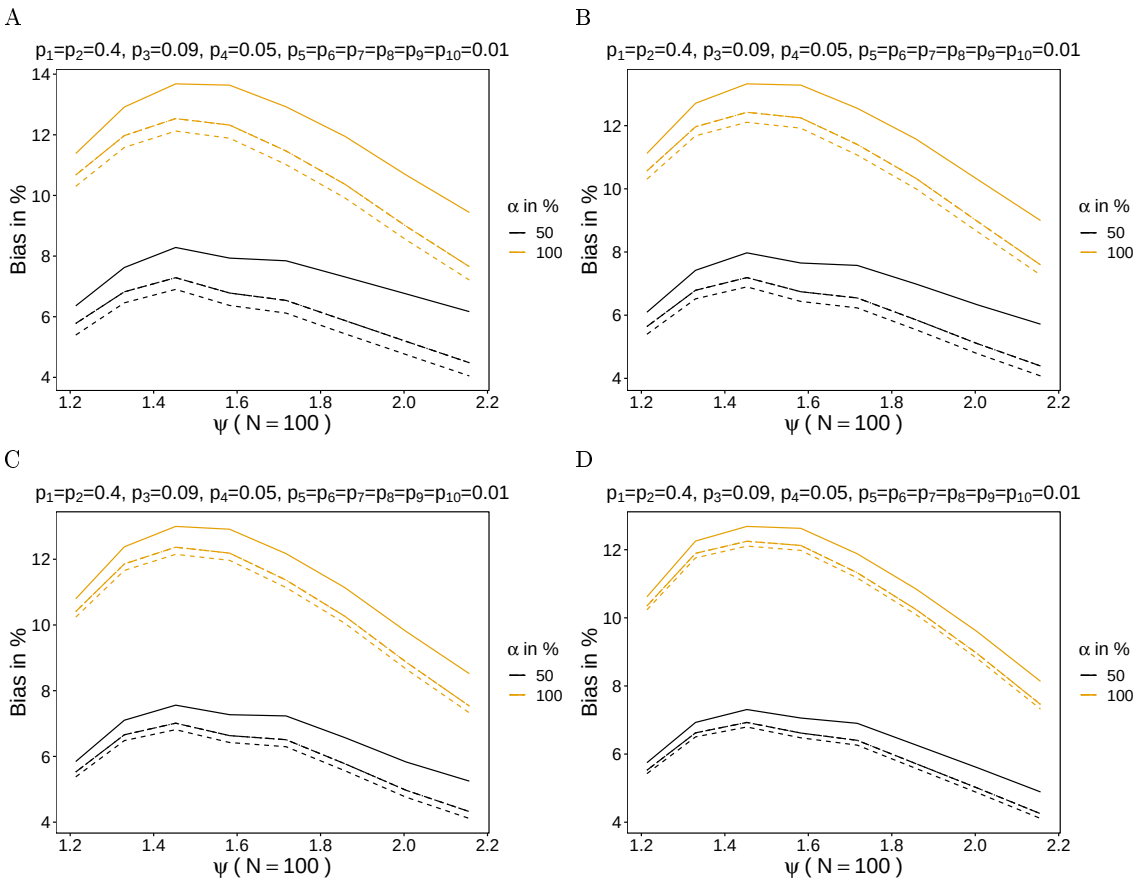

Figure 7: Same as Figure 3.

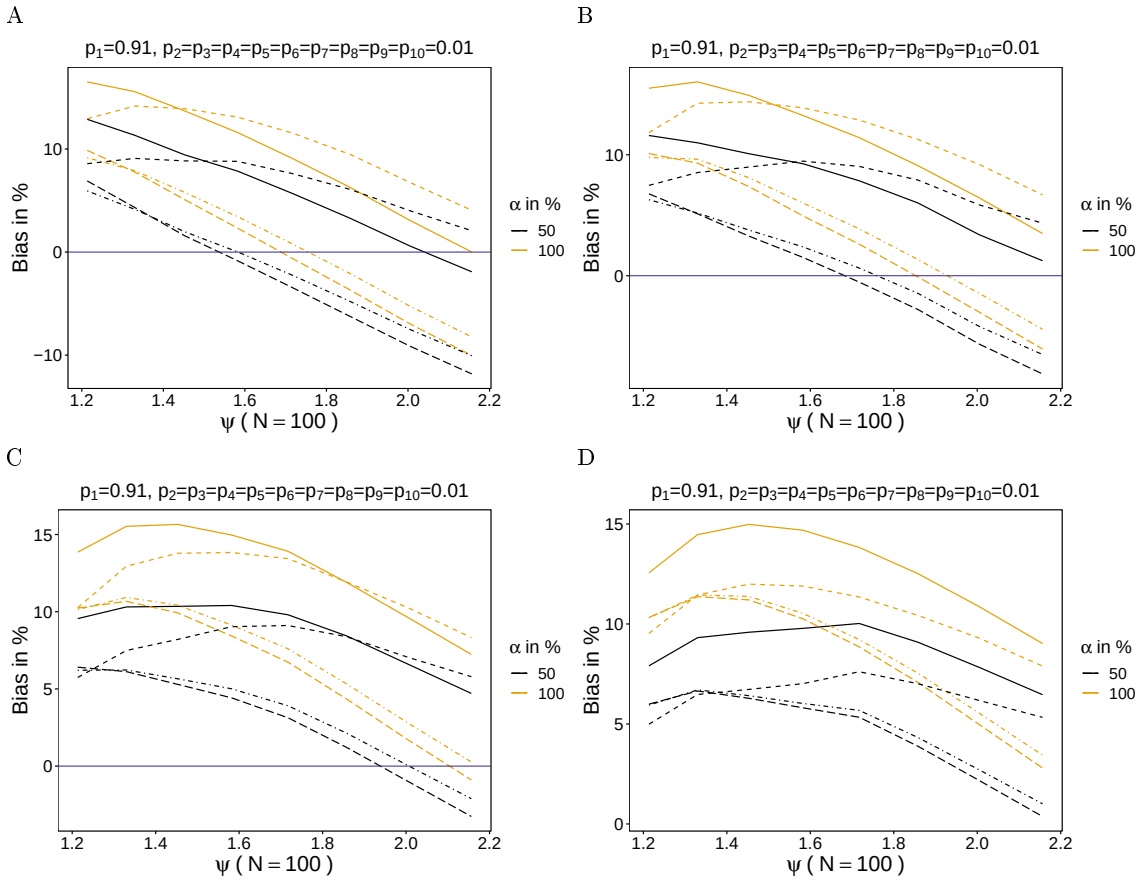

Figure 8: Same as Figure 3.

3 CV of $\hat{\lambda}$

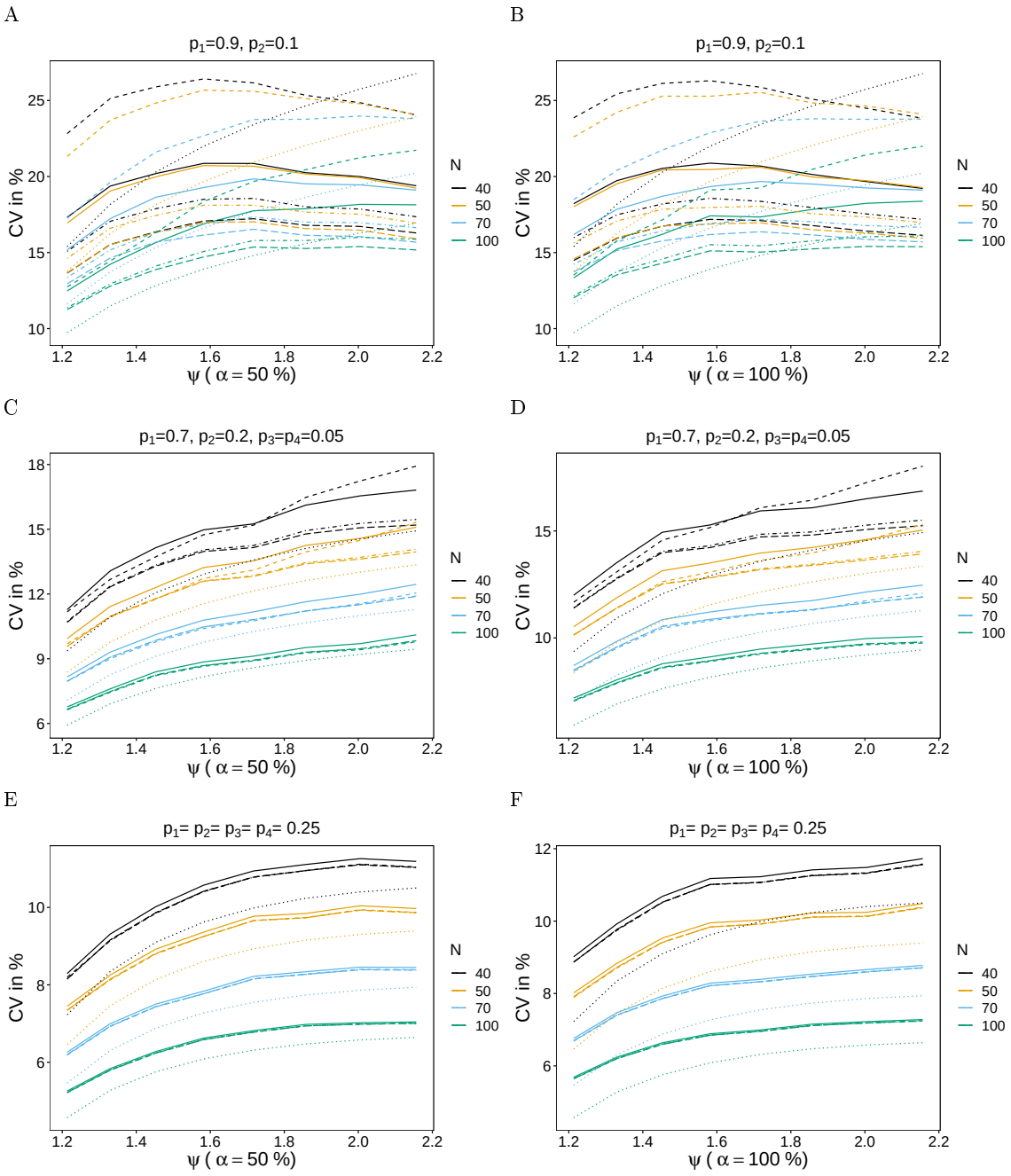

Figure 9: **CV of bias-corrected MLE under conditional negative binomial model**. Same as Figure 1 but for coefficient of variation. The dotted lines are the Cramér Rao lower bounds.

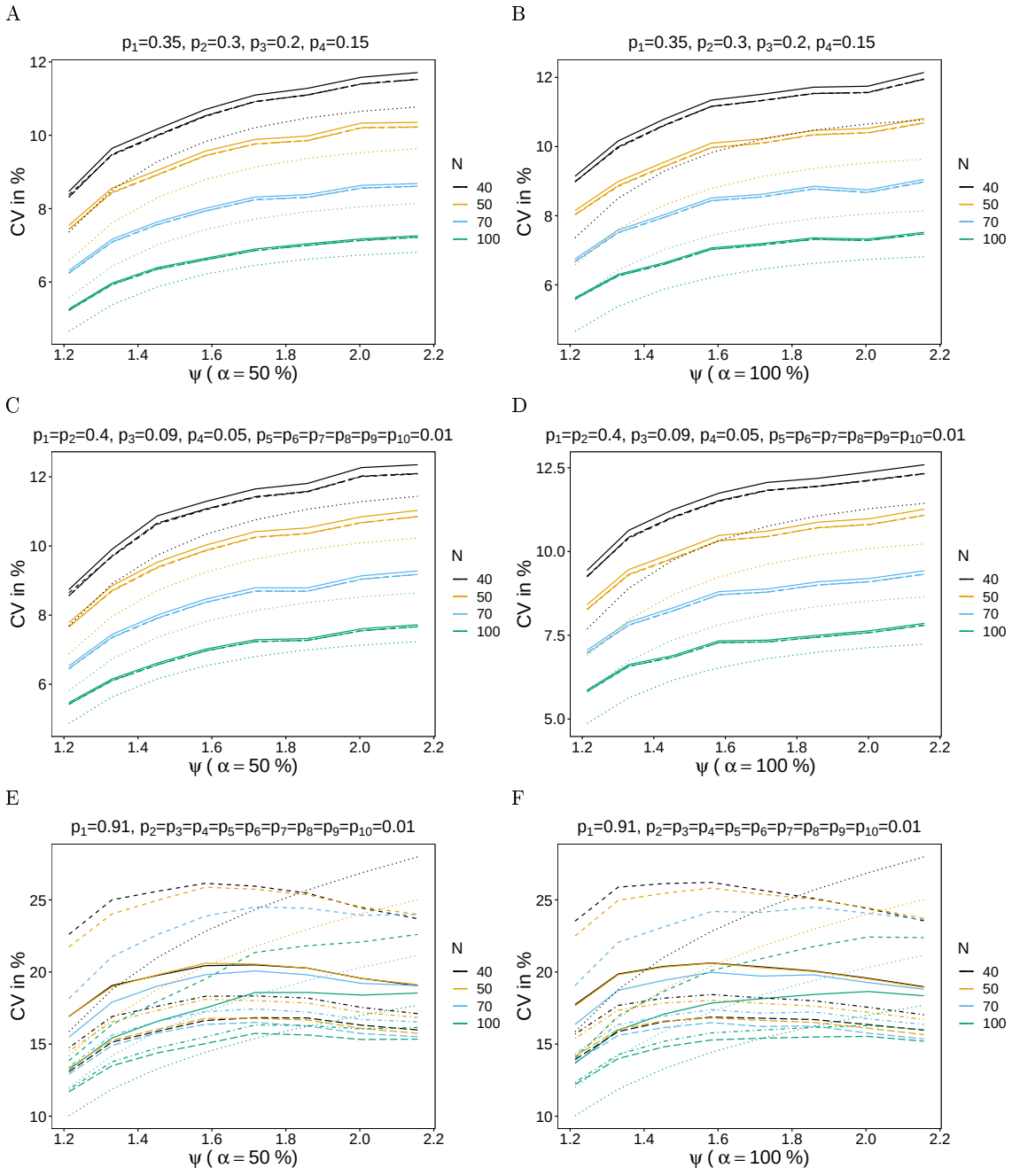

Figure 10: Same as Figure 9.

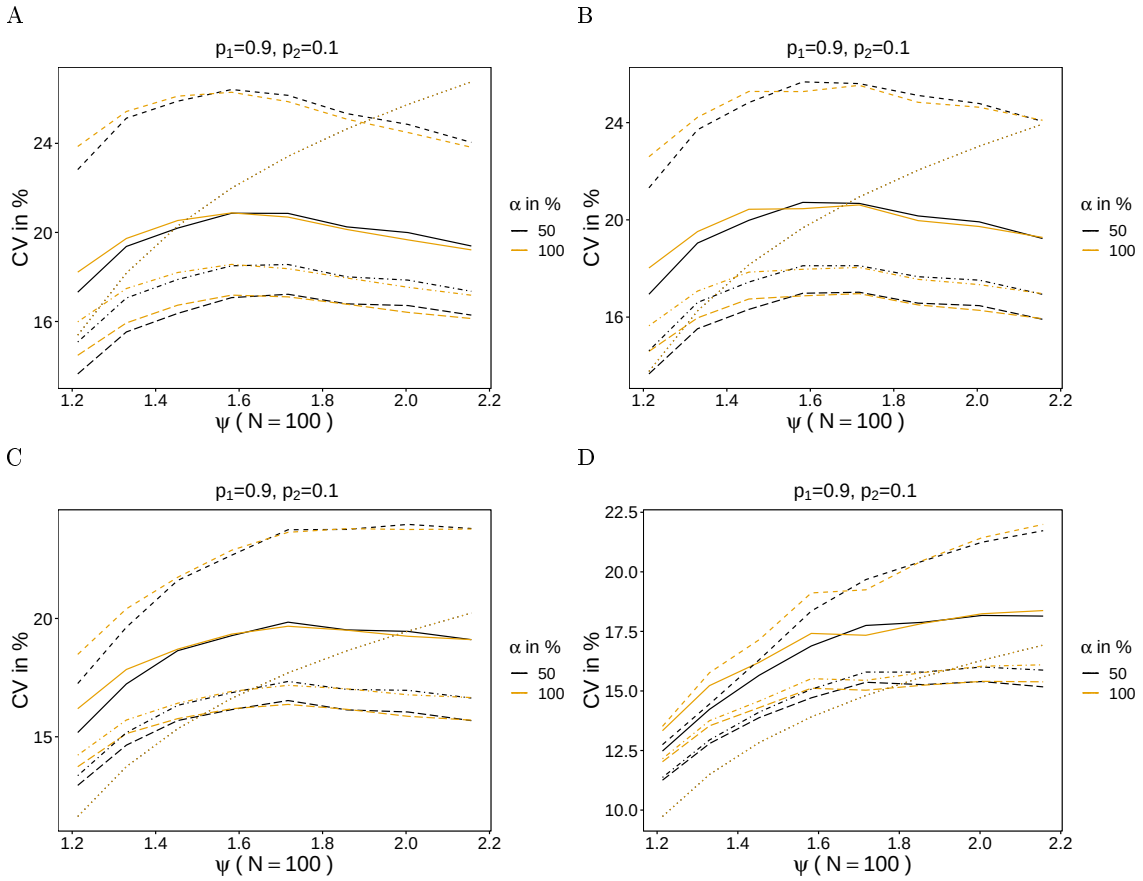

Figure 11: **Bias of bias-corrected MLE under conditional negative binomial model**. Same as Figure 9 but every plot corresponds to a fixed sample size N. Colored lines correspond to different levels of dispersion. The dotted lines are the Cramér Rao lower bounds.

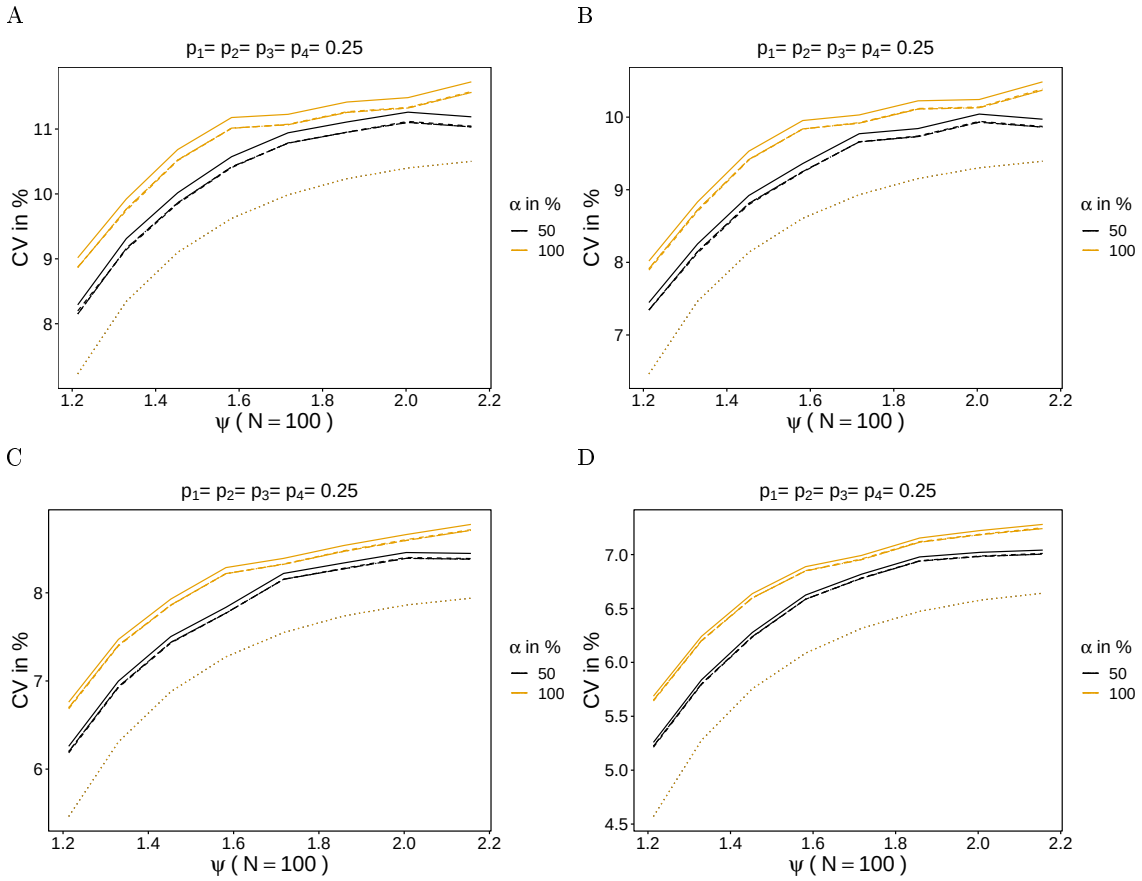

Figure 12: Same as Figure 11.

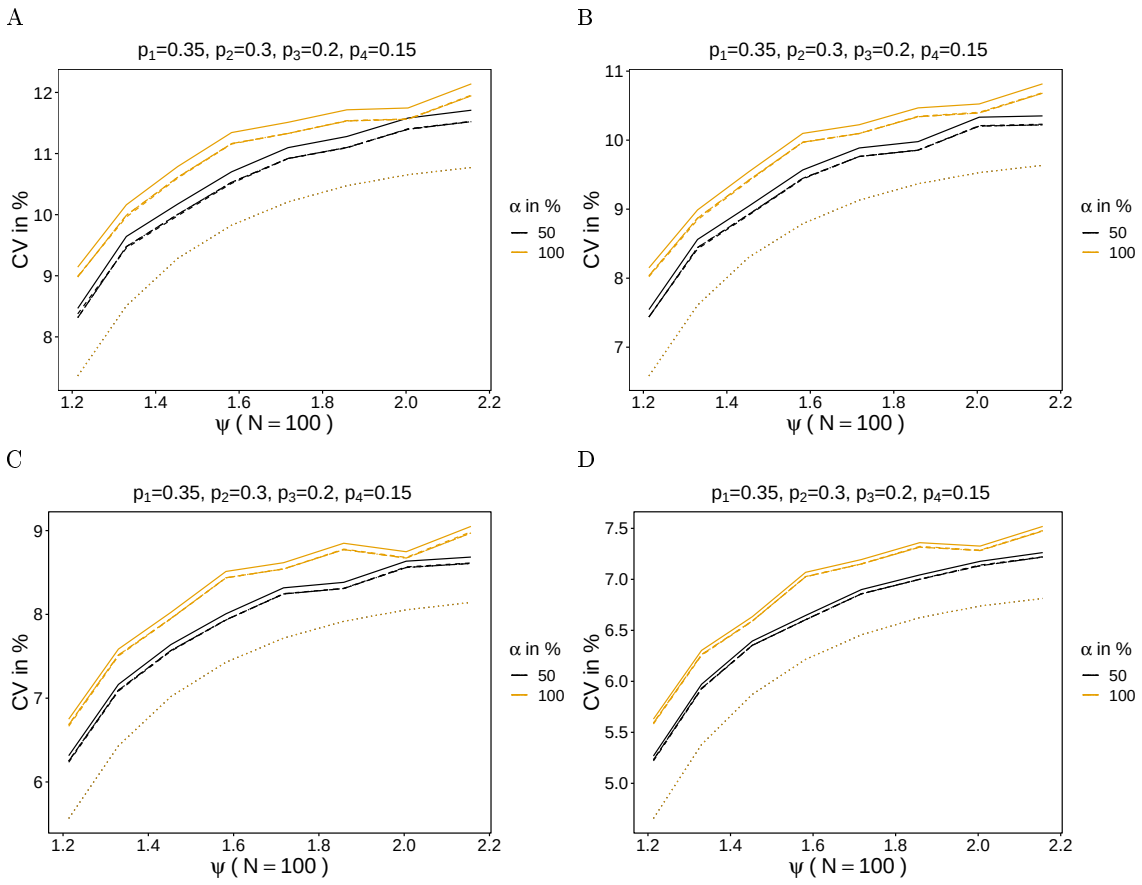

Figure 13: Same as Figure 11.

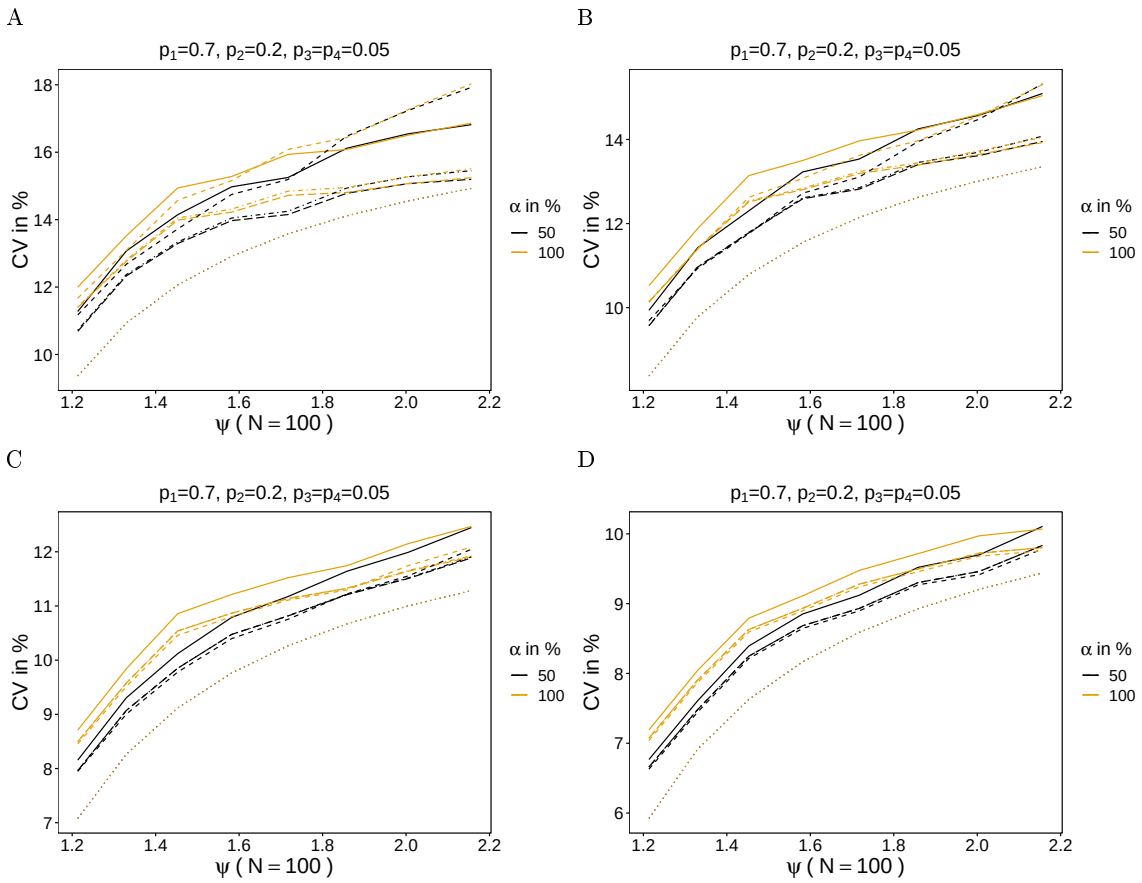

Figure 14: Same as Figure 11.

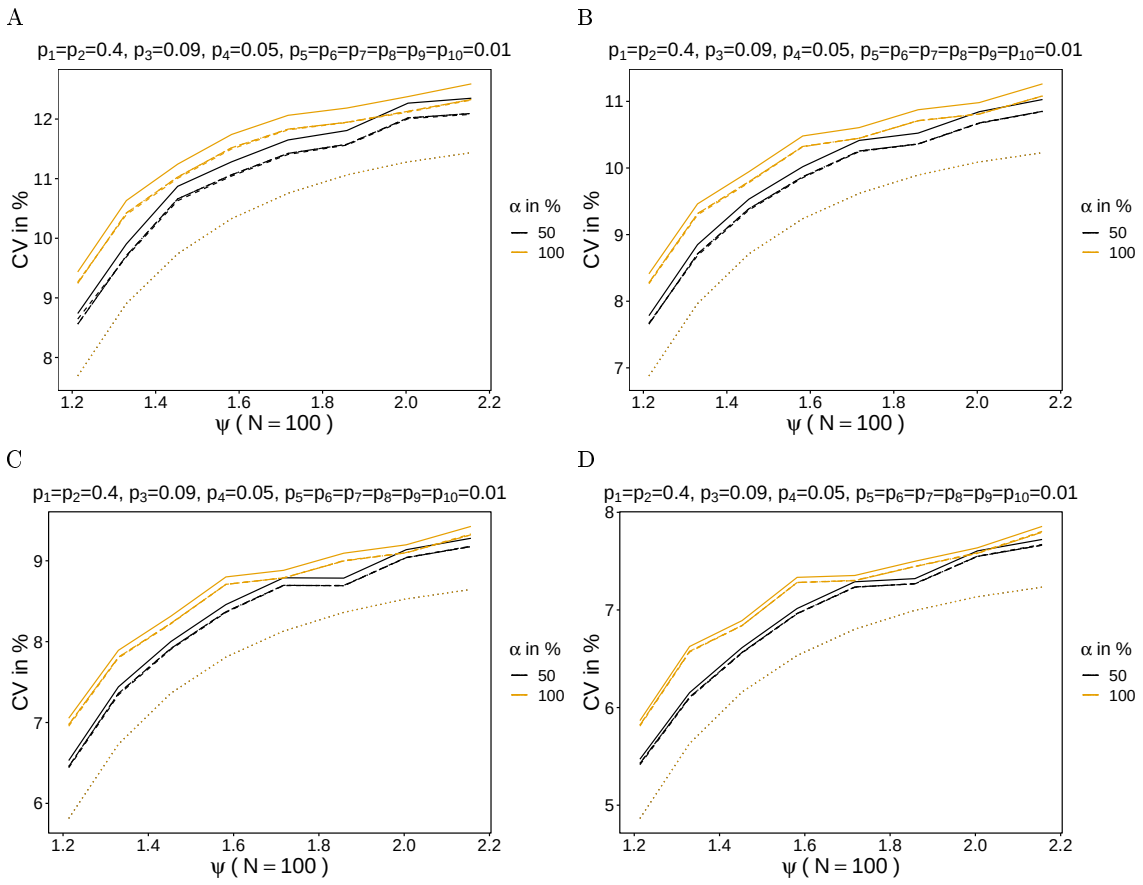

Figure 15: Same as Figure 11.

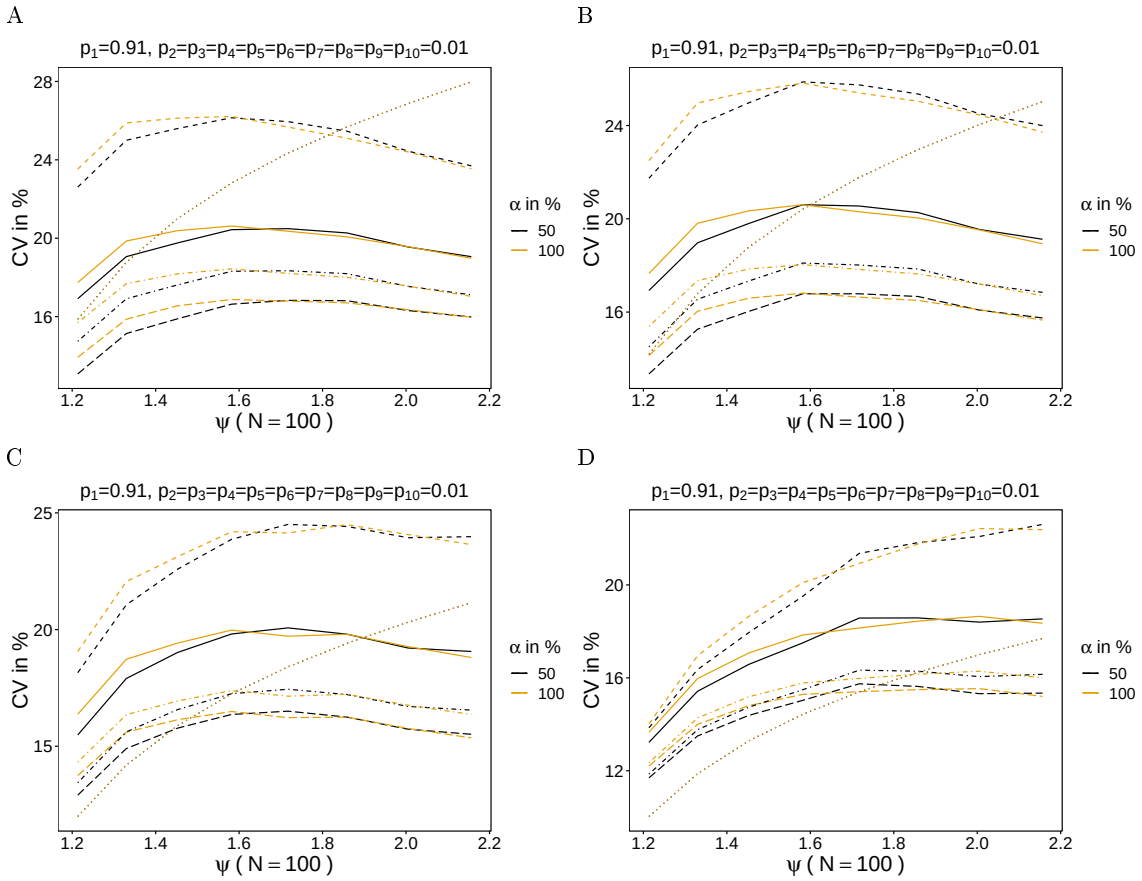

Figure 16: Same as Figure 11.