Blouch Model Checking Results

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Contents

1 Introduction

Prior predictive checks generate predictions from the model using only the prior distribution(s) in order to assess whether the priors are appropriate – they are equivalent to running the model without data (Gabry et al. 2019). Posterior predictive checks generate data according to the posterior predictive distribution and compare it to the observed data to assess

the fit of the model (Gabry et al. 2019). *Blouch* includes Stan functions to run prior and posterior predictive checks for each of the included models, and their use is shown the simulation and empirical examples in the main manuscript and on the vignettes on the *blouch* github.com site. Below are the results for all models included in the release version of *blouch*.

I evaluated the model's fit on data I simulated using the Model Checking Code SBR2.R script available in the Model Checking folder in the blouch-project project github.com. All data was simulated on a randomly sampled set of 50 tip species from the 10K trees primate phylogeny. This data were then analyzed using the requisite *blouch* model.

All simulations were run with the true parameter values were set to: $hl = 0.1; Vy = 20$ and other parameter values following those used in the Validation Results. Priors were set to: $hl \sim lognormal(log(0.25), 0.75); Vy \sim exponential(5)$ with other values following those used in the Validation Results.

Each model accounted for measurement error. Measurement error was added to the X and Y variables by simulating from a random normal distribution with $\mu = 0$ and $\sigma = 0.01$. For the models that test hypotheses of regime placement, All runs were using two chains were 2000 iterations per chain.

For each model the Prior and Posterior Check results shows the density estimates of the observed species data (in blue) versus the simulated data (in pale red) drawn from the posterior distribution.

Results show that all models are well fit, with simulated data looking similar to the observed data.

2 Simulated Regimes

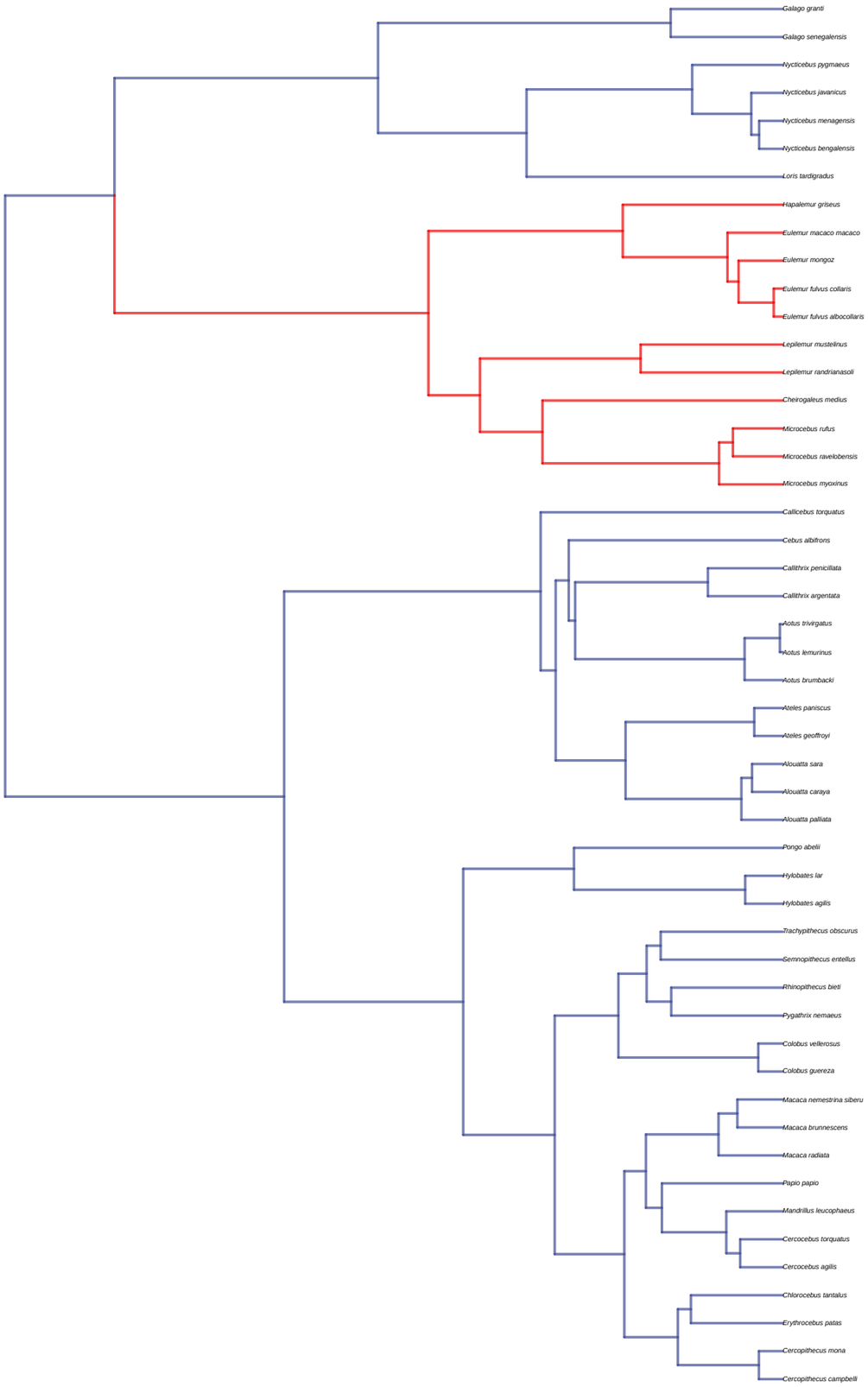


Figure 1: Simulated regimes for Multi-Optima Models

3 Basic Models

3.0.1 Direct effect Model

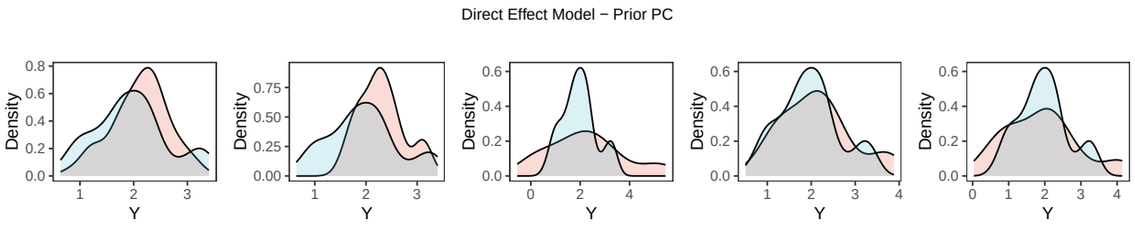


Figure 2: Prior Predictive Check

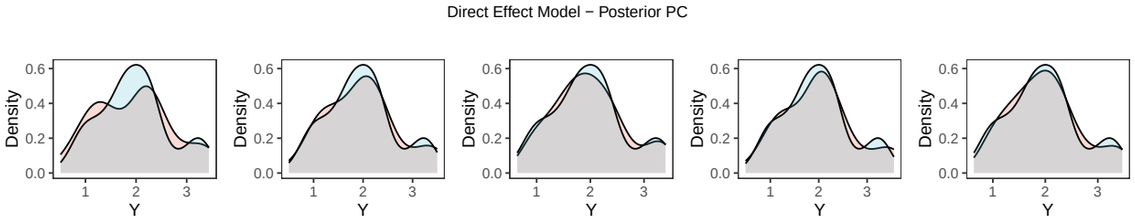
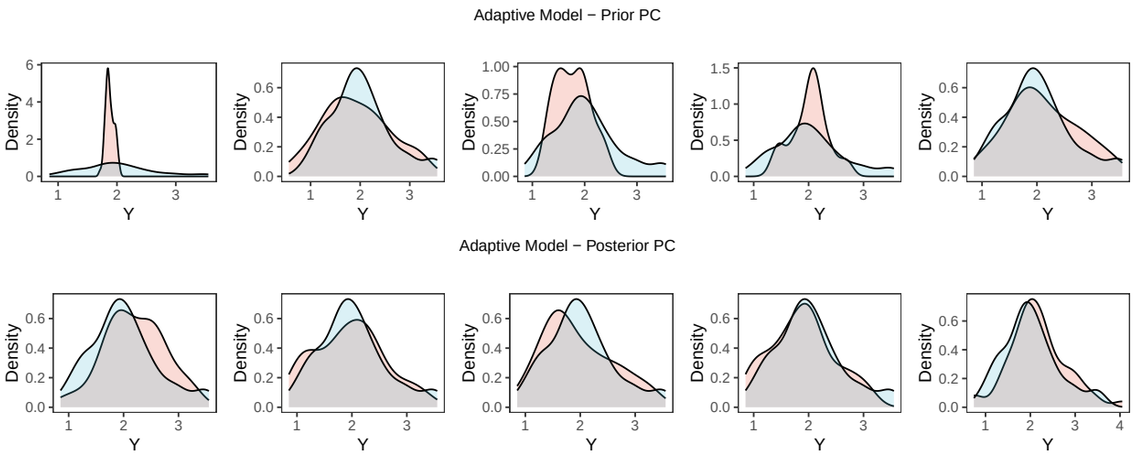
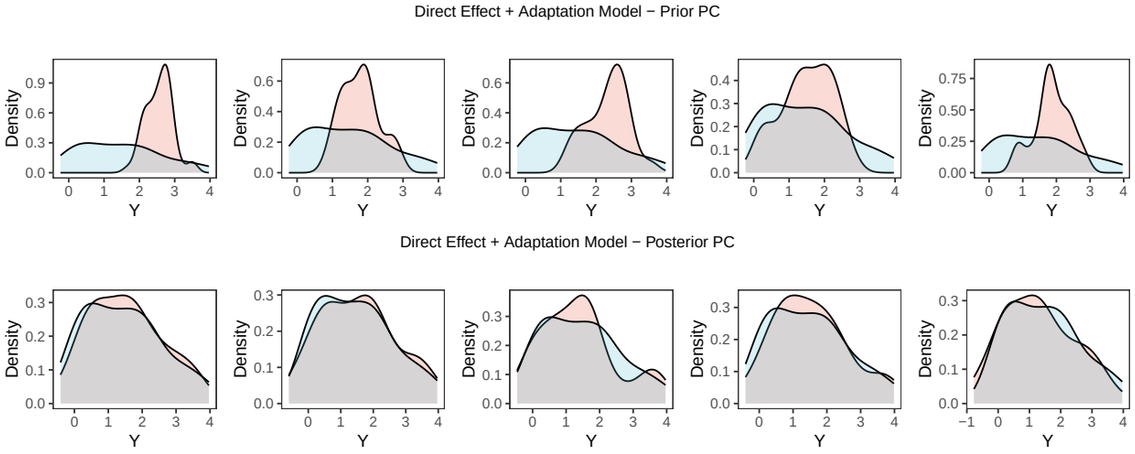


Figure 3: Posterior Predictive Check

3.0.2 Adaptation Model

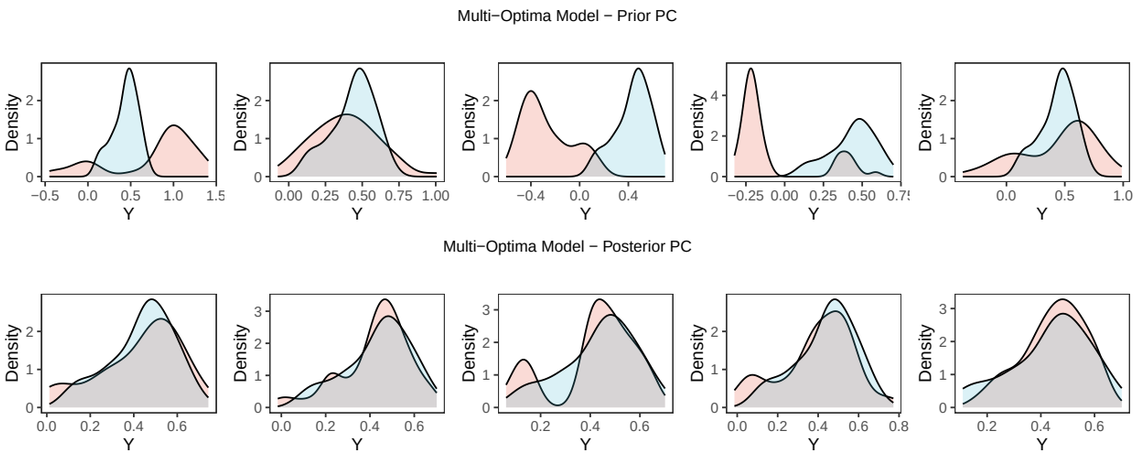


3.0.3 Direct Effect Adaptation Model

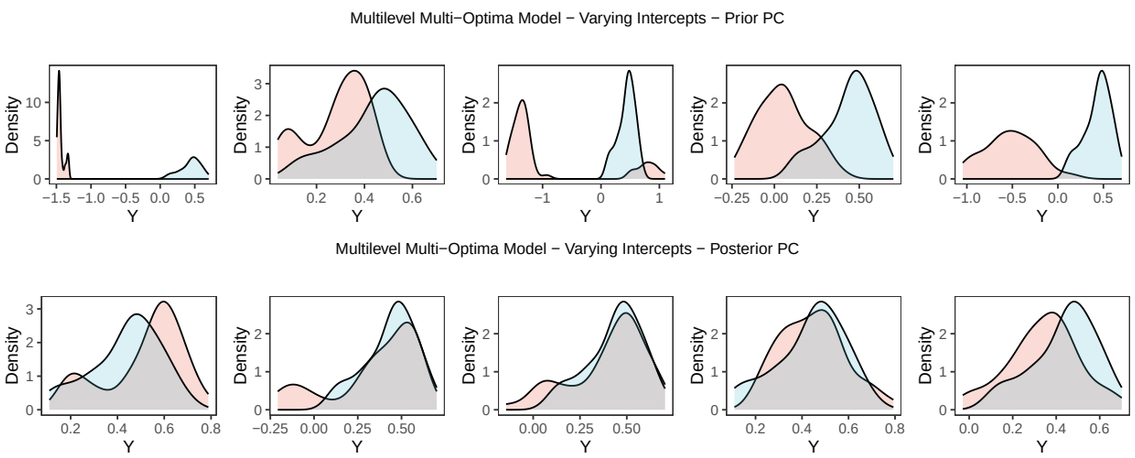


4 Multi-Optima Models

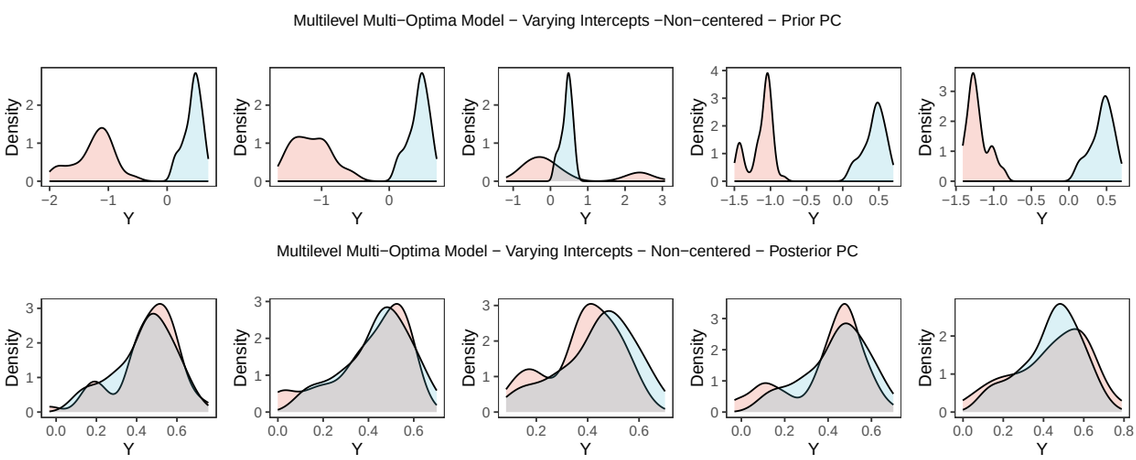
4.0.1 Multi-Optima Model



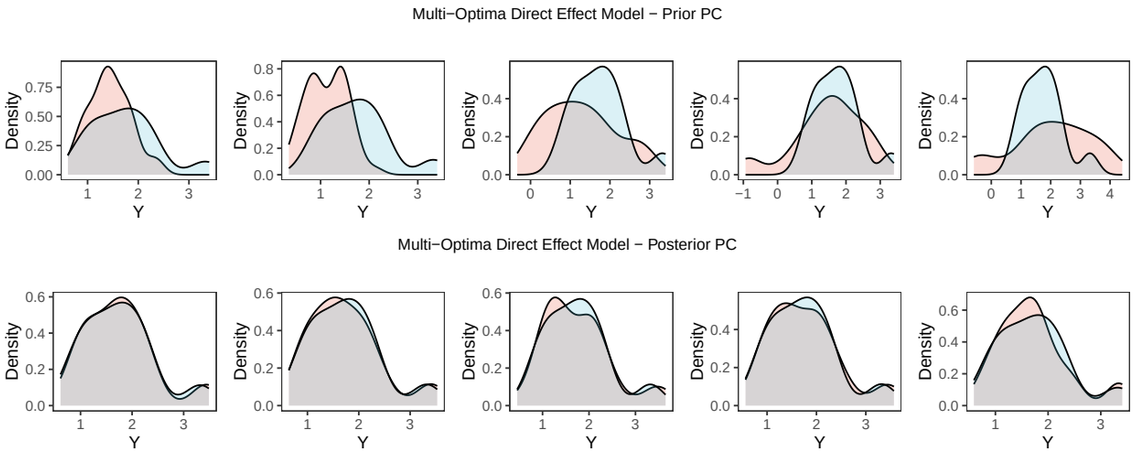
4.0.2 Multilevel Multi-Optima Model - Varying Intercepts



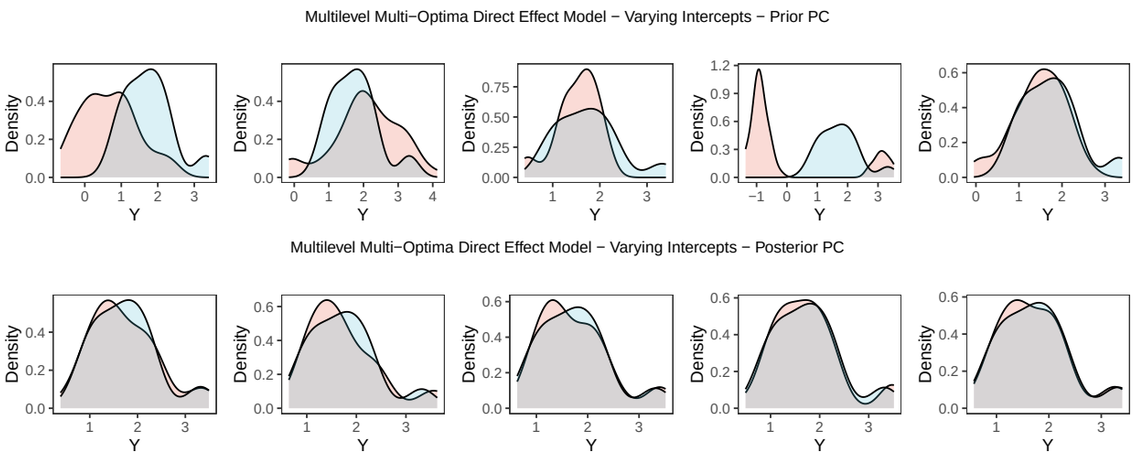
4.0.3 Multilevel Multi-Optima Model - Varying Intercepts - Non-centered



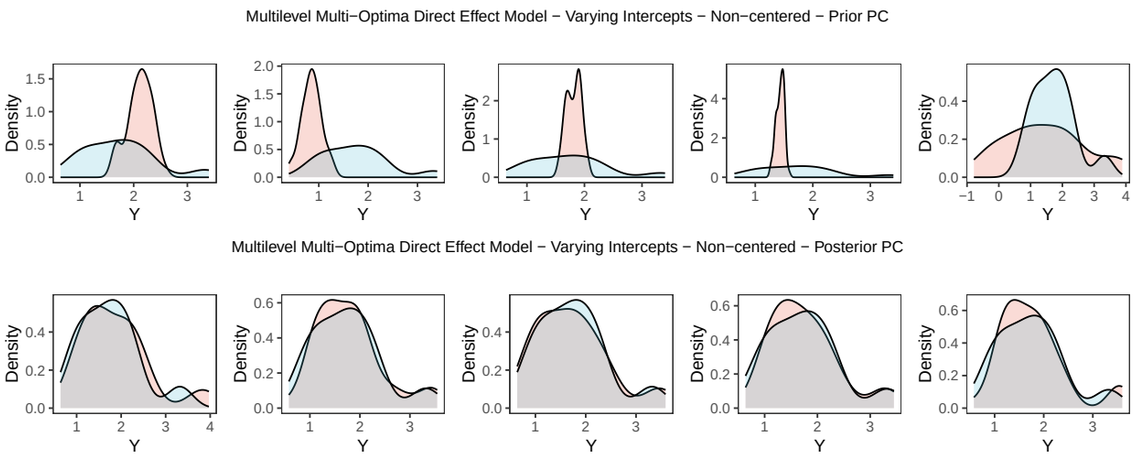
4.0.4 Multi-Optima Direct Effect Model



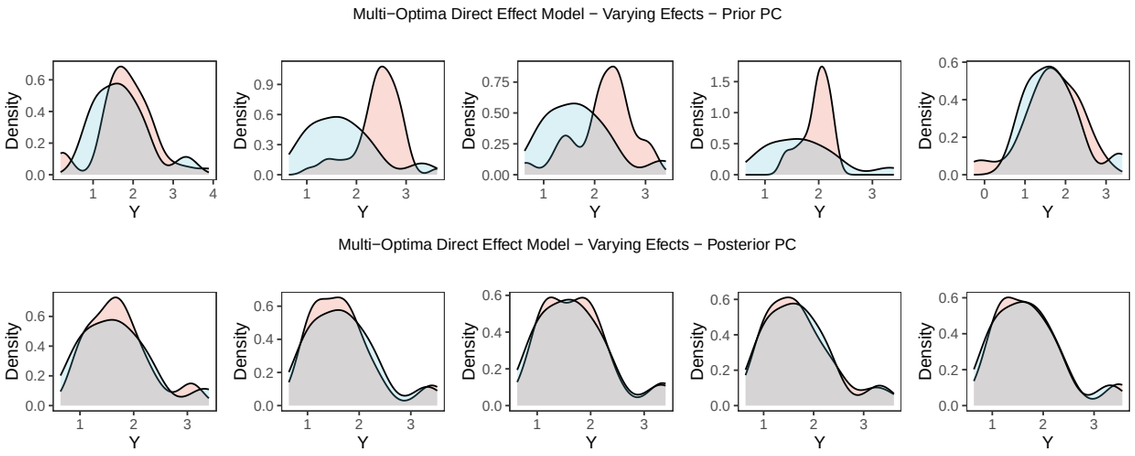
4.0.5 Multilevel Multi-Optima Direct Effect Model - Varying Intercepts



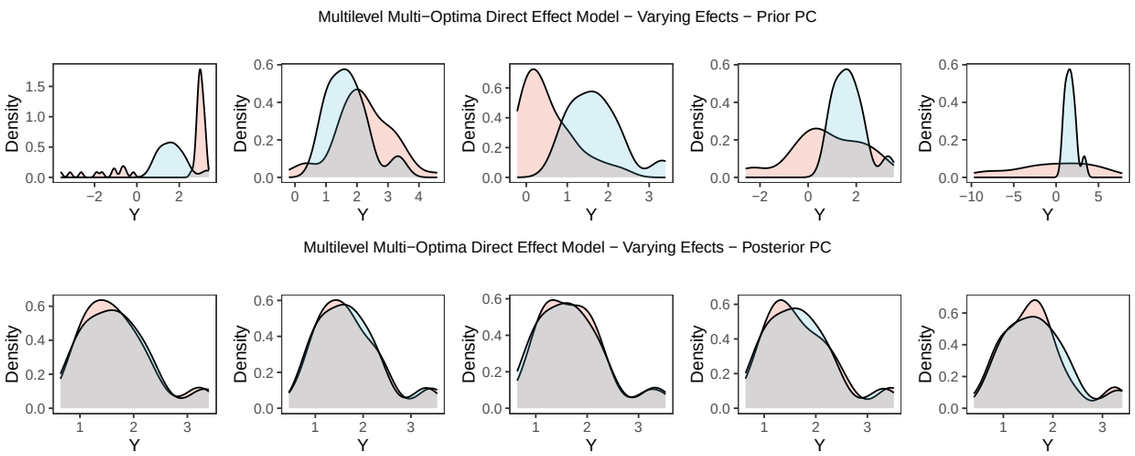
4.0.6 Multilevel Multi-Optima Direct Effect Model - Varying Intercepts - Non-centered



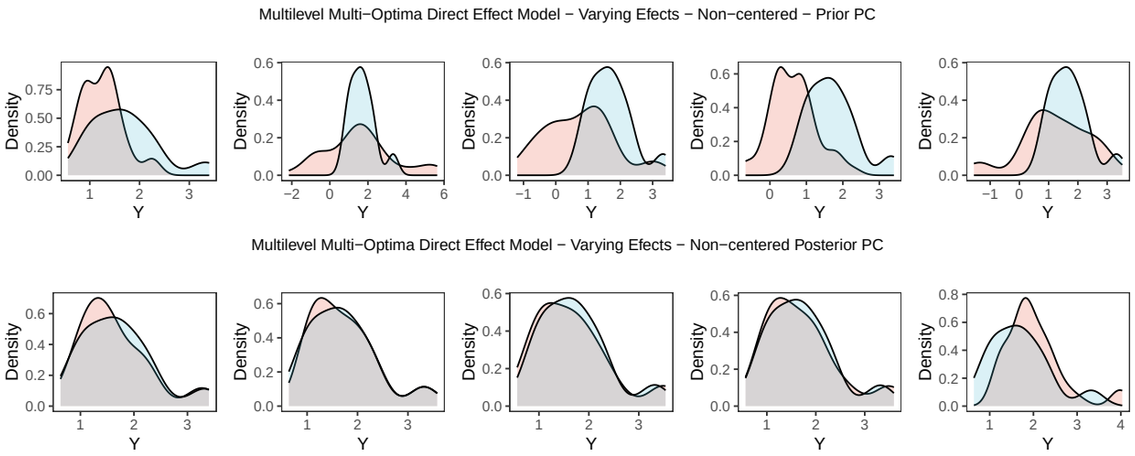
4.0.7 Multi-Optima Direct Effect Model - Varying Effects



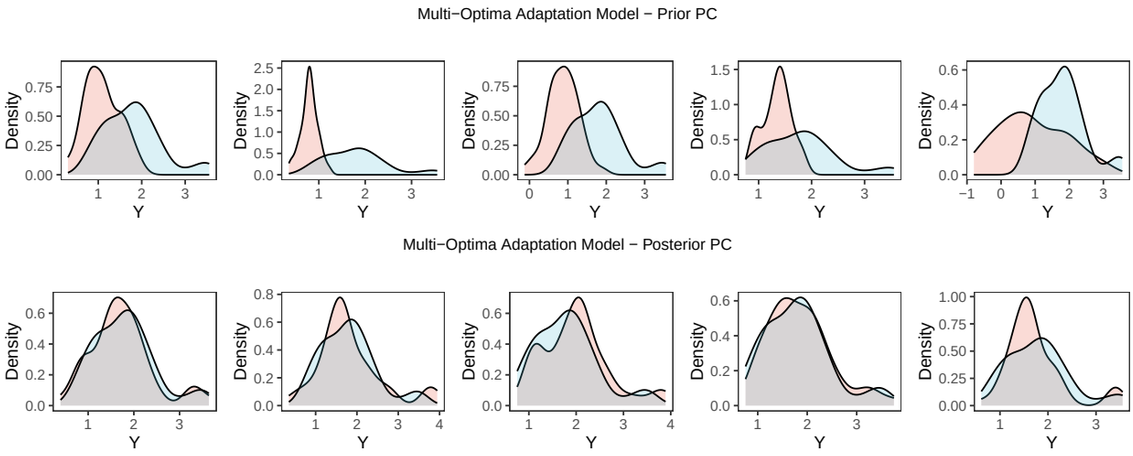
4.0.8 Multilevel Multi-Optima Direct Effect Model - Varying Effects



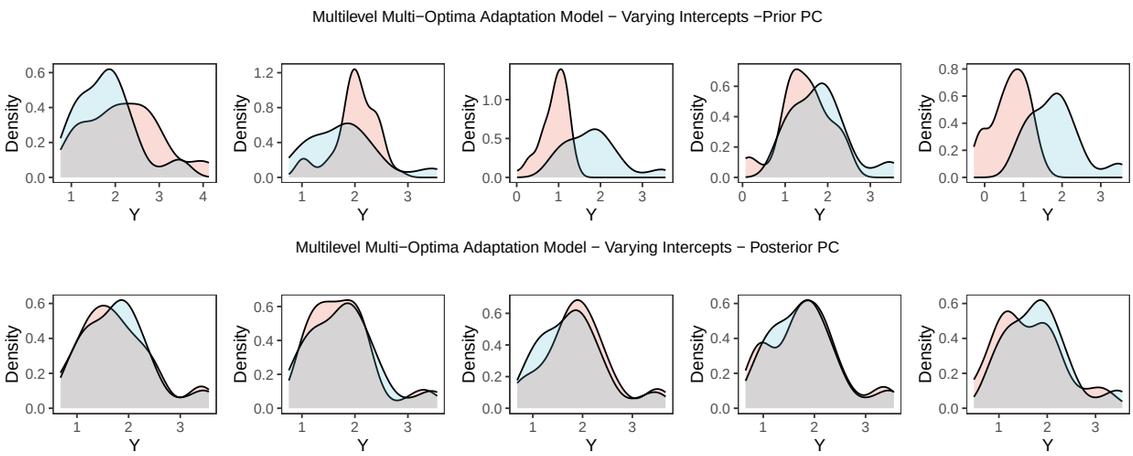
4.0.9 Multilevel Multi-Optima Direct Effect Model - Varying Effects - Non-centered



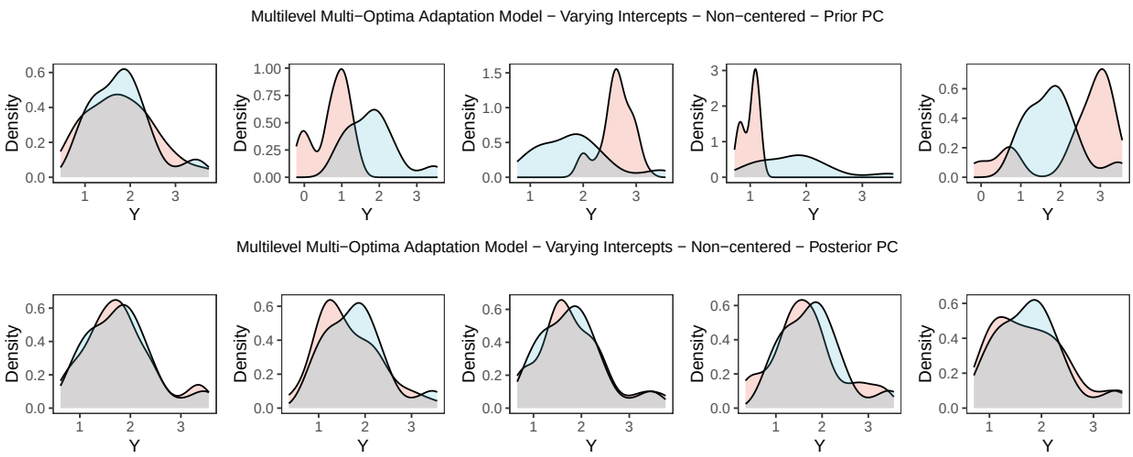
4.0.10 Multi-Optima Adaptation Model



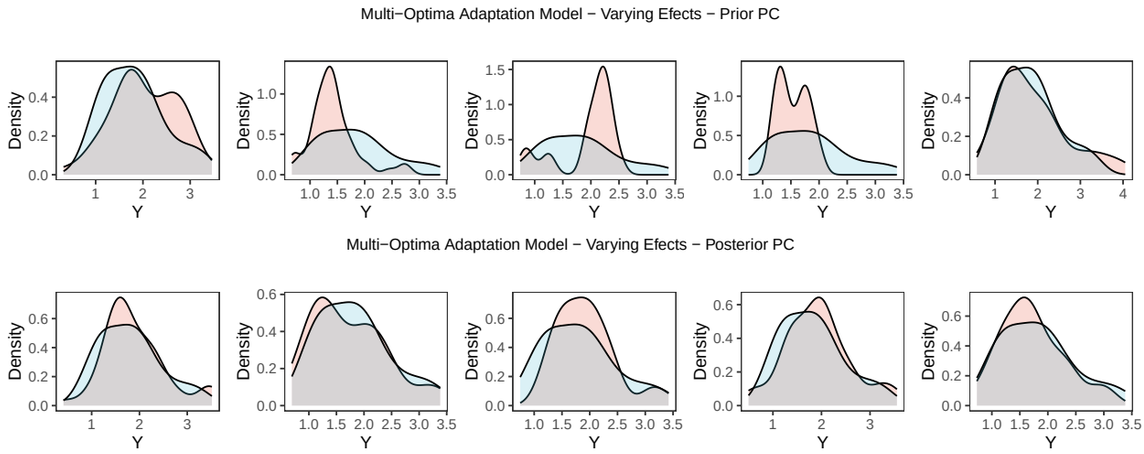
4.0.11 Multilevel Multi-Optima Adaptation Model - Varying Intercepts



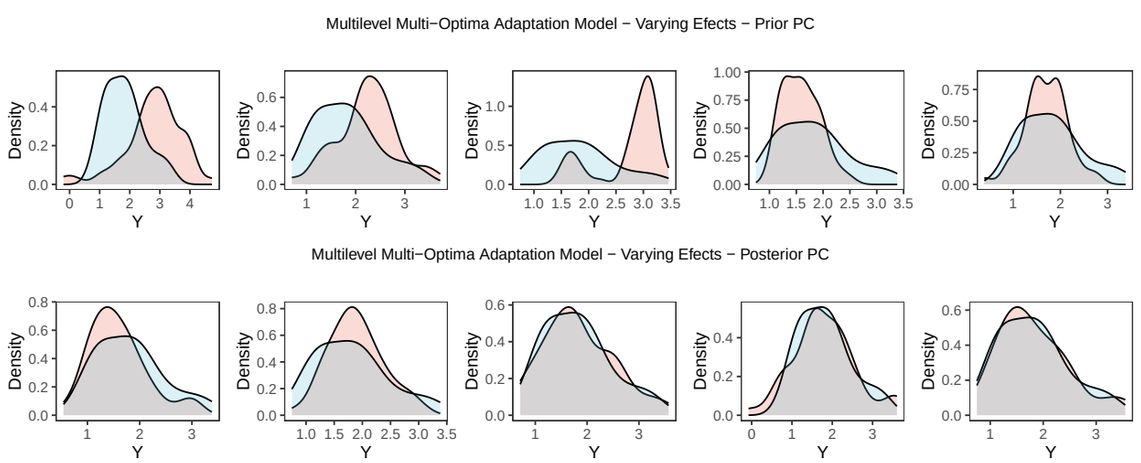
4.0.12 Multilevel Multi-Optima Adaptation Model - Varying Intercepts - Non-centered



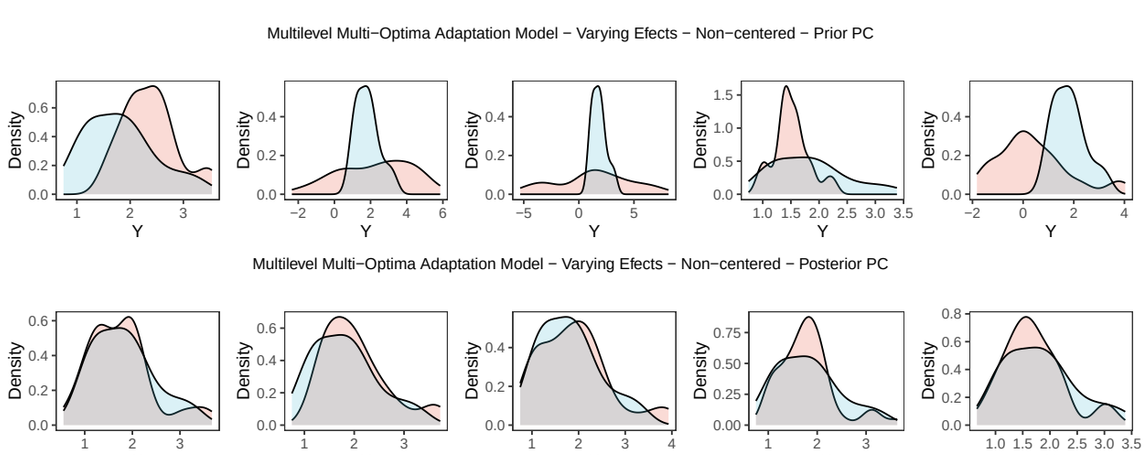
4.0.13 Multi-Optima Adaptation Model - Varying Effects



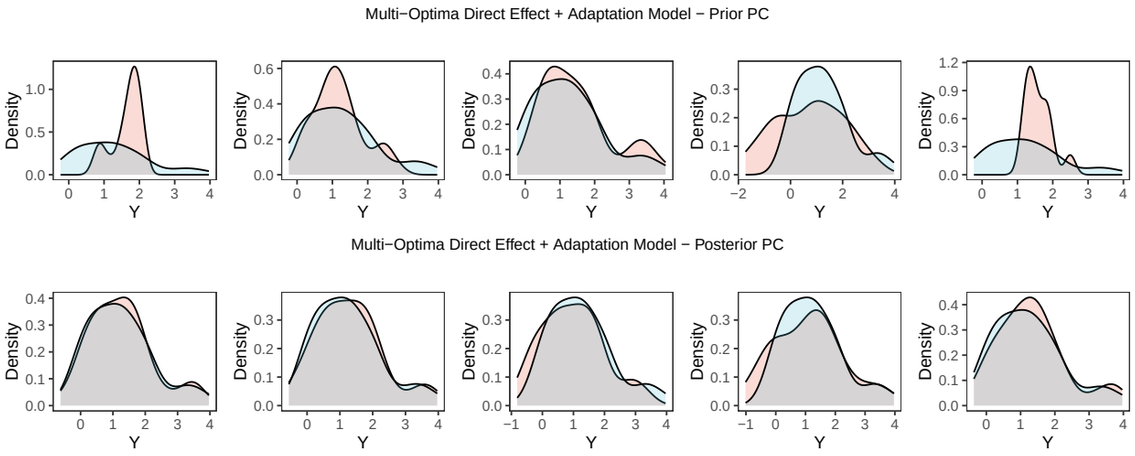
4.0.14 Multilevel Multi-Optima Adaptation Model - Varying Effects



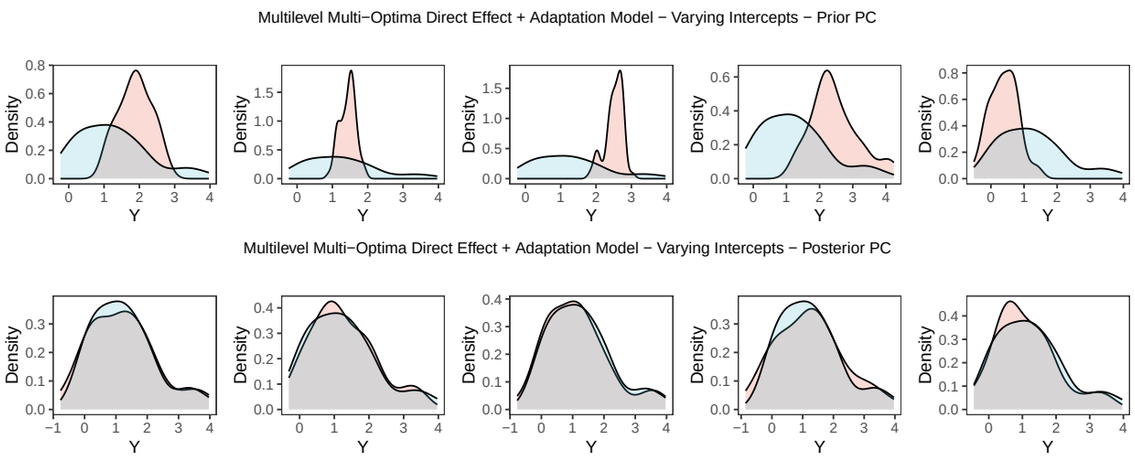
4.0.15 Multilevel Multi-Optima Adaptation Model - Varying Effects - Non-centered



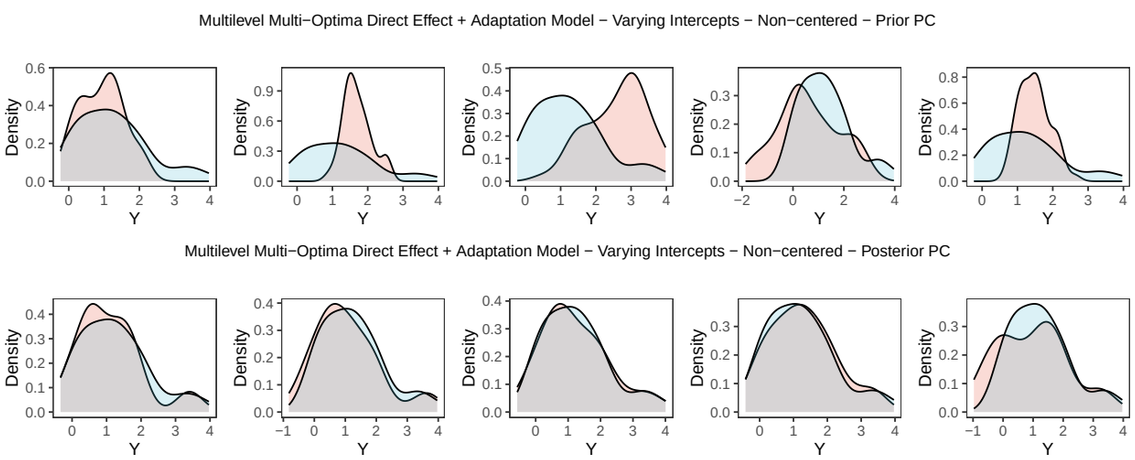
4.0.16 Multi-Optima Direct Effect Adaptation Model



4.0.17 Multilevel Multi-Optima Direct Effect Adaptation Model - Varying Intercepts



4.0.18 Multilevel Multi-Optima Direct Effect Adaptation Model - Varying Intercepts - Non-centered



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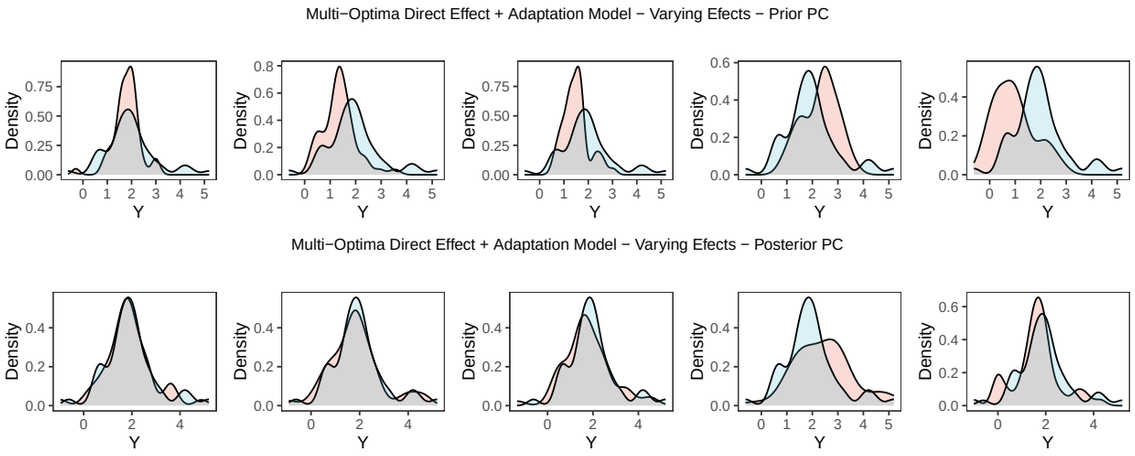
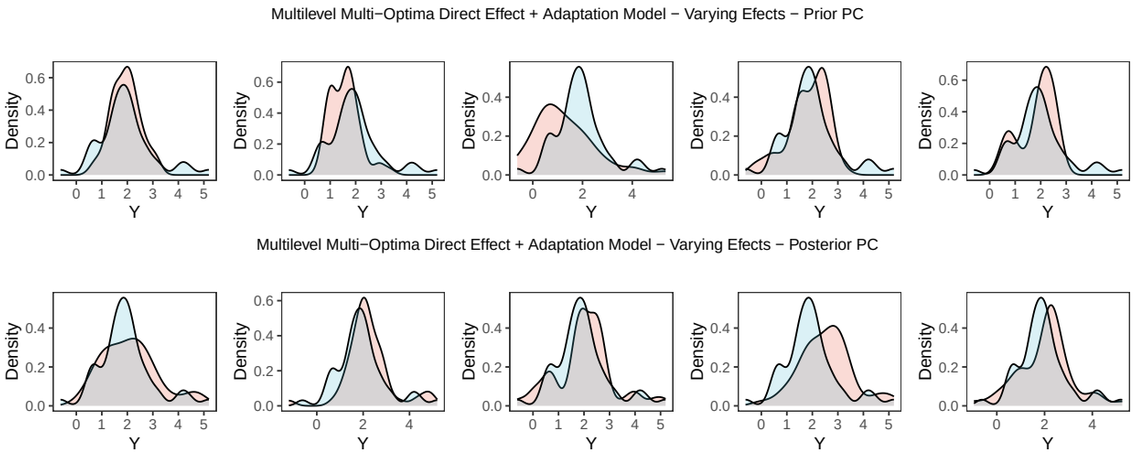


4.0.20 Multilevel Multi-Optima Direct Effect Adaptation Model - Varying Effects



4.0.21 Multilevel Multi-Optima Direct Effect Adaptation Model - Varying Effects - Non-centered