Stacking Copas selection models over varying grids

Here we explore the consistency of stacking of Copas selection models. Briefly, the Copas model is defined by

$$y_i = \theta_i + \sigma_i \epsilon_i \tag{1}$$

$$z_i = \gamma_0 + \gamma_1 / s_i + \delta_i \tag{2}$$

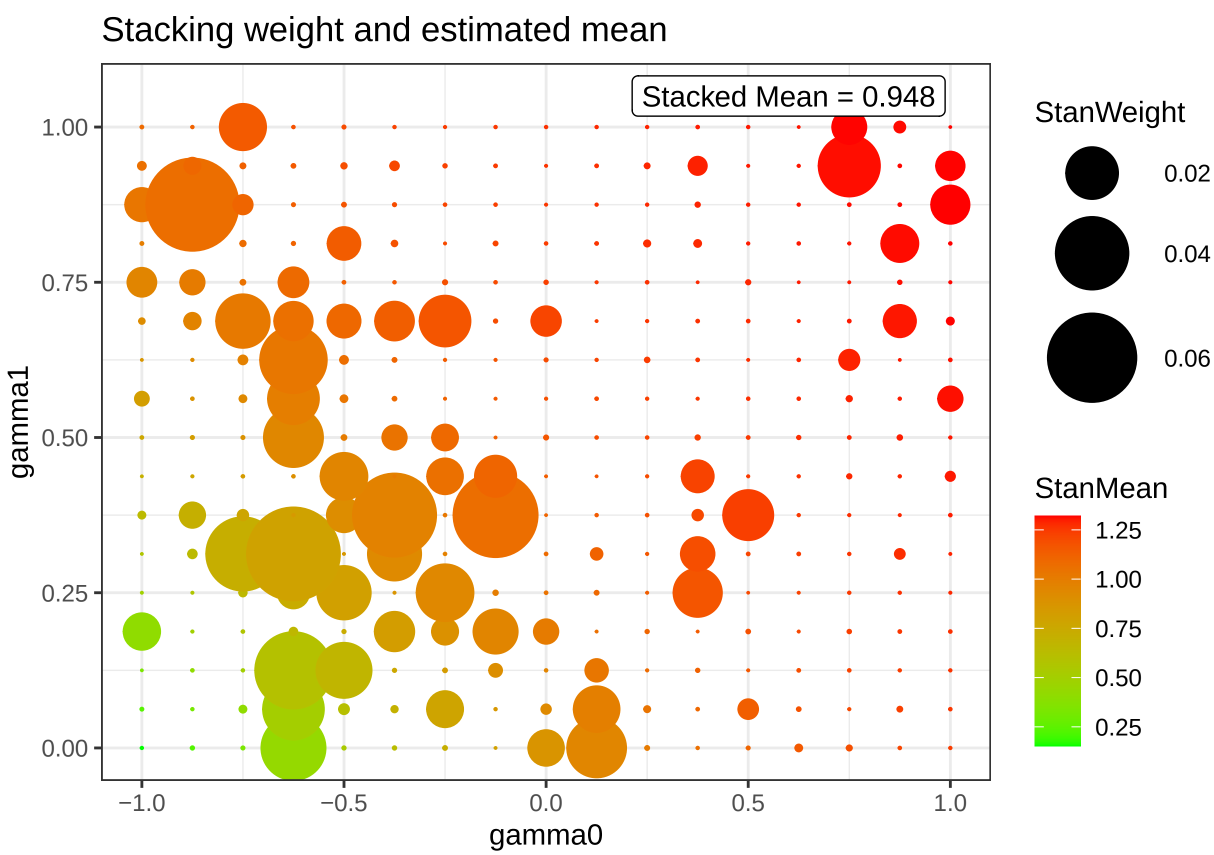
$$\epsilon_i, \delta_i \sim \mathrm{N}(0,1), \quad \mathrm{corr}(\epsilon_i, \delta_i) = \rho \tag{3}$$

$$\theta_i \sim \mathrm{N}(\theta, \tau^2), \tag{4}$$

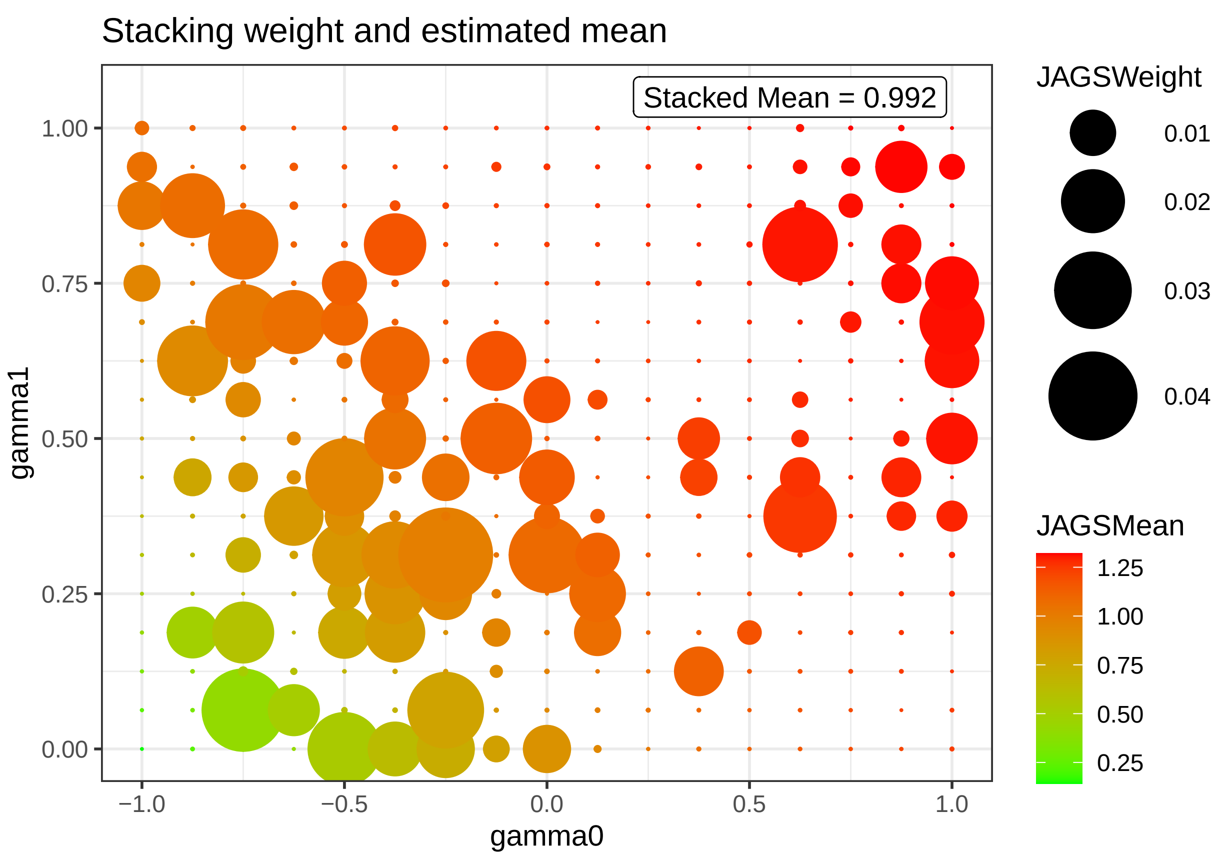
and we only observe y_i if the latent selection parameter $z_i > 0$. The parameters γ_0 and γ_1 control the probability of publication. Larger γ_0 (=) larger probability of publication, larger γ_1 (=) larger selection effect based on the size of the study (standard error s_i). A single Copas selection model assumes values of γ_0 and γ_1, and estimates the overall mean effect θ, the heterogeneity parameter τ^2, and the correlation coefficient ρ, which controls the relationship between effect size y_i and the probability of publication.

We stack over grids of Copas models, with grids being defined by choices of γ_0 and γ_1. We start with a fine grid comprised of each pairwise combination of $\gamma_0 \in (-1, -0.875, -0.75 \ldots, 0.875, 1)$ and $\gamma_1 \in (0, 0.0625, 0.125, \ldots, 1)$ for a 17×17 grid. We fit the Copas selection model for each pair (γ_0, γ_1) using both Stan and JAGS, and calculate stacking weights using the methods described in Yao et al. (2018) with the loo package in R. We then repeat the process with 9×9 and 5×5 sub-grids of the original 17×17 grid, by taking every other and every fourth value of both γ_0 and γ_1.

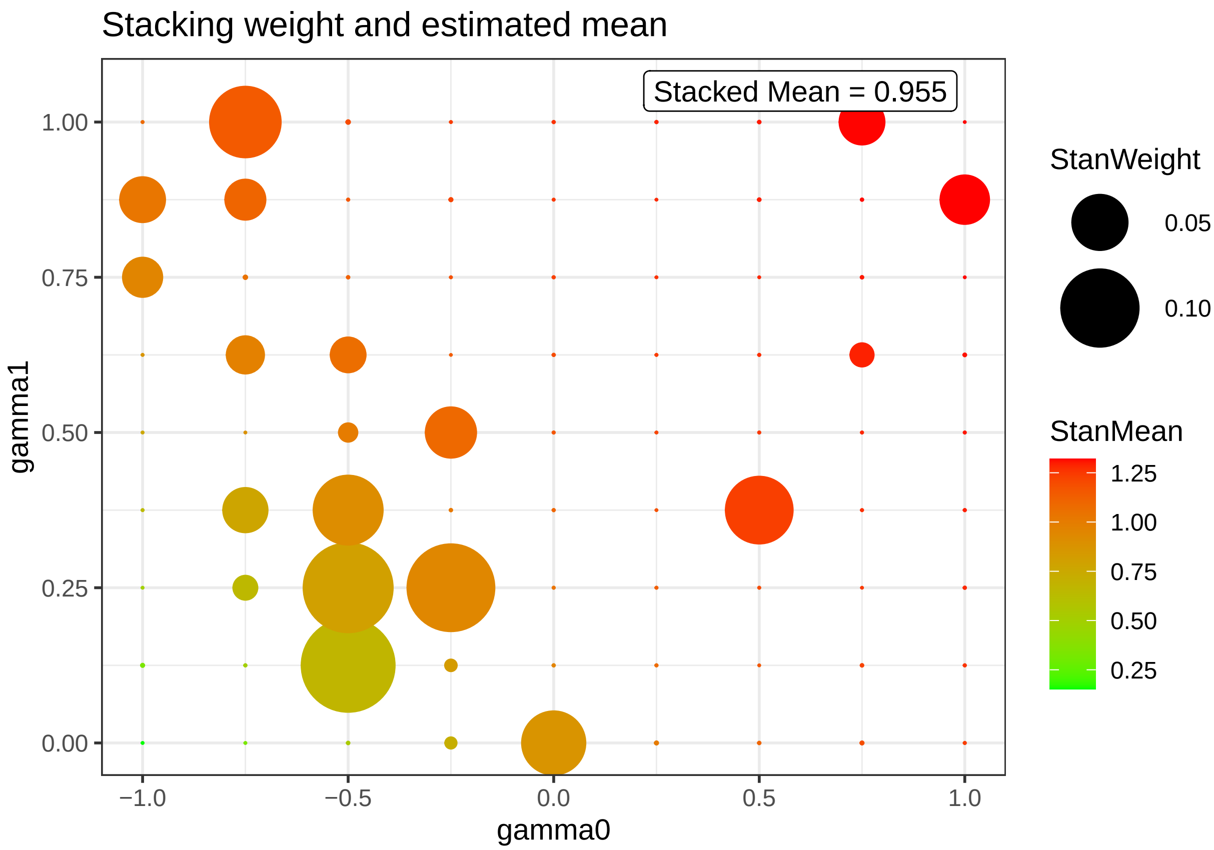
Below are plots comparing results for each grid using both Stan and JAGS. The top set of plots show the fine grid, with increasing coarseness in the second and third sets. For each plot, we display the stacked mean in the top-right corner.

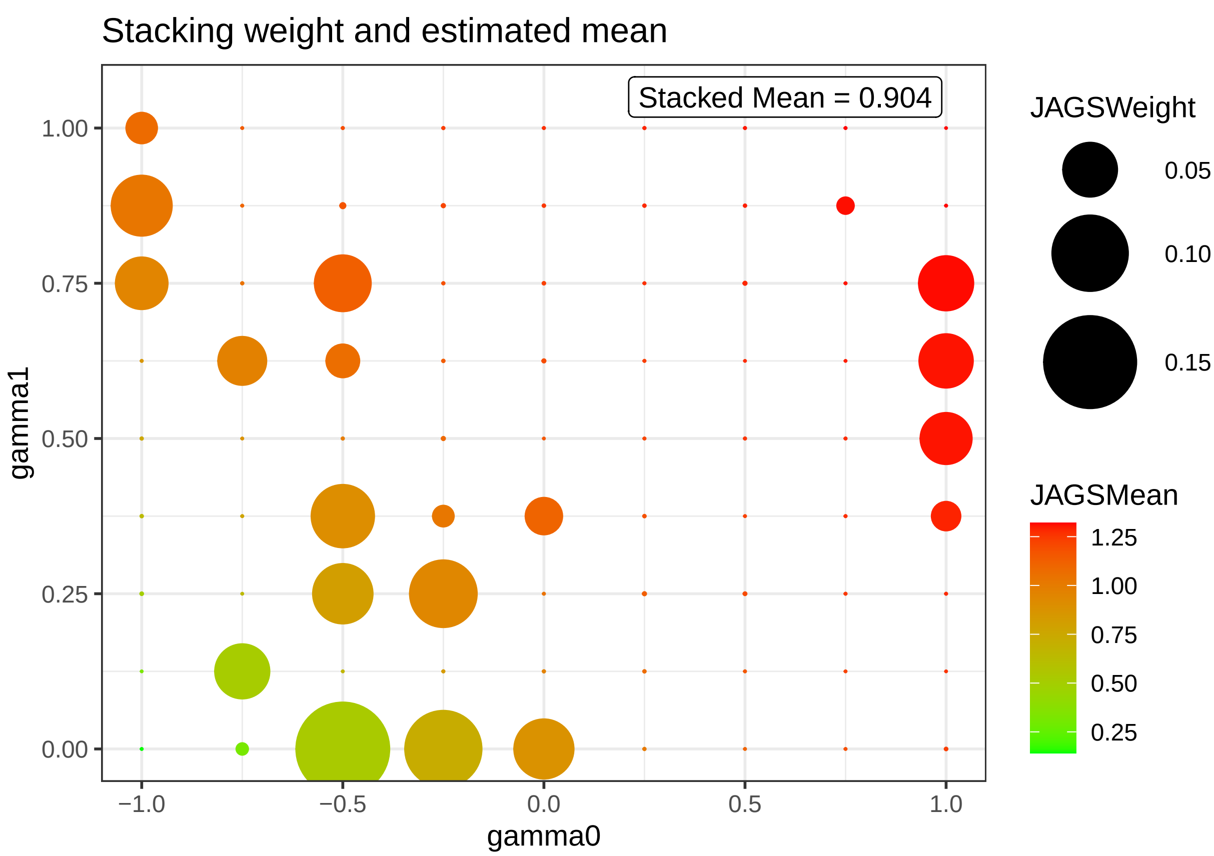


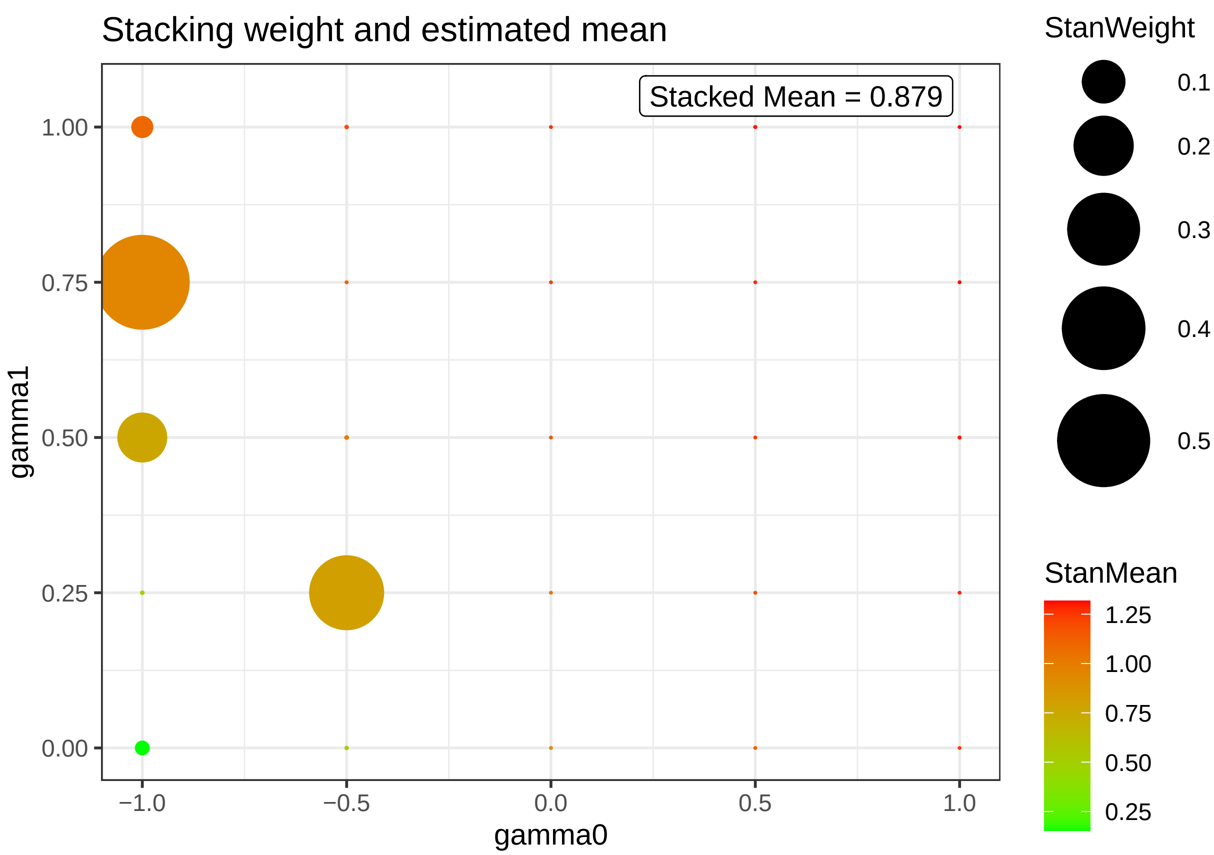
Stacking weight and estimated mean
Stacked Mean = 0.948
gamma1
1.00
0.75
0.50
0.25
0.00
−1.0
−0.5
0.0
0.5
1.0
gamma0
StanWeight
0.02
0.04
0.06
StanMean
1.25
1.00
0.75
0.50
0.25

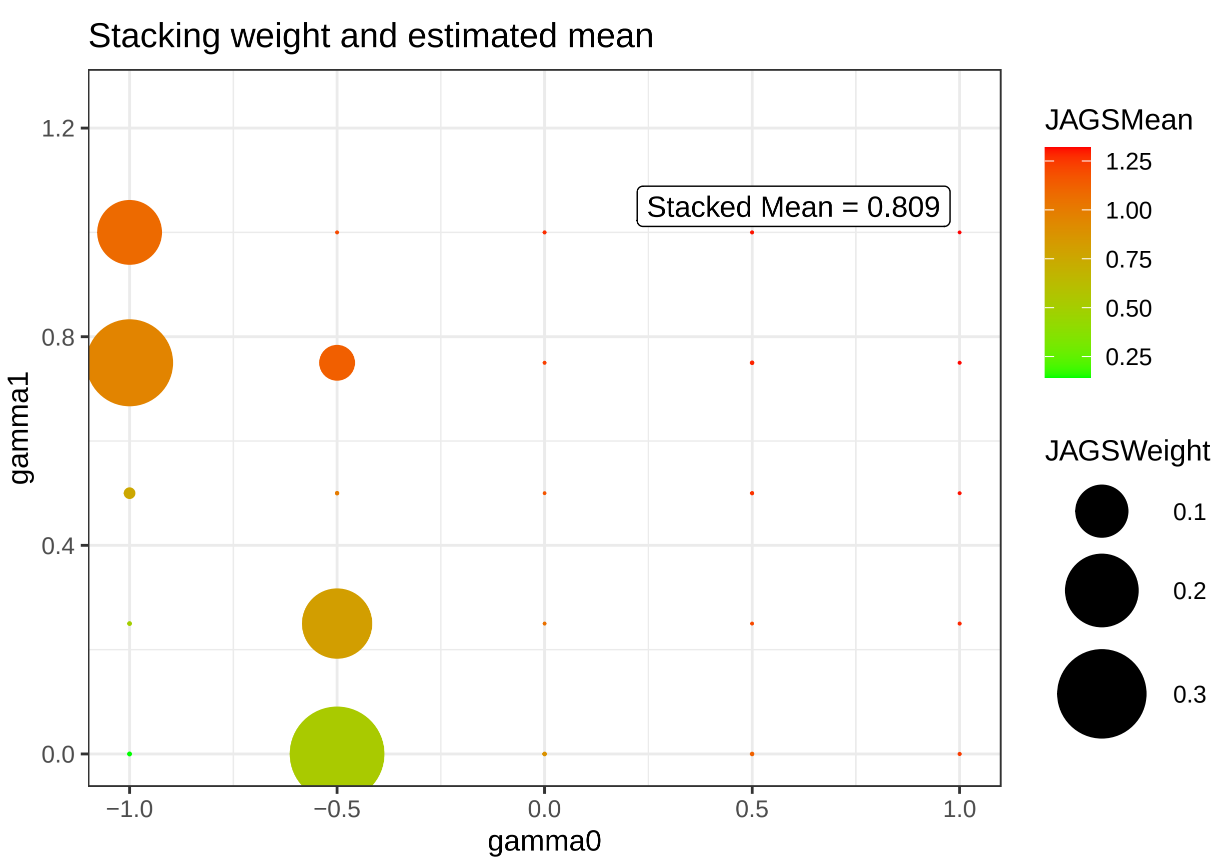


Stacking weight and estimated mean
Stacked Mean = 0.992
gamma1
1.00
0.75
0.50
0.25
0.00
−1.0
−0.5
0.0
0.5
1.0
gamma0
JAGSWeight
0.01
0.02
0.03
0.04
JAGSMean
1.25
1.00
0.75
0.50
0.25


Stacking weight and estimated mean
Stacked Mean = 0.955
1.00
0.75
0.50
0.25
0.00
gamma1
−1.0
−0.5
0.0
0.5
1.0
gamma0
StanWeight
0.05
0.10
StanMean
1.25
1.00
0.75
0.50
0.25

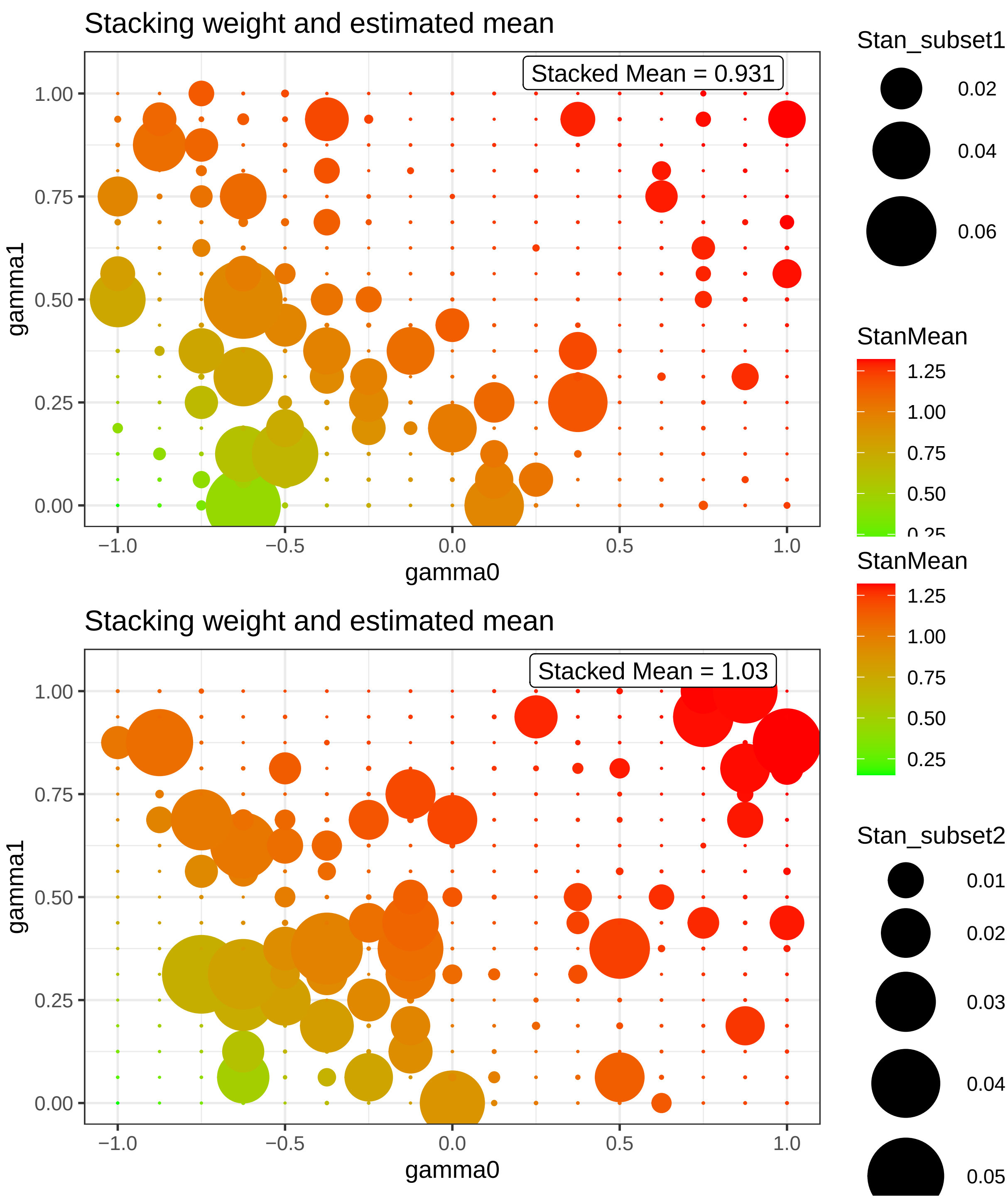

Stacking weight and estimated mean
Stacked Mean = 0.904
1.00
0.75
0.50
0.25
0.00
gamma1
−1.0
−0.5
0.0
0.5
1.0
gamma0
JAGSWeight
0.05
0.10
0.15
JAGSMean
1.25
1.00
0.75
0.50
0.25

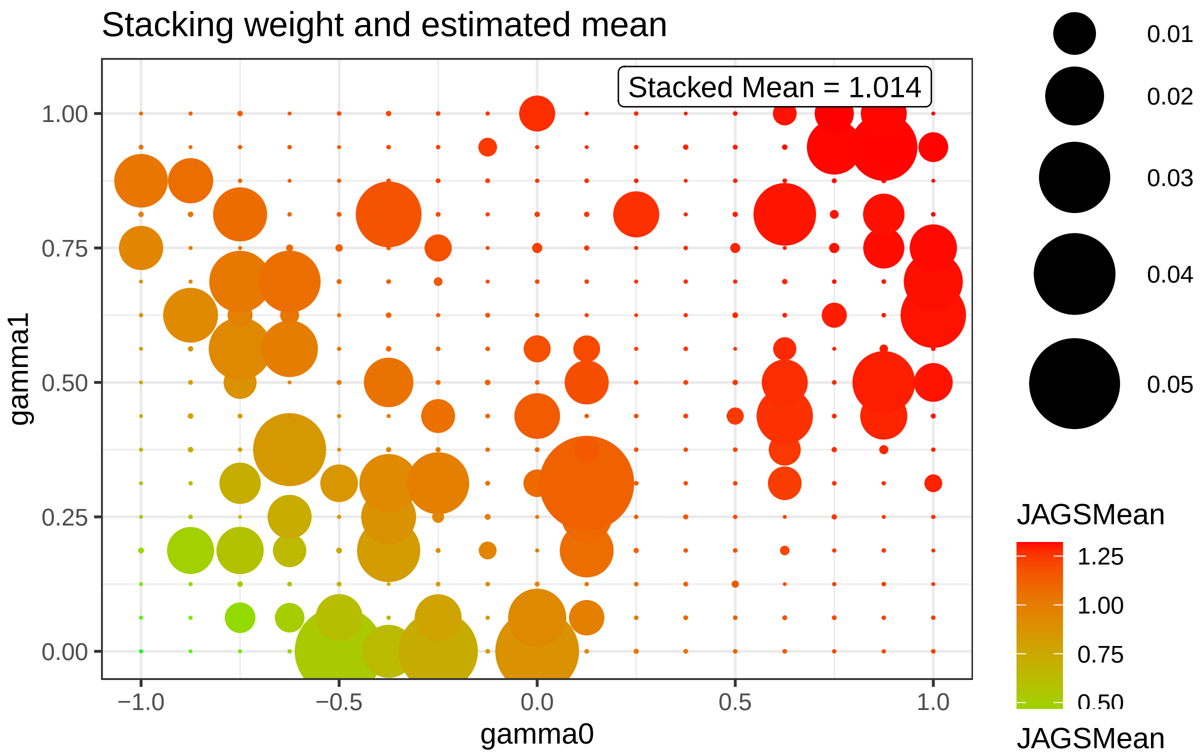

Stacking weight and estimated mean
Stacked Mean = 0.879
1.00
0.75
0.50
0.25
0.00
gamma1
−1.0
−0.5
0.0
0.5
1.0
gamma0
StanWeight
0.1
0.2
0.3
0.4
0.5
StanMean
1.25
1.00
0.75
0.50
0.25


Stacking weight and estimated mean
Stacked Mean = 0.809
1.2
0.8
0.4
0.0
gamma1
−1.0
−0.5
0.0
0.5
1.0
gamma0
JAGSMean
1.25
1.00
0.75
0.50
0.25
JAGSWeight
0.1
0.2
0.3

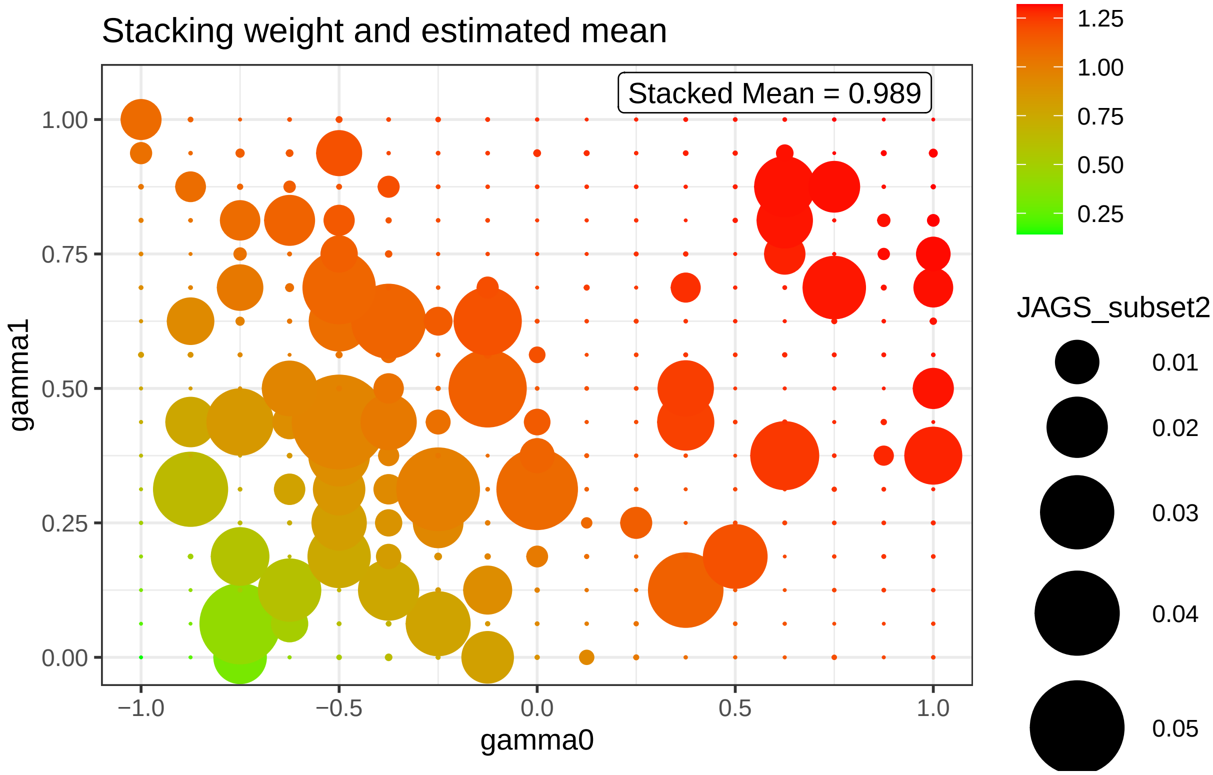
Using subsets of posterior draws to determine stacking weights

The above plots stacked over all 5000 posterior MCMC samples (1250 from 4 chains) for each fitted model. Here, we take two subsets of 2500 posterior samples (625 from each of 4 chains), stack over those samples, and see if results change.





Stacking weight and estimated mean
Stacked Mean = 1.014
gamma1
1.00
0.75
0.50
0.25
0.00
−1.0
−0.5
0.0
0.5
1.0
gamma0
0.01
0.02
0.03
0.04
0.05
JAGSMean
1.25
1.00
0.75
0.50



Stacking weight and estimated mean
Stacked Mean = 0.989
gamma1
1.00
0.75
0.50
0.25
0.00
−1.0
−0.5
0.0
0.5
1.0
gamma0
JAGSMean
1.25
1.00
0.75
0.50
0.25
JAGS_subset2
0.01
0.02
0.03
0.04
0.05