

ADDITIONAL RESULTS ON THE PERFORMANCE OF LOCATION SCALE MODELS IN META-ANALYSIS

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1. INTRODUCTION

THE RANDOM-EFFECTS MODEL

The random-effects model can be understood as a regression model

$$\hat{\theta}_i = \beta_0 + u_i + e_i$$

μ_{θ} $u_i \sim N(0, \tau^2)$ τ^2 : Heterogeneity parameter $e_i \sim N(0, \sigma_i^2)$ σ_i^2 : Sampling variance of study i

THE MIXED-EFFECTS MODEL

When there is substantial heterogeneity...

$$\hat{\theta}_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip} + u_i + e_i$$

Predictor variables

THE LOCATION-SCALE MODEL

For predicting both, the overall effect size and the heterogeneity

$$\begin{cases} \hat{\theta}_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip} + u_i + e_i & \text{Location part} \\ \ln(\tau_i^2) = \alpha_0 + \alpha_1 z_{i1} + \dots + \alpha_q z_{iq} & \text{Scale part} \end{cases}$$

GOAL

TO PRESENT ADDITIONAL RESULTS REGARDING THE PREDICTED HETEROGENEITY VALUES AND THE ESTIMATES OF THE SCALE COEFFICIENTS.

2. METHOD

MONTECARLO SIMULATION

- Programmed in R
- Meta-analyses of standardized mean differences
- 4 crossed factors: 10 x 3 x 2 x 28 = 1680 conditions
- 10,000 replicates x 1680 = 16,800,000 meta-analyses

NUMBER OF STUDIES	10	10, 20, 30, 40, 50, 60, 70, 80, 90, 100
AVERAGE SAMPLE SIZE	3	30, 50, 100
MODERATOR VARIABLE	2	Dichotomous vs. Continuous
τ_1^2 AND τ_2^2	28	Pairs between .01, .02, .04, .08, .16, .32, .64

*1,680 conditions x (+)10,000 meta-analyses = more than 16,800,000 meta-analyses simulated.

Results were conditioned to the needed limitations imposed on the space of possible values to estimate the model coefficients a_0 and a_1 .

4. CONCLUSIONS

In summary...

WHAT HAVE WE GOT?

With respect to τ_1^2 and τ_2^2 ...

- τ_1^2 tends to be better predicted (less biased) than τ_2^2 .
- There is a greater difference between the absolute bias of $\hat{\tau}_1^2$ and $\hat{\tau}_2^2$ when a continuous predictor is analysed.
- The greater the heterogeneity and the fewer the included studies, the greater the absolute bias of $\hat{\tau}_1^2$ and $\hat{\tau}_2^2$.

With respect to α_0 and α_1 ...

- α_0 and α_1 tend to be underestimated but, as the difference in the heterogeneity of the predictor levels becomes greater, α_1 tend to be overestimated.
- There is a greater difference between the absolute bias of $\hat{\alpha}_0$ and $\hat{\alpha}_1$ when a qualitative predictor is analysed, and as there is a greater difference in the heterogeneity of the predictor levels.
- The MSE of $\hat{\alpha}_1$ is greater than the MSE of $\hat{\alpha}_0$ in most scenarios.
- There is a greater difference between the MSE of $\hat{\alpha}_1$ and $\hat{\alpha}_0$ as the heterogeneity is lower and as there is a greater difference in the heterogeneity of the predictor levels.

SOME IMPORTANT PAPERS

Blázquez-Rincón, D., López-López, J. A., & Viechtbauer, W. (2022). Performance of Location-Scale Models in Meta-Analysis: A Simulation Study. <https://doi.org/10.17605/OSF.IO/AX27Z>

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. *Research Synthesis Methods*, 1(2), 97-111. <https://doi.org/10.1002/jrsm.12>

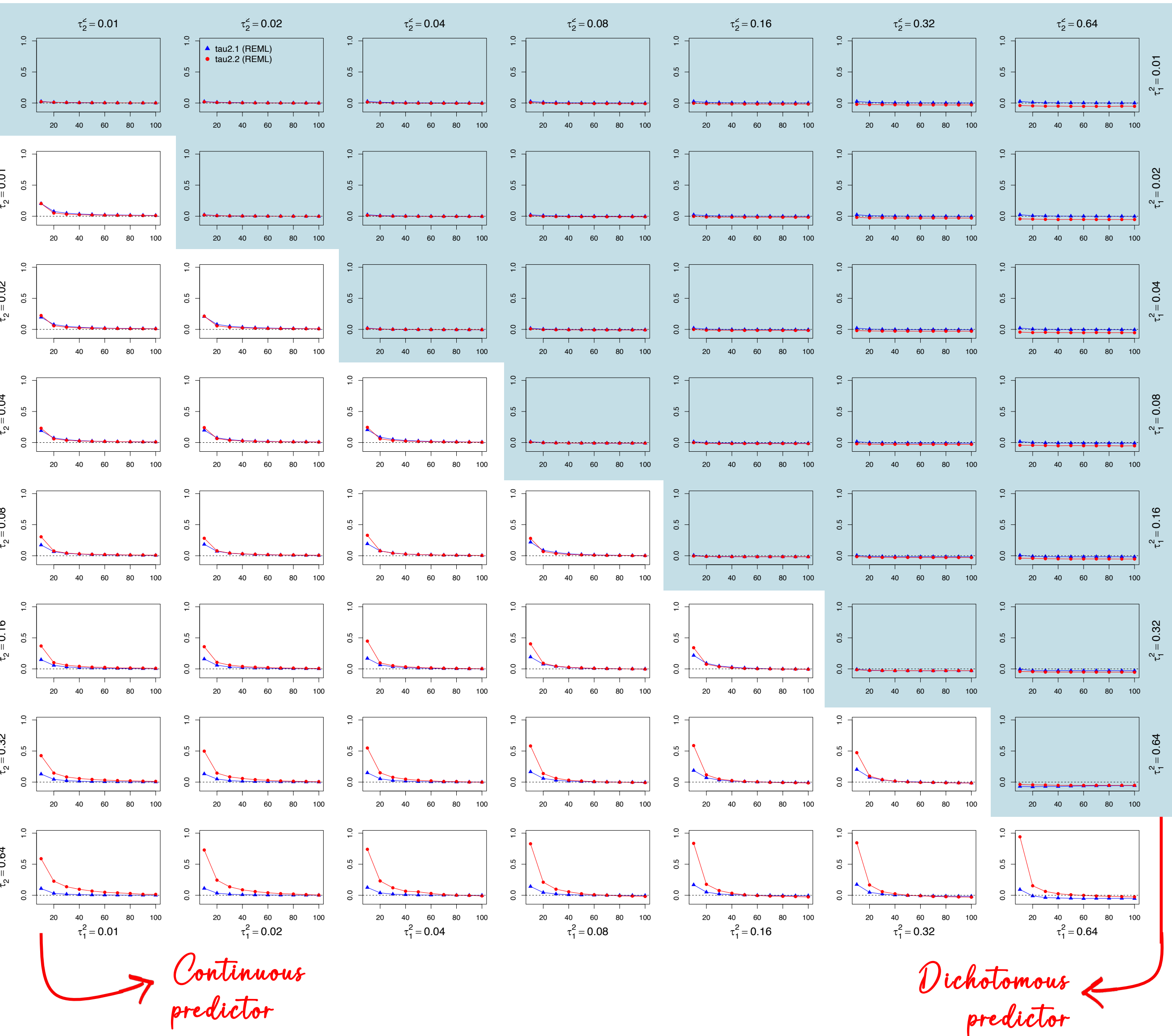
Viechtbauer, W., & López-López, J. A. (2022). Location-scale models for meta-analysis. *Research Synthesis Methods*, 13(6), 697-715. <https://doi.org/10.1002/jrsm.1562>

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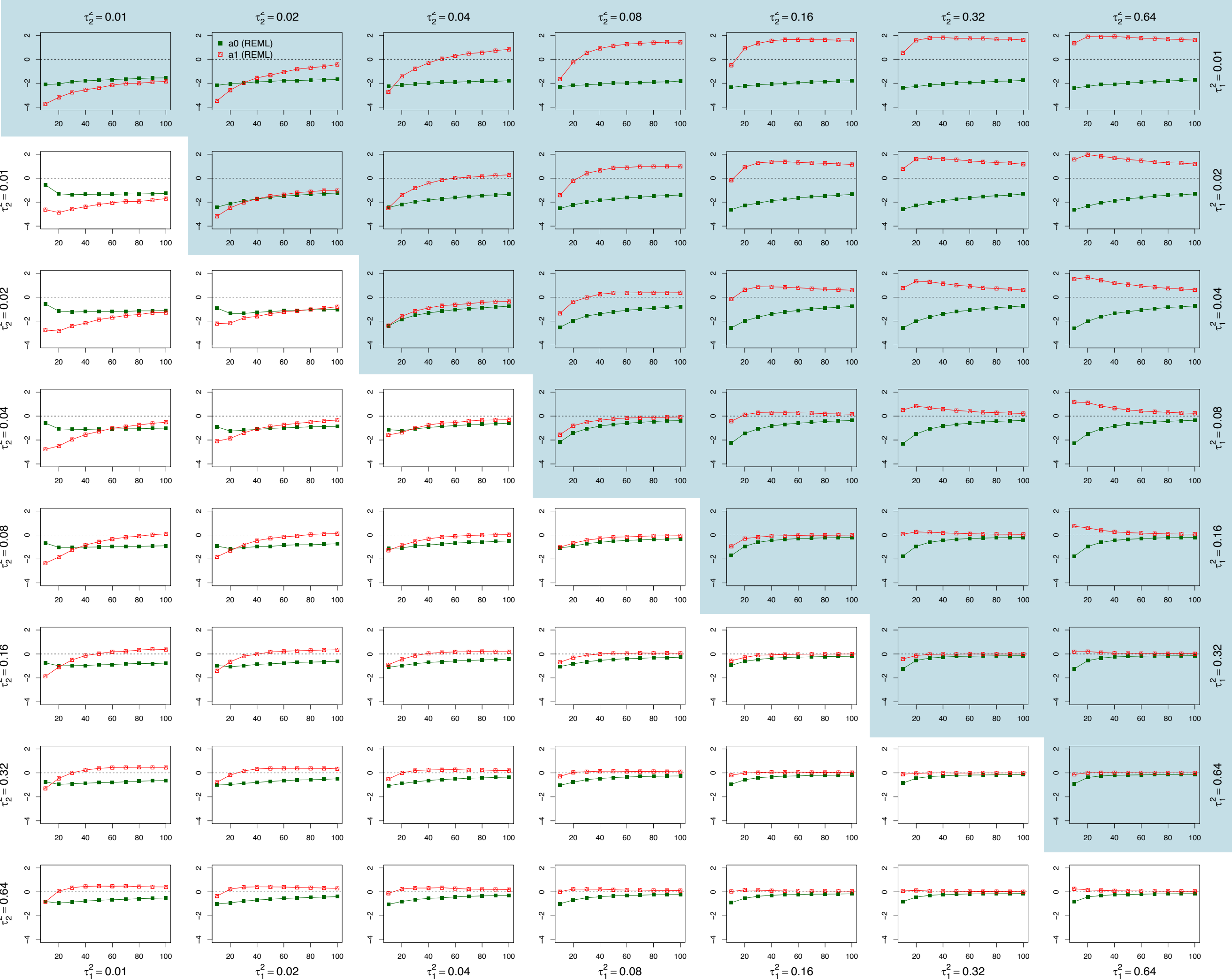


3. RESULTS

ABSOLUTE BIAS OF THE PREDICTED HETEROGENEITY $\hat{\tau}_1^2$ and $\hat{\tau}_2^2$



ABSOLUTE BIAS OF THE ESTIMATED MODEL COEFFICIENTS $\hat{\alpha}_0$ and $\hat{\alpha}_1$



MEAN SQUARED ERROR OF THE ESTIMATED MODEL COEFFICIENTS $\hat{\alpha}_0$ and $\hat{\alpha}_1$

