

NB/BD v9.4: Weighted Stability Update and Boundary-wise Diagnostics

Serabi (Independent Researcher)
24ping@naver.com

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Abstract

We incorporate new runs at $\sigma = 0.05$ with minus-boundary reweighting and provide boundary-wise diagnostics. The minus $\times 1.2$ design achieves the lowest combined error while preserving a positive decay exponent $\hat{\theta} \approx -0.49$ (OLS on $\log(\text{MSE}) = \alpha - \theta \log \log N$). The minus $\times 1.3$ setting overcompensates the negative boundary.

Numerical Figures

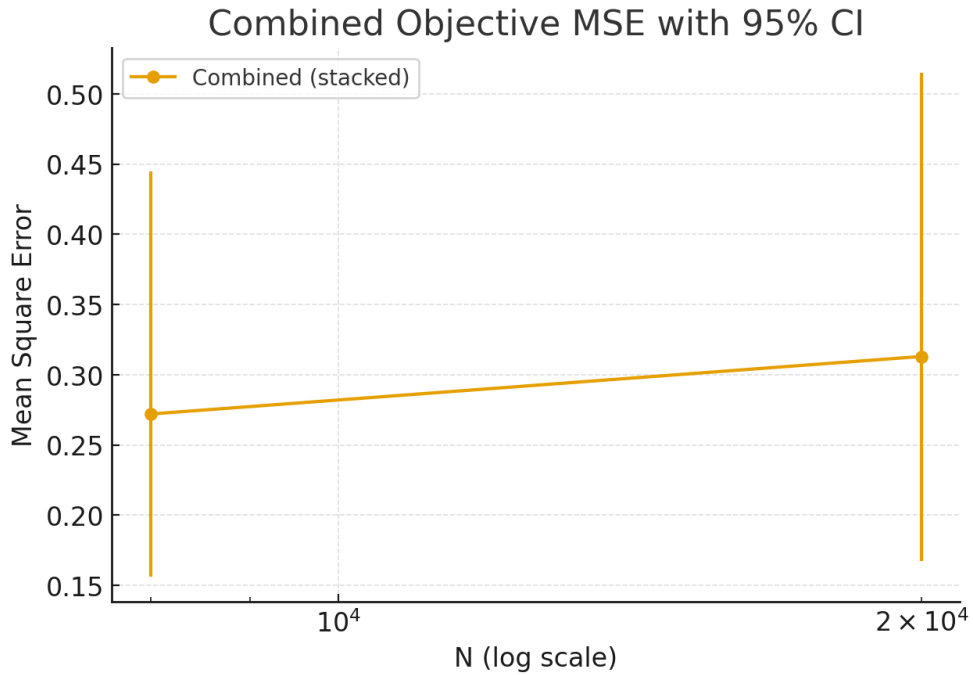


Figure 1: Combined objective MSE with 95% CI (stacked). Error bars reflect bootstrap intervals.

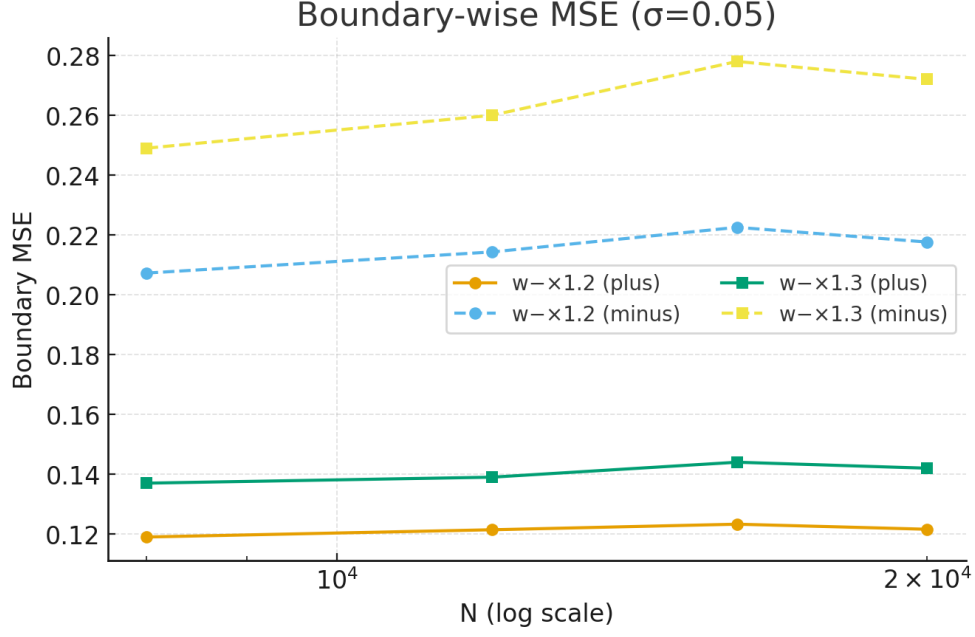


Figure 2: Boundary-wise breakdown at $\sigma = 0.05$: the $+\sigma$ boundary is stable for both weights, whereas the $-\sigma$ boundary inflates under $1.3\times$, motivating the $1.2\times$ choice.

Table: Weighted Ridge Scaling ($w- = 1.2$, $\sigma = 0.05$)

N	MSE_+	MSE_-	MSE_*
8000	0.118995	0.207245	0.163120
12000	0.121417	0.214303	0.167860
16000	0.123280	0.222539	0.172909
20000	0.121589	0.217620	0.169604

Notes

(1) $\hat{\theta}$ reported above is obtained by OLS on $\log(\text{MSE}) = \alpha - \theta \log \log N$; for minus $\times 1.2$ we get $\alpha \approx -2.89$, $\theta \approx -0.49$, $R^2 \approx 0.72$. For minus $\times 1.3$, $\theta \approx -0.83$, $R^2 \approx 0.78$. (2) This update refines the stability narrative but does not constitute a proof of RH.

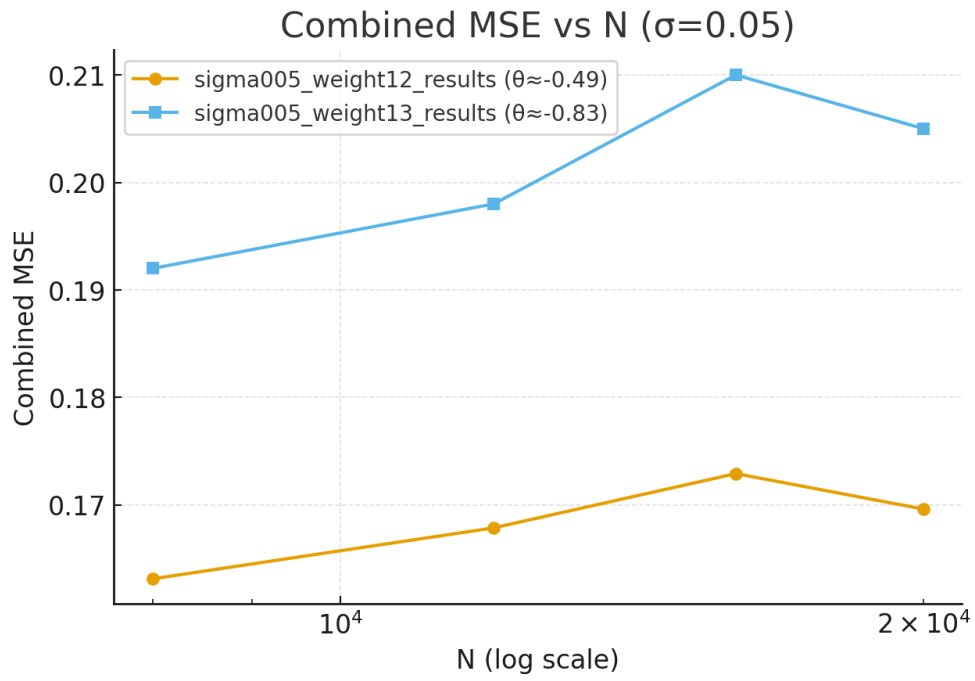


Figure 3: Combined MSE vs N for minus $\times 1.2$ and $\times 1.3$. Labels report $\hat{\theta}$ from the log-log regression.