

Simulation Results

2026-01-21

Simulation Setup

This simulation is performed with $n = 200$ and $d = 100$, using the 2-d lattice as the underlying graph. $s = 5$ parameters are set to be nonzero, and the beta parameter is chosen to be $\beta = 0$. The attached results are for a 10-replication simulation. The parameter vector θ has sparse components other than the following:

Parameter.Index	Value
3	0.447
28	0.447
47	-0.447
59	-0.447
64	-0.447

but for brevity, our simulation only estimates the indices of θ in $\mathcal{C} = \{3, 28, 73, 41\}$ elements of θ . Accordingly, **all statistics and visuals are indicative of performance only on the set \mathcal{C} .**

The results from our code are compared to those of Cai, Guo, and Ma (2021).

The attached results include the mean-squared error for each parameter estimate, as well as boxplots for a selection of nonzero and zero-valued parameters. In the boxplots, the green line represents the true value of the estimated parameter.

After these, I show coverage statistics for 95% symmetric confidence intervals for each of the parameters.

Results

Mean-squared error comparison

Table 1: Mean-Squared Error of Parameter Estimates

	proposed	cgm
theta[3]	0.048	0.027
theta[28]	0.030	0.013
theta[73]	0.013	0.018
theta[41]	0.007	0.009
total	0.024	0.017

Table 2: Mean-Squared Error of First-Step Parameter Estimates

	proposed	cgm
theta[3]	0.180	0.071

	proposed	cgm
theta[28]	0.137	0.081
theta[73]	0.000	0.000
theta[41]	0.002	0.000
total	0.080	0.038

Mean absolute deviation comparison $\frac{1}{n.\text{sim}} \sum_{i=1}^{n.\text{sim}} \frac{1}{|\mathcal{C}|} \|\hat{\theta}_i - \theta\|$

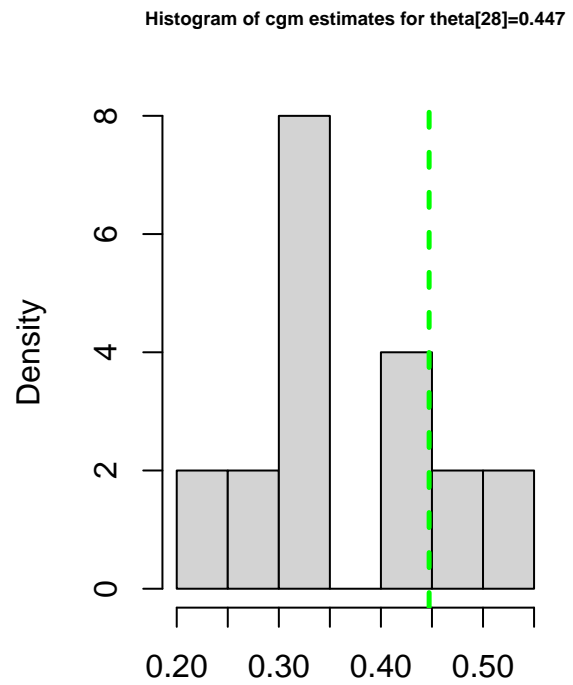
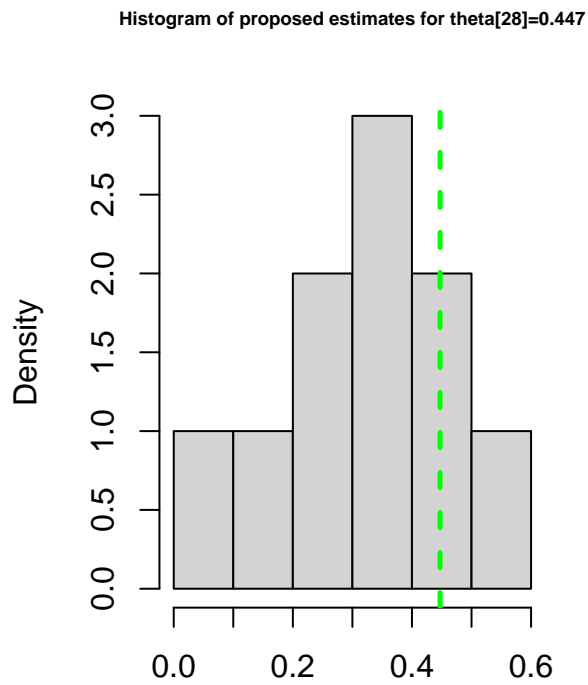
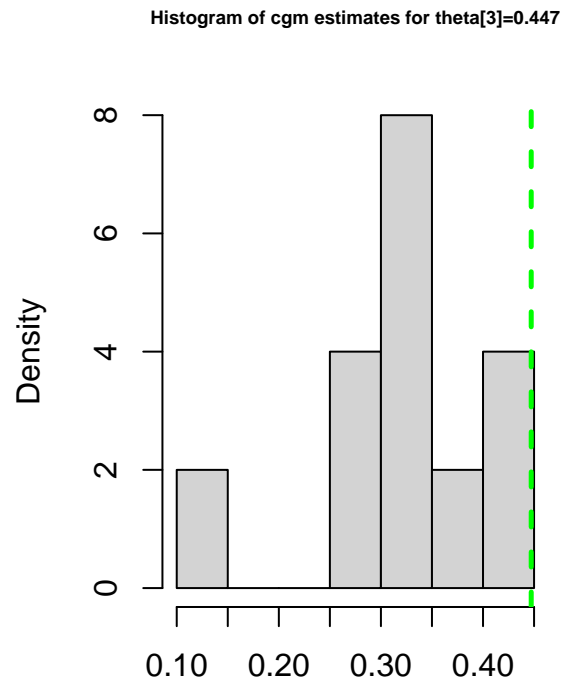
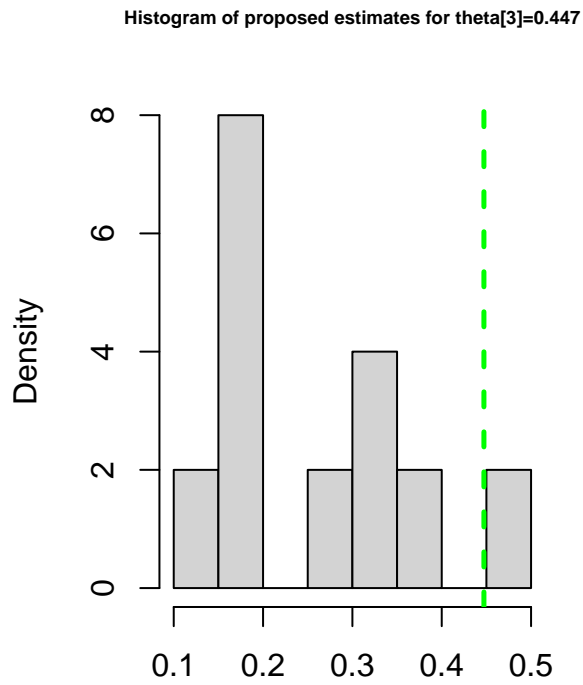
Table 3: Mean Absolute Deviation of Parameter Estimates

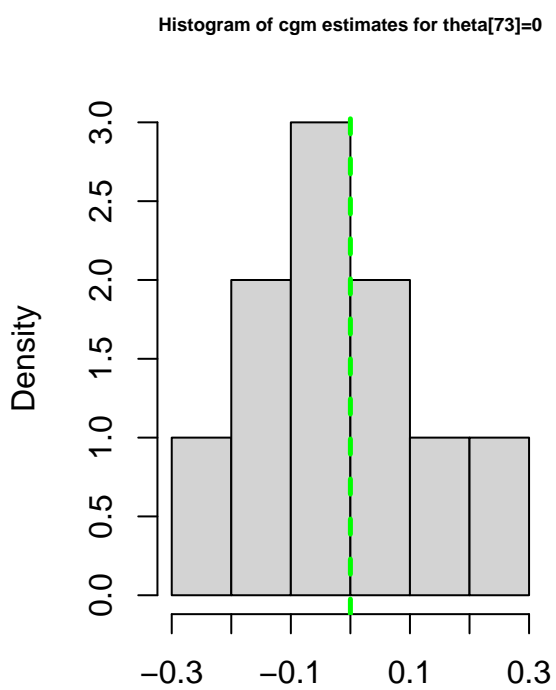
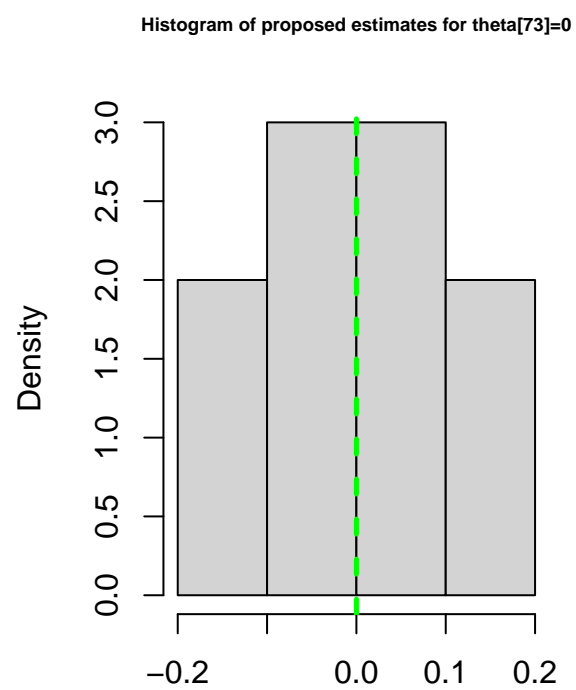
	proposed	cgm
theta[3]	0.196	0.138
theta[28]	0.138	0.101
theta[73]	0.100	0.104
theta[41]	0.071	0.078
total	0.126	0.105

Table 4: Mean Absolute Deviation of First-Step Parameter Estimates

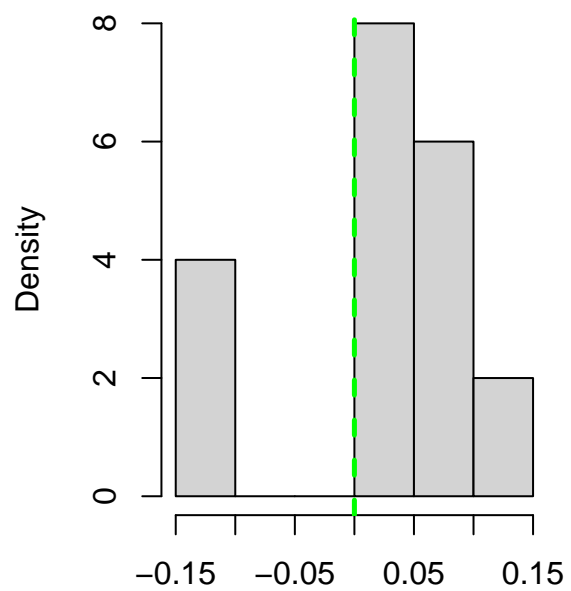
	proposed	cgm
theta[3]	0.423	0.243
theta[28]	0.356	0.265
theta[73]	0.000	0.000
theta[41]	0.016	0.000
total	0.199	0.127

Boxplots

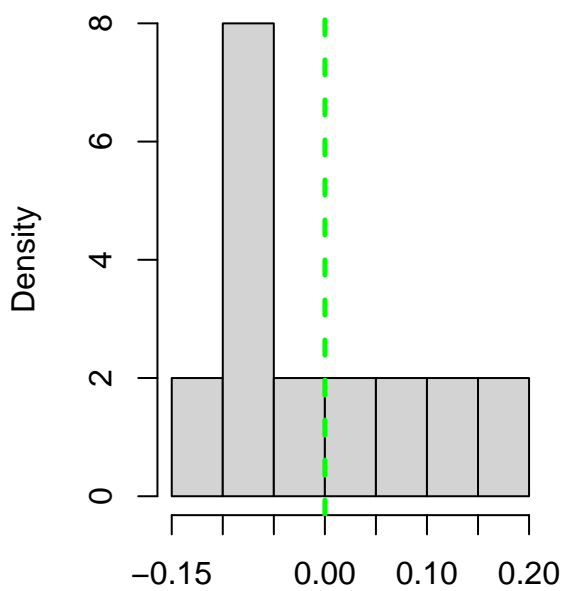




Histogram of proposed estimates for $\theta_{41}=0$



Histogram of cgm estimates for $\theta_{41}=0$



Statistics and 95% Confidence Intervals from per-Replicate Estimates

Statistics for Theoretical 95% Confidence Intervals

Table 5: Theoretical 95% Confidence Interval Statistics (averaged across replications) for proposed Estimates

	Estimate	SE	lower.CI	upper.CI	cvg
theta[3]	0.254	0.123	0.012	0.496	0.5
theta[28]	0.320	0.118	0.088	0.552	0.8
theta[73]	-0.006	0.127	-0.254	0.242	1.0
theta[41]	0.019	0.119	-0.214	0.252	1.0

Table 6: Theoretical 95% Confidence Interval Statistics (averaged across replications) for cgm Estimates

	Estimate	SE	lower.CI	upper.CI	cvg
theta[3]	0.309	0.102	0.109	0.509	0.8
theta[28]	0.372	0.102	0.172	0.571	0.9
theta[73]	-0.015	0.097	-0.206	0.175	0.8
theta[41]	-0.002	0.099	-0.196	0.191	1.0