Simulation Results

2026-01-20

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
6	0.447
24	0.447
28	0.447
80	-0.447
84	-0.447

but for brevity, our simulation only estimates the indices of θ in $\mathcal{C} = \{$ 6, 24, 71, 42$\}$ 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[6]	0.059	0.027
theta[24]	0.033	0.054
theta[71]	0.012	0.017
theta[42]	0.020	0.025
total	0.031	0.031

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

	proposed	cgm
theta[6]	0.157	0.036

	proposed	cgm
theta[24]	0.141	0.039
theta[71]	0.000	0.000
theta[42]	0.000	0.010
total	0.075	0.021

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

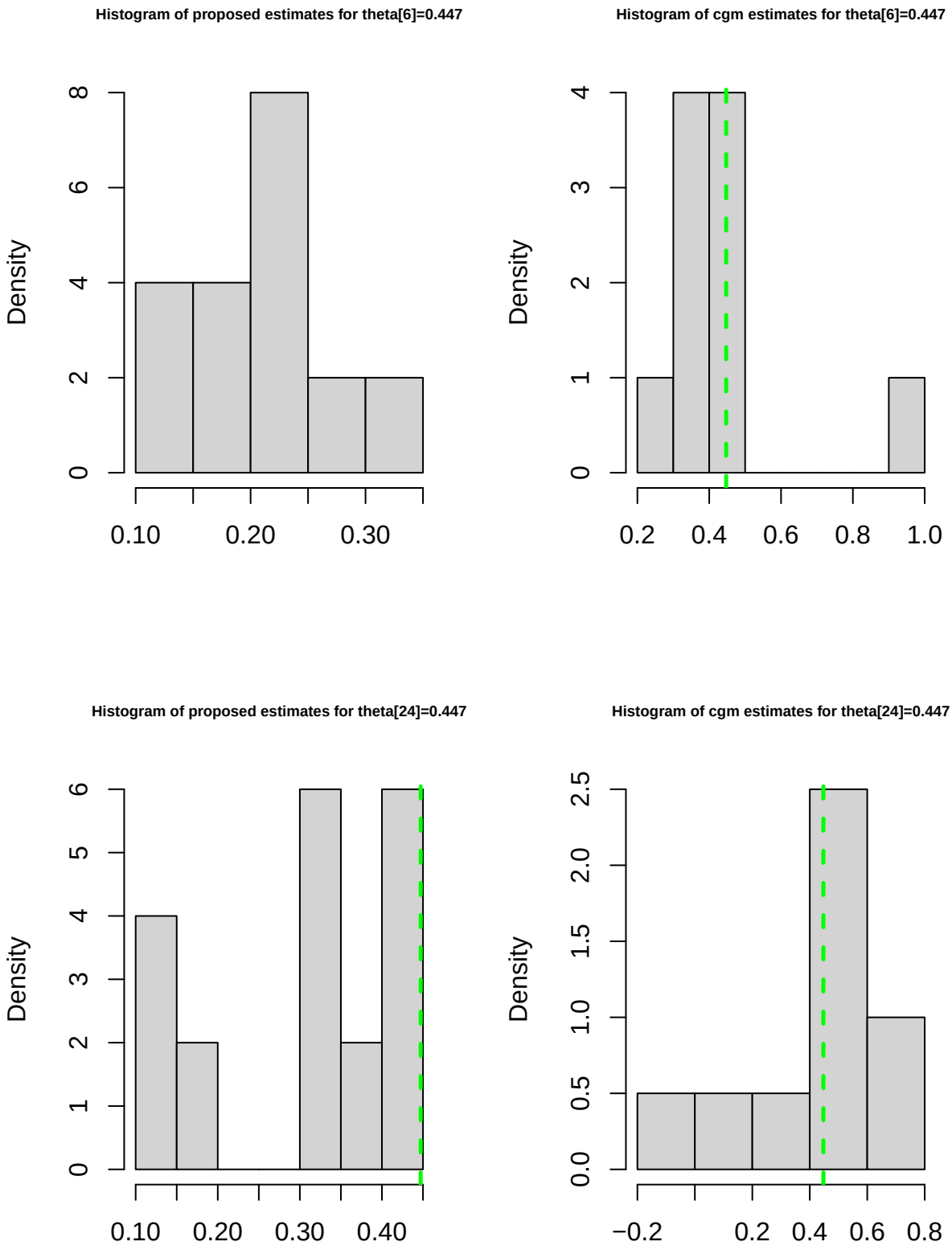
Table 3: Mean Absolute Deviation of Parameter Estimates

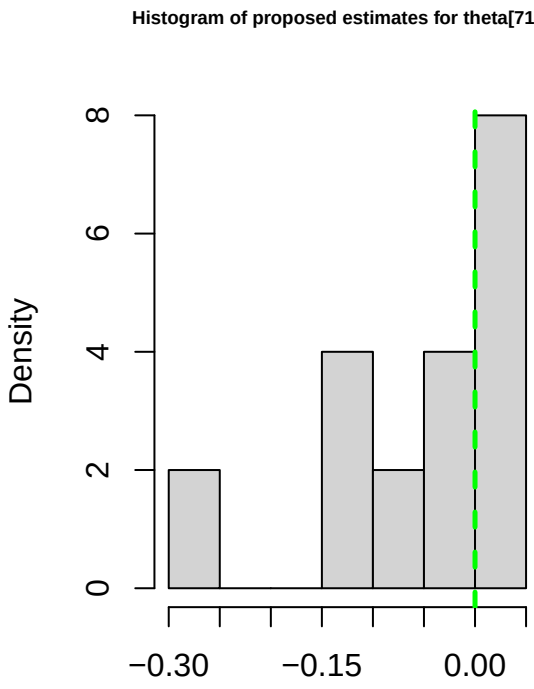
	proposed	cgm
theta[6]	0.236	0.104
theta[24]	0.141	0.182
theta[71]	0.084	0.111
theta[42]	0.113	0.133
total	0.144	0.132

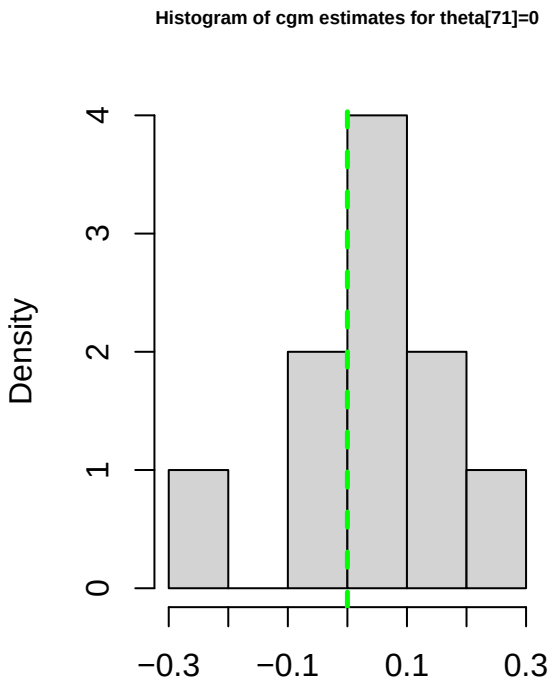
Table 4: Mean Absolute Deviation of First-Step Parameter Estimates

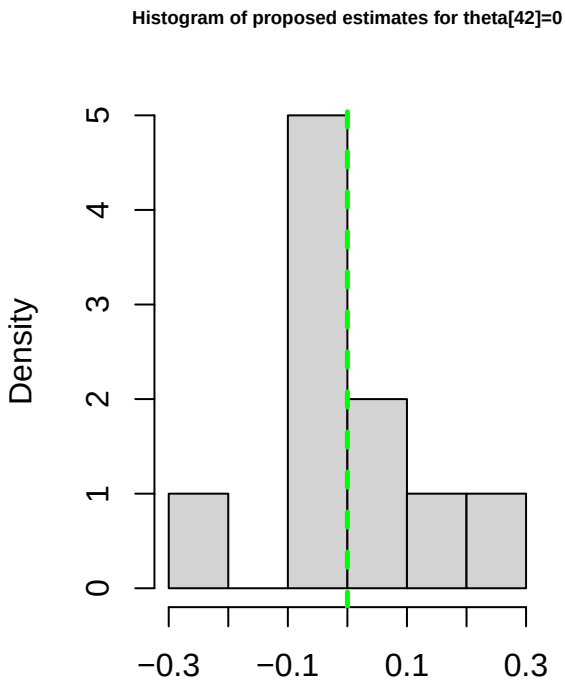
	proposed	cgm
theta[6]	0.389	0.168
theta[24]	0.363	0.159
theta[71]	0.000	0.000
theta[42]	0.007	0.042
total	0.190	0.092

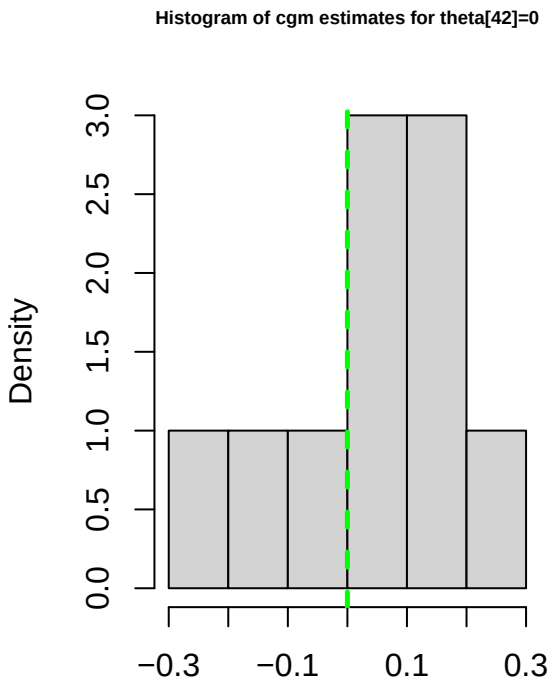
Boxplots


Histogram of proposed estimates for theta[6]=0.447
Density
0.10
0.20
0.30
Histogram of cgm estimates for theta[6]=0.447
Density
0.2
0.4
0.6
0.8
1.0
Histogram of proposed estimates for theta[24]=0.447
Density
0.10
0.20
0.30
0.40
Histogram of cgm estimates for theta[24]=0.447
Density
−0.2
0.2
0.4
0.6
0.8


Histogram of proposed estimates for theta[71]=0
Density
0
2
4
6
8
−0.30
−0.15
0.00


Histogram of cgm estimates for theta[71]=0
Density
0
1
2
3
4
−0.3
−0.1
0.1
0.3


Histogram of proposed estimates for theta[42]=0
Density
0
1
2
3
4
5
−0.3
−0.1
0.1
0.3


Histogram of cgm estimates for theta[42]=0
Density
0.0
0.5
1.0
1.5
2.0
2.5
3.0
−0.3
−0.1
0.1
0.3

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[6]	0.212	0.123	-0.030	0.453	0.5
theta[24]	0.306	0.127	0.058	0.554	0.7
theta[71]	-0.056	0.119	-0.290	0.178	0.9
theta[42]	0.003	0.120	-0.233	0.238	0.8

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

	Estimate	SE	lower.CI	upper.CI	cvg
theta[6]	0.439	0.120	0.203	0.674	0.9
theta[24]	0.435	0.133	0.174	0.696	0.7
theta[71]	0.034	0.121	-0.202	0.271	1.0
theta[42]	0.049	0.122	-0.190	0.288	0.8