Supplementary Material for "Considerations for Fitting Dynamic Bayesian Networks with Latent Variables: A Monte Carlo Study"

Ray E. Reichenberg
University of Nebraska - Lincoln

Roy Levy
Arizona State University

Adam Clark
University of Nebraska - Lincoln

Results of the Simulation Study

Tables S1 – S10 contain the results of the parameter recovery simulation study for the raw bias, relative bias, and efficiency in the estimation of the transition probability and measurement model parameters as well as classification accuracy values for all models save for the L-CDM model. Table S11 presents the relative bias values for the L-DCM measurement model parameters. Additional tables, such as results for other parameters (i.e., the prior probability of mastery parameter) and/or for other indices (i.e., root mean squared error [RMSE]) are available upon request of the corresponding author (rreichenberg@unl.edu).

Table S1.

Raw bias in the estimation of the transition probability across manipulated design facets.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	.166	.129	.102	.008	.001	.002
	J = 1, *T* = 10	.047	.025	.015	.000	.001	.003
	J = 3, *T* = 5	.041	.023	.015	.001	.000	.001
	J = 3, *T* = 10	.005	.005	.007	.001	.001	.001
	J = 5, *T* = 5	.014	.008	.005	.000	.001	.001
	J = 5, *T* = 10	.004	.005	.005	.002	.000	.001
TP = High, *IP* = Low	*J* = 1, *T* = 5	.061	.045	.037	.000	.001	-.001
	J = 1, *T* = 10	.018	.007	-.003	-.003	-.001	.000
	J = 3, *T* = 5	.024	.011	.004	.002	.001	.001
	J = 3, *T* = 10	.000	.003	-.003	.002	.001	.002
	J = 5, *T* = 5	.011	.004	.003	.002	.001	.001
	J = 5, *T* = 10	-.003	.001	.002	.001	.001	.001
TP = Low, *IP* = High	*J* = 1, *T* = 5	.158	.118	.080	-.002	.000	.002
	J = 1, *T* = 10	.061	.028	.018	.000	.002	.003
	J = 3, *T* = 5	.027	.015	.009	-.001	.000	.001
	J = 3, *T* = 10	.004	.005	.008	.002	.001	.000
	J = 5, *T* = 5	.005	.004	.005	.002	.001	.001
	J = 5, *T* = 10	.003	.005	.007	.003	.000	.000
TP = High, *IP* = High	*J* = 1, *T* = 5	.047	.049	.029	-.011	-.008	-.002
	J = 1, *T* = 10	.021	.005	-.007	-.010	-.004	.000
	J = 3, *T* = 5	.014	.007	-.001	-.001	.001	.002
	J = 3, *T* = 10	.003	-.008	-.006	-.001	-.001	.001
	J = 5, *T* = 5	-.002	-.002	.003	.001	.000	.001
	J = 5, *T* = 10	-.004	.000	.005	.002	.001	.001

Table S2.

Relative bias in the estimation of the transition probability across manipulated design facets.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	83.00%	64.50%	51.00%	4.00%	0.50%	1.00%
	J = 1, *T* = 10	23.50%	12.50%	7.50%	0.00%	0.50%	1.50%
	J = 3, *T* = 5	20.50%	11.50%	7.50%	0.50%	0.00%	0.50%
	J = 3, *T* = 10	2.50%	2.50%	3.50%	0.50%	0.50%	0.50%
	J = 5, *T* = 5	7.00%	4.00%	2.50%	0.00%	0.50%	0.50%
	J = 5, *T* = 10	2.00%	2.50%	2.50%	1.00%	0.00%	0.50%
TP = High, *IP* = Low	*J* = 1, *T* = 5	15.25%	11.25%	9.25%	0.00%	0.25%	-0.25%
	J = 1, *T* = 10	4.50%	1.75%	-0.75%	-0.75%	-0.25%	0.00%
	J = 3, *T* = 5	6.00%	2.75%	1.00%	0.50%	0.25%	0.25%
	J = 3, *T* = 10	0.00%	0.75%	-0.75%	0.50%	0.25%	0.50%
	J = 5, *T* = 5	2.75%	1.00%	0.75%	0.50%	0.25%	0.25%
	J = 5, *T* = 10	-0.75%	0.25%	0.50%	0.25%	0.25%	0.25%
TP = Low, *IP* = High	*J* = 1, *T* = 5	79.00%	59.00%	40.00%	-1.00%	0.00%	1.00%
	J = 1, *T* = 10	30.50%	14.00%	9.00%	0.00%	1.00%	1.50%
	J = 3, *T* = 5	13.50%	7.50%	4.50%	-0.50%	0.00%	0.50%
	J = 3, *T* = 10	2.00%	2.50%	4.00%	1.00%	0.50%	0.00%
	J = 5, *T* = 5	2.50%	2.00%	2.50%	1.00%	0.50%	0.50%
	J = 5, *T* = 10	1.50%	2.50%	3.50%	1.50%	0.00%	0.00%
TP = High, *IP* = High	*J* = 1, *T* = 5	11.75%	12.25%	7.25%	-2.75%	-2.00%	-0.50%
	J = 1, *T* = 10	5.25%	1.25%	-1.75%	-2.50%	-1.00%	0.00%
	J = 3, *T* = 5	3.50%	1.75%	-0.25%	-0.25%	0.25%	0.50%
	J = 3, *T* = 10	0.75%	-2.00%	-1.50%	-0.25%	-0.25%	0.25%
	J = 5, *T* = 5	-0.50%	-0.50%	0.75%	0.25%	0.00%	0.25%
	J = 5, *T* = 10	-1.00%	0.00%	1.25%	0.50%	0.25%	0.25%

Table S3.

Efficiency in the estimation of the transition probability across manipulated design facets.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	.192	.146	.089	.045	.031	.020
	J = 1, *T* = 10	.113	.069	.040	.024	.017	.011
	J = 3, *T* = 5	.096	.061	.037	.024	.016	.011
	J = 3, *T* = 10	.043	.029	.019	.017	.011	.007
	J = 5, *T* = 5	.059	.039	.023	.020	.015	.010
	J = 5, *T* = 10	.030	.020	.013	.016	.011	.007
TP = High, *IP* = Low	*J* = 1, *T* = 5	.181	.136	.087	.060	.046	.029
	J = 1, *T* = 10	.141	.104	.064	.043	.031	.021
	J = 3, *T* = 5	.113	.075	.047	.033	.024	.015
	J = 3, *T* = 10	.076	.052	.034	.029	.020	.013
	J = 5, *T* = 5	.074	.055	.034	.028	.021	.013
	J = 5, *T* = 10	.055	.037	.023	.026	.020	.012
TP = Low, *IP* = High	*J* = 1, *T* = 5	.185	.152	.100	.048	.033	.022
	J = 1, *T* = 10	.141	.088	.047	.029	.020	.013
	J = 3, *T* = 5	.115	.062	.039	.028	.020	.012
	J = 3, *T* = 10	.051	.035	.022	.020	.013	.009
	J = 5, *T* = 5	.060	.043	.026	.024	.018	.011
	J = 5, *T* = 10	.033	.024	.016	.019	.014	.008
TP = High, *IP* = High	*J* = 1, *T* = 5	.188	.153	.104	.066	.049	.035
	J = 1, *T* = 10	.160	.119	.079	.052	.037	.023
	J = 3, *T* = 5	.126	.091	.055	.038	.027	.018
	J = 3, *T* = 10	.100	.063	.039	.033	.023	.014
	J = 5, *T* = 5	.090	.062	.041	.035	.024	.015
	J = 5, *T* = 10	.069	.046	.029	.030	.021	.014

Table S4.

Raw bias in the estimation of the conditional probability of a correct response for a *Master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	-.027	-.028	-.033	-.008	-.002	-.001
	J = 1, *T* = 10	-.003	-.004	.000	-.001	.001	.002
	J = 3, *T* = 5	-.011	-.009	-.005	-.003	-.002	.000
	J = 3, *T* = 10	.000	.000	.003	.000	.000	.000
	J = 5, *T* = 5	-.004	-.003	.000	-.004	-.002	.000
	J = 5, *T* = 10	.000	.001	.002	-.001	-.001	.000
TP = High, *IP* = Low	*J* = 1, *T* = 5	.001	-.002	-.004	.001	.000	.002
	J = 1, *T* = 10	.001	.002	.003	.002	.002	.003
	J = 3, *T* = 5	-.002	-.001	.002	-.002	.000	.000
	J = 3, *T* = 10	.002	.001	.004	-.001	.000	.000
	J = 5, *T* = 5	.000	.000	.002	-.002	-.001	.000
	J = 5, *T* = 10	.001	.002	.002	-.001	.000	.000
TP = Low, *IP* = High	*J* = 1, *T* = 5	-.014	-.015	-.017	.000	.001	.001
	J = 1, *T* = 10	-.001	.000	.001	.001	.002	.002
	J = 3, *T* = 5	-.002	-.003	-.001	-.002	-.001	.000
	J = 3, *T* = 10	.002	.001	.003	-.001	.000	.000
	J = 5, *T* = 5	.000	.000	.001	-.002	.000	.000
	J = 5, *T* = 10	.000	.002	.002	-.001	-.001	.000
TP = High, *IP* = High	*J* = 1, *T* = 5	.006	.001	.000	.005	.004	.003
	J = 1, *T* = 10	.003	.003	.004	.002	.003	.003
	J = 3, *T* = 5	.001	.001	.003	.000	-.001	.001
	J = 3, *T* = 10	.002	.003	.005	.000	.001	.000
	J = 5, *T* = 5	.003	.001	.002	-.001	.000	.000
	J = 5, *T* = 10	.002	.003	.003	-.001	.000	.000

Table S5.

Relative bias in the estimation of the conditional probability of a correct response for a *Master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	-4.50%	-4.67%	-5.50%	-1.07%	-0.27%	-0.13%
	J = 1, *T* = 10	-0.50%	-0.67%	0.00%	-0.13%	0.13%	0.27%
	J = 3, *T* = 5	-1.83%	-1.50%	-0.83%	-0.40%	-0.27%	0.00%
	J = 3, *T* = 10	0.00%	0.00%	0.50%	0.00%	0.00%	0.00%
	J = 5, *T* = 5	-0.67%	-0.50%	0.00%	-0.53%	-0.27%	0.00%
	J = 5, *T* = 10	0.00%	0.17%	0.33%	-0.13%	-0.13%	0.00%
TP = High, *IP* = Low	*J* = 1, *T* = 5	0.17%	-0.33%	-0.67%	0.13%	0.00%	0.27%
	J = 1, *T* = 10	0.17%	0.33%	0.50%	0.27%	0.27%	0.40%
	J = 3, *T* = 5	-0.33%	-0.17%	0.33%	-0.27%	0.00%	0.00%
	J = 3, *T* = 10	0.33%	0.17%	0.67%	-0.13%	0.00%	0.00%
	J = 5, *T* = 5	0.00%	0.00%	0.33%	-0.27%	-0.13%	0.00%
	J = 5, *T* = 10	0.17%	0.33%	0.33%	-0.13%	0.00%	0.00%
TP = Low, *IP* = High	*J* = 1, *T* = 5	-2.33%	-2.50%	-2.83%	0.00%	0.13%	0.13%
	J = 1, *T* = 10	-0.17%	0.00%	0.17%	0.13%	0.27%	0.27%
	J = 3, *T* = 5	-0.33%	-0.50%	-0.17%	-0.27%	-0.13%	0.00%
	J = 3, *T* = 10	0.33%	0.17%	0.50%	-0.13%	0.00%	0.00%
	J = 5, *T* = 5	0.00%	0.00%	0.17%	-0.27%	0.00%	0.00%
	J = 5, *T* = 10	0.00%	0.33%	0.33%	-0.13%	-0.13%	0.00%
TP = High, *IP* = High	*J* = 1, *T* = 5	1.00%	0.17%	0.00%	0.67%	0.53%	0.40%
	J = 1, *T* = 10	0.50%	0.50%	0.67%	0.27%	0.40%	0.40%
	J = 3, *T* = 5	0.17%	0.17%	0.50%	0.00%	-0.13%	0.13%
	J = 3, *T* = 10	0.33%	0.50%	0.83%	0.00%	0.13%	0.00%
	J = 5, *T* = 5	0.50%	0.17%	0.33%	-0.13%	0.00%	0.00%
	J = 5, *T* = 10	0.33%	0.50%	0.50%	-0.13%	0.00%	0.00%

Table S6.

Efficiency in the estimation of the conditional probability of a correct response for a *Master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	.062	.053	.029	.043	.034	.022
	J = 1, *T* = 10	.030	.021	.014	.017	.013	.008
	J = 3, *T* = 5	.046	.034	.021	.023	.017	.011
	J = 3, *T* = 10	.019	.014	.009	.013	.009	.006
	J = 5, *T* = 5	.037	.026	.016	.022	.015	.010
	J = 5, *T* = 10	.017	.012	.008	.012	.009	.006
TP = High, *IP* = Low	*J* = 1, *T* = 5	.044	.034	.019	.031	.024	.015
	J = 1, *T* = 10	.020	.014	.009	.014	.011	.007
	J = 3, *T* = 5	.031	.021	.014	.021	.014	.009
	J = 3, *T* = 10	.015	.011	.007	.011	.008	.005
	J = 5, *T* = 5	.027	.018	.012	.018	.013	.008
	J = 5, *T* = 10	.014	.010	.006	.011	.008	.005
TP = Low, *IP* = High	*J* = 1, *T* = 5	.053	.046	.028	.034	.026	.018
	J = 1, *T* = 10	.029	.021	.012	.016	.012	.007
	J = 3, *T* = 5	.039	.027	.018	.021	.015	.009
	J = 3, *T* = 10	.018	.013	.009	.012	.008	.005
	J = 5, *T* = 5	.029	.022	.014	.018	.013	.008
	J = 5, *T* = 10	.016	.011	.007	.011	.008	.005
TP = High, *IP* = High	*J* = 1, *T* = 5	.043	.032	.018	.027	.021	.014
	J = 1, *T* = 10	.019	.014	.009	.014	.010	.006
	J = 3, *T* = 5	.031	.021	.013	.019	.013	.008
	J = 3, *T* = 10	.015	.011	.007	.011	.008	.005
	J = 5, *T* = 5	.027	.018	.012	.018	.013	.008
	J = 5, *T* = 10	.014	.010	.006	.011	.008	.005

Table S7.

Raw bias in the estimation of the conditional probability of a correct response for a *Non-master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	-.029	-.037	-.044	-.004	.000	-.001
	J = 1, *T* = 10	-.013	-.012	-.006	.007	.004	-.001
	J = 3, *T* = 5	-.012	-.009	-.006	.002	.001	.000
	J = 3, *T* = 10	.002	.000	.000	.003	.002	.001
	J = 5, *T* = 5	-.003	-.002	-.001	.002	.002	.000
	J = 5, *T* = 10	.001	.000	.000	.004	.002	.000
TP = High, *IP* = Low	*J* = 1, *T* = 5	-.021	-.024	-.023	.013	.007	.002
	J = 1, *T* = 10	.002	.001	.005	.030	.015	.007
	J = 3, *T* = 5	-.003	-.004	.001	.005	.003	.001
	J = 3, *T* = 10	.009	.007	.011	.009	.005	.002
	J = 5, *T* = 5	.001	.000	.001	.004	.001	.001
	J = 5, *T* = 10	.009	.005	.005	.008	.004	.002
TP = Low, *IP* = High	*J* = 1, *T* = 5	-.006	-.015	-.027	.007	.003	-.001
	J = 1, *T* = 10	.003	-.002	-.004	.011	.005	.000
	J = 3, *T* = 5	-.008	-.005	-.004	.004	.001	.000
	J = 3, *T* = 10	.006	.003	.001	.005	.003	.001
	J = 5, *T* = 5	.000	-.003	-.001	.003	.001	.001
	J = 5, *T* = 10	.004	.001	.001	.006	.003	.001
TP = High, *IP* = High	*J* = 1, *T* = 5	.005	.001	.000	.031	.016	.007
	J = 1, *T* = 10	.025	.020	.024	.046	.023	.010
	J = 3, *T* = 5	.006	.005	.005	.009	.004	.001
	J = 3, *T* = 10	.019	.016	.015	.017	.008	.003
	J = 5, *T* = 5	.006	.004	.003	.006	.003	.000
	J = 5, *T* = 10	.013	.008	.005	.011	.006	.003

Table S8.

Relative bias in the estimation of the conditional probability of a correct response for a *Non-master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	-7.25%	-9.25%	-11.00%	-1.60%	0.00%	-0.40%
	J = 1, *T* = 10	-3.25%	-3.00%	-1.50%	2.80%	1.60%	-0.40%
	J = 3, *T* = 5	-3.00%	-2.25%	-1.50%	0.80%	0.40%	0.00%
	J = 3, *T* = 10	0.50%	0.00%	0.00%	1.20%	0.80%	0.40%
	J = 5, *T* = 5	-0.75%	-0.50%	-0.25%	0.80%	0.80%	0.00%
	J = 5, *T* = 10	0.25%	0.00%	0.00%	1.60%	0.80%	0.00%
TP = High, *IP* = Low	*J* = 1, *T* = 5	-5.25%	-6.00%	-5.75%	5.20%	2.80%	0.80%
	J = 1, *T* = 10	0.50%	0.25%	1.25%	12.00%	6.00%	2.80%
	J = 3, *T* = 5	-0.75%	-1.00%	0.25%	2.00%	1.20%	0.40%
	J = 3, *T* = 10	2.25%	1.75%	2.75%	3.60%	2.00%	0.80%
	J = 5, *T* = 5	0.25%	0.00%	0.25%	1.60%	0.40%	0.40%
	J = 5, *T* = 10	2.25%	1.25%	1.25%	3.20%	1.60%	0.80%
TP = Low, *IP* = High	*J* = 1, *T* = 5	-1.50%	-3.75%	-6.75%	2.80%	1.20%	-0.40%
	J = 1, *T* = 10	0.75%	-0.50%	-1.00%	4.40%	2.00%	0.00%
	J = 3, *T* = 5	-2.00%	-1.25%	-1.00%	1.60%	0.40%	0.00%
	J = 3, *T* = 10	1.50%	0.75%	0.25%	2.00%	1.20%	0.40%
	J = 5, *T* = 5	0.00%	-0.75%	-0.25%	1.20%	0.40%	0.40%
	J = 5, *T* = 10	1.00%	0.25%	0.25%	2.40%	1.20%	0.40%
TP = High, *IP* = High	*J* = 1, *T* = 5	1.25%	0.25%	0.00%	12.40%	6.40%	2.80%
	J = 1, *T* = 10	6.25%	5.00%	6.00%	18.40%	9.20%	4.00%
	J = 3, *T* = 5	1.50%	1.25%	1.25%	3.60%	1.60%	0.40%
	J = 3, *T* = 10	4.75%	4.00%	3.75%	6.80%	3.20%	1.20%
	J = 5, *T* = 5	1.50%	1.00%	0.75%	2.40%	1.20%	0.00%
	J = 5, *T* = 10	3.25%	2.00%	1.25%	4.40%	2.40%	1.20%

Table S9.

Efficiency in the estimation of the conditional probability of a correct response for a *Non-master*.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	.052	.046	.033	.040	.030	.020
	J = 1, *T* = 10	.039	.033	.024	.029	.021	.014
	J = 3, *T* = 5	.043	.031	.019	.022	.015	.010
	J = 3, *T* = 10	.029	.022	.014	.018	.013	.008
	J = 5, *T* = 5	.034	.023	.015	.020	.014	.009
	J = 5, *T* = 10	.026	.019	.012	.018	.012	.008
TP = High, *IP* = Low	*J* = 1, *T* = 5	.050	.042	.031	.051	.038	.027
	J = 1, *T* = 10	.038	.034	.029	.044	.036	.025
	J = 3, *T* = 5	.046	.034	.022	.028	.020	.012
	J = 3, *T* = 10	.036	.031	.021	.026	.019	.012
	J = 5, *T* = 5	.038	.029	.018	.025	.017	.011
	J = 5, *T* = 10	.035	.025	.016	.023	.017	.011
TP = Low, *IP* = High	*J* = 1, *T* = 5	.063	.055	.041	.046	.034	.026
	J = 1, *T* = 10	.047	.042	.032	.035	.026	.016
	J = 3, *T* = 5	.053	.037	.024	.026	.018	.012
	J = 3, *T* = 10	.038	.027	.018	.021	.015	.009
	J = 5, *T* = 5	.040	.029	.018	.024	.017	.011
	J = 5, *T* = 10	.031	.022	.014	.020	.014	.009
TP = High, *IP* = High	*J* = 1, *T* = 5	.056	.047	.035	.059	.052	.037
	J = 1, *T* = 10	.041	.040	.037	.054	.043	.030
	J = 3, *T* = 5	.056	.042	.029	.034	.025	.016
	J = 3, *T* = 10	.050	.037	.028	.031	.023	.015
	J = 5, *T* = 5	.051	.037	.025	.029	.021	.013
	J = 5, *T* = 10	.041	.032	.021	.027	.020	.012

Table S10.

Classification accuracy (validation), as a percentage across manipulated design facets.

		MQ = Low			*MQ* = Med		
		N = 200	*N* = 400	*N* = 1000	*N* = 200	*N* = 400	*N* = 1000
TP = Low, *IP* = Low	*J* = 1, *T* = 5	66.77	66.67	67.35	80.94	81.42	81.84
	J = 1, *T* = 10	88.06	88.84	89.21	93.19	93.20	93.25
	J = 3, *T* = 5	70.76	72.23	73.47	91.19	91.42	91.46
	J = 3, *T* = 10	89.91	90.20	90.33	97.13	97.11	97.09
	J = 5, *T* = 5	76.17	77.26	77.93	95.08	95.18	95.12
	J = 5, *T* = 10	91.59	91.63	91.84	98.40	98.37	98.39
TP = High, *IP* = Low	*J* = 1, *T* = 5	87.58	88.39	89.48	91.09	91.22	91.38
	J = 1, *T* = 10	99.00	99.18	99.20	99.22	99.27	99.26
	J = 3, *T* = 5	88.86	89.41	89.73	95.63	95.64	95.65
	J = 3, *T* = 10	99.15	99.19	99.19	99.64	99.63	99.65
	J = 5, *T* = 5	89.92	90.18	90.31	97.48	97.49	97.52
	J = 5, *T* = 10	99.17	99.20	99.21	99.80	99.81	99.80
TP = Low, *IP* = High	*J* = 1, *T* = 5	73.75	73.97	75.06	84.66	85.14	85.38
	J = 1, *T* = 10	90.93	91.30	91.84	94.59	94.81	94.91
	J = 3, *T* = 5	76.57	78.02	78.84	93.20	93.34	93.38
	J = 3, *T* = 10	92.19	92.48	92.65	97.82	97.83	97.83
	J = 5, *T* = 5	80.92	81.82	82.35	96.22	96.34	96.33
	J = 5, *T* = 10	93.47	93.68	93.73	98.83	98.81	98.79
TP = High, *IP* = High	*J* = 1, *T* = 5	89.70	91.12	92.07	93.02	93.19	93.35
	J = 1, *T* = 10	99.20	99.37	99.39	99.43	99.44	99.45
	J = 3, *T* = 5	91.18	91.80	92.18	96.61	96.68	96.70
	J = 3, *T* = 10	99.33	99.37	99.40	99.73	99.72	99.73
	J = 5, *T* = 5	91.96	92.50	92.67	98.14	98.12	98.14
	J = 5, *T* = 10	99.39	99.41	99.41	99.85	99.86	99.86

Note. ■: ≤ 70%, ■: 70% - 79.99%, ■: 80% - 89.99%, None: ≥ 90%.

Table S11.

Relative estimation bias by sample size and measurement quality for the L-DCM measurement model parameters.

	MQ = Low			*MQ* = Medium			*MQ* = High		
	N = 200	*N* = 400	*N* = 1,000	*N* = 200	*N* = 400	*N* = 1,000	*N* = 200	*N* = 400	*N* = 1,000
$P(X_1=1\|\theta_1=NM)$	2.00%	-1.25%	-0.50%	-0.80%	3.60%	2.40%	7.00%	1.00%	0.00%
$P(X_1=1\|\theta_1=M)$	4.83%	5.33%	3.50%	1.47%	1.33%	0.13%	0.78%	0.33%	0.56%
$P(X_5=1\|\theta_2=NM)$	-5.25%	-5.25%	-0.75%	1.60%	0.00%	1.60%	11.00%	3.00%	2.00%
$P(X_5=1\|\theta_2=M)$	3.67%	1.33%	2.17%	-0.80%	0.13%	-0.13%	-0.44%	-0.44%	0.00%
$P(X_{11}=1\|\theta_3=NM)$	-2.50%	-4.75%	-3.25%	2.00%	0.80%	0.00%	5.00%	0.00%	4.00%
$P(X_{11}=1\|\theta_3=M)$	4.83%	2.83%	2.67%	0.80%	2.40%	-0.80%	0.00%	0.56%	-0.11%
$P(X_{16}=1\|\theta_4=NM)$	-3.00%	-4.25%	2.00%	-1.60%	-2.40%	-0.40%	-3.00%	7.00%	0.00%
$P(X_{16}=1\|\theta_4=M)$	3.67%	5.17%	0.00%	-0.13%	-0.40%	0.00%	0.00%	-0.56%	-0.33%