

# Supporting Information Online Appendix A: Simulation Studies

In this online appendix, we perform exhaustive simulation studies to shed light on the following issues:

- (1) Optimal Choice of  $\alpha$  for Winsorization
- (2) Properties of ICSW with and without Misspecification
- (3) Bootstrap Confidence Interval Coverage

## Baseline Data Generating Process

The following parameters define the “baseline” data generating process (DGP). Note the very flexible specification, which allows for a wide variety of compliance scores and relationships between covariates, compliance and heterogeneity.

$$X1_i, X2_i, X3_i \sim U(-1, 1)$$

$$a, b, c, d, e, f, g, h \sim U(-2, 2)$$

$$AC_i = I[2 + a + bX1_i + cX2_i + dX3_i + N(0, 3)]$$

$$A_i = I[-2 + e + fX1_i + gX2_i + hX3_i + N(0, 3)]AC_i$$

$$C_i = AC_i - A_i$$

$$D_i = D_i Z_i + A_i$$

$$Y_{0i} = 5AC_i + N(0, 1)$$

$$\tau_i = 5 \times (1 + X1_i + X2_i + X3_i)$$

$$Y_i = Y_{0i} + \tau_i D_i$$

We observe and use  $X1_i, X2_i, X3_i$  both as covariates in 2SLS, and for the compliance

score model.

## **Misspecified Data Generating Processes**

### **Heterogeneous Treatment Effects, Conditioning on Random Noise**

Same as baseline, except:

$X1'_i, X2'_i, X3'_i \sim U(-1, 1)$  are the observed covariates, which are entirely independent from  $X1_i, X2_i, X3_i$ .

### **Homogeneous Treatment Effects, Conditioning on Random Noise**

Same as the previous DGP, except:

$$\tau_i = 5, \forall i.$$

### **Heterogeneous Treatment Effects, Model is Incorrect**

Same as the baseline DGP, except:

$$AC_i = \text{I}[2 + a + (1 + bX1_i)(1 + cX2_i) + dX3_i^3/3 + \text{Logistic}(0, 3)]$$

$$A_i = \text{I}[-2 + e + (1 + fX1_i)(1 + gX2_i) + hX3_i^3/3 + \text{Logistic}(0, 3)]AC_i$$

$$\tau_i = 5 \times (1 + X1_i + X2_i + X1_iX2_i + X3_i)$$

### **Heterogeneous Treatment Effects, Insufficient Conditioning Set**

Same as baseline, except only  $X1_i$  is observed.

## **(1) Optimal Choice of $\alpha$ for Winsorization**

Assuming that the model is correct, we present plots of RMSE vs.  $\alpha$  for  $n \in 500, 1000, 2500, 5000, 10000, 25000$ , generated using 2,500 iterations each, in Figures

A1 and A2. We subclassify each of these plots to DGPs with low ( $\text{mean}(P_C) < 0.33$ ), medium ( $0.33 \leq \text{mean}(P_C) < 0.50$ ) and high ( $0.50 \leq \text{mean}(P_C)$ ) compliance.

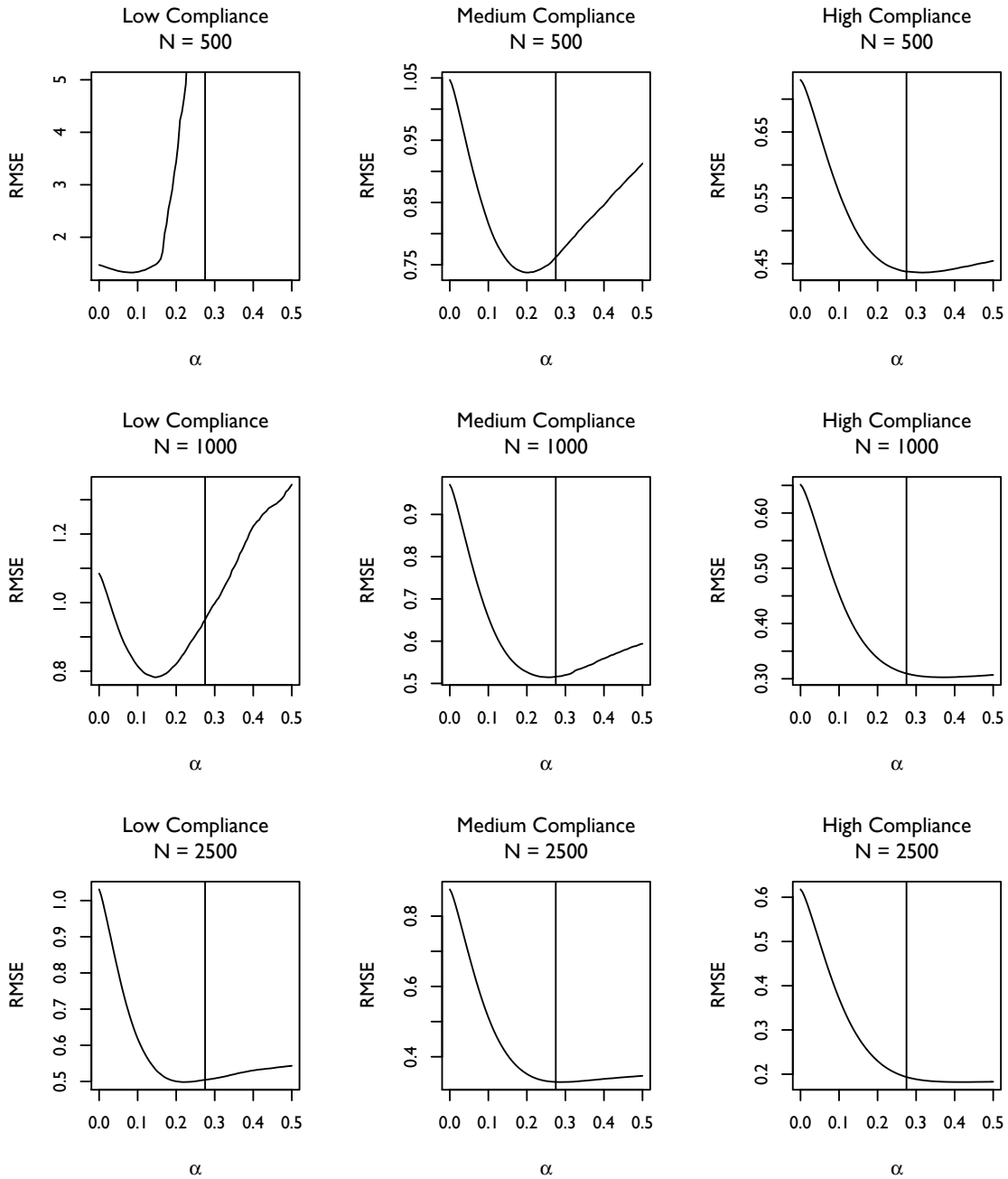


Figure A1: RMSE vs.  $\alpha$  for  $n \in 500, 1000, 2500$ .

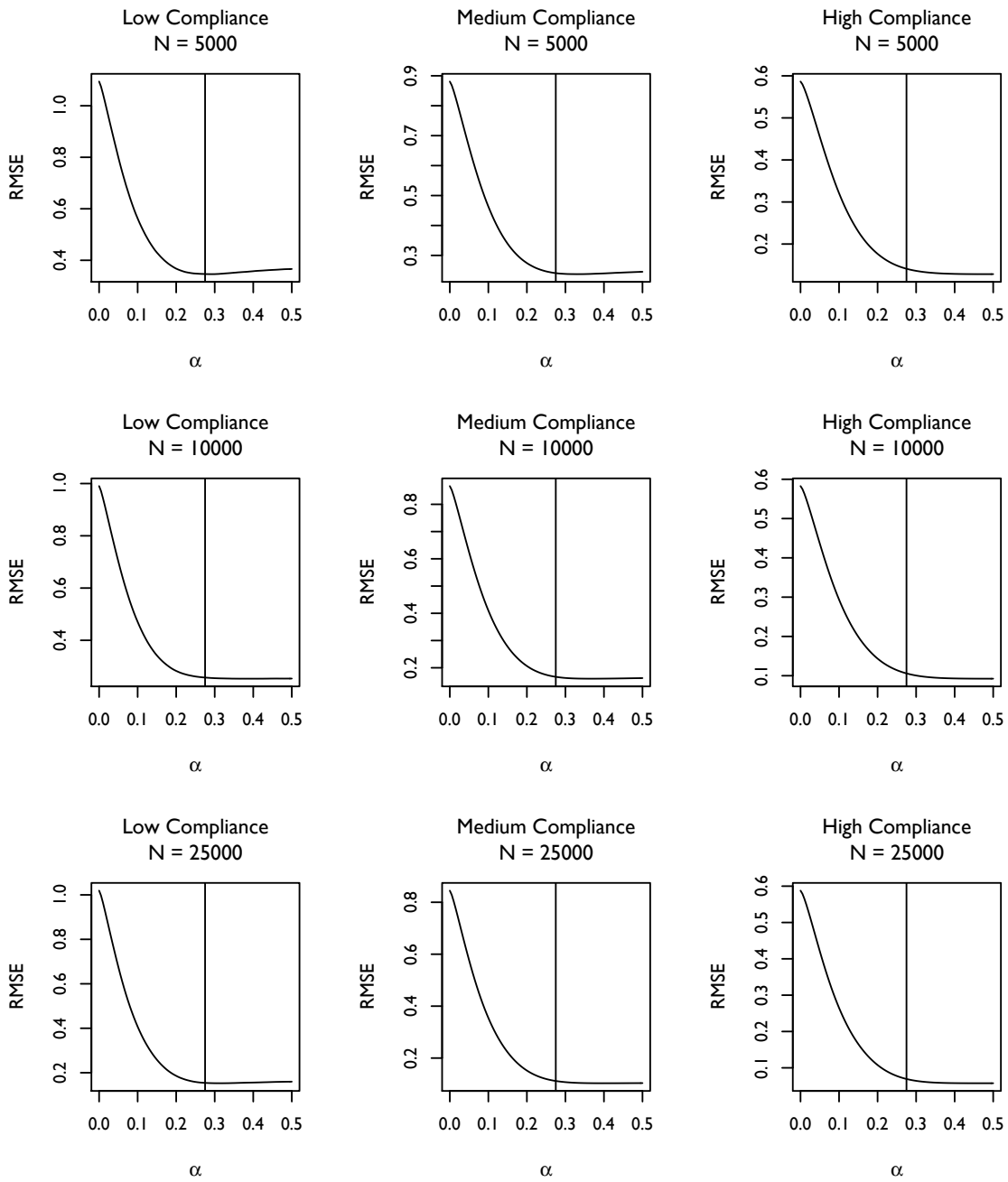


Figure A2: RMSE vs.  $\alpha$  for  $n \in 5000, 10000, 25000$ .

## **(2) Properties of ICSW with and without Misspecification**

We assume  $\alpha = 0.275$ , as recommended in the text. We present tables of RMSE vs  $n \in 500, 1000, 2500, 5000, 10000, 25000$  under the 5 different models, including misspecification.

ICSW is compared to 3 other estimators: OLS (with  $Z_i$ ), OLS (with  $D_i$ ), and 2SLS. We again use 2,500 iterations for each  $n$ . We present these results in Figure A3. These results are also presented in tabular form in Tables A1-A5.

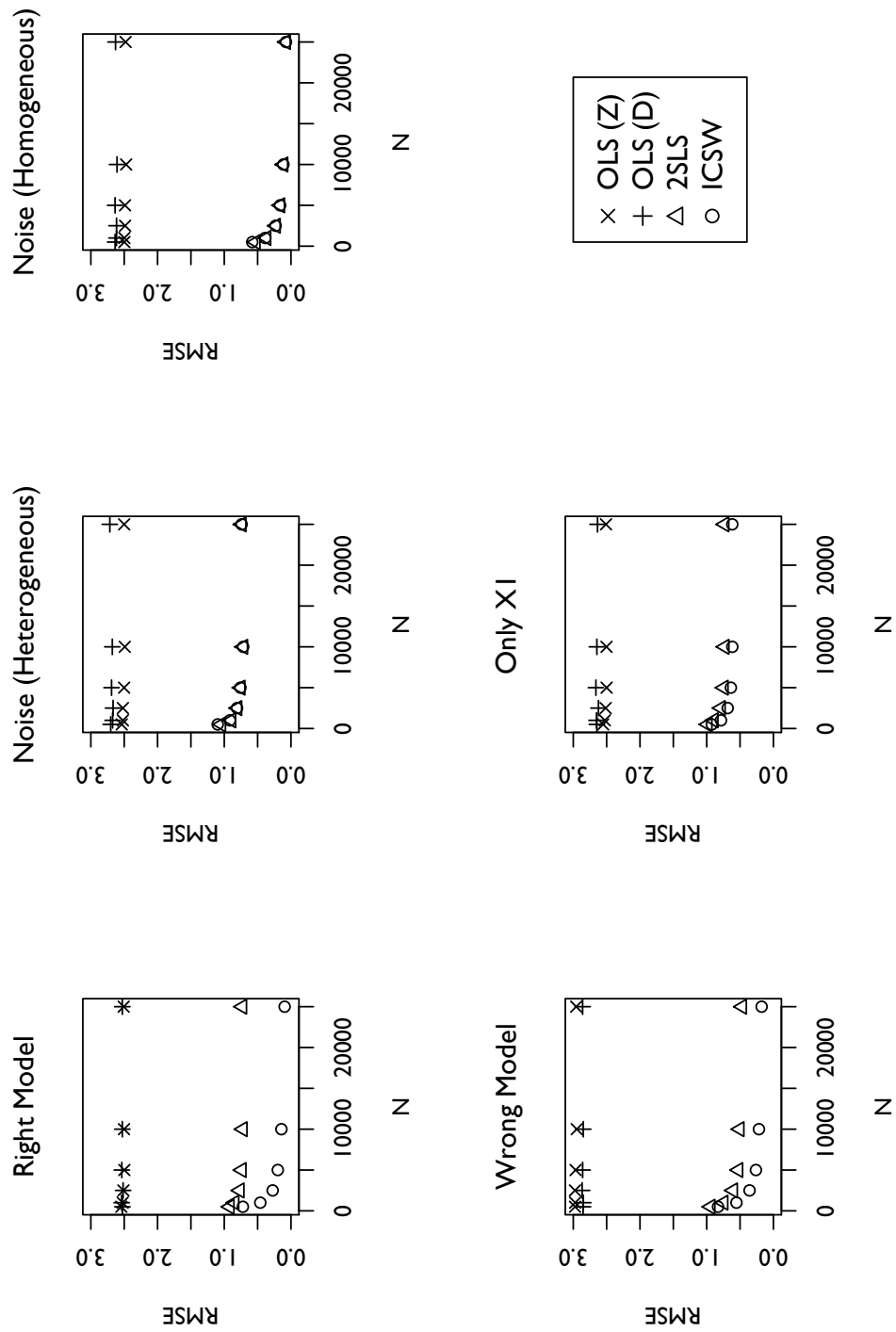


Figure A3: Properties of ICSW with and without Misspecification

$n$	OLS ( $Z$ )	OLS ( $D$ )	2SLS	ICSW
500	2.54	2.53	0.92	0.72
1000	2.52	2.54	0.85	0.46
2500	2.51	2.52	0.77	0.27
5000	2.50	2.54	0.74	0.20
10000	2.50	2.53	0.72	0.14
25000	2.51	2.53	0.73	0.09

Table A1: Right

$n$	OLS ( $Z$ )	OLS ( $D$ )	2SLS	ICSW
500	2.54	2.70	1.05	1.10
1000	2.52	2.67	0.89	0.92
2500	2.52	2.67	0.80	0.81
5000	2.50	2.69	0.75	0.76
10000	2.49	2.68	0.72	0.72
25000	2.50	2.72	0.74	0.74

Table A2: Noise (Heterogeneous)

$n$	OLS ( $Z$ )	OLS ( $D$ )	2SLS	ICSW
500	2.50	2.64	0.53	0.58
1000	2.50	2.62	0.37	0.39
2500	2.49	2.61	0.23	0.23
5000	2.49	2.64	0.16	0.16
10000	2.47	2.61	0.11	0.11
25000	2.48	2.63	0.07	0.07

Table A3: Noise (Homogeneous)

$n$	OLS ( $Z$ )	OLS ( $D$ )	2SLS	ICSW
500	2.97	2.85	0.94	0.83
1000	2.97	2.85	0.75	0.55
2500	2.97	2.87	0.60	0.36
5000	2.97	2.86	0.53	0.26
10000	2.95	2.85	0.51	0.22
25000	2.96	2.86	0.47	0.18

Table A4: Wrong Model

$n$	OLS ( $Z$ )	OLS ( $D$ )	2SLS	ICSW
500	2.55	2.65	0.99	0.92
1000	2.53	2.65	0.90	0.79
2500	2.51	2.62	0.79	0.69
5000	2.50	2.66	0.74	0.64
10000	2.50	2.65	0.73	0.62
25000	2.51	2.64	0.73	0.62

Table A5: Only X1



### (3) Bootstrap Confidence Interval Coverage

In Table A6, we present % coverage with the bootstrap for  $n \in 500, 2500, 5000$  assuming that the model is correct and  $\alpha = 0.275$ . Due to computational limitations, we use only 500 bootstrap iterations and 500 simulations for each  $n$ .

$n$	90% Interval Coverage	95% Interval Coverage
500	0.94	0.98
2500	0.91	0.94
5000	0.92	0.95

Table A6: Bootstrap Coverage

## **Supporting Information Online Appendix B: Compliance Score / Covariate Correlation Matrices**

In Tables A7 and A8, we present compliance score and covariate correlation matrices.

	C. Score	Fam. Size	White	Black	Voted 00	Voted 99	Voted Pri.	Age	Age M.	Dem	Rep	Ind
Comp. Score	1.00	0.37	0.61	0.32	0.40	0.43	0.25	0.23	-0.55	0.38	0.31	-0.47
Columbus	-0.55	-0.17	-0.20	-0.07	-0.15	-0.05	-0.19	-0.00	1.00	-0.11	-0.03	0.79
Detroit	0.05	0.03	-0.30	-0.11	-0.00	-0.24	0.23	0.16	-0.23	-0.28	-0.19	-0.18
Minneapolis	-0.45	-0.24	-0.21	-0.08	-0.06	-0.14	-0.01	-0.14	-0.16	-0.20	-0.14	-0.13
Raleigh	0.75	0.26	0.89	0.33	0.13	0.17	-0.00	0.02	-0.22	0.46	0.43	-0.18
St. Paul	0.07	0.15	-0.18	-0.07	0.16	0.30	0.06	-0.08	-0.14	-0.17	-0.12	-0.11
Fam. Size	0.37	1.00	0.23	0.09	0.07	0.07	0.03	-0.05	-0.17	0.09	0.10	-0.14
White	0.61	0.23	1.00	-0.10	0.13	0.19	-0.00	0.04	-0.20	0.33	0.47	-0.16
Black	0.32	0.09	-0.10	1.00	0.02	-0.00	0.00	-0.04	-0.07	0.32	-0.04	-0.06
Voted 00	0.40	0.07	0.13	0.02	1.00	0.29	0.31	0.16	-0.15	0.08	0.09	-0.24
Voted 99	0.43	0.07	0.19	-0.00	0.29	1.00	0.16	0.16	-0.04	0.15	0.15	-0.09
Voted Pri.	0.25	0.03	-0.00	0.00	0.31	0.16	1.00	0.23	-0.19	-0.07	-0.01	-0.17
Age	0.23	-0.05	0.04	-0.04	0.16	0.16	0.23	1.00	-0.00	0.07	0.02	-0.00
Age Miss.	-0.55	-0.17	-0.20	-0.07	-0.15	-0.04	-0.19	-0.00	1.00	-0.11	-0.03	0.79
Dem	0.38	0.09	0.33	0.32	0.08	0.15	-0.07	0.07	-0.11	1.00	-0.15	-0.14
Rep	0.31	0.10	0.47	-0.04	0.09	0.15	-0.01	0.02	-0.03	-0.15	1.00	-0.10
Ind	-0.47	-0.14	-0.16	-0.06	-0.24	-0.09	-0.17	-0.00	0.79	-0.14	-0.10	1.00

Table A7: Compliance Score / Covariate Correlation Matrix for Green, Gerber and Nickerson (2003). City dummies omitted from columns.

	Comp. Score	Party ID	Interest	Watch News	Educ.	Read News	Female	Income	White
Comp. Score	1.00	0.37	0.65	0.28	0.36	0.62	-0.29	0.01	0.12
Party ID	0.37	1.00	-0.11	-0.02	-0.03	-0.05	0.04	-0.14	-0.22
Political Interest	0.65	-0.11	1.00	0.17	0.25	0.36	-0.06	0.16	0.20
Watch News	0.28	-0.02	0.17	1.00	0.03	0.15	-0.07	-0.03	0.02
Education	0.36	-0.03	0.25	0.03	1.00	0.26	-0.10	0.30	0.15
Read News	0.62	-0.05	0.36	0.15	0.26	1.00	-0.10	0.23	0.17
Female	-0.29	0.04	-0.06	-0.07	-0.10	-0.10	1.00	-0.11	0.00
Income	0.01	-0.14	0.16	-0.03	0.30	0.23	-0.11	1.00	0.08
White	0.12	-0.22	0.20	0.02	0.15	0.17	0.00	0.08	1.00

Table A8: Compliance Score / Covariate Correlation Matrix for Albertson and Lawrence (2009).