simulation-confounding

Joakim Wallmark

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Simulation study

Investigate bias from missing confounders when estimating NDE and NIE.

Simulation scenarios

variable	type	true model
X(additional covariate)	continous	$X \sim gamma(8, 4.5)$
Z(exposure)	binary	$Z = I(Y* > 0)$ where $Z* \sim U_0 + U_1 X + N(0,1)$
M(mediator)	continous	$M \sim B_0 + B_1 Z + B_2 X + \epsilon, \epsilon \sim N(0,1)$
Y(outcome)	continous	$Y \sim \theta_0 + \theta_1 Z + \theta_2 M + \theta_3 ZM + \theta_4 X + \omega, \omega \sim N(0,1)$

$corr(\omega, \epsilon)$ =varied (-0.5,0.5)

Table: Variables used for simulations:

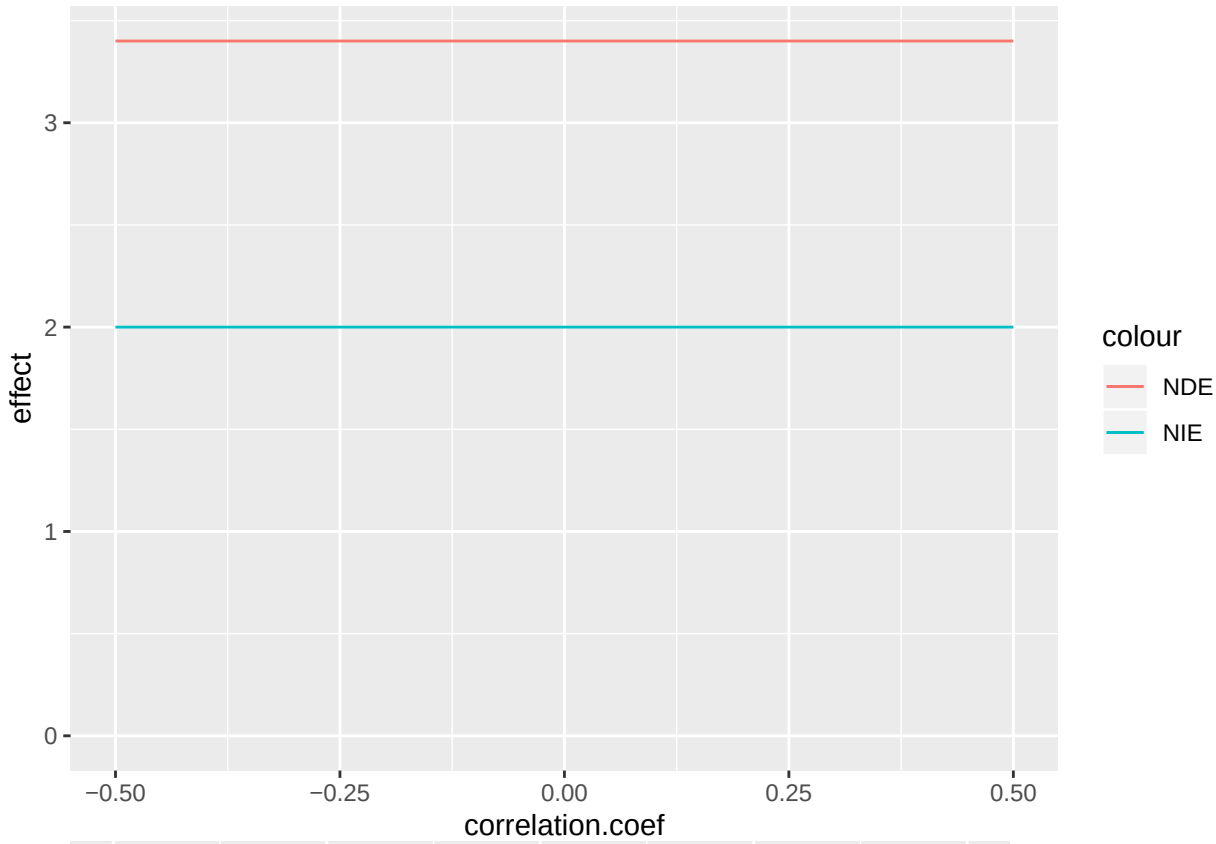
- $U_0 = -0.4$
- $U_1 = 0.01$
- $B_0 = 3$
- $B_1 = 2$
- $B_2 = 0.05$
- $\theta_0 = 5$
- $\theta_1 = 1$
- $\theta_2 = 0.5$
- $\theta_3 = 0.5$
- $\theta_4 = 0.05$

Estimated mediator model was set to the correct one. Estimated outcome model was linear but misspecified without ZM interaction: $Y \sim Z + M + X$.

Results

corr	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.model.SE	nie.model.SE	nde.coverag
-0.50	3.399995	2	4.369867	1.014217	0.3108515	0.2672455	0.3057825	0.2617198	0.1
-0.48	3.399995	2	4.379566	1.027024	0.3025359	0.2572344	0.3034688	0.2588721	0.1
-0.46	3.399995	2	4.315849	1.105518	0.3252302	0.3089219	0.3176932	0.2754750	0.2
-0.44	3.399995	2	4.292160	1.102058	0.3591604	0.2833182	0.3134792	0.2713180	0.2
-0.42	3.399995	2	4.288158	1.135515	0.2978927	0.2570908	0.3179966	0.2759080	0.1
-0.40	3.399995	2	4.202689	1.180752	0.3424437	0.2990982	0.3216942	0.2806723	0.2
-0.38	3.399995	2	4.172566	1.243409	0.2954918	0.2737124	0.3251457	0.2849301	0.3
-0.36	3.399995	2	4.128070	1.263390	0.3046094	0.2699878	0.3295696	0.2911186	0.3
-0.34	3.399995	2	4.037632	1.359653	0.3427630	0.2850102	0.3317220	0.2950559	0.4
-0.32	3.399995	2	4.047842	1.337692	0.3225653	0.3034148	0.3324577	0.2953447	0.4
-0.30	3.399995	2	3.987113	1.459936	0.4077738	0.3439875	0.3375311	0.3044877	0.5
-0.28	3.399995	2	3.970054	1.395265	0.3047451	0.2816125	0.3379854	0.3040503	0.5
-0.26	3.399995	2	3.940552	1.463745	0.3433824	0.2693111	0.3368328	0.3052954	0.6

corr	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.model.SE	nie.model.SE	nde.coverag
-0.24	3.399995	2	3.941601	1.465631	0.3522715	0.2937139	0.3444142	0.3120375	0.6
-0.22	3.399995	2	3.805606	1.632260	0.3860126	0.3271133	0.3537599	0.3284083	0.7
-0.20	3.399995	2	3.812654	1.569729	0.3491267	0.3061005	0.3395288	0.3132073	0.7
-0.18	3.399995	2	3.712662	1.659731	0.3477888	0.3339006	0.3434136	0.3214570	0.8
-0.16	3.399995	2	3.716600	1.667399	0.3444994	0.3243561	0.3445726	0.3206686	0.8
-0.14	3.399995	2	3.656912	1.753542	0.3328227	0.2949367	0.3551883	0.3333221	0.9
-0.12	3.399995	2	3.689743	1.736937	0.3669071	0.3315070	0.3493912	0.3287553	0.8
-0.10	3.399995	2	3.596637	1.776063	0.3716944	0.3238833	0.3507798	0.3317894	0.9
-0.08	3.399995	2	3.567833	1.857247	0.3528787	0.3707764	0.3541194	0.3383692	0.9
-0.06	3.399995	2	3.527183	1.885678	0.3568783	0.3246738	0.3514144	0.3384952	0.9
-0.04	3.399995	2	3.526230	1.938335	0.3835697	0.3692317	0.3595105	0.3465583	0.8
-0.02	3.399995	2	3.405479	1.962148	0.3588523	0.3428044	0.3538228	0.3439014	0.9
0.00	3.399995	2	3.446819	1.940563	0.3729010	0.3384773	0.3480118	0.3394175	0.9
0.02	3.399995	2	3.373566	2.047437	0.3818146	0.3867850	0.3584580	0.3521346	0.9
0.04	3.399995	2	3.377241	2.058685	0.3858342	0.3863824	0.3504835	0.3487264	0.9
0.06	3.399995	2	3.267813	2.119967	0.3412220	0.3813101	0.3497659	0.3493391	0.9
0.08	3.399995	2	3.255385	2.215380	0.3822301	0.3698728	0.3619665	0.3633589	0.9
0.10	3.399995	2	3.161522	2.258776	0.3639568	0.3674463	0.3522299	0.3585803	0.8
0.12	3.399995	2	3.163912	2.256694	0.3460420	0.3375988	0.3486955	0.3583597	0.8
0.14	3.399995	2	3.018379	2.331284	0.3657280	0.3637131	0.3498573	0.3641389	0.7
0.16	3.399995	2	3.165777	2.246770	0.3313025	0.3645387	0.3481004	0.3618529	0.8
0.18	3.399995	2	2.960850	2.438522	0.3413081	0.3882481	0.3492355	0.3713774	0.7
0.20	3.399995	2	3.007350	2.435726	0.3578210	0.3747480	0.3502865	0.3703792	0.7
0.22	3.399995	2	2.924973	2.445238	0.3330319	0.3942846	0.3474924	0.3723655	0.7
0.24	3.399995	2	2.872564	2.482901	0.3495585	0.3725757	0.3429716	0.3719791	0.6
0.26	3.399995	2	2.886298	2.537810	0.3243939	0.3337242	0.3383690	0.3698994	0.6
0.28	3.399995	2	2.889455	2.526571	0.3590543	0.4213681	0.3377420	0.3702893	0.6
0.30	3.399995	2	2.740372	2.674312	0.3241320	0.3619134	0.3438607	0.3814135	0.5
0.32	3.399995	2	2.770199	2.651036	0.3302762	0.3743936	0.3306511	0.3771095	0.4
0.34	3.399995	2	2.685624	2.658380	0.3216572	0.3422219	0.3276417	0.3749275	0.3
0.36	3.399995	2	2.584052	2.794912	0.2966692	0.3509697	0.3340854	0.3881648	0.2
0.38	3.399995	2	2.581717	2.764524	0.3209726	0.3900107	0.3291484	0.3843870	0.2
0.40	3.399995	2	2.517151	2.830629	0.3326270	0.3811414	0.3239789	0.3831699	0.2
0.42	3.399995	2	2.526759	2.838850	0.3328389	0.3518744	0.3198662	0.3840209	0.2
0.44	3.399995	2	2.504159	2.882201	0.2945547	0.3779907	0.3137908	0.3840952	0.1
0.46	3.399995	2	2.468237	2.910231	0.3040088	0.3218952	0.3194918	0.3904851	0.1
0.48	3.399995	2	2.422942	2.947340	0.3128951	0.4162601	0.3071732	0.3884880	0.1
0.50	3.399995	2	2.387770	3.019785	0.3189744	0.4073820	0.3108297	0.3934472	0.1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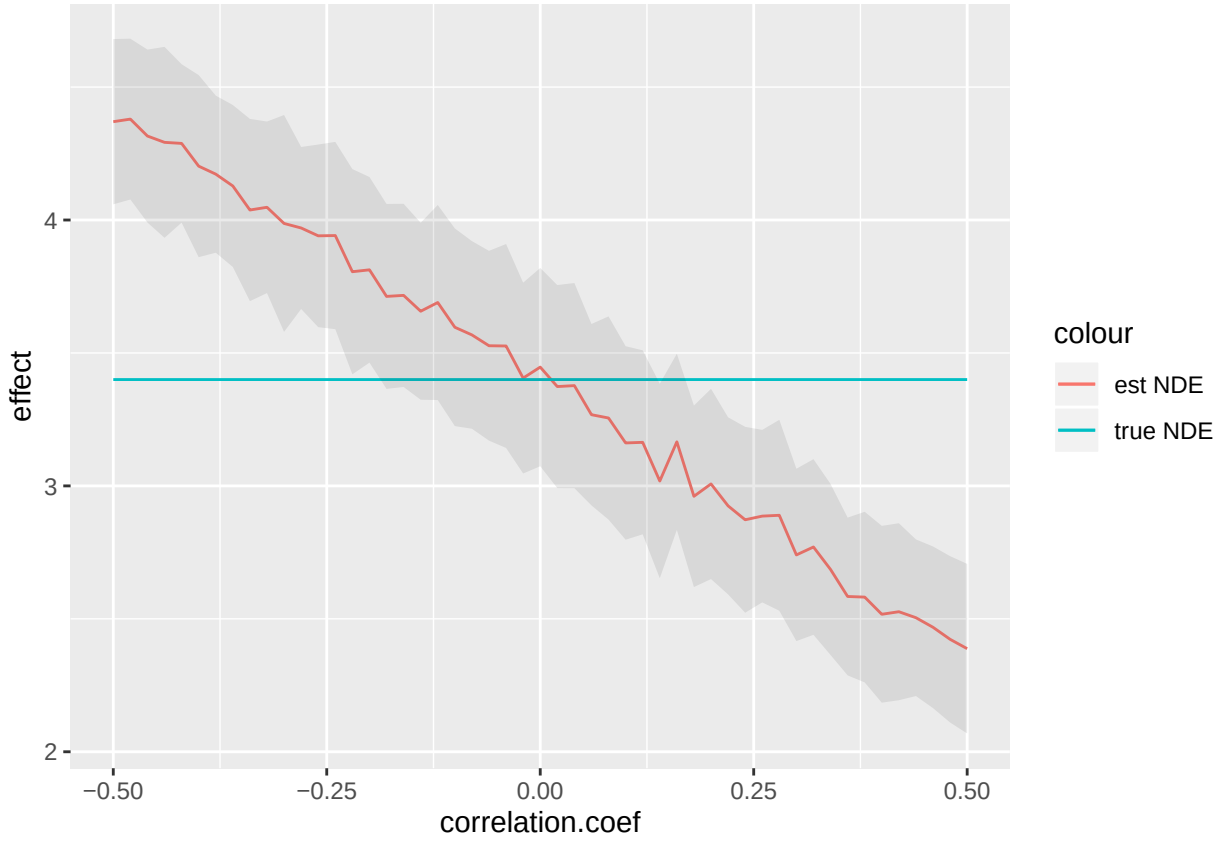
NDE
NIE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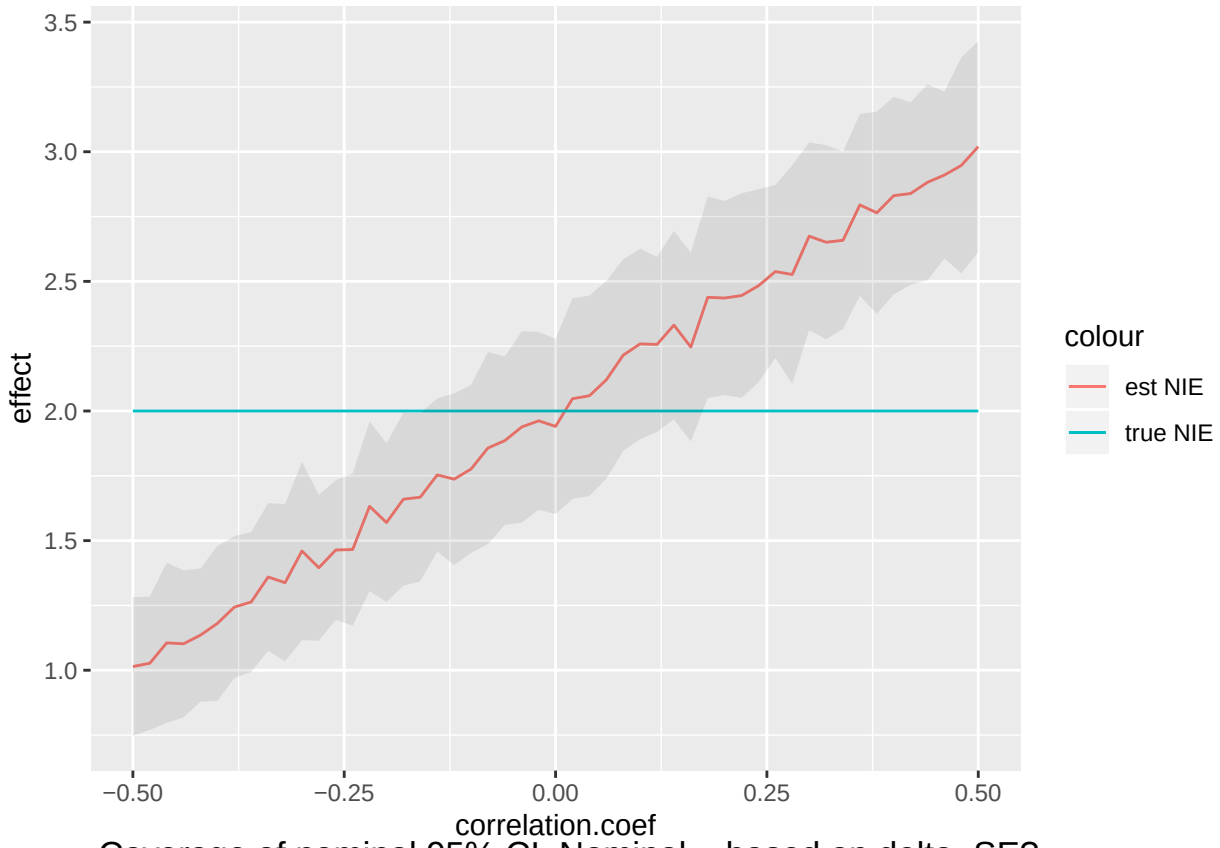
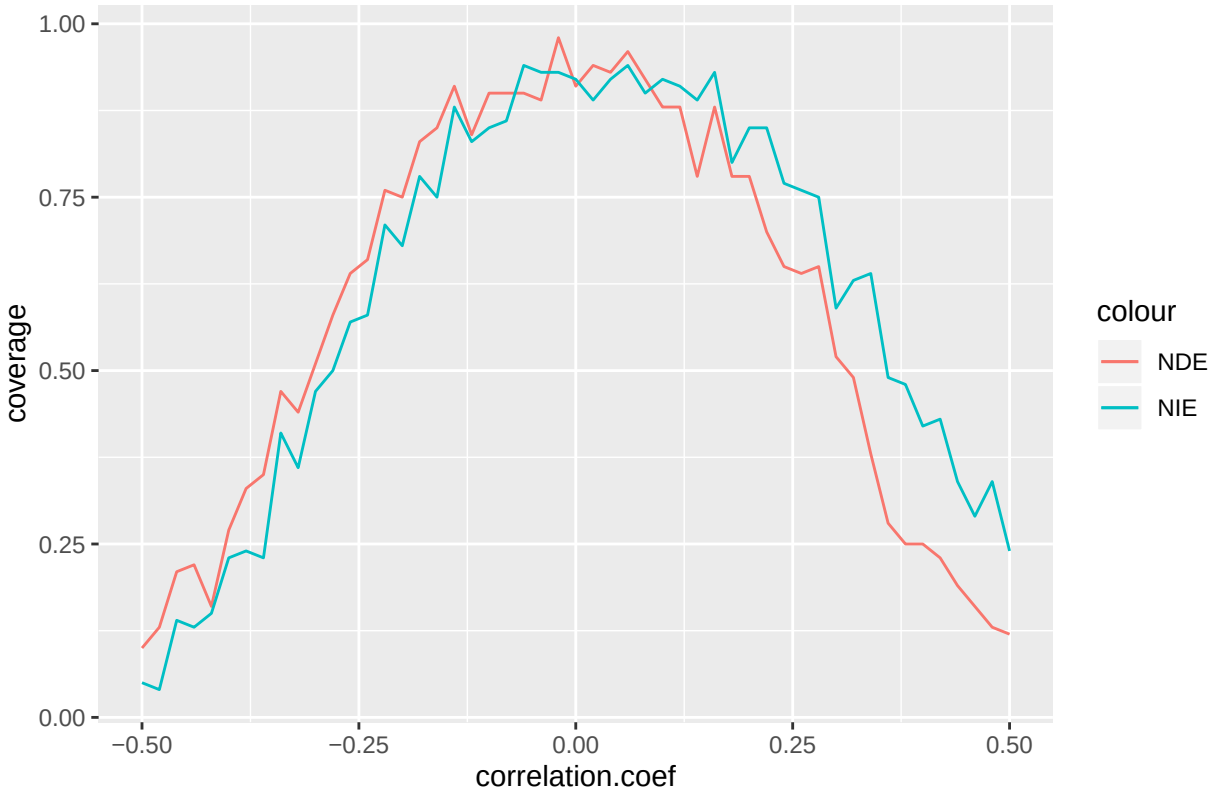
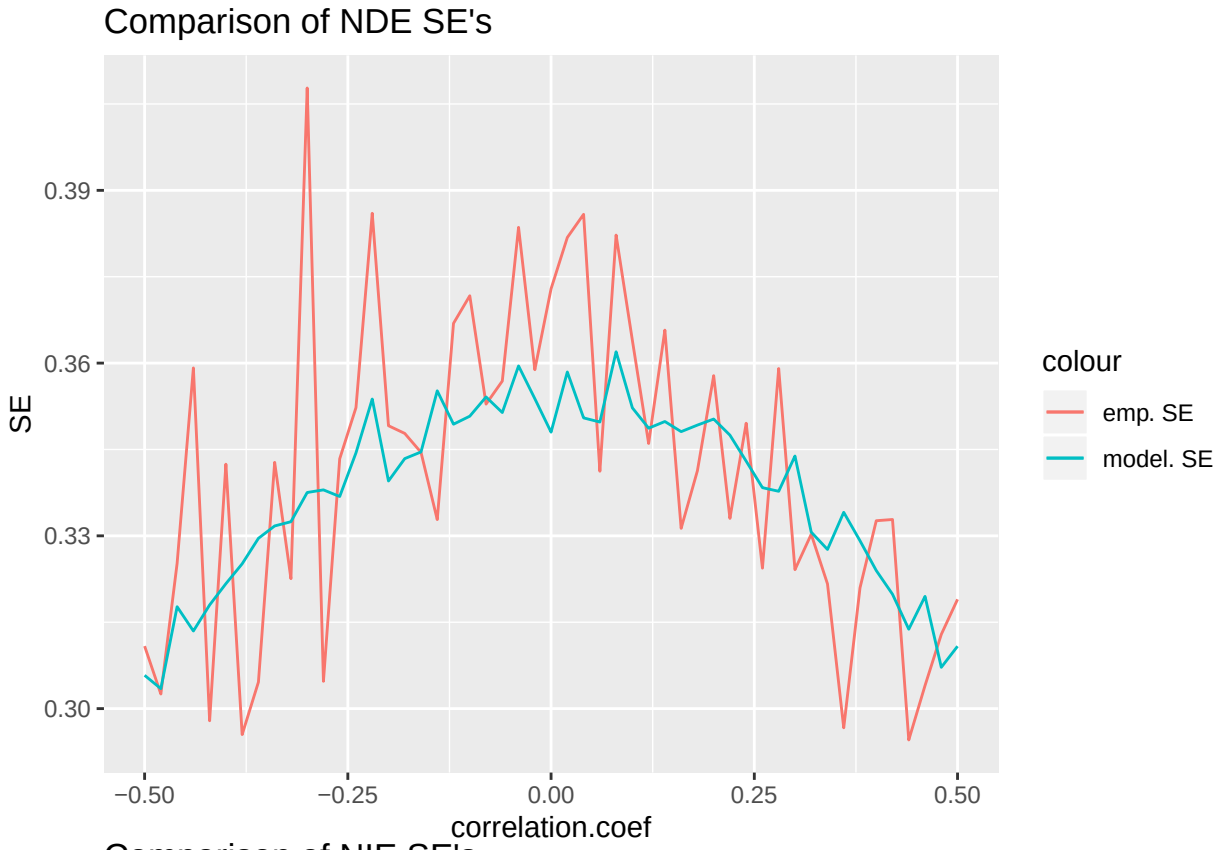
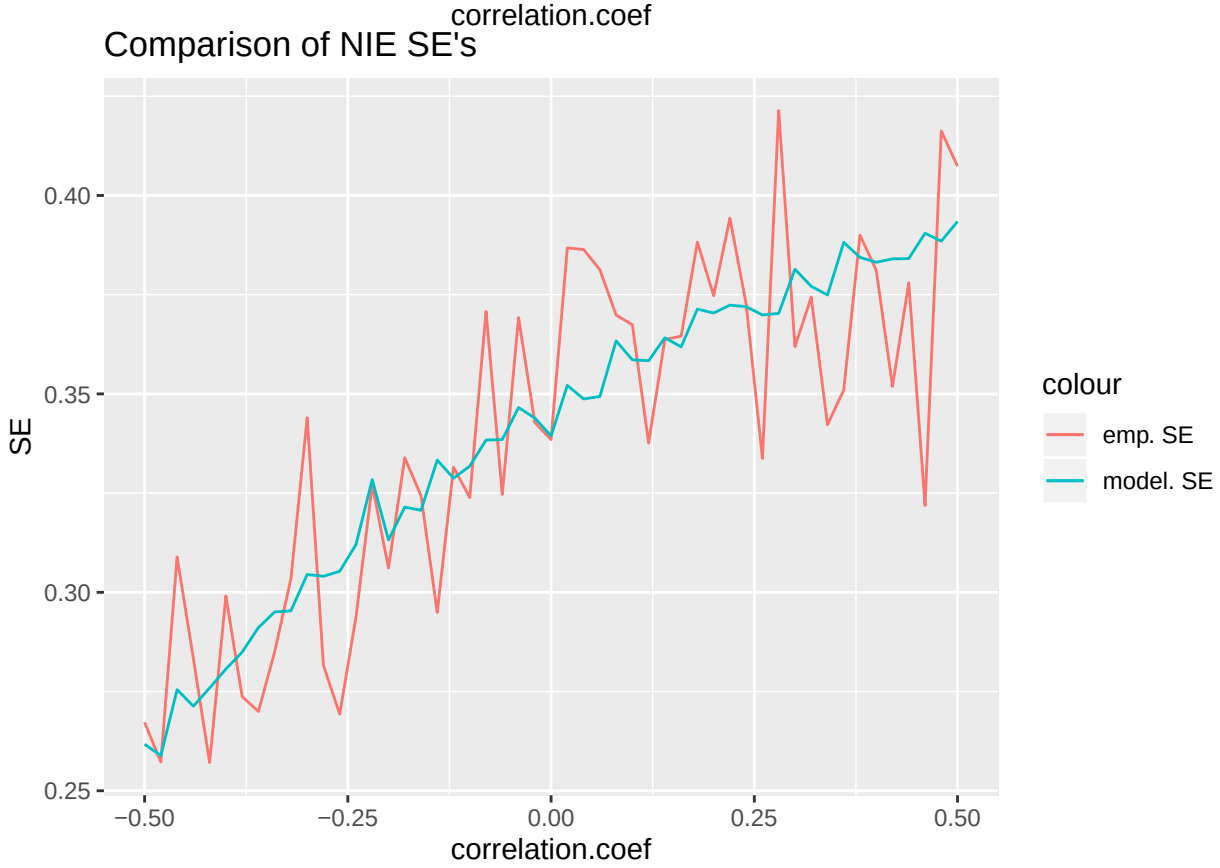
colour
est NDE
true NDE



Coverage of nominal 95% CI. Nominal = based on delta−SE?




Comparison of NDE SE's
SE
0.39
0.36
0.33
0.30
−0.50
−0.25
0.00
0.25
0.50
correlation.coef
colour
emp. SE
model. SE


Comparison of NIE SE's
SE
0.40
0.35
0.30
0.25
−0.50
−0.25
0.00
0.25
0.50
correlation.coef
colour
emp. SE
model. SE