

# simulation summary

Joakim Wallmark

11/2/2019

## Simulation study

Investigate bias from model misspecification when estimating NDE and NIE.

## Simulation scenarios

Table 1: Variables used for simulations:

variable	type	true model
X(additional covariate)	continous	$X \sim \text{gamma}(8, 4.5)$
Z(exposure)	binary	$Z = I(Z^* > 0)$ where $Z^* \sim U_0 + U_1X + N(0, 1)$
M(mediator)	continous	$M \sim B_0 + B_1Z + B_2X + N(0, 1)$
Y(outcome)	continous	$Y \sim \theta_0 + \theta_1Z + \theta_2M + \theta_3ZM + \theta_4X + N(0, 1)$

- $U_0 = -0.4$
- $U_1 = 0.01$
- $B_0 = 3$
- $B_1 = 2$
- $B_2 = 0.05$
- $\theta_0 = 5$
- $\theta_1 = 1$
- $\theta_2 = 0.5$
- $\theta_3 = \text{varied}[-0.5, 0.5]$
- $\theta_4 = 0.05$

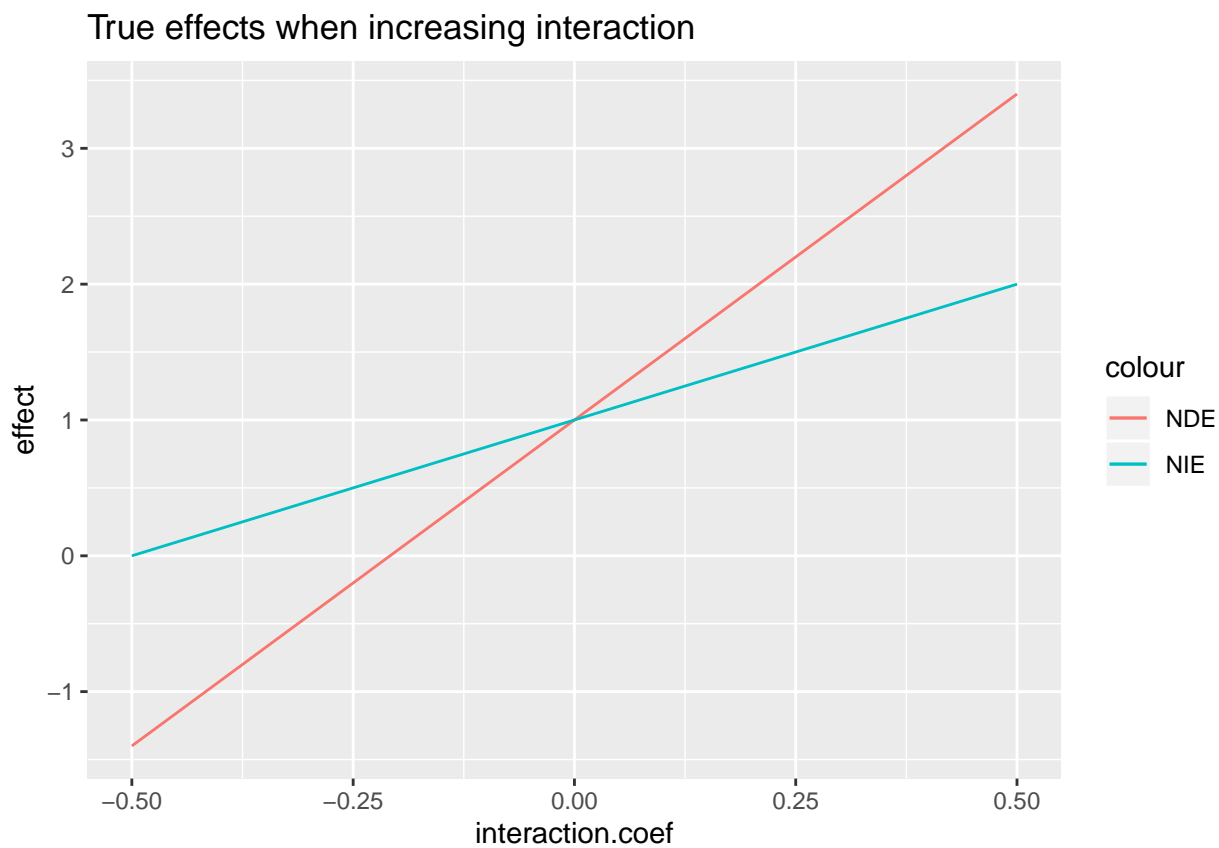
Estimated mediator model was set to the correct one. Estimated outcome model was linear but misspecified without  $ZM$  interaction:  $Y \sim Z + M + X$ .

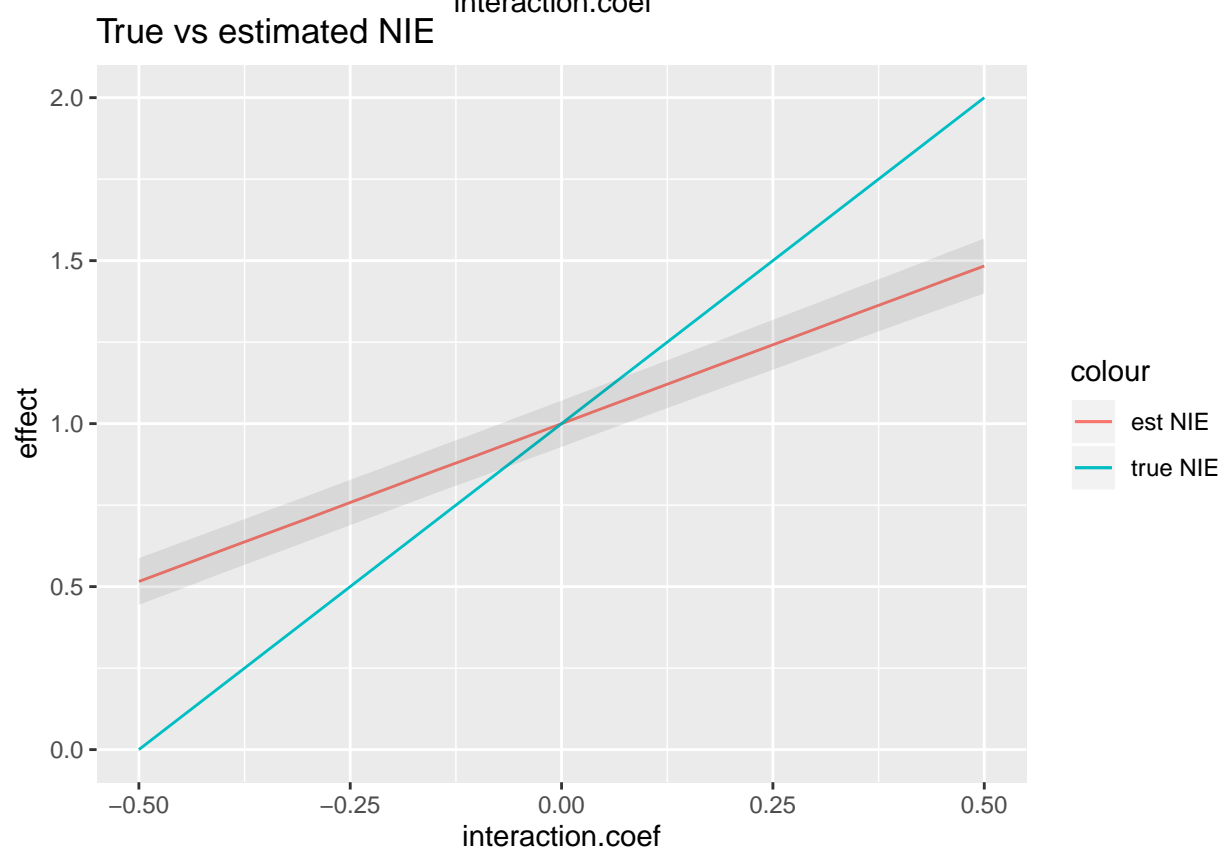
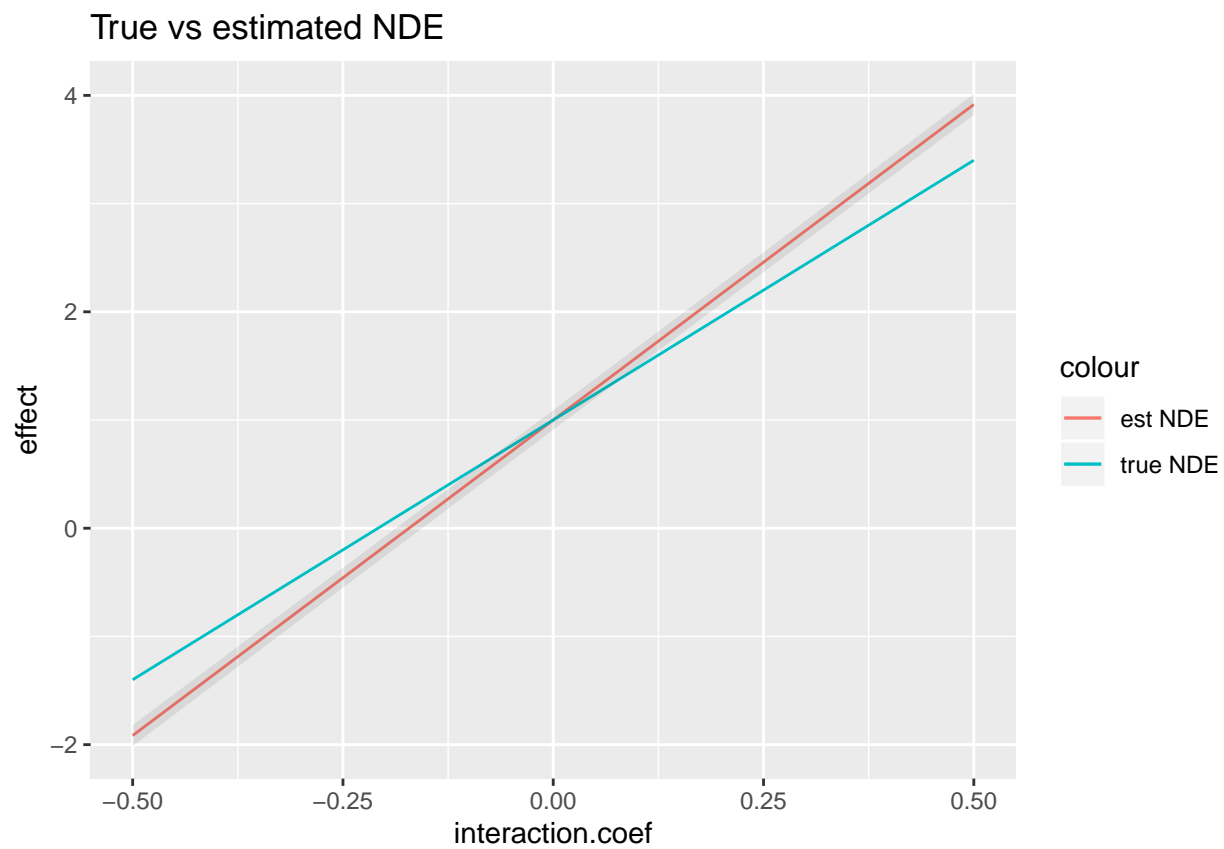
## Results

In this scenario, changing the interaction effect has a higher effect on the direct effect.

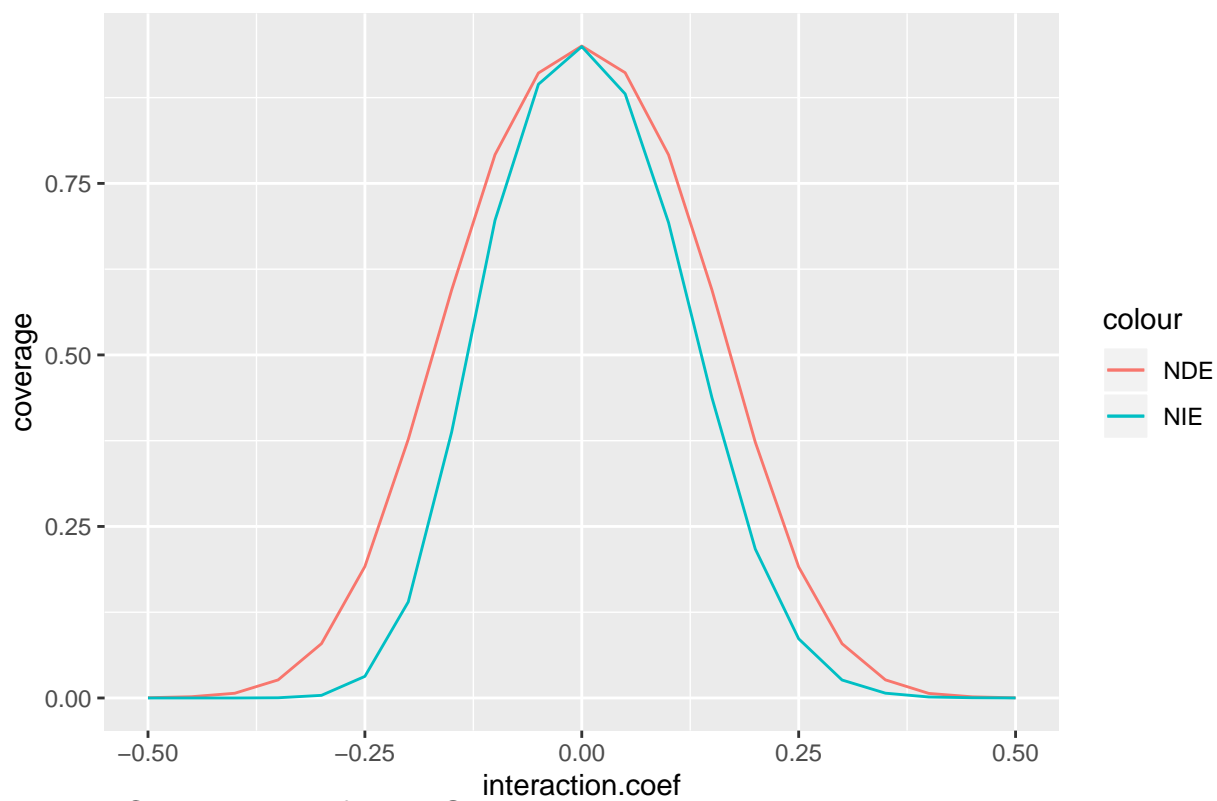
interaction.coefficient	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.model.SE	nie.m
-0.50	-1.3999687	0.0	-1.9155482	0.5158371	0.0965992	0.0714677	0.0937033	0.0
-0.45	-1.1599812	0.1	-1.6238320	0.5642456	0.0956264	0.0712476	0.0929935	0.0
-0.40	-0.9200857	0.2	-1.3326361	0.6130675	0.0940045	0.0702320	0.0923642	0.0
-0.35	-0.6800040	0.3	-1.0407292	0.6612991	0.0933931	0.0700434	0.0917729	0.0
-0.30	-0.4400941	0.4	-0.7490047	0.7091805	0.0924511	0.0696239	0.0912636	0.0
-0.25	-0.2000311	0.5	-0.4579278	0.7581090	0.0919748	0.0696272	0.0908443	0.0
-0.20	0.0400296	0.6	-0.1658642	0.8064374	0.0909011	0.0692561	0.0905043	0.0
-0.15	0.2799879	0.7	0.1250719	0.8554025	0.0905350	0.0694770	0.0902320	0.0
-0.10	0.5199962	0.8	0.4173574	0.9027818	0.0901176	0.0699013	0.0900163	0.0
-0.05	0.7600021	0.9	0.7085438	0.9513844	0.0899524	0.0704435	0.0899085	0.0
0.00	1.0000000	1.0	1.0002538	0.9997336	0.0898467	0.0709850	0.0898665	0.0
0.05	1.2400112	1.1	1.2912757	1.0485142	0.0901418	0.0718233	0.0899027	0.0
0.10	1.4799732	1.2	1.5830490	1.0966584	0.0897321	0.0725746	0.0900333	0.0

interaction.coefficient	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.model.SE	nie.m
0.15	1.7199868	1.3	1.8748650	1.1451068	0.0903921	0.0738747	0.0902327	0.0
0.20	1.9600320	1.4	2.1666837	1.1936683	0.0912085	0.0748964	0.0905071	0.0
0.25	2.1999982	1.5	2.4580248	1.2419281	0.0917664	0.0764915	0.0908650	0.0
0.30	2.4401130	1.6	2.7494810	1.2900463	0.0921609	0.0774353	0.0912863	0.0
0.35	2.6799494	1.7	3.0407678	1.3389220	0.0933691	0.0792399	0.0917740	0.0
0.40	2.9199755	1.8	3.3326090	1.3868898	0.0939909	0.0803801	0.0923574	0.0
0.45	3.1599913	1.9	3.6240518	1.4355838	0.0958820	0.0825903	0.0929972	0.0
0.50	3.4000021	2.0	3.9158976	1.4836539	0.0968931	0.0841164	0.0937200	0.0





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



Comparison of NDE SE's

