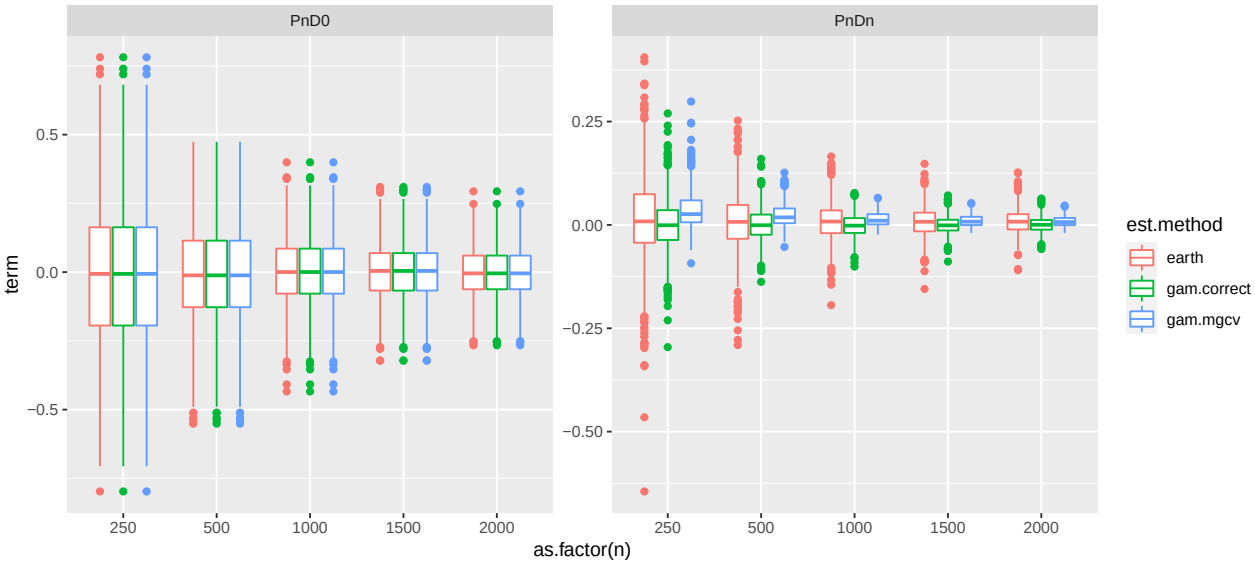
Simulation.rewrite.rst

3 Scenario 3

$$W_1 \sim Unif(-1, 1)$$
$$W_2 \sim Unif(-1, 1)$$
$$W_3 \sim Bernoulli(0.5)$$
$$A \sim Bernoulli(\pi_0) \; where \; \pi_0 = expit(0.5 + \frac{1}{3}W_1)$$
$$Y \sim N(\mu_0, 1) \; where \; \mu_0 = 0.1 + 0.25 * A + 0.75A(W_1^2 + W_3) + W_1 + W_2^2$$
$$\tau(W) = 0.25 + 0.75 * (W_1^2 + W_3)$$
$$\psi_0 = 0.956$$
$$\theta_0 = 0.191$$

```
# gam.correct: gam.model <- as.formula("Y ~ W1 + I(W2^2) + I(W1^2):A + A*W3")
# earth: SL.library = c("SL.earth")
# gam.mgcv: gam.model <- as.formula("Y ~ s(W1) + s(W2) + s(W1, by=A) + s(W2, by=A) + A*W3")
# mu.reg <- mgcv::gam(gam.model, data = AW, method = "REML")
```

$$R_{n,\psi,1} = (P_n - P_0)(D_n - D_0)$$



```
# PnDn.1 <- mean(2 * tau.hat * (Y - mu.hat) * Z.hat)
# PnDn.11 <- mean((Y - mu.hat)^2)
# PnDn.12 <- mean((Y - mu.hat))
# PnDn.21 <- mean(tau.hat * (Y - mu.hat))
# PnDn.22 <- mean((Y - mu.hat) * Z.hat)
# PnDn.23 <- mean(tau.hat * (Y - mu.hat) * Z.hat)
```

Table 1: gam.correct

n	median.PnDn.1	median.PnDn.11	median.PnDn.12	median.PnDn.21	median.PnDn.22	median.PnDn.23
100	-0.004797	0.922785	0	0.000491	0.000095	-0.002398
250	-0.000749	0.971672	0	-0.000146	-0.000718	-0.000375
500	-0.000734	0.985133	0	0.000252	-0.000051	-0.000367
750	0.000159	0.988249	0	-0.000004	0.000058	0.000080
1000	-0.001760	0.990552	0	0.000242	-0.000159	-0.000880
1500	-0.001057	0.995613	0	0.000148	-0.000032	-0.000529
2000	0.000288	0.996411	0	-0.000007	0.000016	0.000144

Table 2: earth

n	median.PnDn.1	median.PnDn.11	median.PnDn.12	median.PnDn.21	median.PnDn.22	median.PnDn.23
100	0.014298	0.903608	0	0.000000	0.044828	0.007149
250	0.008533	0.936641	0	-0.001265	0.008777	0.004267
500	0.007427	0.967044	0	-0.001189	0.003241	0.003714
750	0.007650	0.970993	0	-0.001478	0.003040	0.003825
1000	0.008185	0.977042	0	-0.001559	0.003556	0.004092
1500	0.007592	0.986973	0	-0.001420	0.003761	0.003796
2000	0.007822	0.989783	0	-0.001362	0.003438	0.003911

Table 3: gam.mgcv

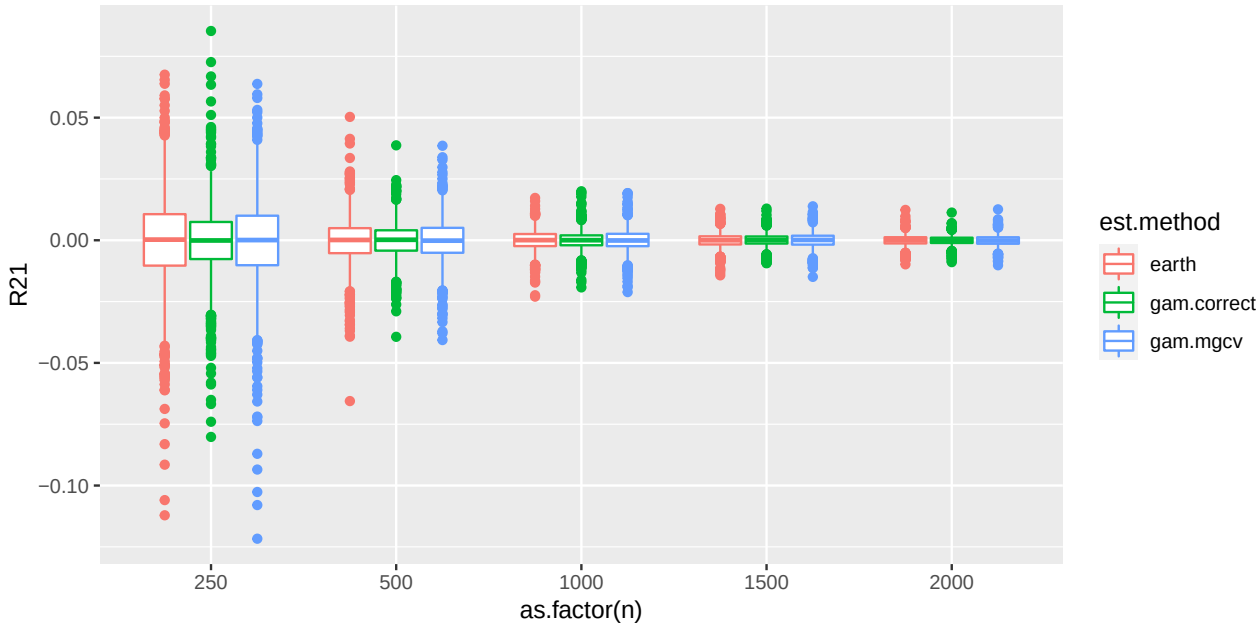
n	median.PnDn.1	median.PnDn.11	median.PnDn.12	median.PnDn.21	median.PnDn.22	median.PnDn.23
100	0.033062	0.861017	0	0.004147	0.000263	0.016531
250	0.026115	0.939453	0	0.003281	0.000246	0.013058
500	0.018237	0.970168	0	0.002363	0.000168	0.009119
750	0.014598	0.975344	0	0.002075	0.000152	0.007299
1000	0.010325	0.981390	0	0.001955	0.000121	0.005163
1500	0.007831	0.988059	0	0.001547	0.000099	0.003915
2000	0.006861	0.991588	0	0.001230	0.000086	0.003430

```
# # PnDn
# PnDn <- mean(psi.eif.hat)
# # PnD0
# PnD0 <- mean(2 * tau0 * (Y - mu0(A, W)) * Z0 + tau0^2 - mean(tau0^2))

# n <- 10000
# j <- 2000
# P0Dn
# P0Dn <- mean(psi.eif.hat)
# PnD0
# P0D0 <- mean(2 * tau0 * (Y - mu0(A, W)) * Z0 + tau0^2 - mean(tau0^2))
```

```
## gam.correct P0Dn:  -1e-04
## earth P0Dn:  0.0031
## gam.mgcv P0Dn:  0.0025
## gam.correct P0D0:  -0.001
## earth P0D0:  -7e-04
## gam.mgcv P0D0:  5e-04
```

$$R_{n,\psi,2} = 2P_0\{\tau_n[\mu_n - \mu_0][g_n - g_0]\frac{z_n}{g_0}\} - P_0(\tau_n - \tau_0)^2$$




```
# g.hat <- (A * pi.hat + (1-A) * (1-pi.hat))
# g0 <- (A * pi0(W) + (1-A) * (1-pi0(W)))
# R21 <- mean(tau.hat*(mu.hat-mu0(A, W))*(g.hat-g0)*Z.hat/g0)
```

$$R_{n,\theta,2} = 2P_0\{\eta_n[\mu_n - \mu_0][g_n - g_0]\frac{z_n}{g_0}\} - P_0(\eta_n - \eta_0)^2 + 2(\gamma_n - \gamma_0)(P_n - P_0)\tau_n$$

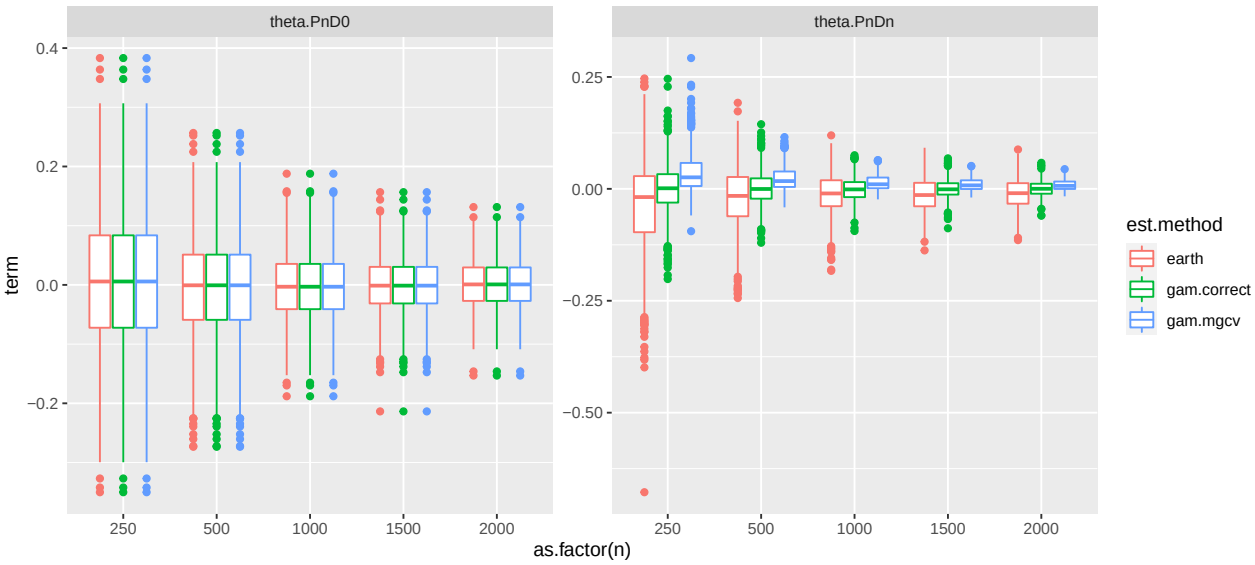


Table 4: gam.correct

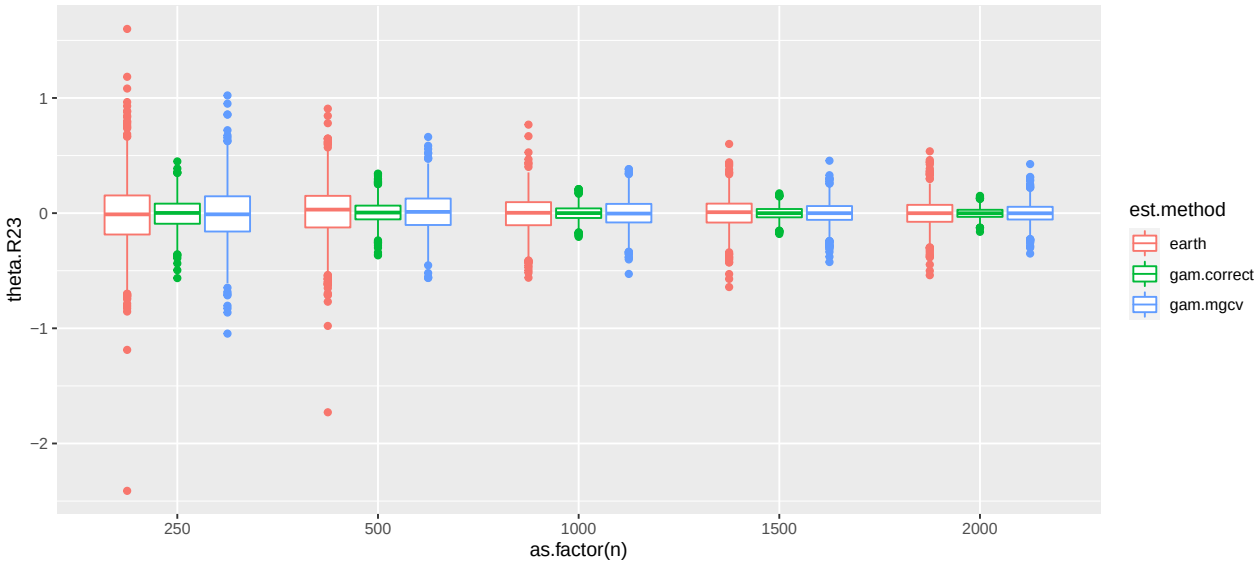
n	median.theta.PnDn
100	-0.005328
250	0.001274
500	-0.000284
750	0.000730
1000	-0.001223
1500	-0.001037
2000	0.000136

Table 5: earth

n	median.theta.PnDn
100	-0.006536
250	-0.018372
500	-0.015758
750	-0.009027
1000	-0.010237
1500	-0.013844
2000	-0.009699

Table 6: gam.mgcv

n	median.theta.PnDn
100	0.030971
250	0.025713
500	0.017347
750	0.014322
1000	0.010244
1500	0.007818
2000	0.006726




```
## # A tibble: 5 x 4
## # Groups:   n [5]
##       n     earth gam.correct  gam.mgcv
##   <int>     <dbl>       <dbl>     <dbl>
## 1   250 -0.0107      0.00185  -0.0104
## 2   500  0.0308      0.00503   0.0110
## 3  1000  0.00299     0.000391 -0.00353
## 4  1500  0.00832    -0.000194 -0.000392
## 5  2000 -0.000571   -0.000916 -0.00126
```