

# # Debugging Sandwich Variance of DR ATE #

--- 10월 7일 Version

## <What To Do>

: true value  $\theta^*$  에 대해 # of obs 바꾸어가며 ( $n=100, 1000, 10000, 20000$ )

$\bar{z}(\theta^*) = \frac{1}{n} \sum_{i=1}^n \psi_i(\theta^*)$  의 Sample Variance 계산 (1000번 replication)

:  $E[\psi(\theta^*) \psi(\theta^*)^T]$  계산  $\Rightarrow$  실제 계산 어렵기 때문에 # of obs = 50000 으로 하여

Monte Carlo Approximation 통해 근사치 계산

## [Result]

\*  $E[\psi(\theta^*) \psi(\theta^*)^T]$  Monte Carlo Approximation

```
> apply(nu_true_array, c(1,2), mean)
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	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	8.948808682	0.5071253788	-1.0129350504	-1.0109361808	-0.5017310531	-0.009565930	-0.0101459287	-0.0028478307	0.0204396985
[2,]	0.507125379	1.6728490053	-1.0086641911	0.0020839476	-0.5023677878	0.002113445	-0.0001777562	-0.0005371309	0.0001653495
[3,]	-1.012935050	-1.008664191	1.0092700440	0.1212922620	0.5004906028	-0.004256434	0.0008701605	-0.0001079156	-0.0026823053
[4,]	-1.010936181	0.0020839476	0.1212922620	0.1212922620	0.0601241950	0.001791926	0.0011330054	0.0002185715	-0.0024447795
[5,]	-0.501731053	-0.5023677878	0.5004906028	0.0601241950	0.5004906028	-0.004570849	-0.0001079156	-0.0001079156	-0.0020929759
[6,]	-0.009565930	0.0021134450	-0.0042564344	0.0017919262	-0.0045708490	1.013062213	-0.0026823053	-0.0020929759	0.0018949461
[7,]	-0.010145929	-0.0001777562	0.0008701605	0.0011330054	-0.0001079156	-0.002682305	0.1053538494	0.0527845302	0.0005089425
[8,]	-0.002847831	-0.0005371309	-0.0001079156	0.0002185715	-0.0001079156	-0.002092976	0.0527845302	0.0527845302	0.0008813136
[9,]	0.020439699	0.0001653495	-0.0026823053	-0.0024447795	-0.0020929759	0.001894946	0.0005089425	0.0008813136	0.1053816955

$\nu_1$   $\nu_0$   $\approx$   $\beta$

\*  $\bar{z}(\theta^*)$  의 Sample Variance : # of obs = 100 일 때

```
> var(z_true)
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	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	0.0833887638	5.913023e-03	-9.371410e-03	-9.292225e-03	-4.146079e-03	-1.619213e-03	-1.649143e-04	-2.621968e-04	-3.535159e-04
[2,]	0.0059130229	1.650809e-02	-9.712081e-03	-4.641558e-05	-4.918403e-03	-4.410232e-04	9.334158e-05	5.516848e-05	6.057821e-05
[3,]	-0.0093714103	-9.712081e-03	9.518059e-03	1.104122e-03	4.831510e-03	3.089517e-04	1.504155e-05	1.380523e-05	1.937345e-05
[4,]	-0.0092922249	-4.641558e-05	1.104122e-03	1.107259e-03	4.993664e-04	1.706296e-04	2.885304e-05	3.478974e-05	4.616574e-05
[5,]	-0.0041460792	-4.918403e-03	4.831510e-03	4.993664e-04	4.868821e-03	6.703923e-05	7.789846e-05	2.296917e-05	3.742166e-05
[6,]	-0.0016192131	-4.410232e-04	3.089517e-04	1.706296e-04	6.703923e-05	9.285253e-03	6.772722e-06	3.498928e-06	1.094618e-04
[7,]	-0.0001649143	9.334158e-05	1.504155e-05	2.885304e-05	7.789846e-05	6.772722e-06	1.114492e-03	5.480218e-04	7.313380e-05
[8,]	-0.0002621968	5.516848e-05	1.380523e-05	3.478974e-05	2.296917e-05	3.498928e-06	5.480218e-04	5.404104e-04	2.706036e-05
[9,]	-0.0003535159	6.057821e-05	1.937345e-05	4.616574e-05	3.742166e-05	1.094618e-04	7.313380e-05	2.706036e-05	1.089614e-03

$\nu_1$   $\nu_0$   $\approx$   $\beta$

\*  $\bar{Z}(\theta^*)$ 의 Sample Variance : # of obs = 1000 일 때

> var(z\_true)

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	9.028783e-03	3.564293e-04	-7.800870e-04	-1.007170e-03	-3.416734e-04	1.763024e-05	1.595356e-05	-3.203134e-06	-2.162356e-05
[2,]	3.564293e-04	1.613930e-03	-9.224852e-04	2.219588e-05	-4.530020e-04	3.344007e-05	8.197218e-06	-8.742965e-07	3.675494e-06
[3,]	-7.800870e-04	-9.224852e-04	8.982600e-04	9.234995e-05	4.468994e-04	-4.708693e-05	8.094548e-06	6.578819e-06	8.343814e-06
[4,]	-1.007170e-03	2.219588e-05	9.234995e-05	1.195177e-04	4.196927e-05	-3.033916e-06	1.607829e-07	9.956277e-07	3.687121e-06
[5,]	-3.416734e-04	-4.530020e-04	4.468994e-04	4.196927e-05	4.880883e-04	-1.579659e-05	1.332457e-05	9.155539e-06	1.051984e-06
[6,]	1.763024e-05	3.344007e-05	-4.708693e-05	-3.033916e-06	-1.579659e-05	1.003630e-03	-9.236314e-06	-5.516915e-06	-1.460192e-05
[7,]	1.595356e-05	8.197218e-06	8.094548e-06	1.607829e-07	1.332457e-05	-9.236314e-06	9.705416e-05	5.075010e-05	-1.214042e-06
[8,]	-3.203134e-06	-8.742965e-07	6.578819e-06	9.956277e-07	9.155539e-06	-5.516915e-06	5.075010e-05	5.429635e-05	-2.965799e-06
[9,]	-2.162356e-05	3.675494e-06	8.343814e-06	3.687121e-06	1.051984e-06	-1.460192e-05	-1.214042e-06	-2.965799e-06	1.080202e-04

$\nu_1$     $\nu_0$     $\alpha$     $\beta$

\*  $\bar{Z}(\theta^*)$ 의 Sample Variance : # of obs = 10000 일 때

> var(z\_true)

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	8.593965e-05	2.613297e-05	-8.057100e-05	-9.751055e-05	-4.037362e-05	-2.768898e-06	1.653826e-06	2.358612e-06	-3.565075e-06
[2,]	2.613297e-05	1.696687e-04	-1.011542e-04	3.021088e-06	-5.012064e-05	-4.524690e-06	-4.744274e-07	2.060799e-07	-6.464125e-07
[3,]	-8.057100e-05	-1.011542e-04	9.808907e-05	9.572707e-06	4.917002e-05	2.284593e-06	-6.448335e-07	-7.432882e-07	1.212340e-06
[4,]	-9.751055e-05	3.021088e-06	9.572707e-06	1.174723e-05	4.877054e-06	2.002866e-07	-2.985418e-07	-3.143512e-07	4.504490e-07
[5,]	-4.037362e-05	-5.012064e-05	4.917002e-05	4.877054e-06	4.754964e-05	-7.940996e-07	-9.429928e-07	-5.190544e-07	1.368452e-06
[6,]	-2.768898e-06	-4.524690e-06	2.284593e-06	2.002866e-07	-7.940996e-07	9.969840e-05	-7.358215e-07	3.328952e-07	-5.447920e-07
[7,]	1.653826e-06	-4.744274e-07	-6.448335e-07	-2.985418e-07	-9.429928e-07	-7.358215e-07	1.048796e-05	5.353965e-06	-1.193861e-07
[8,]	2.358612e-06	2.060799e-07	-7.432882e-07	-3.143512e-07	-5.190544e-07	3.328952e-07	5.353965e-06	5.240656e-06	-3.720360e-08
[9,]	-3.565075e-06	-6.464125e-07	1.212340e-06	4.504490e-07	1.368452e-06	-5.447920e-07	-1.193861e-07	-3.720360e-08	1.084531e-05

$\nu_1$     $\nu_0$     $\alpha$     $\beta$

\*  $\bar{Z}(\theta^*)$ 의 Sample Variance : # of obs가 20000 일 때

> var(z\_true)

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]
[1,]	4.186802e-04	2.740754e-05	-4.720597e-05	-4.688306e-05	-2.196881e-05	5.788612e-06	1.810921e-06	1.703670e-06	-2.564255e-06
[2,]	2.740754e-05	8.528458e-05	-4.885128e-05	2.502364e-07	-2.401496e-05	1.767138e-06	2.458773e-07	2.620934e-07	-9.809969e-07
[3,]	-4.720597e-05	-4.885128e-05	4.699940e-05	5.451934e-06	2.302431e-05	-2.059189e-06	-5.002033e-07	-4.759655e-07	6.177953e-07
[4,]	-4.688306e-05	2.502364e-07	5.451934e-06	5.619765e-06	2.550867e-06	-6.159557e-07	-2.266446e-07	-2.098816e-07	2.412517e-07
[5,]	-2.196881e-05	-2.401496e-05	2.302431e-05	2.550867e-06	2.332288e-05	-1.443911e-06	3.392477e-07	-2.594522e-07	8.506946e-08
[6,]	5.788612e-06	1.767138e-06	-2.059189e-06	-6.159557e-07	-1.443911e-06	5.060945e-05	3.796718e-07	1.376873e-07	-5.822297e-07
[7,]	1.810921e-06	2.458773e-07	-5.002033e-07	-2.266446e-07	3.392477e-07	3.796718e-07	5.157210e-06	2.537346e-06	-6.233103e-08
[8,]	1.703670e-06	2.620934e-07	-4.759655e-07	-2.098816e-07	-2.594522e-07	1.376873e-07	2.537346e-06	2.483816e-06	-7.142363e-08
[9,]	-2.564255e-06	-9.809969e-07	6.177953e-07	2.412517e-07	8.506946e-08	-5.822297e-07	-6.233103e-08	-7.142363e-08	4.920934e-06

$\nu_1$     $\nu_0$     $\alpha$     $\beta$