Consistency test about mu0 and mu1 - 7/15 ver

1) Generating 한 100,000,0 개의 Sample 이용해 $E[Y'|E=1]$ true value 와 $\hat{E}[Y|E=1]$ 이 수렴하는지 Check!
($E[Y^0|E=1]$) ($\hat{E}[Y|E=0]$)

	Value		Value
true μ_0	0.2113706	true μ_1	0.9045177
$\hat{E}[Y^0\|E=1]$	0.437256	$\hat{E}[Y'\|E=1]$	1.132825

; # of obs가 5000, 20000, 80000, 320000개 일 때, $\hat{E}[Y|E=1]$, $\hat{E}[Y|E=0]$ 이 μ_0, μ_1 true value에 수렴하는지 확인!

	bias of mu_0 estimator	variance of mu_0 estimator	bias of mu_1 estimator	variance of mu_1 estimator
#of obs = 5000	0.3414792	2.602438e-04	0.3455804	0.0016821134
#of obs = 20000	0.3444285	7.733425e-05	0.3494102	0.0006605543
#of obs = 80000	0.3418712	1.550495e-05	0.3472813	0.0001063829
#of obs = 320000	0.3427255	5.218972e-06	0.3480456	0.0000308092

Bias가 줄어들지 않음

Bias가 줄어들지 않음.

2) true μ_0, μ_1 계산하는 공식 Double check!

; $E[Y^e|E=1] = E[\log 1.2 \cdot U + \log 1.5 \cdot B + \log 2 \cdot C + \log 2 \cdot E \,|\, E=1]$

$= \log 1.2 \times E[U|E=1] + \log 1.5 \times E[B|E=1] + \log 1.2 \times E[C|E=1]$

① true μ_0, μ_1 계산할 때 "$\log 1.2 \times E[U|E=1]$" term 포함한 경우

; $\hat{\mu}_0$, $\hat{\mu}_1$ 추정량 3가지 고려

Ver 04
$\hat{\mu}_0 = \log 1.5 \times P(B|E=1) + \log 2 \cdot E[C|E=1]$
$\hat{\mu}_1 = \hat{\mu}_0 + \log 2$

Ver 05
$\hat{\mu}_1$ = mean(result_model$fitted.values[data$E==1])
$\hat{\mu}_0$ = mean(result_model$fitted.values[data$E==0])

Ver 08
$\hat{\mu}_1 = \frac{\sum \hat{\omega}_i A_i Y_i}{\sum \hat{\omega}_i A_i}$
$\hat{\mu}_0 = \frac{\sum \hat{\omega}_i (1-A_i) Y_i}{\sum \hat{\omega}_i (1-A_i)}$
($\hat{\omega}_i$는 weight 의미)

[Result]

① Ver 04:

	bias of mu_0 estimator ver1	variance of mu_0 estimator ver1	bias of mu_1 estimator ver1	variance of mu_1 estimator ver1
#of obs = 5000	-0.09656163	7.370285e-04	-0.09656163	7.370285e-04
#of obs = 20000	-0.09265362	4.185374e-04	-0.09265362	4.185374e-04
#of obs = 80000	-0.09606809	4.723340e-05	-0.09606809	4.723340e-05
#of obs = 320000	-0.09574396	1.374988e-05	-0.09574396	1.374988e-05

② Ver 05 :

	bias of mu_0 estimator ver2	variance of mu_0 estimator ver2	bias of mu_1 estimator ver2	variance of mu_1 estimator ver2
#of obs = 5000	0.1345376	4.574931e-04	0.1346682	0.0016821134
#of obs = 20000	0.1392778	1.763451e-04	0.1384980	0.0006605543
#of obs = 80000	0.1351296	3.497748e-05	0.1363691	0.0001063829
#of obs = 320000	0.1363608	8.974540e-06	0.1371334	0.0000308092

③ Ver 08 :

	bias of mu_0 estimator ver3	variance of mu_0 estimator ver3	bias of mu_1 estimator ver3	variance of mu_1 estimator ver3
#of obs = 5000	0.1345376	4.574931e-04	0.1346682	0.0016821134
#of obs = 20000	0.1392778	1.763451e-04	0.1384980	0.0006605543
#of obs = 80000	0.1351296	3.497748e-05	0.1363691	0.0001063829
#of obs = 320000	0.1363608	8.974540e-06	0.1371334	0.0000308092

⇒ 모든 추정량에 대해 Bias가 줄어드는 경향은 보이지 않는다.

② true μ_0, μ_1 계산할 때 "log 1.2 × E[U|E=1]" term 포함하지 않은 경우

; $\hat{\mu}_0$, $\hat{\mu}_1$ 추정량 3가지 고려

Ver 04
$$\begin{cases} \hat{\mu}_0 = \log 1.5 \times P(B|E=1) + \log 2 \cdot E[C|E=1] \\ \hat{\mu}_1 = \hat{\mu}_0 + \log 2 \end{cases}$$

/ Ver 05
$$\begin{cases} \hat{\mu}_1 = \text{mean}(\text{result\_model\$fitted.values}[\text{data\$E==1}]) \\ \hat{\mu}_0 = \text{mean}(\text{result\_model\$fitted.values}[\text{data\$E==0}]) \end{cases}$$

Ver 08
$$\begin{cases} \hat{\mu}_1 = \dfrac{\sum \hat{\omega}_i A_i Y_i}{\sum \hat{\omega}_i A_i} \\ \hat{\mu}_0 = \dfrac{\sum \hat{\omega}_i (1-A_i) Y_i}{\sum \hat{\omega}_i (1-A_i)} \end{cases}$$ ($\hat{\omega}_i$는 weight 의미)

[Result]

① Ver 04:

	bias of mu_0 estimator ver1	variance of mu_0 estimator ver1	bias of mu_1 estimator ver1	variance of mu_1 estimator ver1
#of obs = 5000	-0.005363696	7.370285e-04	-0.005363696	
#of obs = 20000	-0.001455690	4.185374e-04	-0.001455690	
#of obs = 80000	-0.004870154	4.723340e-05	-0.004870154	
#of obs = 320000	-0.004546028	1.374988e-05	-0.004546028	

	variance of mu_1 estimator ver1
#of obs = 5000	7.370285e-04
#of obs = 20000	4.185374e-04
#of obs = 80000	4.723340e-05
#of obs = 320000	1.374988e-05

② Ver 05 :

	bias of mu_0 estimator ver2	variance of mu_0 estimator ver2	bias of mu_1 estimator ver2	variance of mu_1 estimator ver2
#of obs = 5000	0.2257355	4.574931e-04	0.2258662	0.0016821134
#of obs = 20000	0.2304757	1.763451e-04	0.2296960	0.0006605543
#of obs = 80000	0.2263275	3.497748e-05	0.2275670	0.0001063829
#of obs = 320000	0.2275588	8.974540e-06	0.2283313	0.0000308092

③ Ver 08 :

	bias of mu_0 estimator ver3	variance of mu_0 estimator ver3	bias of mu_1 estimator ver3	variance of mu_1 estimator ver3
#of obs = 5000	0.2257355	4.574931e-04	0.2258662	0.0016821134
#of obs = 20000	0.2304757	1.763451e-04	0.2296960	0.0006605543
#of obs = 80000	0.2263275	3.497748e-05	0.2275670	0.0001063829
#of obs = 320000	0.2275588	8.974540e-06	0.2283313	0.0000308092

⇒ 모든 추정량에 대해 Bias 가 줄어드는 경향을 보이지는 않는다.