Our situation in IPTW ATT Robust variance

a_{11} 모두 0

$$A(\xi) = -E\begin{bmatrix} \partial\psi_{\alpha_0}/\partial\alpha_0 & \partial\psi_{\alpha_0}/\partial\alpha_1 & \partial\psi_{\alpha_0}/\partial\alpha_2 & \partial\psi_{\alpha_0}/\partial\mu_1 & \partial\psi_{\alpha_0}/\partial\mu_0 \\ \partial\psi_{\alpha_1}/\partial\alpha_0 & \partial\psi_{\alpha_1}/\partial\alpha_1 & \partial\psi_{\alpha_1}/\partial\alpha_2 & \partial\psi_{\alpha_1}/\partial\mu_1 & \partial\psi_{\alpha_1}/\partial\mu_0 \\ \partial\psi_{\alpha_2}/\partial\alpha_0 & \partial\psi_{\alpha_2}/\partial\alpha_1 & \partial\psi_{\alpha_2}/\partial\alpha_2 & \partial\psi_{\alpha_2}/\partial\mu_1 & \partial\psi_{\alpha_2}/\partial\mu_0 \\ \partial\psi_1/\partial\alpha_0 = 0 & \partial\psi_1/\partial\alpha_1 = 0 & \partial\psi_1/\partial\alpha_2 = 0 & \partial\psi_1/\partial\mu_1 & \partial\psi_0/\partial\mu_0 \\ \partial\psi_0/\partial\alpha_0 & \partial\psi_0/\partial\alpha_1 & \partial\psi_0/\partial\alpha_2 & \partial\psi_0/\partial\mu_1 & \partial\psi_0/\partial\mu_0 \end{bmatrix}$$

a_{21}

$$\begin{bmatrix} P(A=1) & 0 \\ 0 & P(A=1) \end{bmatrix}$$

우리의 상황은 $P(A_T=1 \mid \underset{\sim}{L_T}) = \exp(\alpha_0+\alpha_1 B+\alpha_2 C) \,/\, 1+\exp(\alpha_0+\alpha_1 B+\alpha_2 C) \rightarrow h(L_T;\alpha)$ 라 define.

1) $\psi_{\alpha_0} = A_T - \{h(\underset{\sim}{L_T};\alpha) / (1+h(\underset{\sim}{L_T};\alpha))\}$

① $\dfrac{\partial\psi_{\alpha_0}}{\partial\alpha_0} = -\dfrac{h(L_T;\alpha)}{(1+h(L_T;\alpha))^2}$ ② $\dfrac{\partial\psi_{\alpha_0}}{\partial\alpha_1} = -\dfrac{h(L_T;\alpha)\times B_T}{(1+h(L_T;\alpha))^2}$ ③ $\dfrac{\partial\psi_{\alpha_0}}{\partial\alpha_2} = -\dfrac{h(L_T;\alpha)\times C_T}{(1+h(L_T;\alpha))^2}$

2) $\psi_{\alpha_1} = \{A_T - (h(L_T;\alpha) / (1+h(L_T;\alpha))\} B_T$

① $\dfrac{\partial\psi_{\alpha_1}}{\partial\alpha_0} = -\dfrac{h(L_T;\alpha)\times B_T}{(1+h(L_T;\alpha))^2}$ ② $\dfrac{\partial\psi_{\alpha_1}}{\partial\alpha_1} = -\dfrac{h(L_T;\alpha)\times B_T^2}{(1+h(L_T;\alpha))^2}$ ③ $\dfrac{\partial\psi_{\alpha_1}}{\partial\alpha_2} = -\dfrac{h(L_T;\alpha)\times B_T\times C_T}{(1+h(L_T;\alpha))^2}$

3) $\psi_{\alpha_2} = \{A_T - (h(L_T;\alpha) / (1+h(L_T;\alpha))\} C_T$

① $\dfrac{\partial\psi_{\alpha_2}}{\partial\alpha_0} = -\dfrac{h(L_T;\alpha)\times C_T}{(1+h(L_T;\alpha))^2}$ ② $\dfrac{\partial\psi_{\alpha_2}}{\partial\alpha_1} = -\dfrac{h(L_T;\alpha)\times B_T\times C_T}{(1+h(L_T;\alpha))^2}$ ③ $\dfrac{\partial\psi_{\alpha_2}}{\partial\alpha_2} = -\dfrac{h(L_T;\alpha)\times C_T^2}{(1+h(L_T;\alpha))^2}$

$\Rightarrow$ 이때, $h(L_T;\alpha) / (1+h(L_T;\alpha))^2 = \dfrac{h(L_T;\alpha)}{1+h(L_T;\alpha)} \times \dfrac{1}{1+h(L_T;\alpha)} = P(A_T=1 \mid \underset{\sim}{L_T}) \times (1-P(A_T=1 \mid \underset{\sim}{L_T}))$

그러면, $a_{11} = \begin{bmatrix} -\dfrac{h(L_T;\alpha)}{(1+h(L_T;\alpha))^2}(1, B_T, C_T)^T \\ -\dfrac{h(L_T;\alpha)}{(1+h(L_T;\alpha))^2}(B_T, B_T^2, B_T C_T)^T \\ -\dfrac{h(L_T;\alpha)}{(1+h(L_T;\alpha))^2}(C_T, B_T C_T, C_T^2)^T \end{bmatrix}$

Code $\rightarrow$ $W = \mathrm{diag}\left(-\dfrac{h(L_i;\alpha)}{(1+h(L_i;\alpha))^2}\right)$

X = Design matrix $\begin{pmatrix} 1 & \underset{\sim}{L_1} \\ 1 & \underset{\sim}{L_2} \\ & \vdots \\ 1 & \underset{\sim}{L_n} \end{pmatrix}$

$\Rightarrow$ crossprod(sqrt(W), X)

4) $\psi_0 = (Y_T - \mu_0)(1-A_T)\, h(L_T;\alpha)$

① $\dfrac{\partial\psi_0}{\partial\alpha_0} = (Y_T-\mu_0)(1-A_T)\,h(L_T;\alpha)$ ② $\dfrac{\partial\psi_0}{\partial\alpha_1} = (Y_T-\mu_0)(1-A_T)\,h(L_T;\alpha)\times B_T$

③ $\dfrac{\partial\psi_0}{\partial\alpha_2} = (Y_T-\mu_0)(1-A_T)\,h(L_T;\alpha)\times C_T$

그러면, $a_{21} = (Y_T-\mu_0)(1-A_T)\,h(L_T;\alpha)\,(1, B_T, C_T)^T$

$$B(\xi) = E\left[\begin{array}{ccc|cc}
\psi^2_{\alpha 0} & \psi_{\alpha 0}\psi_{\alpha 1} & \psi_{\alpha 0}\psi_{\alpha 2} & \psi_{\alpha 0}\psi_1 & \psi_{\alpha 0}\psi_0 \\
\psi_{\alpha 0}\psi_{\alpha 1} & \psi_{\alpha 1}^2 & \psi_{\alpha 1}\psi_{\alpha 2} & \psi_{\alpha 1}\psi_1 & \psi_{\alpha 1}\psi_0 \\
\psi_{\alpha 0}\psi_{\alpha 2} & \psi_{\alpha 1}\psi_{\alpha 2} & \psi_{\alpha 2}^2 & \psi_{\alpha 2}\psi_1 & \psi_{\alpha 2}\psi_0 \\
\hline
\psi_1\psi_{\alpha 0} & \psi_1\psi_{\alpha 1} & \psi_1\psi_{\alpha 2} & \psi_1^2 & \psi_1\psi_0 \\
\psi_0\psi_{\alpha 0} & \psi_0\psi_{\alpha 1} & \psi_0\psi_{\alpha 2} & \psi_0\psi_1 & \psi_0^2
\end{array}\right]$$