Assignment 10 (Treatment Effects)   Consider the following DGP

$$y_i = a + bd_i + e_i, \quad d_i = 1\{d_i^* = \delta x_i + u_i\}$$

$$\begin{bmatrix} e_i \\ u_i \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right)$$

Q1. Compare the finite sample performance among propensity score weighted and matching estimators. (15 points)

(Hint: There are many estimators. You have to compare them one by one in terms of bias, variance etc.)

Q2. Now assume x_i is not observable. You have a proxy variable w for x. To be specific, let

$$w_i = \phi x_i + \varepsilon_i$$

where $\varepsilon_i \sim iidN\left(0, \sigma_\varepsilon^2\right)$ and $\phi = 1$. Repeat Q1 with the proxy variable w_i. Here we assume that x_i is not observable. Analyze the impact of σ_ε^2 on the estimation of treatment effects. (10 points)