

- a. The variable d_i does not hold all the information required, since it's the totally onto the people to choose whether to follow the diet or not
- b. 1. X is exogenous and there is no relation between the error terms and X . This means, whether or not the individual lives in a region where the diet has been advertised is not correlated to the unexplained factors in the error term.
2. b converges to β as $n \rightarrow \infty$. This means that the advertising has a significant impact on the success of the individual's diet.
- c. No, we would more instruments.
- d.

$$\begin{aligned}
 & \text{b) } Z = \begin{pmatrix} 1 & z_1 \\ 1 & z_2 \\ \vdots & \vdots \\ 1 & z_n \end{pmatrix} \quad X = \begin{pmatrix} 1 & d_1 \\ 1 & d_2 \\ \vdots & \vdots \\ 1 & d_n \end{pmatrix} \\
 & (Z'X)^{-1}Z'y = \begin{pmatrix} n & \sum d_i \\ \sum z_i & \sum d_i z_i \end{pmatrix}^{-1} \begin{pmatrix} \sum y_i \\ \sum z_i y_i \end{pmatrix} \\
 & = \frac{1}{n \sum d_i z_i - \sum z_i \sum d_i} \begin{pmatrix} \sum d_i z_i - \sum d_i \\ -\sum z_i & n \end{pmatrix} \begin{pmatrix} \sum y_i \\ \sum z_i y_i \end{pmatrix} \\
 & \hat{\beta} = \frac{n \sum z_i y_i - \sum y_i \sum z_i}{n \sum d_i z_i - \sum z_i \sum d_i} = \frac{\sum z_i y_i - \frac{1}{n} \sum y_i \sum z_i}{\sum d_i z_i - \frac{1}{n} \sum z_i \sum d_i} \\
 & = \frac{\frac{1}{\sum z_i} \sum z_i y_i - \frac{1}{n} \sum y_i}{\frac{1}{\sum z_i} \sum d_i z_i - \frac{1}{n} \sum d_i} = \frac{\Delta' - \Delta}{\delta' - \delta} //
 \end{aligned}$$