

Weak instruments

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Strength of IVs:

- Strength of an IV \equiv how well it predicts treatment received (A)
 - \rightarrow Strong instrument: highly predictive of treatment
 - \hookrightarrow encouragement greatly increases prob. of treatment
 - \rightarrow weak instrument: weakly predictive of treatment
 - \hookrightarrow encouragement barely increases probability of treatment

Measure strength of IV:

- \rightarrow Simply estimate the proportion of compliers : $E(A|Z=1) - E(A|Z=0)$
 - \hookrightarrow in practice identifiable from observed data by observed proportion of treated subjects ($A=1$) for $Z=1$ and for $Z=0$.
- if proportion of compliers $\begin{cases} \nearrow \text{close to } 1: \text{Strong IV} \\ \searrow \text{close to } 0: \text{weak IV} \end{cases}$

Weak Instruments:

example: 1% of population are compliers

- \rightarrow if the sample size is n , then only 1% of n have useful information about the causal effect (\rightarrow low effective sample size).
- leads to noisy & unstable estimates of causal effects
 - \Rightarrow large variance for the causal effect estimates
(wide confidence interval (CI) w/ a weak IV)
- IV analysis is not a good option if the instrument (IV) is weak
 - \hookrightarrow it would likely produce CI that are too wide to be useful
- area of active research:

WORK ON METHODS TO STRENGTHENING IVs

- \hookrightarrow example: near / far matching
 - \circ Match on covariates (i.e. confounders) that are similar but the instrument is very different