

# ECON3360 - Tutorial 4

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# Regression Equations (Lecture 3 Slides)

**First Stage regression:**

$$S_i = \alpha_1 + \rho_1 Z_i + \kappa_i$$

where  $Z_i$  is the IV and  $S_i$  is the endogenous variable.

**Second Stage regression:**

$$Y_i = \alpha_2 + \rho_2 S_i + h_i$$

**Reduced Form equation:**

$$Y_i = \alpha_3 + \rho_3 Z_i + \lambda_i$$

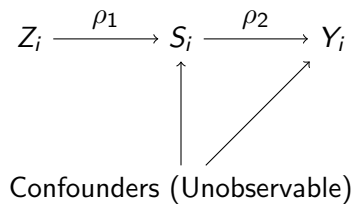
# Validity of Instruments (Lecture 3 Slides)

$$Y_i = \alpha_2 + \rho_2 S_i + h_i$$

2 important conditions for a valid IV:

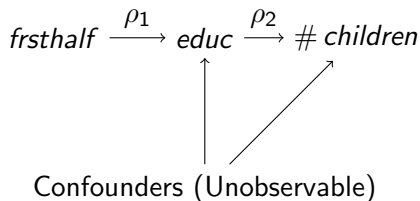
1.  $\text{Cov}(S_i, Z_i) \neq 0$  : the IV is relevant, it is correlated with the endogenous regressor (1st stage exists).
2.  $\text{Cov}(Z_i, h_i) = 0$  : exclusion restriction,  $Z$  is uncorrelated with any other determinants of the dependent variable.

# Causal Graph



## Problem 1 - 3

1.  $\text{Cov}(S_i, Z_i) \neq 0$  (**Relevance**): We confirmed this with the first-stage estimations.
2.  $\text{Cov}(Z_i, h_i) = 0$  (**Exclusion Restriction**): Can *frsthalf* affect the number of children any other way than education?



## Problem II - 3

- ▶ For example, the price of cigarettes depends on the demand for cigarettes and therefore some of the drivers of smoking which may also affect birth weight (drinking alcohol, physical activity...)
- ▶ It may also depend on the State's wealth which could be correlated with the quality of medical care provided which could affect birth weight
- ▶ There are other pathways through which cigarette prices can relate to babies birth weights outside of the effect via the mother's smoking quantity.
- ▶ Can we test exclusion restriction?

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- ▶ It may also depend on the State's wealth which could be correlated with the quality of medical care provided which could affect birth weight
- ▶ There are other pathways through which cigarette prices can relate to babies birth weights outside of the effect via the mother's smoking quantity.
- ▶ Can we test exclusion restriction?
  - ▶ **No** (mostly)!!

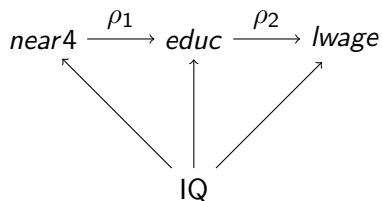
## Problem III - 3

- ▶ We showed that *near4* is not a weak IV. But,
- ▶ *near4* is likely to be correlated with factors in the error term, such as parents' characteristics.
  - ▶ For example, *near4* is possibly correlated with the error term if more motivated and wealthy parents move to regions near colleges. Parents' motivation and wealth are most likely correlated with children's education and future wages.
- ▶ So, it is not clear that *near4* meets the exogeneity assumption



## Problem III - 5

- ▶ IQ is significantly higher for men who grew up near a four-year college.
- ▶ But IQ which proxies ability is also correlated with education and wages.
- ▶ We conclude that *nearc4* is unlikely to satisfy the exclusion restriction for IV as it is correlated with *u*, i.e. with other factors missing from the regression and which affect education and wages



## Problem III - 7

**Conditional on those regional dummy variables, *near4c* is more likely to satisfy the exogeneity condition for an IV.**

