

# PAPE tutorial #03

In this session, we will explore the use of instrumental variables outside of an RCT. The goal will be to replicate the main results of the paper by Angrist and Evans (1996). To do so, you will need to load the data available on Moodle.

```
## set your working directory
setwd("your working directory")

## load library
library(arrow)

## load dataset
df <- read_parquet("angrist_clean.parquet")
```

## Laying the playground

We want to estimate the causal effect of having more children on female labor supply using the model:

$$labor\_supply\_i = \beta_0 + \beta_1 \cdot children_i + X_i\gamma + \varepsilon\_i$$

where ( $X_i$ ) represents control variables.

1. Why might **ordinary least squares (OLS)** provide a **biased estimate** of ( $\beta_1$ )?
2. What are some possible **confounding factors** that could affect both fertility and labor supply?
3. In what ways might **reverse causality** be a concern in this context?

## Choosing a Valid Instrument

To address endogeneity, Angrist & Evans use **the sex composition of the first two children** (`same_sex`) as an instrument.

4. What makes a **good instrumental variable (IV)**? State the necessary conditions for an IV to be valid.
5. Justify whether `same_sex` is likely to satisfy these conditions.
6. Can you think of any **potential violations** of IV assumptions in this setting?

## IV Estimation

We now estimate the effect of fertility on labor supply using `same_sex` as an instrument.

7. Run the **first-stage regression** to check instrument relevance:

$$morekids_i = \pi_0 + \pi_1 \cdot same\_sex_i + X_i\delta + \nu_i$$

- Report and interpret the coefficient ( $\pi_1$ ).
  - Does `same_sex` significantly affect the probability of having more than two children?
  - What would it mean if ( $\pi_1$ ) were **close to zero**?
  - How do the results differ if you do not include control variables? *Hint: you can include as control variables age of the mother, as well as race (like Angrist and Evans do – variables names are `agem1`, `agefstm`, `blackm`, `hisp` and `othracem`).*
  - You will use the predicted values from this first-stage regression in the second stage regression. Why do we do so?
  - Plot the predicted values for `morekids_i`, and put an emphasis on the difference in the predicted values depending on the value of `same_sex`. *Hint: the `fitted()` function and library `ggplot` will be useful.*
8. Run the **second-stage regression** using the fitted values from the first stage:

$$labor\_supply_i = \beta_0 + \beta_1 \cdot \widehat{morekids}_i + X_i\gamma + \varepsilon_i$$

- In the exercise, we will use the variable `workedm` as a proxy for labor supply. How is it defined according to you? Can you provide its average value for our sample of interest?
- Compare the estimate from using directly the IV regression (library `ivreg`) to the 2SLS regression.
- Compare the **IV estimate** ( $\beta_1$ ) with the OLS estimate from directly regression labor supply on the `morekids` variable (+ controls).

- How do they differ in magnitude and statistical significance?
- How do you interpret the IV estimate in **causal terms**?

## Comparing Two IV Strategies

Angrist & Evans also use **twin births at second birth (multi2nd)** as an alternative instrument.

9. Estimate the IV regression using `multi2nd` as the instrument.
10. Compare the IV estimates using `samesex` vs. `multi2nd`.
  - Are they similar or different? What might explain any differences?
  - What assumptions are we making when using **twins as an IV**?
  - Which instrument do you think is **stronger and more credible**? Why?
  - What happens if the assumptions for the IV are not met? Is it still likely to be better than no instrument at all?
11. Would the effect of having more than 2 kids be different for women with different **education levels**? How could you test this?
12. Do you think the results would be the same in another country? Do you think they would be the same with a more recent database?

## Further questions

Food for thought: Can you think of another possible IV for fertility that might be used in a similar setting?

## References

Angrist, Joshua, and William Evans. 1996. "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size." Cambridge, MA. <https://doi.org/10.3386/w5778>.