Labor Supply II

Contents

- More on instrumental variables

- Identification
- Hausman test or Sargan test

Identification

- Our model was:

  (D): $H_i = a_1 + b_1 W_i + u_i$

  (S): $H_i = a_2 + b_2 W_i + c_2 X_i + d_2 NK_i + v_i$

  – problem: both hours and wages are endogenous

- Instrumental variables and identification to get around this problem
- If we had a model

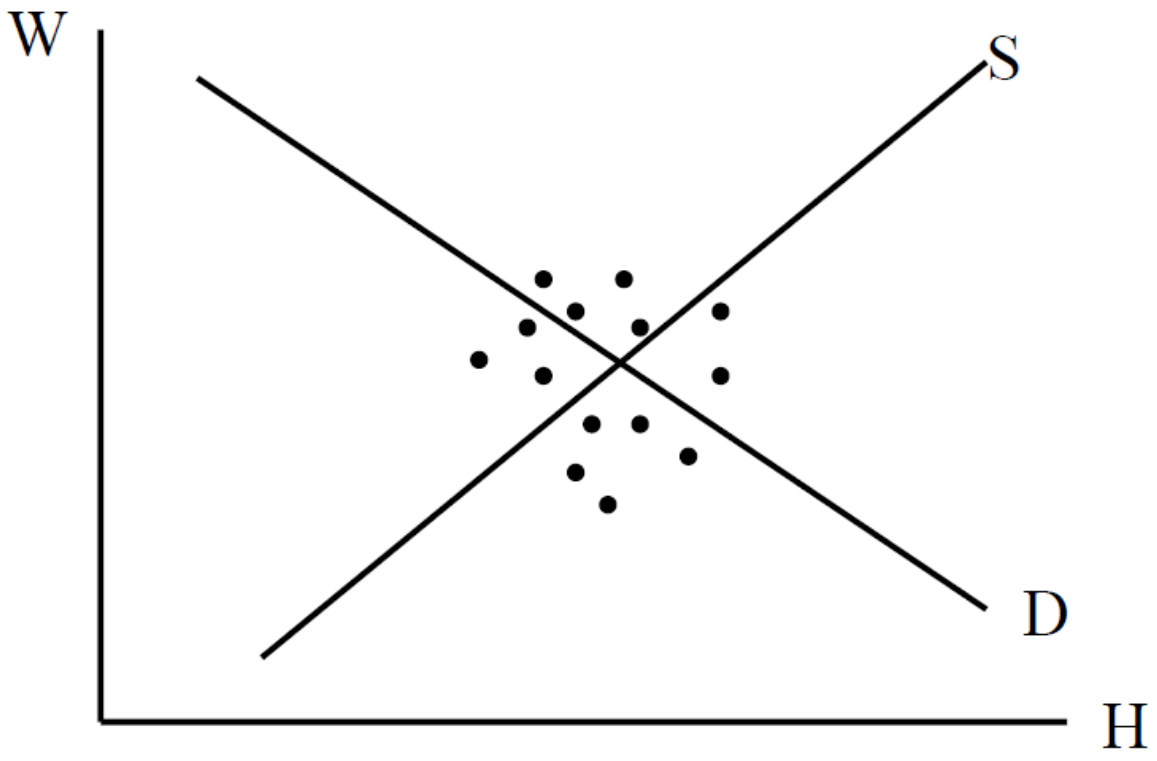
  (D): $H_i = a_1 + b_1 W_i + e_{1i}$

  (S): $H_i = a_2 + b_2 W_i + e_{2i}$

  – from economic theory we'd expect $b_1 < 0$ and $b_2 > 0$

Identification (2)

- If we run a regression of hours on wages, we don't know what equation from the graph is estimated:



Identification (3)

- In order to determine which curve the regression estimates, we need to identify one of the equations

- Think back to the model and add one more variable to the supply equation:

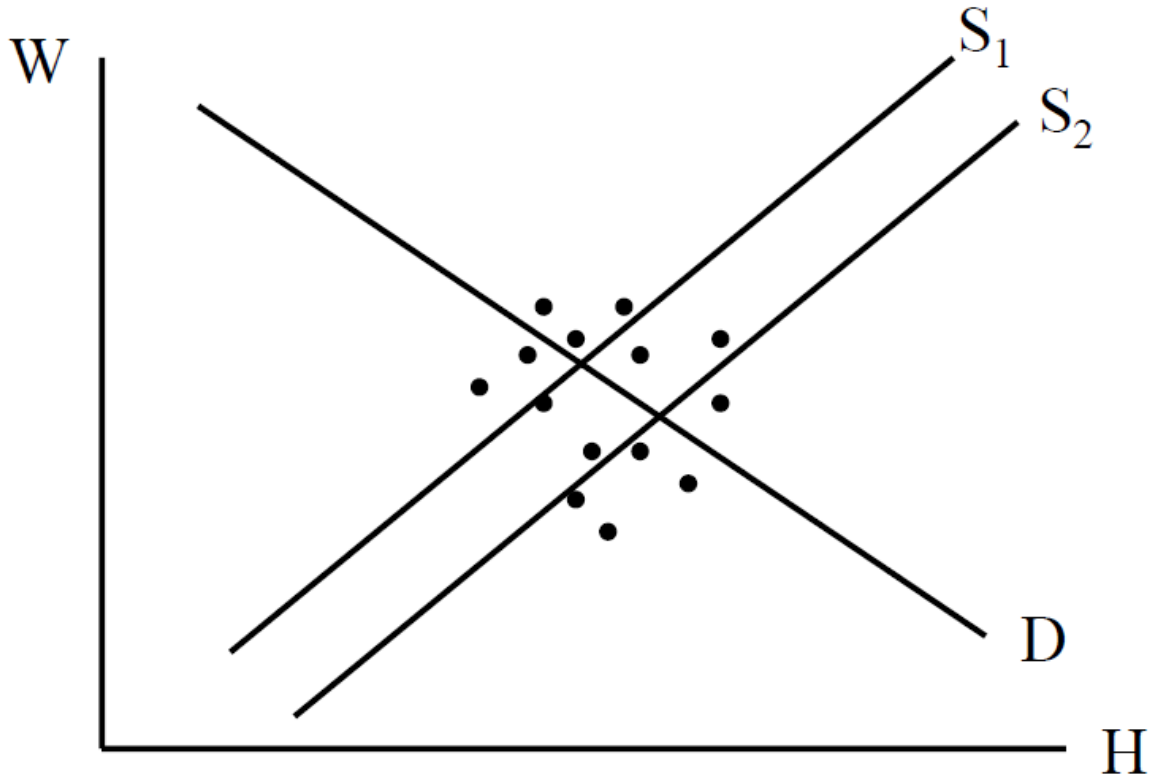
$$\text{(D): } H_i = a_1 + b_1 W_i + e_{1i}$$

$$\text{(S): } H_i = a_2 + b_2 W_i + c_2 X_1 + e_{2i}$$

  - Where X_1 is age

Identification (4)

- With each additional variable that's not included in the other equation, we trace out another supply curve:



Identification (5)

- Each additional variable must be a factor of one equation but not the other

- Example: if age is a factor of demand such that employers hire aging workers for less hours, system is no longer identified

Order condition

1) "Just identified": If we have one variable that differentiates demand from supply
2) "Over-identification": If we have more than one variable that differentiates demand and supply

- Must have variables that are exogenous to the system that don't count in both equations!
- Example1.xls:
  - over-identified: two additional variables
  - wrong sign on b_1

Sargan test

- How do we know the system was identified at all?
- Need to test to see if:
  - added variables are in fact exogenous instruments

- Sargan test for over-identification
  - We have an estimating equation [2nd stage of TSLS]:

$$Y_i = a_1 + b_1 \hat{X}_i + u_i$$

  - First we have: $X_i = a_2 + b_2 Z_i + v_i$ [1st stage of TSLS]
  - Idea of test: look for correlation between the instruments Z_i and the u_i from the 2nd stage equation
    - if there is correlation, Z_i is no longer a valid instrument

Steps for the Sargan test

1) Regress errors from the second stage equation on the instrumental variables:

$$u_i = \gamma_0 + \gamma_1 Z_{1i} + \ldots + \gamma_m Z_{mi} + \eta_i$$

2) Calculate $R^2 * n$

- test is distributed: $[R^2 * \text{n}] \sim \chi^2_{(m-q)}$ where q is the number of endogenous variables
- we have m-1 over-identifying variables
- null hypothesis: H_0: $E(Z, u) = 0$
- In this test, R^2 is:

$$R^2 = \frac{\hat{\gamma}_j \sum_j Zu}{\sum u^2}$$

We want numerator to tend towards zero

Quick summary

- Example1.xls
  - Shows how to construct Sargan test

- We've learned so far:
  - How to estimate given simultaneity (TSLS)
  - Working with instrumental variables
  - How to test if simultaneity still exists with the selected instruments (Sargan test)