Econometrics

Exercise: Instrumental Variables

NOTE: You will need the package 'AER' for this exercise. So please **before class** open up RStudio, go to the top panel and select Tools, then select Install Packages, then type in AER and hit Install.

Load the data 'jec_data.csv'

This is data based on the Joint Executive Committee (JEC) cartel. They controlled rail transport of grain from the Midwest in the US before the Antitrust Act was passed. They kept the price of transport high, but sometimes the cartel broke down because members cheated. Here you will use variation in transportation supply associated with the collapses of the cartel to estimate the demand elasticity for rail transport for grain.

Suppose the demand function for rail transport is given by:

$ln(Q) = \beta_0 + \beta_1 ln(P) + \beta_2 Ice + \sum_{j=1}^{12} \beta_{2+j} Seas_j + u$

Where 'Ice' is whether the Great Lakes were frozen over (if not you could use them for transport). And 'Seas' capture seasonal variation in demand.

1. Estimate the above by OLS. A somewhat easier way to code this rather than write out seas1+seas2+.... is the following:
'lm(quantity I(log(price)) + . -price -cartel, data = mydata)'. The '.' adds all other variables not already listed, while the -price and -cartel removes them since we don't want those in there.
What is the estimated elasticity of demand?

2. How might the interaction of supply and demand bias this?
(Hint: draw many supply and demand curves and mark their intersection and then erase the lines but leave the intersection points.)

3. Do you think 'Cartel' is a valid instrument for price? Argue why it might meet both conditions necessary for a valid IV.

4. Estimate the first stage regression. Is cartel a weak instrument? (Note you will use the output of this regression later)

To estimate using IV regression lets load the library AER: 'library(AER)'

To use IV regression we will use the call 'ivreg'. The main change is that we need to tell R what are the exogenous regressors and instruments

For example if Y is my dependent variable, W is my endogenous independent variable, X are my exogenous dependent variables, and Z is my instrument, I call:

```
out.iv <- ivreg(y~W+X | X + Z, data = mydata)

summary(out.iv)
```

5. What is the estimated elasticity?

Now we could have also done this 'by hand'. That is by using the fitted values from our first regression (out.first$fitted.values) in place of our edogenous variable in a normal linear regression.

Show that the estimates are the same (though the SEs will likely differ).