14.75: PROBLEM SET 1

Please include stata do-file code and output for all exercises.

(1) Stata Exercises.
   (a) Open a blank stata dataset and set the number of observations to 100.
   (b) Generate a variable, t, running from 1 to 100.
   (c) Generate another variable α which has value 3 for all 100 observations.
   (d) Generate ϵ_t as a random normal variable with mean 0 and standard deviation 1.
   (e) Generate x_t as a random uniform variable with range [0,1]
   (f) Generate outcome variable y_t where $\beta = 2$,
   $$y_t = \alpha + \beta x_t + \epsilon_t.$$
   (g) Estimate $\widehat{\beta}$.
      (i) Test $H_0 : \ \beta = 0$.
      (ii) Test $H_0 : \ \beta = 1.2$.
   (h) Generate v_t as a random normal variable with mean 0 and standard deviation 1.Generate q_t as
   $$q_t = x_t + 2x_t^3 + v_t.$$
   What is the correlation between q and x? Generate outcome variable z_t where $\beta = 2$, $\gamma = 3$,
   $$z_t = \alpha + \beta x_t + \gamma q_t + \epsilon_t.$$
   Estimate $\widehat{\beta}$ from (misspecified) model:
   $$z_t = \alpha + \beta x_t + u_t.$$
   Test $H_0 : \ \beta = 2$.
   Discuss.

(2) (A review of linear regression.) Use the AssassinationsData.dta dataset.
   (a) Define `absnpolity2dummy11` as the absolute value of `n`polity2dummy11.
   (b) Regress whether the institution changed from 1 year before the attempt to 1 year after the attempt on whether or not the attempt was successful.
      (i) Interpret $\widehat{\beta}$.
      (ii) What assumptions do we need to interpret this as the expected difference in outcomes between when the attempt succeeds and when it fails?
      (iii) Why might these assumptions fail?
      (iv) Test the hypothesis that $\beta = 0$ at the 5% level. Do you reject or fail to reject the null?
   (c) Control for whether the weapon was discharged in the specification from (a).
      (i) Why would you want to include these controls?
      (ii) Does your interpretation of $\widehat{\beta}$ change? If so, how so?
      (iii) Under what assumptions can we interpret $\widehat{\beta}$ as the expected difference in outcomes between when the attempt succeeds and when it fails?
      (iv) Test the hypothesis that $\beta = 0.1$ at the 5% level. Do you reject or fail to reject the null?

(3) (Instrumental Variables.) Use the AJRData.dta dataset.
   (a) Regress the log GDP per capita in 1995 on the average protection against expropriation risk (avexpr).
      (i) Interpret $\widehat{\beta}_{ols}$.
      (ii) Is your interpretation causal? Why or why not?
      (iii) Plot log GDP per capita in 95 against avexpr.
   (b) Regress the average protection against expropriation risk on settler mortality. Call this $\widehat{\pi}$.
      (i) Plot avexpr against settler mortality.
      (ii) Interpret the relationship.
   (c) Regress the log GDP per capita in 1995 on settler mortality. Call this $\widehat{\gamma}$.
      (i) Plot the relationship.
      (ii) What is $\frac{\widehat{\gamma}}{\widehat{\pi}}$?
   (d) Compute a 2SLS regression of log GDP per capita in 1995 on avexpr, using settler mortality as an instrumental variable.
      (i) Interpret $\widehat{\beta}_{2sls}$.
      (ii) Compare $\widehat{\beta}_{2sls}$ to $\widehat{\beta}_{ols}$. Are they similar or different? Why do you think this is the case?
      (iii) Under what assumption can you interpret each of these *causally*.
      (iv) Compare $\widehat{\beta}_{2sls}$ to $\frac{\widehat{\gamma}}{\widehat{\pi}}$. Explain, mathematically, the relationship between $\widehat{\beta}_{2sls}$, $\widehat{\pi}$, and $\widehat{\gamma}$.

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