Midterm Exam

Buan 6340

Thursday, June 28th, 2018

Answer any two of the following three questions. If you answer all three, I will grade all your answers and take the lowest two.

Question 1

Analyze the data in hprice1.csv using python. A complete answer will include group-by statements, summary statistics, linear models, and matplotlib. A thorough answer will include careful analysis with useful models and meaningful statistics to analyze the data set.

Question 2

In the Numberphile video that follows, various figures are created using different fixed turning angle choices.

`https://www.youtube.com/watch?v=sj8Sg8qnjOg&t=713s`

Create the figures from that video in python using matplotlib. Show the figures for a few different input angles to show that your code is working.

Question 3

In your homework, I gave you the following DGP:

$$y_t = \rho y_{t-1} + e_t,\ e_t \sim iid\mathcal{N}\left(0, \sigma^2\right)$$

for $t = 1, \ldots, T$. Given that DGP, you ran the following two OLS regressions and calculated the bias:

$$y_t = \beta_1 y_{t-1} + \varepsilon_t \quad (1)$$

$$y_t = b_0 + b_1 y_{t-1} + \varepsilon_t \quad (2)$$

From my theoretical models and calculations using simulation, I found:

$$E\left[\hat{\beta}_1 - \rho\right] \approx -1.6514\frac{\rho}{T}.$$

Similarly for the model with a constant, I calculated the approximation:

$$E\left[\hat{b}_1 - \rho\right] \approx -0.8027\frac{\left(1 + 4\rho + \rho^2\right)}{T}.$$

Your job is to create a bias-corrected estimator in python based on Eq.(1) using the bias we calculated. If this new estimator is $\hat{\beta}_1^{\dagger}$, show that $E\left[\hat{\beta}_1^{\dagger}\right] \approx 0$. Find a similar bias-corrected estimator for Eq.(2) and show the same.