

PLSC 503: “Multivariate Analysis for Political Research”

Exercise Seven

March 17, 2025

Introduction

This homework focuses on the bootstrap. It’s pretty easy, TBH.

Exercise: Simulation

Your task is to assess differences in inferences between standard and bootstrapped standard error estimates, and specifically to explore when and to what extent the two tend to differ. To do so, consider a simple bivariate regression model:

$$Y_i = \beta_0 + \beta_1 X_i + u_i$$

where the errors u_i follow three possible processes:

$$u_i \sim N(0, \sigma^2) \text{ (OLS errors)} \quad (1)$$

$$u_i \sim N(\tau, \sigma^2), \tau > 0 \text{ (biased errors)} \quad (2)$$

$$u_i = u_{i-1} + \epsilon_i, \epsilon_i \sim N(0, \sigma_\epsilon^2) \text{ (autocorrelated errors)}. \quad (3)$$

Your task for this part of the assignment is as follows:

1. Beginning with $N = 10$,
 - (a) Simulate and fit models for each of the three types of errors described, while estimating both conventional and bootstrap standard errors and confidence intervals for $\hat{\beta}_0$ and $\hat{\beta}_1$.
 - (b) Present and display your findings for each of the three types, and discuss what you found.
2. Repeat part (1) using samples of $N = 100$ and discuss any changes you observe as sample sizes increase.

Hints: (a) Remember that bootstrapping doesn’t deal with bias in your $\hat{\beta}$ s. (b) As in previous exercises: A single simulation doesn’t tell you anything. (c) At the same time, to keep computation times down, limit the number of simulations (*not* bootstrap reps) to 200 or so.

Exercise: Data Analysis

The data for this exercise are taken from the [2016 American National Election Study](#) (ANES) post-election survey. Along with an ID variable, they comprise “feeling thermometer” responses for 32 different individuals and entities, indicated by the variable names. Your task is to examine the association between the 2016 feeling thermometer scores for two entities of your choosing.

Your (simple) assignment is the following:

1. Choose two feeling thermometer scales, and fit and plot the bivariate regression of one on the other. Provide a brief (3-4 sentence) discussion of what you find.
2. Reestimate the model coefficients and standard errors, using a nonparametric bootstrap. Describe the details of what you did, and briefly (1-2 sentences) discuss the differences between the conventional and bootstrap results (if any).

This homework is due *electronically* by 11:59 p.m. EST on **Wednesday, March 26, 2025**, in the usual fashion. It is worth 50 possible points.