

Appendix C-1 Practice

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Simple Regression Simulation

Let X be a random variable that follows an exponential distribution with rate parameter $\lambda = 1$. Let Y be a random variable that depends on X according to the known linear structural population model $Y = \beta_0 + \beta_1 X + u$, where:

- $\beta_0 = 2$
- $\beta_1 = -0.5$
- $u \sim N(0, 1)$

Create a loop that does the following:

1. Simulate samples of sizes 1-1000 for X , u , and Y .
2. Estimate the equation for Y to obtain $\hat{\beta}_0$ and $\hat{\beta}_1$ for each sample size.
3. Show the convergence of the sample estimate of β_1 towards the known population value of -1 for sample sizes 1 through 1000 by plotting the squared deviations from the true value.

Regression CLT Practice

Using the same population parameters and variables as the previous exercise, create a loop that does the following:

1. Simulate 1000 *distributions* of $\hat{\beta}_1$ with 1000 values estimates each from samples X , u , and Y ranging from 1-1000.
2. Estimate the equation for Y to obtain $\hat{\beta}_0$ and $\hat{\beta}_1$ for each sample size.
3. Plot the convergence of the distribution of $\hat{\beta}_1$ towards a normal distribution.