

# OLS and Discrete Choice

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## Exercise 1 Data creation

After setting a seed, construct the following objects

- X1: vector of 10,000 draws from a uniform distribution with range 1:3.
- X2: vector of 10,000 draws from a gamma distribution with shape 3 and scale 2
- X3: vector of 10,000 draws from a binomial distribution with probability 0.3
- eps: vector of 10,000 draws from a normal distribution with mean 2 and sd 1.

Create the variables

- $Y = 0.5 + 1.2 X1 + -0.9 X2 + 0.1 X2 + \text{eps}$
- $y_{dum} = \begin{cases} 1, & \text{if } Y > \text{mean}(Y) \\ 0, & \text{otherwise} \end{cases}$

## Exercise 2 OLS

- Calculate the correlation between Y and X1. How different is it from 1.2?
- We are interested in the outcome of the regression of Y on X where  $X = (0.5, X1, X2, X3)$ .
- Calculate the coefficients on this regression.
- Calculate the standard errors
  - Using the standard formulas of the OLS.
  - Using bootstrap with 49 and 499 replications respectively.

## Exercise 3 Numerical Optimization

We consider the probit estimation of ydum on X.

- Write a function that returns the likelihood of the probit.
- Implement the steepest ascent optimization algorithm to maximize that likelihood.
- How different are the parameters from the true parameters?

## **Exercise 4      Discrete choice**

We consider the determinants of `ydum`.

- Write and optimize the probit, logit, and the linear probability model. You can use pre-programmed optimization packages.
- Interpret and compare the estimated coefficients. How significant are they?

## **Exercise 5      Marginal Effects**

We consider the determinants of `ydum`.

- Compute the marginal effect of X on Y according to the probit and logit models.
- Compute the standard deviations using
  - The delta method
  - Bootstrap