CE 486
Urban Transportation Planning
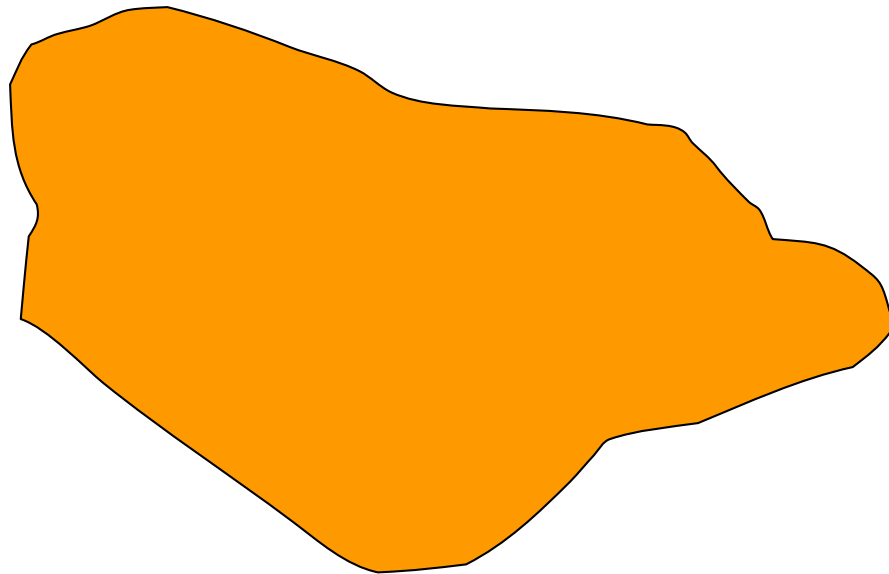
Lec. 2
Trip Generation
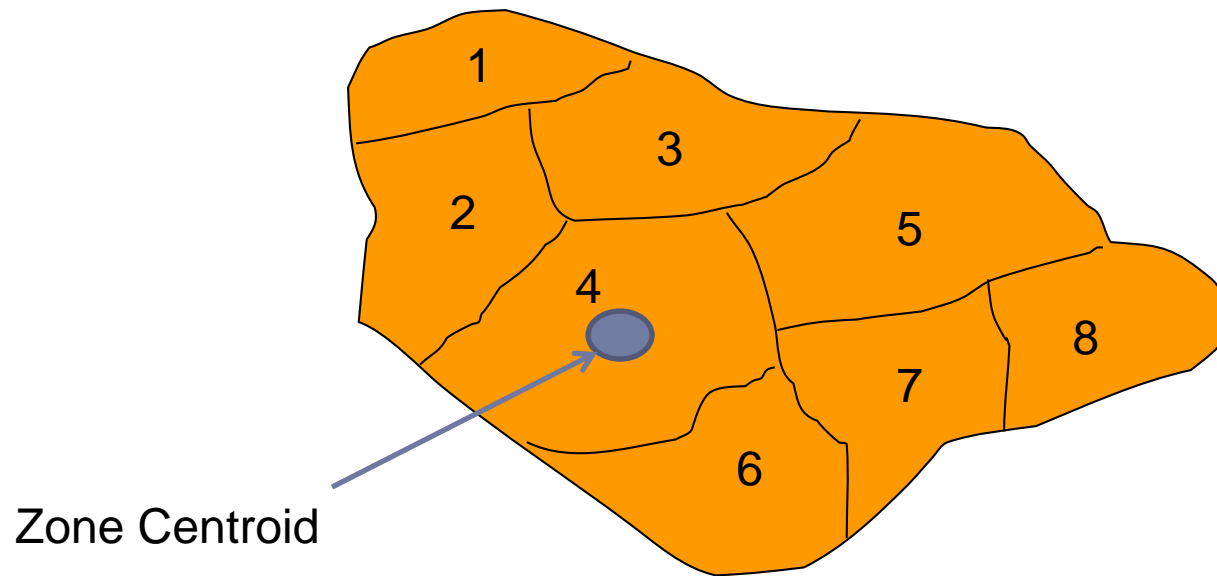
Dr. Mahmoud Owais

Trip Generation

- Forecast the trips that produced or attracted by each TAZ for a "typical" day

- Attraction
  - Number and types of retail facilities
  - Number of employees
  - Land use
- Production
  - Car ownership
  - Income
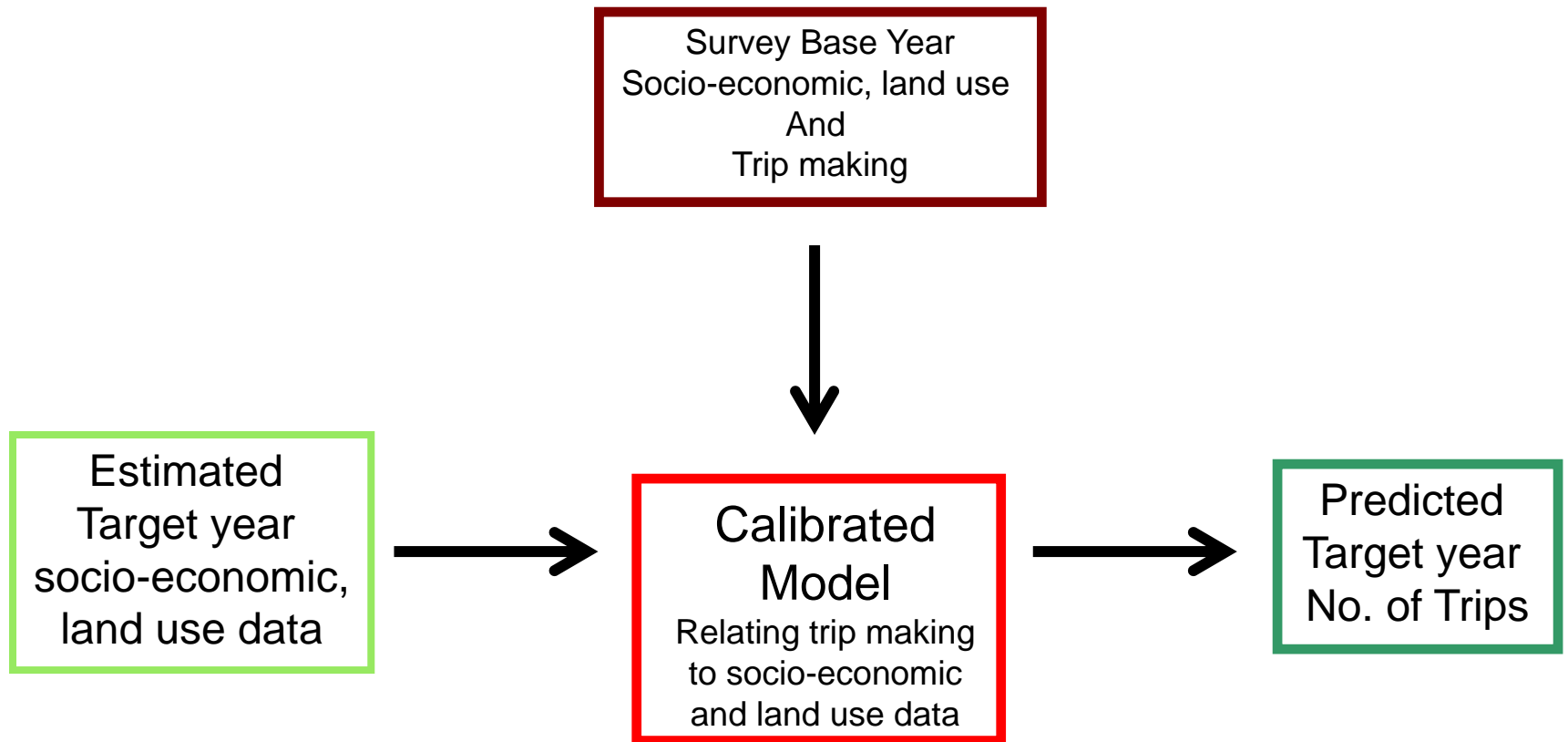 - Population (employment characteristics)

Study Area

Zoning System

1

3

2

5

4

8

7

6

Zone Centroid

Trip Generation
Developing and Using the Model

Trip Generation
Developing and Using the Model

The trip generation model typically can take the form of

No. of trips/unit time/place = Function (pop, income, auto ownership rates)

The model is developed and calibrated using BASE year data

Trip Generation

Demographics and Trip Making Factors affected by Land Use

The land use pattern may affect

- ➢ **Car ownership rates**
- ➢ **Household size and composition**
- ➢ **Number of daily trips**
- ➢ **Mode of trips**
- ➢ **Length of trips**

Trip Generation
What is Predicted?

Trip generation models predict so called TRIP ENDS for each zone

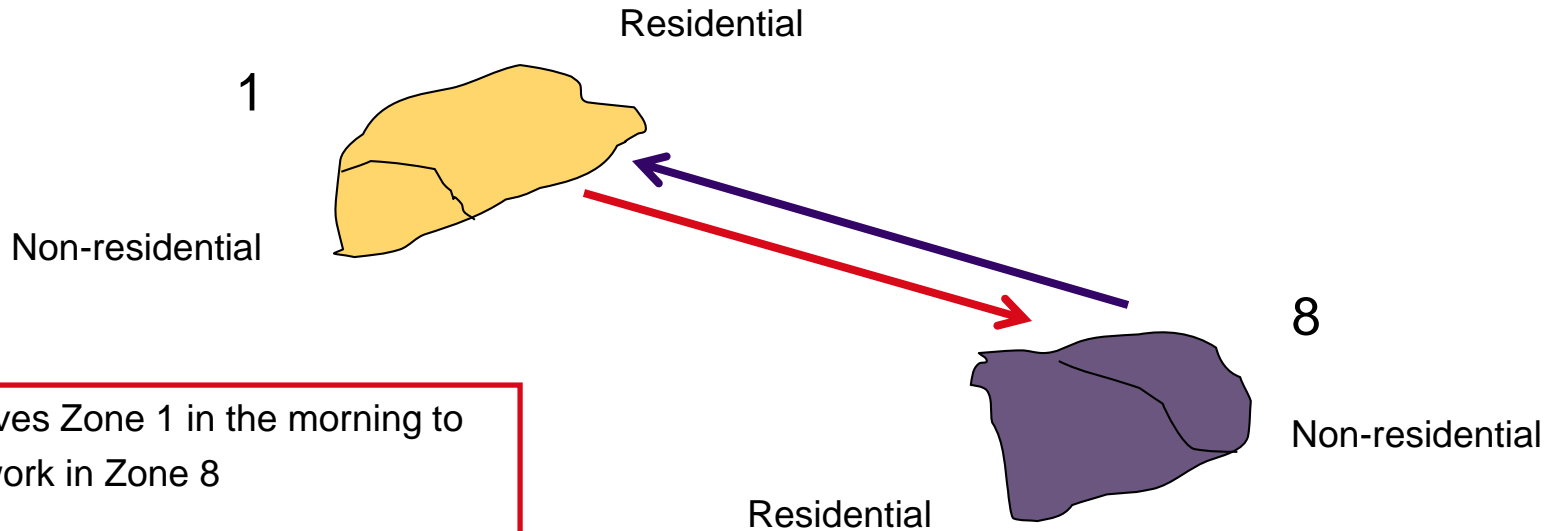The trip ends maybe classified as either

- ORIGINS and DESTINATIONS (O-D)

or

- PRODUCTIONS and ATTRACTIONS

The two sets of terms sound similar but there is a technical difference

Origins and Destinations

Residential

1

Non-residential

8

Non-residential

Residential

A worker leaves Zone 1 in the morning to
go to work in Zone 8

This results in 2 trip ends:
- One Origin for Zone 1
- One Destination for Zone 8

When that same worker leaves Zone 8 in
the evening to go to home to Zone 1

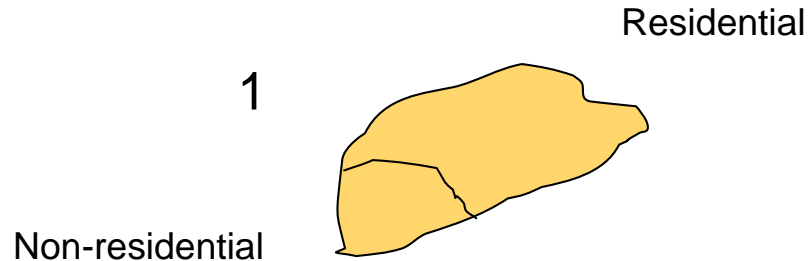This results in another 2 trip ends:
- One Destination for Zone 1
- One Origin for Zone 8

Total Number of Trip Ends

Zone 1: 2 Trip Ends (1 O, 1 D)

Zone 8: 2 Trip Ends (1 O, 1 D)

Modeling Productions and Attractions

Residential

1

Non-residential

For example, Trip Ends for Zone 1 would be reported as
1. 1000 Production Trip Ends
2. 500 Attraction Trip Ends

Trip generation models typically model separately, i) residential trip production, ii) non-residential trip attractions

Regression Analysis

Regression Modeling Steps

- Define problem or question
- Specify model
- Collect data
- Do descriptive data analysis
- Estimate unknown parameters
- Evaluate model
- Use model for prediction

Types of Regression Models
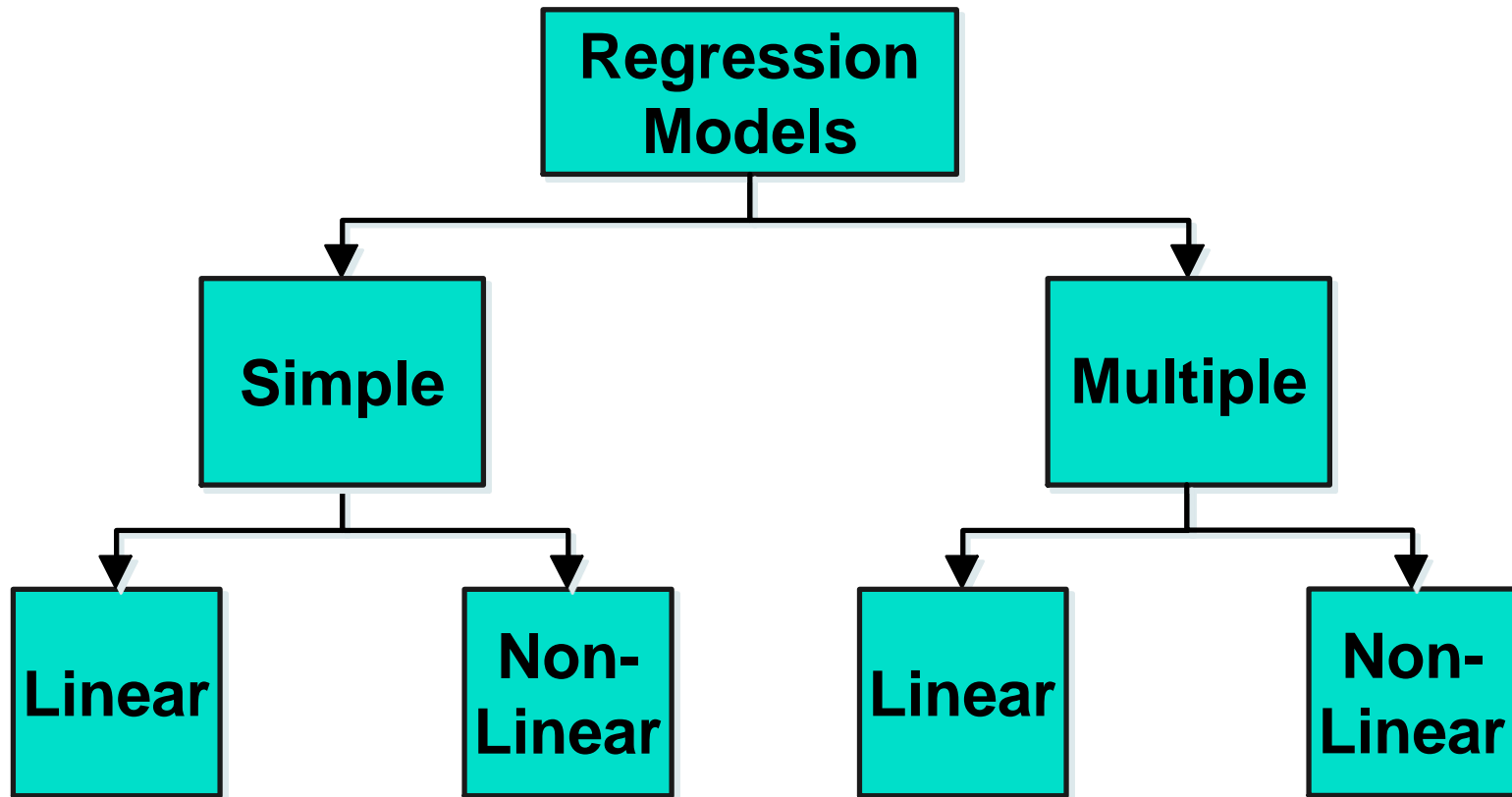
Goal

Develop a statistical model that can predict the values of a *dependent* (response) variable based upon the values of the *independent* (explanatory) variables.

Simple Regression

A statistical model that utilizes **one** *quantitative* *independent* variable "X" to predict the *quantitative* *dependent* variable "Y."

Multiple Regression

A statistical model that utilizes **two or more** *quantitative* and *qualitative* explanatory variables $(x_1,...., x_p)$ to predict a *quantitative* dependent variable Y.
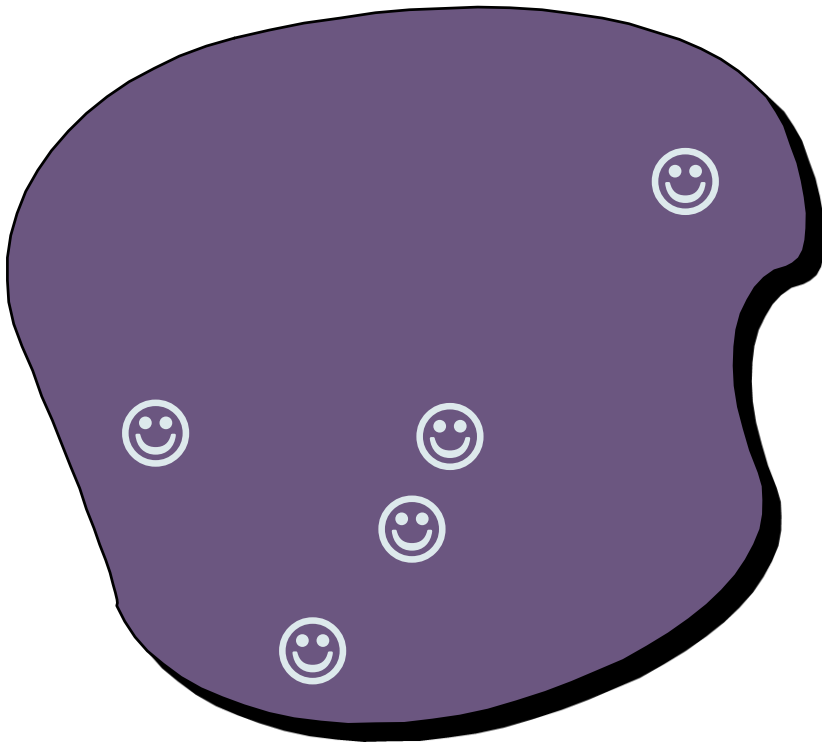
Linear Model

Relationship between one dependent & two or more independent variables is a linear function

Population Y-intercept

Population slopes

$$Y = a_0 + a_1 X_1 + a_2 X_2 + \cdots + a_n X_n$$

Dependent *(response)* variable

Independent *(explanatory)* variables
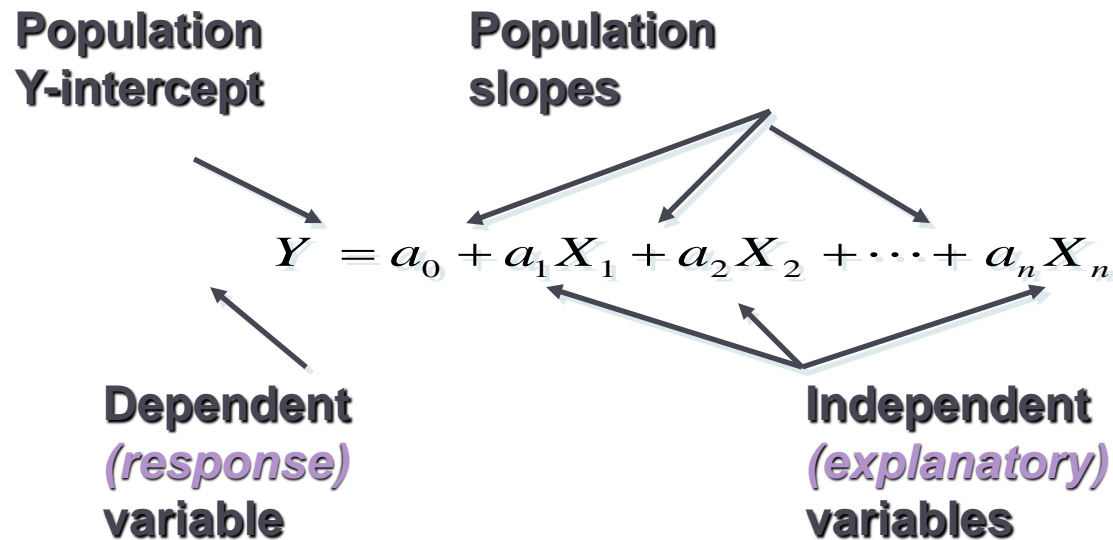
Population & Sample Regression Models

Population

Population & Sample Regression Models
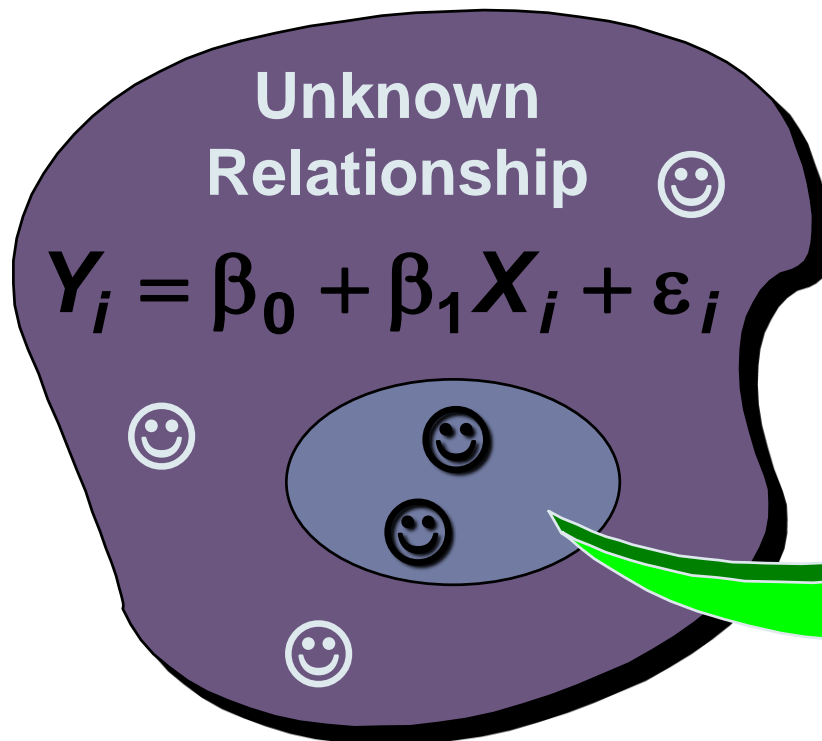
Population

Unknown Relationship ☺

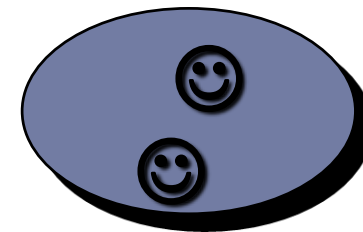$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

Population & Sample Regression Models

Population

Random Sample

Unknown Relationship

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

Population & Sample Regression Models

Population

Random Sample

Unknown Relationship

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

$$Y_i = \hat{\beta}_0 + \hat{\beta}_1 X_i + \hat{\varepsilon}_i$$
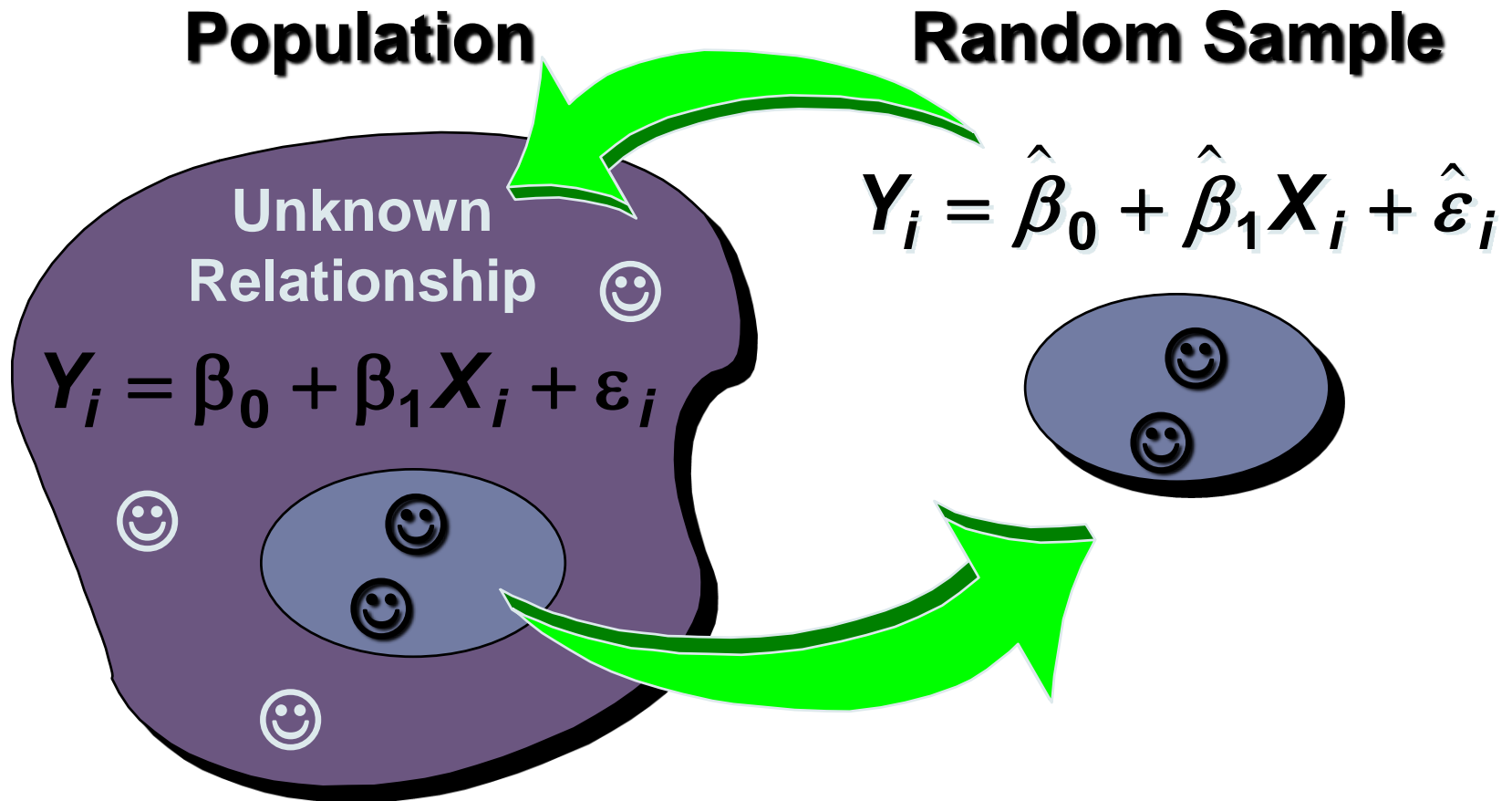
Population Linear Regression Model

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

Observed value

ε_i = **Random error**

$$E(Y) = \beta_0 + \beta_1 X_i$$

Observed value
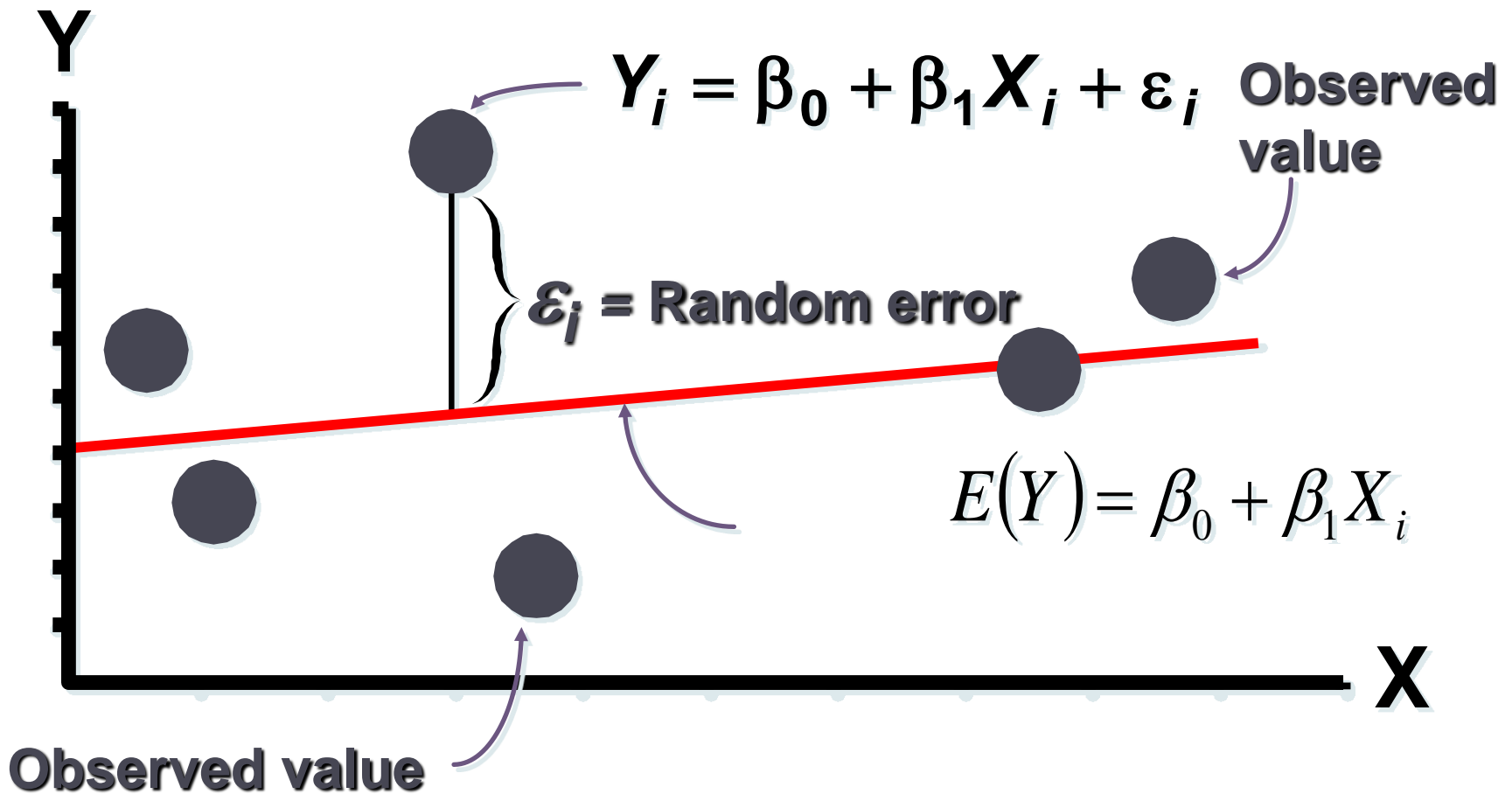
Sample Linear Regression Model

$$Y_i = \hat{\beta}_0 + \hat{\beta}_1 X_i + \hat{\varepsilon}_i$$

$\hat{\varepsilon}_i$ = Random error

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$$

Unsampled observation

Observed value