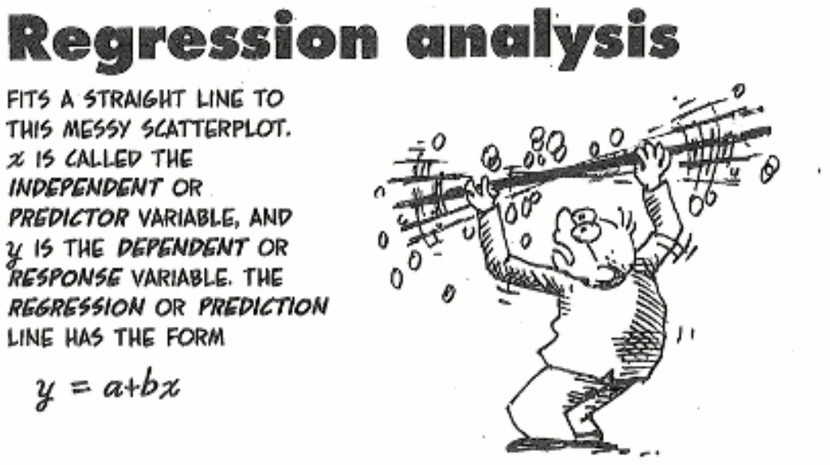
Welcome To….

Regression Analysis

(Part-1)



Learning Outcomes

When you will complete this chapter, you would be able to-

- Development of Mathematical Equation for modeling the relationship of the variables.
- Use of the Equation for the purpose of prediction.

Outlines

From this lecture, you are going to learn…

- Definition of Regression with Examples
- Define Independent and Dependent variables
- Types of Regression with definition (Simple & multiple)
- Fit/ Estimate Simple linear regression Line/model

(Part-1)

- Estimation of regression coefficients with interpretation
- Interpret Coefficient of determination

(Part-2)

Regression with Examples

Regression analysis:
It is concerned with the study of forming a mathematical equation of the dependence of one variable (the dependent variable) on one or more other variables (the independent variables).

Examples:

- The marketing director of a company may want to know how the demand for the company's product is related, to say advertising expenditure.

- Suppose the sales manager of a company say X, wants to determine how the number of credit cards sell is related to the number of call.

Dependent and Independent variables with Example

Dependent variable: The dependent variable is the variable being predicted or estimated. It is denoted by *y.*

Independent variable: The Independent Variable provides the basis for estimation. It is the predictor variable. It is denoted by *x.* It is also called as Explanatory variable.

Example:

If we want to know the expected weekly production of a company then production will be the dependent variable and the predictor/independent variables could be the capital, number of labors engaged, supply of raw materials etc.

Types of Regression Model

Based on number of variables Regression model is of 2 types:

1. **Simple Regression model**
2. **Multiple Regression model**

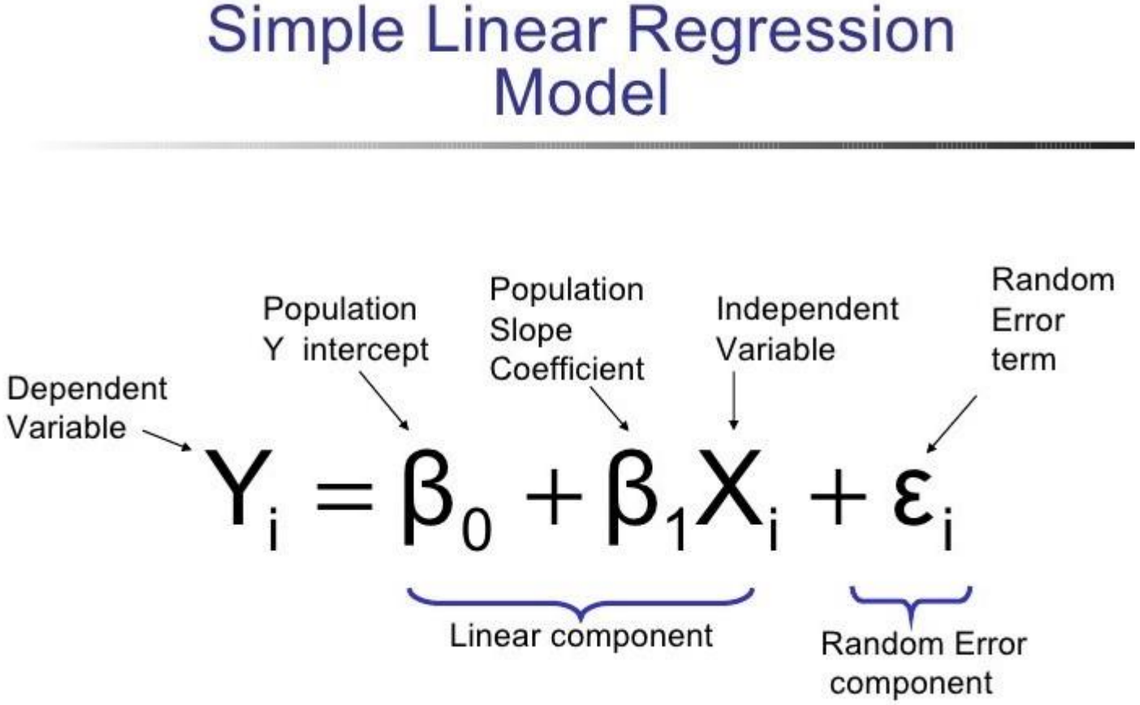
Based on nature of dependent variables Regression model is of several types:

1. **Linear Regression Model**
2. **Logistic Regression Model and so on.**

Type of regression	Dependent variable and its nature	Independent variable and its nature	Relationship between variables
Simple linear	One, continuous, normally distributed	One, continuous, normally distributed	Linear
Multiple linear	One, continuous	Two or more, may be continuous or categorical	Linear
Logistic	One, binary	Two or more, may be continuous or categorical	Need not be linear
Polynomial (logistic) [multinomial]	Non-binary	Two or more, may be continuous or categorical	Need not be linear
Cox or proportional hazards regression	Time to an event	Two or more, may be continuous or categorical	Is rarely linear

Simple Linear Regression Model with Example

Simple Linear Regression Model :
Regression model that consists of one dependent variable and one independent variable is called simple regression model.



Suppose here,
X= Income and
Y= Expenditure

Multiple Linear Regression Model with Example

Multiple Linear Regression Model :

Regression model that consists of one dependent variable and more than one independent variables is called multiple regression model.

Multiple Linear Regression Model :

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \varepsilon_i$$

Suppose here,
X= Income
Z= Family Size and
Y= Expenditure

Estimate Simple linear regression Model

Let, Estimated Simple linear regression Model,

$$\widehat{\boldsymbol{Y}}_{\boldsymbol{i}} = \hat{\beta}_{\boldsymbol{0}} + \hat{\beta}_{\boldsymbol{1}}\boldsymbol{X}_{\boldsymbol{i}} + \boldsymbol{\varepsilon}_{\boldsymbol{i}}$$

Formula of getting the value of regression coefficients:

Slope → $$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Intercept → $$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$$