

# Difference between simple and multiple linear regression

**Estimated reading time:** 3 minutes

## Learning Objective:

- Differentiate between simple and multiple linear regression

You have learned about simple and multiple linear regression, their assumptions, limitations, and applications. You have also learned to build simple and multiple regression models and how to implement them. Let's recap what you have learned.

## Regression analysis

Regression analysis is a cluster of statistical methods that determines the relationship between the dependent variable and one or more independent variables by holding other independent variables constant. There are various types of regression analysis, such as linear, logistic, and polynomial. Every kind of regression analyzes the impact of independent variables on dependent variables.

In this reading, you will learn about linear regression analysis.

## Linear regression analysis

Linear regression analysis is helpful to predict a variable's value based on another variable's value. The variable you want to predict is called the dependent variable. However, the variable you are using to predict the other variable's value is called the independent variable.

Linear regression analysis has two types: Simple and multiple linear regression analysis.

Simple linear regression analysis examines the correlation between a single dependent and independent variable. For example, if you want to predict an employee's salary, you could consider just one independent variable from the various variables, such as their level of education, years of experience, weekly working hours, or age.

You can determine simple linear regression with the help of an equation,

$Y = a + bX$ ; where Y = Dependent variable  
X = Independent variable  
a = Intercept  
b = Slope

However, multiple linear regression analysis uses various independent variables, such as level of education, years of experience, weekly working hours, or age, to predict an employee's salary.

You can determine multiple linear regression with the help of an equation.

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + E$ , where; Y = Dependent variable  
X = Independent variable  
 $\beta$  = Beta coefficients or regression coefficients  
E = Residuals or regression model errors

Now, let's understand the distinction between simple and multiple linear regressions.

Simple linear regression involves one dependent variable and one independent variable, whereas multiple linear regression involves one dependent variable and two or more independent variables.

In a simple linear regression model, you can calculate the value of the dependent variable by using the equation of a straight line,  $Y = a + bX$ . On the other hand, in a multiple linear regression model, you can estimate the value of the dependent variable by using the equation  $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + E$ .

Simple linear regression has only two variables and represents a two-dimensional graph. However, multiple linear regression involves more than two variables and creates a comprehensive model.

Simple linear regression is appropriate when a single independent variable directly affects the dependent variable. However, multiple linear regression is appropriate when an event depends on multiple independent factors or variables.

Simple linear regression assumes that errors are independent, the variance of errors is constant, and the relationship between variables is linear. However, multiple linear regression assumes multicollinearity, which means that independent variables are highly correlated.

## Summary

In this reading, you learned the difference between simple and multiple linear regression.

- Simple linear regression involves one dependent and one independent variable and shows a two-dimensional graph.
- Simple linear regression assumes independence, a constant error variance, and a linear relationship between variables.
- Multiple linear regression involves one dependent variable and two or more independent variables and creates a comprehensive model.
- Multiple linear regression assumes multicollinearity.



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