

Types of Linear Regression Models

There are two main types of linear regression models: simple linear regression and multiple linear regression. Simple linear regression has one predictor variable. As shown in the first equation, you use simple linear regression to model the relationship between two variables—one predictor (X) and one response (Y). The simple linear regression model can be displayed graphically with a one-dimensional figure—that is, a line.

Multiple linear regression models the relationship between multiple predictors and a response. The multiple linear equation shown here models the relationship between three variables—the two predictor variables, X_1 and X_2 , and the response (Y). In the equation, ϵ is the error term and β_0 , β_1 , and β_2 are unknown parameters. Specifically, β_0 is the Y -intercept; β_1 is the average change in Y for a 1-unit change in X_1 , holding X_2 constant; and β_2 is the average change in Y for a 1-unit change in X_2 , holding X_1 constant.

This relationship can be represented graphically using a two-dimensional figure—that is, a plane. When there is no relationship among the response variable (Y) and the predictors X_1 and X_2 , the model is depicted as a horizontal plane that passes through the point where $X_1 = 0$, $X_2 = 0$, and $Y = \beta_0$.

If there is a linear relationship among Y , X_1 , and X_2 , then the model is a sloping plane that passes through three points: $(X_1 = 0, X_2 = 0, Y = \beta_0)$, $(X_1 = 1, X_2 = 0, Y = \beta_0 + \beta_1)$, and $(X_1 = 0, X_2 = 1, Y = \beta_0 + \beta_2)$. In this graph, there appears to be a linear relationship between Y , X_1 , and X_2 , so the model is a sloping plane. In this case, X_1 , or X_2 , or both affect Y , so the plane tilts.

By the way, the multiple linear regression model is not restricted to modeling only planes. By using higher-order terms (for example, quadratic or cubic powers of the X s or cross products of one X with another), you can model more complex surfaces than planes. You learn more about higher-order terms later in this lesson.