

## What is Correlation?

A statistical tool that helps in the study of the relationship between two variables is known as **Correlation**. It also helps in understanding the economic behaviour of the variables.

### Significance of Correlation

1. It helps determine the degree of correlation between the two variables in a single figure.
2. It makes understanding of economic behaviour easier and identifies critical variables that are significant.
3. When two variables are correlated, the value of one variable can be estimated using the value of the other. This is performed with the regression coefficients.
4. In the business world, correlation helps in taking decisions. The correlation helps in making predictions which helps in reducing uncertainty. It is so because the predictions based on correlation are probably reliable and close to reality.

## Types of Correlation

Correlation can be classified based on various categories:

***Based on the direction of change in the value of two variables, correlation can be classified as:***

### ***1. Positive Correlation:***

When two variables move in the same direction; i.e., when one increases the other also increases and vice-versa, then such a relation is called a **Positive Correlation**. ***For example***, Relationship between the price and supply, income and expenditure, height and weight, etc.

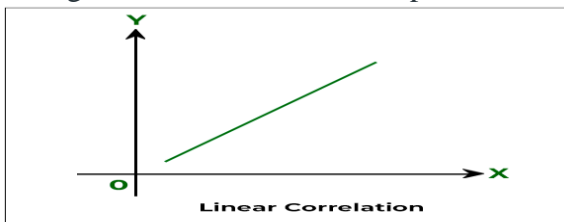
### ***2. Negative Correlation:***

When two variables move in opposite directions; i.e., when one increases the other decreases, and vice-versa, then such a relation is called a **Negative Correlation**. ***For example***, the relationship between the price and demand, temperature and sale of woollen garments, etc.

***Based on the ratio of variations between the variables, correlation can be classified as:***

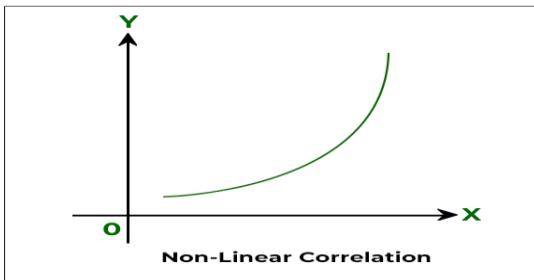
### ***1. Linear Correlation:***

When there is a constant change in the amount of one variable due to a change in another variable, it is known as **Linear Correlation**. This term is used when two variables change in the same ratio. If two variables that change in a fixed proportion are displayed on graph paper, a straight- line will be used to represent the relationship between them.



## 2. Non-Linear (Curvilinear) Correlation:

When there is no constant change in the amount of one variable due to a change in another variable, it is known as a **Non-Linear Correlation**. This term is used when two variables do not change in the same ratio. This shows that it does not form a straight-line relationship. *For example*, the production of grains would not necessarily increase even if the use of fertilizers is doubled.



### Degree of Correlation

Degree of Correlation	Positive Correlation	Negative Correlation
Perfect Correlation	+1	-1
Very High Degree of Correlation	+0.9	-0.9
Fairly High Degree of Correlation	Between +0.75 and +0.9	Between -0.75 and -0.9
Moderate Degree of Correlation	Between +0.25 and +0.75	Between -0.25 and -0.75
Low Degree of Correlation	Between 0 and +0.25.	Between 0 and -0.25.
Zero/No Correlation (uncorrelated)	0	0

## Methods of Studying Correlation

Various methods are there for studying correlation. The most commonly used methods are:

- Scatter plots
- Karl Pearson's Coefficient of Correlation
- Spearman's Rank Correlation

### 1. Scatter Plots

A scatter diagram is a mathematical diagram that displays values for a two-variable data set using Cartesian coordinates. It is also known as a scatter graph, scatter chart, scattergram, or scatter diagram.

A scatter plot is a simple but helpful technique for visually examining the correlation of two variables without any numerical calculation. When scatter plots are used, the given data are plotted on a graph in the form of dots. For each pair of  $x$  and  $y$  values, we put a dot, and we get as many dots on the graph paper as the number of observations.

## 2. Karl Pearson's Coefficient of Correlation

The product-moment correlation and simple correlation coefficient are other names for Karl Pearson's coefficient of correlation. It calculates the degree of a linear relationship between two variables and provides a precise numerical value. It is denoted by the symbol  $r$ .

### Properties

Karl Pearson's Coefficient of Correlation has the following observational properties:

1. The value of  $r$  is always in the range of  $-1$  to  $+1$ , or  $-1 \leq r \leq +1$
2. The degree of correlation is expressed by the value of  $r$ . For example, if  $r$  is  $+1$ , the variables have a perfect positive correlation. If the value is  $-1$ , the variables have a perfect negative correlation, and if the value is  $0$ , there is no correlation between the variables.
3. The sign (+ve) or (-ve) indicates the direction of change
4. It is denoted by the geometric mean of two regression coefficients

## 3. Spearman's Rank Correlation

In some instances, the variables cannot be measured meaningfully. Such variables are called attributes.

### Example: Honesty, beauty, and intelligence

We cannot assign definite values to such attributes. The ranking is considered a better alternative to quantify these attributes. If we want to study the relationship between two attributes, rank correlation is better than simple correlation. Spearman's rank correlation assesses the strength and direction of the relationship between two ranked variables. It essentially measures the monotonicity of a relationship between two variables. In other words, it tells how well the relationship between two variables can be represented using a monotonic function.