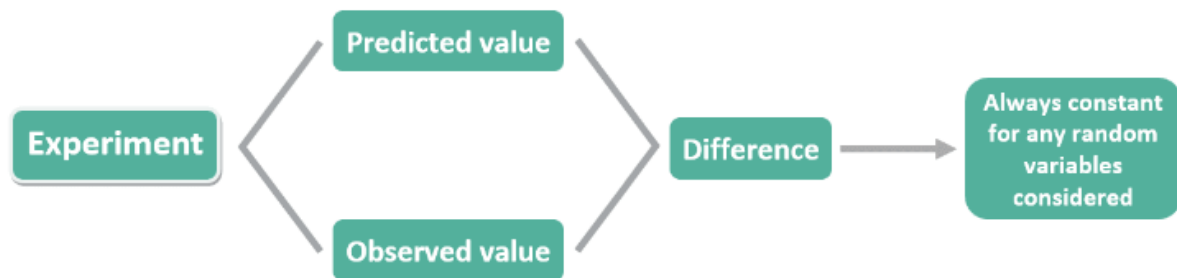


HOMOSCEDASTICITY AND HETEROSCEDASTICITY

Homoscedasticity

Homoscedasticity refers to the difference between **predicted** and **observed** values of an experiment being constant for any random variables considered. It is an important assumption based on which many statistical tests can be conducted. Homoscedasticity test results are considered more reliable owing to unbiased estimates.

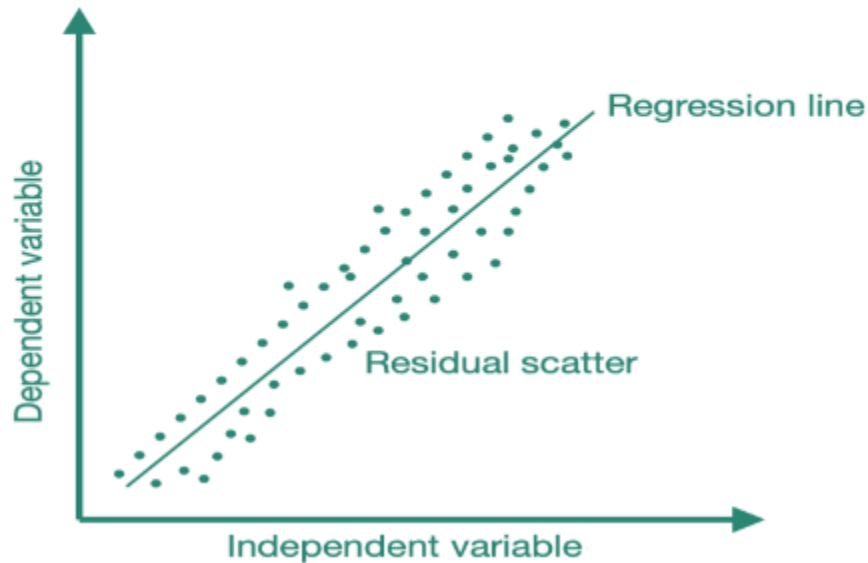
Homoscedasticity Meaning



Moreover, it is also useful in **machine learning algorithms** and statistical pattern recognition.

For example, the time taken for an ice cube to melt depends on the temperature. Here, the temperature is the independent variable, and the time is the dependent one.

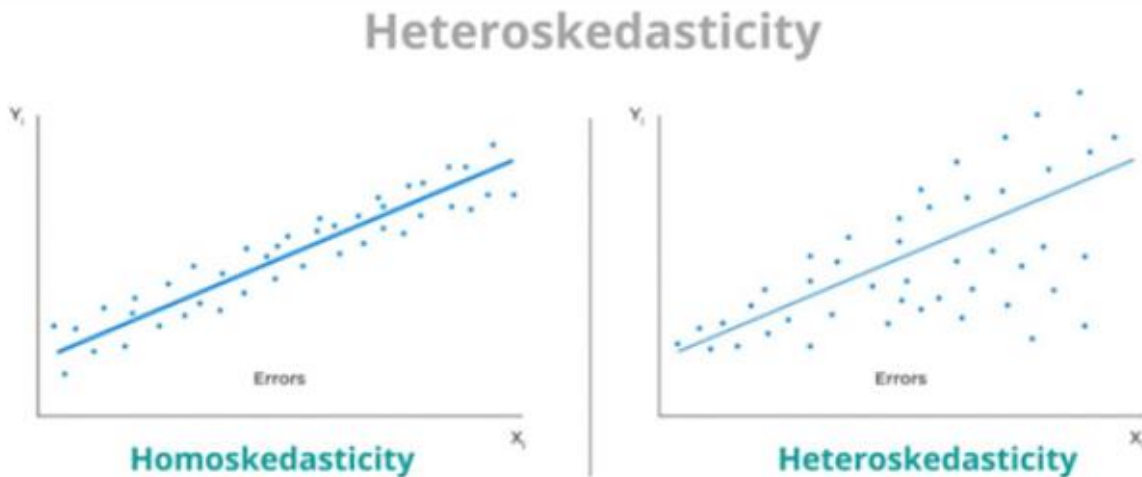
Homoscedasticity Residual Plot



Heteroscedasticity

The heteroskedasticity test refers to ununiform variance in a sequence of variables. It is also referred to as an error.

Heteroscedasticity often occurs when there is a large difference among the sizes of the observations.



· Heteroskedasticity is an unequal scatter of the residual in comparison to measured values.

A classic example of heteroscedasticity is that of income versus expenditure on meals. As one's income increases, the variability of food consumption will increase. A poorer person will spend a rather constant amount by always eating inexpensive food; a wealthier person may occasionally buy inexpensive food and at other times eat expensive meals. Those with higher incomes display a greater variability of food consumption.

Causes and forms of Heteroscedasticity

A common form of heteroscedasticity is when the amount of fluctuation is a fraction of the value. This happens commonly with monetary data such as:

- Prices (stock prices, prices of goods, medical procedure costs),
- Expenditures (household expenditure, employee wages, rents),
- Price indexes (the Gold Price Index example illustrated above).

In residual plots, heteroskedasticity in regression is cone-shaped. In scatter plots, variance increases with the increase in fitted value. For cross-sectional studies like income, the range is from poverty to high-income citizens; when plotted on a graph, the data is heteroskedastic.

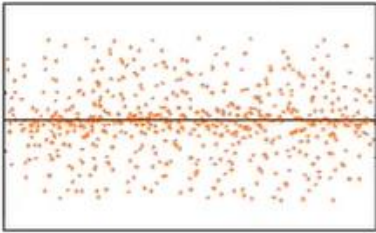
The most basic heteroskedastic example is household consumption. The variance in consumption increases with an increase in income—directly proportional. Because when the income is low, the variance in consumption is also low. Low-income people spend predominantly on necessary items and bills—less variance. In contrast, with the increase in income, people tend to buy luxurious items and develop a plethora of habits—less predictable.

Key Takeaways

Homoscedasticity can be referred to as the condition of homogeneity of variance. This is because the variance between the predicted and observed values will be a constant for any independent variable.

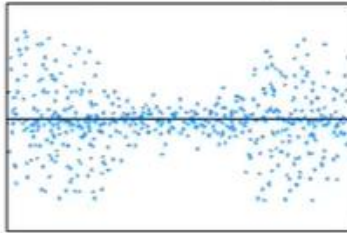
Heteroscedasticity is the opposite phenomenon, whereby the difference between the predicted and observed values will be different, thus increasing the degree of scatter.

Homoscedasticity



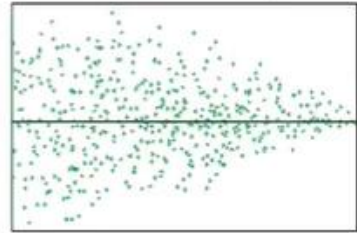
Random Cloud (No Discernible Pattern)

Heteroscedasticity



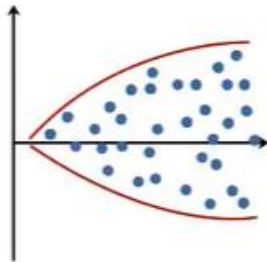
Bow Tie Shape (Pattern)

Heteroscedasticity

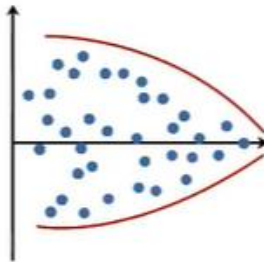


Fan Shape (Pattern)

Heteroscedasticity



Heteroscedasticity



Homoscedasticity

