# Ordinary Least Square Method of Regression

**Ordinary least squares (OLS) regression** is a statistical method of analysis that estimates the relationship between one or more independent variables and a dependent variable; the method estimates the relationship by minimizing the sum of the squares in the difference between the observed and predicted values of the dependent variable configured as a straight line. In this entry, **OLS** regression will be discussed in the context of a bivariate model, that is, a model in which there is only one independent variable ( X ) predicting a dependent variable ( Y ). However, the logic of OLS regression is easily extended to the multivariate model in which there are two or more independent variables.

Ordinary least squares (OLS) is a type of linear least squares method for estimating the unknown parameters in a linear regression model. OLS chooses the parameters of a linear function of a set of explanatory variables by the principle of least squares: minimizing the sum of the squares of the differences between the observed dependent variable (values of the variable being predicted) in the given dataset and those predicted by the linear function.

Geometrically, this is seen as the sum of the squared distances, parallel to the axis of the dependent variable, between each data point in the set and the corresponding point on the regression surface – the smaller the differences, the better the model fits the data. The resulting estimator can be expressed by a simple formula, especially in the case of a simple linear regression, in which there is a single regressor on the right side of the regression equation.

The OLS estimator is consistent when the regressors are exogenous and optimal in the class of linear unbiased estimators when the errors are homoscedastic and serially uncorrelated [citation needed]. Under these conditions, the method of OLS provides minimum-variance mean-unbiased estimation when the errors have finite variances. Under the additional assumption that the errors are normally distributed, OLS is the maximum likelihood estimator.

OLS is used in fields as diverse as economics (econometrics), data science, political science, psychology and engineering (control theory and signal processing).

**Classical OLS Assumption**

Like many statistical analyses, ordinary least squares (OLS) regression has underlying assumptions. When these classical assumptions for linear regression are true, ordinary least squares produces the best estimates. However, if some of these assumptions are not true, you might need to employ remedial measures or use other estimation methods to improve the results.

Many of these assumptions describe properties of the error term. Unfortunately, the error term is a population value that we'll never know. Instead, we'll use the next best thing that is available—the residuals. Residuals are the sample estimate of the error for each observation.

Residuals = Observed value – the fitted value

When it comes to checking OLS assumptions, assessing the residuals is crucial!

There are seven classical OLS assumptions for linear regression. The first six are mandatory to produce the best estimates. While the quality of the estimates does not depend on the seventh assumption, analysts often evaluate it for other important reasons that I'll cover. Below are these assumptions:

**1.** The regression model is linear in the coefficients and the error term

**2.** The error term has a population mean of zero

**3.** All independent variables are uncorrelated with the error term

**4.** Observations of the error term are uncorrelated with each other

**5.** The error term has a constant variance (no heteroscedasticity)

**6.** No independent variable is a perfect linear function of other explanatory variables

**7.** The error term is normally distributed (optional)

## Demerits

**1.** This method is very much rigid in the sense that if any item is added to, or subtracted from the series, it will need a thorough revision of the trend equation to fit a trend line, and find the trend values thereby.

**2.** In comparison to the other methods of trend determination, the method is bit complicated in as much as it involves many mathematical tabulations, computations, and solutions like those of simultaneous equations.

3. Under this method, we forecast the past and future values basing upon the trend values only, and we do not take note of the seasonal, cyclical and irregular components of the series for the purpose.

4. This method is not suitable for business, and economic data which conform to the growth curves like Gompertz's curve, Logistic Pearl-Read curve etc.

5. It needs great care for the determination of the type of the trend curve to be fitted in viz : linear, parabolic, exponential, or any other more complicated curve. An erratic selection of the type of curve may lead to fallacious conclusions.

6. This method is quite inappropriate for both very short and very long series. It is also unsuitable for a series in which the differences between the successive observations are not found to be constant, or nearly so.