The assumptions made while running linear regression models are:

A1. The linear regression model is “linear in parameters.”

A2. There is a random sampling of observations.

A3. The conditional mean should be zero.

A4. There is no multi-collinearity (or perfect collinearity).

A5. Spherical errors: There is homoscedasticity and no auto-correlation

A6: Optional Assumption: Error terms should be normally distributed.

**Properties of OLS Regression Estimators in Detail**

1: Linear

This property is more concerned with the estimator rather than the original equation that is being estimated. In assumption A1, the focus was that the linear regression should be “linear in parameters.” However, the *linear* property of OLS estimator means that OLS belongs to that class of estimators, which are linear in Y, the dependent variable.

2: Unbiasedness

If you look at the regression equation, you will find an error term associated with the regression equation that is estimated. This makes the dependent variable also random. If an estimator uses the dependent variable, then that estimator would also be a random number. Therefore, before describing what unbiasedness is, it is important to mention that unbiasedness property is a property of the estimator and not of any sample.

Unbiasedness is one of the most desirable properties of any estimator. The estimator should ideally be an unbiased estimator of true parameter/population values.

The unbiasedness property of OLS in Econometrics is the basic minimum requirement to be satisfied by any estimator. However, it is not sufficient for the reason that most times in real-life applications, you will not have the luxury of taking out repeated samples. In fact, only one sample will be available in most cases.

3: Best: Minimum Variance

First, let us look at what efficient estimators are. The efficient property of any estimator says that the estimator is the *minimum variance unbiased*estimator. Therefore, if you take all the unbiased estimators of the unknown population parameter, the estimator will have the least variance. The estimator that has less variance will have individual data points closer to the mean. As a result, they will be more likely to give better and accurate results than other estimators having higher variance. In short:

1. If the estimator is unbiased but doesn’t have the least variance – it’s not the best!
2. If the estimator has the least variance but is biased – it’s again not the best!
3. If the estimator is both unbiased and has the least variance – it’s the best estimator.

Now, talking about OLS, OLS estimators have the *least variance* among the class of all *linear unbiased* estimators. So, this property of OLS regression is less strict than efficiency property. Efficiency property says least variance among all unbiased estimators, and OLS estimators have the least variance among all linear and unbiased estimators.

It is worth spending time on some other estimators’ properties of OLS in econometrics. The properties of OLS described below are asymptotic properties of OLS estimators. So far, finite sample properties of OLS regression were discussed. These properties tried to study the behavior of the OLS estimator under the assumption that you can have several samples and, hence, several estimators of the same unknown population parameter. In short, the properties were that the average of these estimators in different samples should be equal to the true population parameter (unbiasedness), or the average distance to the true parameter value should be the least (efficient). However, in real life, you will often have just one sample. Hence, asymptotic properties of OLS model are discussed, which studies how OLS estimators behave as sample size increases. Keep in mind that sample size should be large.

4: Asymptotic Unbiasedness

This property of OLS says that as the sample size increases, the biasedness of OLS estimators disappears.

5: Consistency

An estimator is said to be consistent if its value approaches the actual, true parameter (population) value as the sample size increases. An estimator is consistent if it satisfies two conditions:

a. It is asymptotically unbiased

b. Its variance converges to 0 as the sample size increases.

Both these hold true for OLS estimators and, hence, they are consistent estimators. For an estimator to be useful, consistency is the minimum basic requirement. Since there may be several such estimators, asymptotic efficiency also is considered. Asymptotic efficiency is the sufficient condition that makes OLS estimators the best estimators.